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SITE ONLY

TECHNICAL SPECIFICATIONS FOR

Fayette County Fire and EMS Training Facility

Fayette County, Georgia

September 2, 2022

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SECTION 31 00 00

EARTHWORK

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Work specified in this Section includes, providing total labor, materials, equipment, and incidentals necessary to perform entire excavation, backfill, fill, grading, and finish grading in preparation for building construction, utilities, landscaping and grassing, required to complete the work shown and specified. The work must include, but not be limited to excavation for structures, footings, total backfilling and fill embankment and grading, disposal of waste and surplus materials, and total related work such as sheeting, bracing, and pumping.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 10 00: Site Clearing

B. Section 31 23 00: Excavation and Fill

C. Section 31 25 00: Erosion and Sediment Controls

1.03 REFERENCE DOCUMENTS

A. ASTM D 698-91 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3)); 2012.
B. ASTM D1556/D1556M-15e1, Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015.
C. ASTM D2167-15, Standard Test Method for Density and Unit Weight of Soil in Place by the Balloon Method; 2015.
D. ASTM D2487-17, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017.
E. ASTM D 3017-88, Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2017
F. ASTM D6938-17a, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2017.

1.04 SUBMITTALS

A. Test Reports: Testing laboratory will submit the following reports directly to the Owner, Architect, Civil Engineer, and Contractor.
    1. Analysis of soil materials, whether procured on or off site, including fill, backfill, and borrow materials
    2. Verification of each footing subgrade
    3. In-place density test reports
    4. Moisture-density relationship test reports
    5. Compressive strength or bearing test reports

1.05 QUALITY ASSURANCE

A. Testing Laboratory Services: The Owner will secure and pay for the services of an independent testing laboratory service to classify existing soil materials, recommend and classify proposed borrow materials (when necessary), verify compliance of materials with specified requirements, and perform required field and laboratory testing.

B. Coordinate and schedule in a timely manner with the Testing Agency the following quality control items:
   1. Obtain samples of the structure fill from borrow site.
   2. Determine particle size, liquid limit, plastic limit, plasticity index, and maximum density of each type of soil.
   3. Observe proof rolling
   4. Perform a sufficient number of field density tests to verify compaction and structural fill.
   5. Verify foundation-bearing capacity.
   6. Verify quantities of material removed and quantities of material placed where Unit Prices are involved.

C. Establish and maintain benchmarks on the site for reference. All vertical dimensions must be checked from these benchmarks.

D. Soils having a standard Proctor maximum dry density of less than 90 pcf is unsuitable, unless laboratory evaluations of their stress-strain characteristics indicate they will perform acceptably as determined by the Geotechnical Engineer.

E. The moisture content of suitable soils should not be more than 2 percentage points above or more than 2 percentage points below optimum at the time of compaction. Tighter moisture limits may be necessary with certain soils.

1.06 SITE CONDITIONS

A. Consider the limits of work to make determinations of the amount of grading. Limit grading to the work as shown and do not disturb the existing terrain or trees outside this work.

B. Traffic: Do not interfere with or close public ways without permission of governing authorities. Do not interfere with adjacent private facilities.

C. Ground water may be encountered during foundation excavation. Use a system for controlling ground water to a level at least 3’-0” below the lowest point of the excavation.

D. Site Utilities:
   1. Advise utility companies of excavation activities before starting excavations. Secure and pay for the services of a locating company to locate and identify all underground utilities passing through work area before starting work.
   2. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Civil Engineer immediately for directions. Cooperate the Civil Engineer or other utility companies in keeping respective services and facilities in operation.
   3. Protect existing utilities indicated to remain.
   4. Do not interrupt existing utilities without advance notice to and written approval.

E. Items of historic or archaeological value discovered during earthwork operations must remain property of the Owner.

1.07 DEFINITIONS

A. Earth Excavation: Removal, reuse, and disposal of earth and other naturally occurring or manmade materials encountered other than materials classified as rock or unnecessary excavation.

B. Rock Excavation: Rock Excavation shall consist of all material that cannot be excavated except by drilling, blasting, or wedging. It shall consist of un-decomposed stone that is hard enough to ring under a hammer. The amount of solid stone shall not be less than one (1) cubic yard in volume.

1. Blast Rock (Mass): Any material occupying an original volume of more than one (1) cubic yard, that cannot be excavated with a single tooth ripper mounted on a crawler tractor having a minimum draw bar pull rated at no less than 56,000 pounds (Caterpillar D-8K or equivalent) or by a Caterpillar 977 front-end loader or equivalent, and occupying an original volume of at least one (1) cubic yard.

2. Trench Rock Excavation: Any material occupying an original volume of more than one cubic yard, that cannot be excavated with a hydraulic excavator having a minimum flywheel power rating of 123 kW (165 hp); such as caterpillar 322C L, John Deere 230LC, or a Komatsu PC 220LC-7; equipped with a short tip radius bucket, no wider than forty-two (42) inches.

C. Partially Weathered Rock (PWR): A residual soil with standard penetration resistance of at least 50 blows per six (6") inches.
1. Partially Weathered Rock (PWR) with N-valves of 50/3 inches, or greater penetration, can generally be removed by first loosening the material with a single tooth ripper attached to a suitably sized dozer (Caterpillar D8 or larger).

D. Auger Refusal: Auger refusal generally indicates the depth to sound bedrock; however, auger refusal may indicate floating boulders or pinnacled bedrock areas.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Where sufficient approved materials are not available from required excavations on site, provide materials from approved sources off site without charge to the Owner.

B. For each soil material proposed for use as fill or backfill, whether obtained on or off site, Testing Laboratory must classify soil material, develop Proctor curve, and perform any other tests required.

C. Obtain approval for each soil material.

D. Topsoil: Friable clay loam surface soil.

E. Satisfactory Topsoil: Fertile agricultural soil, typical for locality, capable of sustaining vigorous plant growth; free of subsoil, rocks larger than 2 inches in diameter, clay, toxic matter, plants, weeds, and roots.

F. Fill Materials: Total material used as fill must be evaluated, tested, and approved by the geotechnical engineer. On-site residual soils are general suitable for use as structural fill, provided, they are moisture conditioned for proper compaction. Off-site borrow materials must be used as fill provided they have a liquid limit (LL) not exceeding 50; a plasticity index (PI) of less than 30; and a standard proctor maximum dry density (ASTMD698) greater than 90 pounds per cubic foot (pcf). Soils classified as CL, ML, SM, or SC are considered suitable for fill material.

G. Unsatisfactory Soil Material (ASTM D 2487):
1. OL (Organic Clay)
2. OL (Organic Silt)
3. CH (Fat Clay)
4. MH (Elastic Silt)
5. OH (Organic Clay)
6. OH (Organic Silt)
7. PT (Peat)

PART 3 – EXECUTION

3.01 PREPARATION

A. Stripping Topsoil:
   1. Strip areas are to be occupied by buildings, pavements, areas to be filled, and areas to be impacted by construction activities. Strip topsoil to subsoil depth. Strip only materials that conform to the topsoil specification above.

   2. Stockpile topsoil on site, located where it will not interfere with the work.

B. Protection: Temporary construction fencing is required to indicate limits of work and clear identification of items and areas requiring protection.

C. Barricades, warning signs, and warning lights around open excavations are required to prevent injury to persons.

D. Onsite Contractor is solely responsible for determining the potential for injury to persons and damage to property.
   1. Where such potential is present, take appropriate protective measures.

   2. Protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.

E. Do not allow excavation subgrades and soil at foundations to be subjected to freezing temperatures or frost. Should prepared and compacted subgrades be damaged by freezing, remove soil materials to the depth required by the on-site Geotechnical Engineer and replace recompact in conformance with specified requirements.

3.02 DEWATERING

A. Do not allow surface or groundwater to flow into or accumulate in excavations.

B. Do not allow water to flow in uncontrolled fashion across the project site or to erode slopes or undermine foundations. Do not allow water to be diverted onto adjacent properties. Arrange excavation operations to allow for continual and effective drainage of excavations.

C. Maintain temporary diversion ditches, dikes, and grading as necessary. Do not use trench excavations for this purpose. When required by surface or subsurface water conditions, install sumps, wellpoints, French Drains, pumps, and other control measures necessary to keep excavations free of water. When existence of ground water near or above final excavation level is indicated or suspected, install control measures prior to excavating to water level and maintain water level continuously below working level.

3.03 EXCAVATION

A. General: Excavation includes the removal of any materials necessary to achieve the required subgrade elevations and includes reuse or disposal of such materials.

B. Approval of Subgrade: Notify the Testing Agency when required elevations have been reached.
   1. When required by Testing Agency due to presence of unsatisfactory materials or other factors, perform additional excavation and replace with approved compacted fill material in accordance with the Testing Agency's instructions.

   2. No payment will be made for correction of subgrades improperly protected against damage from freeze-thaw or accumulation of water or for correction of otherwise defective subgrades.

C. Excavation Stabilization: Wherever it is possible to slope faces of excavations to achieve stabilization, do so in compliance with requirements of governing authorities. Otherwise, install shoring and bracing.

D. Excavation for Structures:
   1. Excavate beyond footings and foundations to allow proper construction and inspection of concrete formwork and other materials. Excavate to the required elevation.
      a. Tolerance – plus or minus .10 foot

E. Excavation for Footings and Foundations:
   1. Delay excavation to final grade and final compaction until immediately before concrete will be placed.

   2. Remove any loose or sloughed material and adjust excavations to conform to required lines, grades, and tolerances to form a suitable bearing surface. Do not disturb bottom of completed excavations.

   3. For pile-supported footings, halt excavations 6 to 12 inches above the bottom of the footing before driving piles. After driving piles, continue excavating to required elevations.

F. Excavation for Pavements: Excavate, shape and compact to the lines, subgrade elevations and cross-sections indicated.
   1. Store soil materials without intermixing. Protect from contamination with other soils or debris.

3.04 BACKFILLING

A. Preparation: Backfill excavations as soon as practicable. Complete the following operations before backfilling:
   1. Inspection and acceptance of below-grade construction

   2. Inspection, testing, and approval of underground utilities

   3. Surveying of underground utilities for record documents

   4. Concrete formwork removal

   5. Removal of loose material, muck, debris, and trash from excavation

   6. Installation of temporary or permanent horizontal bracing for structures to receive backfill

B. Remove temporary shoring and bracing as the work progresses and when use is no longer necessary.

C. Place approved soil materials in layers to required subgrade elevations.
   1. Do not place material on muddy or frozen surfaces or on surfaces containing frost.

D. Place satisfactory soil materials in layers to required subgrade elevations.

3.05 FILLING

A. Preparation: Verify that area has been stripped of vegetation, including roots below grade. Remove and dispose of unsatisfactory soils.
   1. When filling slopes steeper than 4 to 1: plow, step, or break up surfaces to promote bond of new to existing material.

   2. Break up existing pavement in areas indicated before filling over.

3. Should density of subgrade receiving fill be less than specified for fill, break up, and pulverize subgrade to a depth of at least 6 inches, moisture condition if necessary, and recompact to required density at optimum moisture content.

B. Place fill materials to required elevations in lifts of required depth. Place fill materials beneath each areas as indicated.
   1. Planted Areas: satisfactory soil materials

   2. Paved Areas: subbase material

   3. Exterior Steps/Ramps: subbase material

   4. Fill placed on slopes should be adequately benched into the existing soils to prevent the formation of a weak sloping interface between the existing soils and newly placed fill.

3.06 PAVEMENT SUBBASE COURSE PLACEMENT

A. Place lifts so that compaction true to grade and level is accomplished with a minimum of surface disturbance and segregation or degradation of materials. Maintain grade control and cross section by means of line and grade stakes. Maintain moisture content within prescribed limits during placing and compacting.

B. When the total thickness of subbase is less than the maximum lift thickness permitted, place material in a single lift. When the total thickness of the subbase is greater than the maximum lift thickness permitted, place materials in two or more lifts of uniform thickness with lift no less than 3 inches in thickness.

C. Place material along the edges of the subbase course to maintain compaction of the subbase course. Construct at least a 1-foot width of shoulder simultaneously with each lift of the subbase course.

D. Cut any overbuild to grade. Should top elevation be lower than allowable tolerances, scarify to a depth of 3 inches, add new material, and recompact to bring to grade within required tolerances.

3.07 FILL PLACEMENT

A. Place fill or backfill lifts in order for compaction true to grade and level is accomplished with a minimum of surface disturbance and segregation or degradation of materials. Maintain grade control and cross section by means of line and grade stakes. Maintain moisture content within prescribed limits during placing and compacting.

B. Do not place structural fill or backfill on subgrade that contains frost, mud, or is frozen.

C. Place materials used in backfilling and filling in layers not exceeding loose depths as follows, unless noted otherwise:
   1. Heavy equipment compaction - 8 inches

   2. Hand-operated tampers - 4 inches

3.08 COMPACTION

A. In-Place Density Requirements: Compact soil will be no less than the values given below, expressed as percentage of maximum dry density, as determined by ASTM D698 at optimum moisture content.
   1. Unpaved Areas: Top 6-inches of subgrade and subsequent lifts at 90 percent.

   2. Paved Areas: Compact the upper 12-inches of subgrade in fill areas to 98 percent of the soil's maximum Standard Proctor Density Value (ASTM-D698) prior to placement of the base course material and 95 percent of the soil's maximum standard proctor density value below this level.

3. Building Slabs, Footings, and Structures: Compact to 95 percent of the soil's maximum Standard Density Value (ASTM D-698) to within 12 inches of finished grades and 98 percent of the soil's maximum Standard Proctor Density Value above that elevation. Structural fill is to be extended horizontally beyond the outer edge of the building foundations, at least 10-feet or a distance equal to the height of the fill to be place; whichever is of greater value.

B. Compact structural fill behind walls to 95 percent standard proctor.

C. Moisture Control: During compaction, control moisture of subgrades and subsequent lifts to within tolerances from optimum moisture content as recommended by testing laboratory. Wet surface with water when additional moisture is required. Aerate soil to aid in drying or replace soil when excessive moisture is present.

3.09 GRADING

A. General: Smooth grade to a uniform surface that complies with compaction requirements and required lines, grades, and cross sections and is free from irregular surface changes.

B. Smooth transition between existing adjacent grades and changed grades. Cut out soft spots, fill low spots, and cut down high spots to conform to required surface tolerances.

C. Slope grades to direct water away from structures and prevent ponding. Finish subgrade to required elevations within the following tolerances:
   1. Unpaved Areas: plus or minus 0.10 feet
   2. Paved Areas: Plus or minus 0.05 feet
   3. Inside Building Lines: ¼ inch as measured with a 10-foot straightedge

3.10 PROOFROLLING

A. After excavation and before any fill placement, fill areas must be proofrolled and approved by the Onsite Geotechnical Engineer.

B. After completion of required compaction and immediately prior to proceeding with subsequent construction, proofroll in the presence of testing laboratory representative.

C. Proofroll using a heavy pneumatic-tired vehicle having four tires abreast, each tire loaded to 20,000 pounds and inflated to manufacturer's recommended pressure. Maintain optimum moisture content during proofrolling. In areas that show pumping, or are otherwise unsatisfactory, undercut fill material and replace with compacted fill, or stabilize in place, as required by the Onsite Geotechnical Engineer.

D. Proofroll Areas to Receive:
   1. Pavement
   2. Building slabs on grade
   3. Existing soils before filling

3.11 FIELD QUALITY CONTROL

A. Testing Laboratory Services: Do not proceed with construction until testing of each subgrade and lift of fill or backfill has been performed and required inspections and approvals have been obtained.

B. In-Place Density Tests: ASTM D-1556 (Sand Cone Method); ASTM D-2167 (Rubber Balloon Method); or ASTM D-6983-17 (Nuclear Method), as applicable.

C. Foundation Bearing Subgrade: Verify foundation subgrade to determine bearing capacity of each material encountered. The Geotechnical Engineer, retained by the Owner, must verify a bearing pressure of 3,000 pounds per square feet (psf).

D. Areas under Slabs and Pavements: Conduct at least one in-place density test of subgrade and one in-place density test of each compacted fill or backfill layer for every 5,000 square feet of fill for each 2-foot thickness of compacted soil.

E. Foundation Wall Backfill: Conduct no less than 2-in place density tests per lift.

F. Trench Backfill: Conduct no less than 2 in-place density tests per lift per trench.

G. If testing service reports indicate that subgrade or fills are below specified density, scarify or remove and replace to the required depth, recompact, and retest at no cost to the Owner.

3.07 MAINTENANCE

A. Completed Areas: Protect from damage by pedestrian or vehicular traffic, freezing, erosion, and contamination with foreign materials.
   1. Repair and re-establish grades to specified tolerances in settled, eroded, or rutted areas.

B. Damage Areas: Where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions; materials must be restored to required conditions. Scarify or remove and replace the required depth; return to optimum moisture content; and compact materials to the required density before continuing construction.

C. Correction: Should settling occur within project correction period, remove finished surfacing, add additional approved material, compact material, and reconstruct surfacing. Construct surfacing to match and blend in with adjacent surfacing nearly as practicable.

3.08 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Properly dispose of excess or unsatisfactory topsoil offsite.

B. Remove material not required for use on the project (including unsatisfactory soil, excess satisfactory soil, trash, and debris) and legally dispose of it off of the Owner’s property.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This section covers clearing, grubbing, and stripping of the construction site, complete as specified.

B. Clear and Grub the area within the limits of construction or as required.

C. Attention is directed to the Manual for Erosion and Sediment Control in Georgia, 2016 Edition.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 10 00: Earthwork

B. Section 31 23 00: Excavation and Fill

C. Section 31 25 00: Erosion and Sediment Controls

1.03 PROTECTION

A. Seventy-two (72) hours prior to excavation, call U.P.C. (Underground Protection Center) 1-800-282-7411 to locate and protect existing utilities. Any damage to these utilities are to be repaired at no additional cost to Owner. Contractor is responsible for locating all utilities, either private or public.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 SILTATION CONTROL

A. Before any clearing and grubbing operations, total sedimentation and erosion control items must be installed.

3.02 CLEARING

A. Clearing shall consist of the removal of exposed objectionable matter such as trees, brush, stumps, logs, grass, weeds, roots, organic matter, poles, stubs, rubbish, refuse dumps, sawdust piles, loose boulders of one cubic yard or less and other debris resting on or protruding through the ground surface. No damage is done to property, trees, or shrubbery to be retained in, or outside the Limits of Construction.

3.03 GRUBBING

A. Grubbing consists of the complete removal of objectionable matter defined under Clearing, which is embedded in the underlying soil. Objectionable roots are defined as matted tree and brush roots, regardless of the size of the roots, and individual roots more than 3/4" in diameter. Remove grubbed items to a minimum depth of 24" below subgrade.

3.04 STRIPPING

A. Stockpile total topsoil. The topsoil is to be protected until it is placed as specified. Topsoil remaining after work is complete will be used on-site in areas designated.

3.05 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

A. The cost of disposal (including hauling, if necessary) of cleared and grubbed material and debris is considered a subsidiary obligation, the cost of which is included in the contract prices. Dispose of complete clearing and grubbing in a proper legal manner offsite. Insure that no damage to adjacent trees, Owners' property, or buildings will occur.

3.06 PRESERVATION OF TREES:

A. Trees to be saved are as designated on the drawings. The Owner reserves the right to change the trees to be saved. Erect such barricades, guards, and enclosures as required for the protection of the trees during total construction operations.

3.07 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

A. Exercise extreme care to avoid causing any unnecessary disturbance to developed private property bordering construction.

B. All soil preservation procedures and replanting operations must be completed under the supervision of a nursery representative experienced in such operations.

3.08 ACTIVE UTILITIES

A. Preserve in operating condition all active utilities traversing the site. Repair damage to total utilities due to work under this Contract, as required by the authority having jurisdiction over the utility.

3.09 EXISTING SERVICE

A. Disconnect or arrange for the disconnection of utility service in accordance with regulations governing the utility concerned and as shown on the drawings or which interfere with the work.

3.10 BENCH MARKS

A. Maintain total benchmarks, monuments, and other reference points.

END OF SECTION

SECTION 31 23 00

EXCAVATION AND FILL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This section includes complete excavation for piping and associated appurtenances including; filling, backfilling, grading, disposal of surplus material and restoration of trench surfaces and easements.

B. Place total sheeting, bracing, and supports and remove from the excavation total materials which the testing agency may deem unsuitable for backfilling.

The bottom of the excavation must be firm, dry and in all respects acceptable. Deposit pipe bedding, or refill for excavation below grade, directly on the bottom of the trench immediately after excavation has reached the proper depth and before the bottom of the trench has become softened or disturbed by any cause whatever. The length of open trench must be related closely to the rate of pipe laying.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 10 00: Site Clearing

B. Section 31 00 00: Earthwork

C. Section 31 25 00: Erosion and Sediment Control

1.03 REFERENCE DOCUMENTS

A. Fayette County Development Regulations, Current Edition.
B. ASTM D1557-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3); 2012.
C. Utility Accomodation Policy Standards, Georgia Department of Transportation.

1.04 DEFINITIONS

A. Earth Excavation: Removal, reuse, and disposal of earth and other naturally occurring or manmade materials encountered other than materials classified as rock or unnecessary excavation.

B. Rock Excavation: Rock Excavation shall consist of all material that cannot be excavated except by drilling, blasting, or wedging. It shall consist of un-decomposed stone that is hard enough to ring under a hammer. The amount of solid stone shall not be less than one (1) cubic yard in volume.

1. Blast Rock (Mass): Any material occupying an original volume of more than one (1) cubic yard, that cannot be excavated with a single tooth ripper mounted on a crawler tractor having a minimum draw bar pull rated at no less than 56,000 pounds (Caterpillar D-8K or equivalent) or by a Caterpillar 977 front-end loader or equivalent, and occupying an orginal volume of at least one (1) cubic yard.

2. Trench Rock Excavation: Any material occupying an original volume of more than one cubic yard, which cannot be excavated with a hydraulic excavator having a minimum flywheel power rating of 123 kW (165 hp); such as caterpillar 322C L, John Deere 230LC, or a Komatsu PC 220LC-7; equipped with a short tip radius bucket, no wider than forty-two (42) inches.

C. Partially Weathered Rock (PWR): A residual soil with standard penetration resistance of at least 50 blows per six (6”) inches.

1. Partially Weathered Rock (PWR) with N-valves of 50/3 inches, or greater penetration, can generally be removed by first loosening the material with a single tooth ripper attached to a suitably sized dozer (Caterpillar D8 or larger).

D. Auger Refusal: Auger refusal generally indicates the depth to sound bedrock; however, auger refusal may also indicate or floating boulders or pinnacled bedrock areas.

PART 2 – MATERIALS

2.01 MATERIALS

A. General

1. Materials for use as fill are described below. For each material, notify the testing agency of the source of the material and furnish, for approval, a representative sample weighing approximately 50 pounds, at least ten calendar days prior to the date of anticipated use of such material.

B. Common Fill

1. Common fill consists of mineral soil free of organic material, loam, wood, trash, snow, ice, frozen soil and other objectionable material which may be compressible or which cannot be compacted properly. Common fill will not contain stones larger than 10" in any dimension, broken concrete, masonry, rubble, or other similar materials. It must have physical properties in order for it to be readily spread and compacted during filling.

2. Material falling within the above specification, encountered during the excavation, may be stored in segregated stockpiles for reuse. Complete material not suitable for reuse will be spoiled, as specified, for disposal of unsuitable materials.

C. Crushed Stone

1. Crushed stone is to be used for pipe bedding, manhole bases, as a drainage layer below structures with underdrains and at other locations indicated on the drawings.

D. Sheeting and Shoring Materials

1. Construction wood sheeting may be new or used lumber of a species or grade suitable for the proposed use.

2. If steel sheet piling is used, it shall conform to ASTM A328 and consist of rolled sections of the continuous interlocking type. Minimum thickness of the web and flange metal shall be 3/8 inch, unless otherwise approved or specified. Rivet steel and structural material as fabricated connections and accessories shall conform to requirements of ASTM A502 and ASTM A36. All steel sheet piles shall be furnished with standard pulling holes located approximately 4-inches below top of the pile.

3. The Contractor shall retain full responsibility for the structural integrity and adequacy of the sheeting.

PART 3 - EXECUTION

3.01 DISPOSAL OF MATERIALS

A. Excavated material is to be stacked without excessive surcharge on the trench bank. Inconvenience to traffic and abutters shall be avoided as much as possible. Excavated material must be segregated for use in backfilling as specified below.

B. Surplus excavated material, suitable for use in backfilling or for replacing rock and boulders, must be stockpiled. Dispose of unsatisfactory surplus material including paving, rock, boulders, and other material.

C. It is expressly understood that no excavated material will be removed from the site of the work or disposed of except as directed by the testing agency. Should conditions make it

impracticable or unsafe to stack material adjacent to the trench, the material is to be hauled and stored. No extra compensation will be made for re-handling material.

3.02 SHEETING AND SHORING ACTIVITIES

A. All excavations shall be properly shored, sheeted and braced or cut back at the proper slope to furnish safe working conditions; to prevent shifting of material; to prevent damage to structures or other work; and to avoid delay to the work. Work shall be performed in all compliance with the most recent U.S. Department of Labor Occupational Safety and Health Administration 29CFR part 1926 Occupational Safety and Health Standards-Excavations, Final Rule. Bracing shall be so arranged as not to place any strain on portions of completed work until the general construction has proceeded far enough to provide ample strength.

B. Timber sheet piles shall be sharpened in a manner which will assist in holding them in true alignment during driving and the tops shall be protected with caps or other means to prevent damage by the driving equipment. Any pieces damaged or split below the point of cutoff shall be removed and replaced with undamaged pieces.

C. Sheet piles shall be carefully located and driven straight and true to desired elevation with secure interlocking for the entire length. Damaged piling or one with faulty alignment shall be withdrawn and new piling driven properly in its place. Jetting will not be permitted. Excavation shall not be carried in advance of sheet piling.

D. Sheeting and bracing shall be removed as the excavation is refilled in such a manner as to avoid caving in of areas or structures. Voids left by withdrawal of the sheeting shall be carefully filled by ramming.

3.03 DENISTY TESTS

1. All trenches 12-inches or wider, as measured at the top, that are within roadways, roadway rights-of-way, parking areas, and areas to be paved shall be tested for conformance to specified compaction requirements:
   a. These trenches shall be backfilled and compacted to their full length.

   b. Tests shall be made within 400 square feet of trench areas for each one foot of lift above top of conduit. Tests taken in one foot lifts shall be staggered.

   c. Compaction shall not be less than that of the surrounding areas or 95% of the maximum dry density as determined by the Standard Proctor Test. The top 12” shall be compacted to a minimum of 98% of the maximum dry density.

3.03 TEST PITS

A. As an aid in establishing the precise location of new work, contact and coordinate with local utilities before excavating test pits for the purpose of locating underground utilities of structures.

B. Excavation of test pits will be considered work incidental to laying sewer pipe.

C. If for any reason a test pit is left open for any period of time, it must be barricaded and lighted.

3.04 DRAINAGE

A. Total material and equipment and perform all incidental work required to maintain the drainage system proposed for handling groundwater or surface water.

B. Pumping equipment and devices must be capable of proper removal and disposal of all water entering trench and excavation for structures. The grade is to be maintained acceptably dry until structures to be built are completed.

C. Pipe and masonry must not be laid in water or submerged within 24 hours after being placed. Water must not flow over new masonry within four days after placement.

D. Prevent water from rising to cause unbalanced pressure on structures until the concrete or mortar has set at least 24 hours. Prevent flotation of the pipe by promptly placing backfill.

E. Pipe, crushed stone graded from coarse to fine, pumps, and equipment necessary to maintain the water level continuously at the required elevation are required if underdrains are used for handling water. Pipe underdrains must be laid with open joints and bedded in crushed stone for the full width of trench, to a depth of 6" below the invert of underdrain.

The invert of underdrain is to be 12" below the normal subgrade. Pipe underdrains have no permanent outlet and are to be sealed at the completion of the work. An impervious bulkhead of clay or concrete shall be constructed in the trench bottom between 100 ft. lengths of the underdrainage system to obstruct the free flow of groundwater after construction is completed. For all excavation below normal grade for the purpose underdrains, the crushed stone and underdrain pipe must be considered a part of the drainage work to be done under the pipe items. Continuously guard against the loss of earth through subbase or the underdrain.

3.05 EXCAVATION

A. The Contractor shall perform all excavation in accordance with the most recent OSHA standards and to the depths required or as shown on Standard Details. During excavation, materials suitable for backfilling shall be piled a minimum distance of 2 feet from the banks of the excavation to avoid overloading and to prevent slides and cave-ins.

B. Excavated materials not required for fill or back-fill shall be removed from the Site. Ubless otherwise indicated or specified, all excavation shall be made open by open cut. No tunneling shall be done.

C. Excavation shall not be carried below the designated level except where special bedding required due to unforeseen conditions, or is specified or shown on the Standard Details. Excess excavation below the designated level shall be backfilled with crushed stone and tamped.

D. Excess excavation for manholes and other structures shall be filled with crushed stone or concrete to the required elevation.

E. Trenches shall be only of sufficient width to provide a free working space on each side of the pipe. To prevent excess pressure on the pipe, maximum width of pipe trench at the top of the pipe shall not be greater than two feet more than the pipe diameter. If this maximum width is exceeded for water or sewer pipelines, the Contractor shall provide Class A bedding as presented in Article 7 of these Regulations. The top portion of the trench above 4 feet shall be excavated with sloping sides in accordance with OSHA standards to any width which will not damage adjoining structures, roadways, pavements, utilities or private property. If it is deemed necessary to excavate trench with vertical sides, then OSHA approved shoring and sheeting methods shall be used.

F. All water mains shall have a minimum of 48-inches of cover above the top of the pipe or 48-inches below edge of pavement, whichever is greater. All water mains 12-inches and larger shall have a minimum of 60-inches of cover above the top of the pipe or 60-inches below edge of pavement, whichever is greater unless otherwise indicated.

G. The trench bottom shall be made to conform as near as possible to the shape of the lower third of the pipe. Excavation shall be made for joints of all pipes, and shall be of sufficient depth to permit access to the joint for construction and inspection. In no case

shall the joints be used to support the body of the pipe. Bell holes shall be excavated in the trenches so as to relieve the pipe bells of all load, but small enough to insure that support is provided throughout the length of the pipe barrel.

H. Unstable soil or soil unable to achieve 95% compaction as per Standard Proctor shall be removed and replaced with crushed stone, which shall be tamped.

I. Ground adjacent to all excavations shall be graded to prevent inflow water.

J. The excavation of the trench shall not advance more than 100 feet ahead of the completed pipe work.

K. The Contractor shall remove any water accumulated during excavation, whether from ground or surface sources.

L. The Inspector shall be notified immediately upon encountering site conditions at variance to those indicated and any active or inactive utility encountered not indicated on the Standard Detais.

M. No work shall be done to correct or incorporate unforeseen conditions until written instructuins are issued.

N. No trenches will be permitted to be left open overnight, on weekends, or on holidays.

3.06 ROCK EXCAVATION

A. All rock encountered shall be removed 6-inches below the bottom grade of the trench where pipe is being laid, and the trench built back to the correct grade with suitable select material thoroughly tamped into place, unless Contractor is specifically directed to place stabilization material.

B. Blasting permits for each development shall be required. Blasting shall be done with the precautions specified by the State Fire Marshall and the Paulding County Fire Chief.

C. The Contractor shall notify County Fire Departments prior to blasting operations.

D. All blasting operations and all handling, storage and use of blasting materials shall be in strict accordance with State, Federal, and Local ordinances and regulations and shall be approved by the State Fire Marshall. Blasts shall be restricted to the extent that no appreciable shock will be transmitted to existing structures, pipe lines, sewers, cables, or other public or private facilities. The Contractor shall be wholly responsible for any and all personal injury or property damage resulting from blasting.

3.07 PIPE BEDDING

A. Bedding is required as shown on the drawings. Regardless of the type of bedding used, holes in the trench shall be provided to receive the pipe bell.

3.08 BACKFILLING

A. No backfilling shall be done over pipelines until all pipes have been inspected and approval received from the Inspector, unless otherwise directed.

B. Trenches shall be backfilled with earth backfill materials (Minimum Class D; see Standard Details) placed evenly around and on both sides of the pipe in 6-inches maximum layers, and tamped until pipe has cover of no less than 12-inches above the top of the pipe. The remaining backfill shall be placed evenly in 12-inches layers compacting each layer thoroughly to the specified compaction. Water settling shall not be permitted.

Any trenches where settlement occurs shall be reopened, refilled, and compacted, with the surface restored to the specified grade and compaction, and leveled for grassing.

C. Prior to backfilling manholes, structures, and other accessories, all forms, trash, and debris shall be removed. Backfill material shall be symmetrical on all sides in 8-inch maximum layers. Each layer shall be moistened and compacted with tamps.

D. Where pipes are in a fill section or are projecting into fill sections, ductile iron pipe shall be provided. Where pipe is not structurally supported, unstable material shall be removed and trench stabilization provided. A pipe bed shall be constructed of No. 57 crushed stone and be compacted to at least 90 percent of the maximum dry density, unless otherwise specified.

E. The material shall be placed evenly in 6-inch maximum layer to the proper subgrade unless otherwise directed by the Department. After the trench has been specialized, normal backfill and compaction operations shall resume as speciedied herein.

F. Prior to final acceptance of the pipeline installations, the Contractor shal refill all sunken trenches and excavations to final grade.

G. Earth backfill shall be free of stone and boulders. Acceptable backfill material may be from excavation or borrowed.

H. No rock will be allowed in the backfill within a distance of 6-inches from the pipe or the ground surface, and rock larger than 6-inches in the greatest dimension will not be permitted in any part of the trench.

3.09 SUBSURFACE OBSTRUCTIONS

A. The Standard Details indicated underground utilities or obstructions that are known to exist according to the best information available to Local Jursidiction. The Contractor, as required by Georgia Law, shall call the Utilities Protection Center (UPC) and those utilites, agencies, or departments that own and/or operate utilities in the vicinity of the construction work site to verify the location of, and possible interference with, the existing utilities, arrange for necessary suspension of service and make arrangements to locate and to avoid interference with said utilities. Where these or unforeseen underground utilities are encountered, the location and alignment of the new facilities may be changed to avoid interference, upon written approval from Local Jurisdiction.

B. The Contractor shall furnish and have available at all times an electronic pipe detector, in good working order, to locate existing pipe lines or other obstructions.

C. While excavating, backfilling and laying pipe, care must be taken not to remove, disturb or injure any existing water, sewer, or gas pipes, or other conduits or structures. If necessary, the Contractor shall sling, shore up, and maintain such structures in operation, and within a reasonable time shall repair any damage done to them. Before final acceptance of work, he shall return all such structures to original condition.

D. The Contractor shall give sufficient notice to the interested utility of his intention of removing or disturbing any pipes, conduits, etc., and shall abide by their regulations governing such work. In the event that any subsurface structure becomes broken or damaged in the course of the work, the Contractor shall immediately notify the proper authorities, and shall be responsible for all damage to persons or property caused by such damage.

E. When pipe or conduits providing services to adjoining buildings are broken during the progress of the work, the Contractor shall repair them at once, or if repaired by the utility involved, shall pay the utility any charges for having such repairs made by the utility.

F. The Department will not be liable for any claim made by the Contractor based on the underground obstructions being different to that indicated in these Regulations or on the plans.

3.10 RESTORING TRENCH SURFACE

A. Where the trench occurs adjacent to paved street, in shoulders, sidewalks, or in cross-country areas, thoroughly consolidate the backfill and maintain the surface as the work progresses. If settlement takes place, immediately deposit additional fill to restore the level of the ground.

B. The surface of any driveway or any other area which is disturbed by the trench excavation and which is not a part of the paved highway is to be restored to a condition at least equal to that existing before work began.

3.11 FILL PLACEMENT

A. General:

1. Material placed in fill areas under and around structures is to be deposited within the lines and to the grades shown on the drawings, making due allowance for settlement of the material. Fill is to be placed only on properly prepared surfaces which have been inspected. No fill is to be placed on a frozen surface, nor shall snow, ice, or frozen material of any sort be placed in fill.

2. Fill is to be brought up to substantial level lifts throughout the site, starting in the deepest portion of the fill. The entire surface of the work is to be maintained free from ruts, and in such condition that construction equipment can readily travel over any section. Fill shall not be placed against concrete structures until they have attained sufficient strength.

3. Fill is to be dumped and spread in layers by a bulldozer or other approved method. During the process of dumping and spreading, all roots are to be removed from the fill areas.

4. If the compacted surface of any layer of material is determined to be too smooth to bond properly with the succeeding layer, loosen the surface by harrowing or by another approved method before the succeeding layer is placed.

a. All fill materials must be placed and compacted in a dry condition. Dewater excavated areas as required to perform the work and to preserve the undisturbed state of the natural inorganic soils.

3.12 COMPACTION

A. Gravel, sand, and backfill in trenches must be placed in layers not exceeding eight (8) inches in depth, as measured before compaction. Each layer must be compacted by a minimum of four (4) coverages with the equipment described below, to at least 95% of maximum dry density as determined by ASTM D1557, Method D. Incidental compaction due to traffic by construction equipment will not be credited toward the required minimum four (4) coverages.

B. Common fill not within trenches must be placed and compacted in a manner similar to that described above, with the following exceptions:

1. Layer thickness prior to compaction may be increased to 10" in open areas.

2. Common fill (except dike fill) required below water level in peat excavation areas may be placed as one lift, in-the-wet, to an elevation one (1) foot above the water level at the time of filling.

C. Compaction equipment in open areas consist of fully loaded ten-wheel dump trucks; tractor dozers weighing at least 30,000 pounds and operated at top speed; or by vibratory roller.

D. Areas adjacent to structures and other confined areas inaccessible to the roller or truck is to be compacted with approved hand guided mechanical compaction equipment. Compaction of the fill by such means is to be to the same degree of compaction as obtained by the rubber-tired equipment. Fill compacted by mechanical compactors is to be placed in 6" layers and thoroughly tamped over the entire surface.

E. It is the intention that the fill materials, with respect to moisture, be used in the condition they are excavated insofar as this is practicable. Material that is too wet shall be spread on the fill area and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits.

F. If the testing agency determines that added moisture is required, water is to be applied by sprinkler tanks or other sprinkler systems, which will ensure uniform distribution of the water over the area to be treated, and give complete and accurate control of the amount of water to be used. If too much water is added, the area is to be permitted to dry before compaction is continued.

3.13 GRADING

A. Grading must be performed at such places as indicated on the drawings; to the lines, grades, and elevations shown, and must be made in such a manner that the requirements for formation of embankments can be followed. All unacceptable material encountered, of whatever nature within the limits indicated, are to be removed and disposed of. During the process of excavation, the grade shall be maintained in the condition that it will be well drained at all times.

B. If at the time of excavation it is not possible to place any material in its proper section of the permanent structure, it must be stockpiled in approved areas for later use.

C. The right is reserved to make minute adjustments or revisions in lines or grades if found necessary as the work progresses due to discrepancies on the drawings or in order to obtain satisfactory construction.

D. Stones or rock fragments larger than 4" in their greatest dimensions will not be permitted in the top 6" of the subgrade line of all dikes, fills or embankments.

E. All fill slopes must be uniformly dressed to the slope, cross-section, and alignment on the drawings.

F. In cuts, all loose or protruding rocks on the back slopes must be barred loose or otherwise removed to line or finished grade of slope. All cut and fill slopes must be uniformly dressed to the slope, cross-section and alignment shown on the drawings.

G. No grading is to be done in areas where there are existing pipe lines that may be uncovered or damaged until such lines which must be maintained are relocated, or where lines are to be abandoned, all required valves are closed and drains are plugged at manholes.

3.14 DISPOSAL OF UNSUITABLE SURPLUS MATERIAL

A. Unsuitable and surplus activated materials and pavement are to be removed and disposed of off the project site.

B. Suitable excavated materials may be used for fill or backfill if it meets the Specification for common fill. Excavated material so approved may be neatly stockpiled at the site where designated.

C. Surplus excavated materials may be used to fill depressions or other purposes as the Owner's Representative may direct.

END OF SECTION

SECTION 31 25 00

EROSION AND SEDIMENT CONTROL

PART 1 – GENERAL

1.01 SUMMARY

A. Scope of Work

1. The work specified in this Section includes providing, maintaining, and removing temporary erosion and sedimentation controls, as necessary. Temporary erosion controls include, but are not limited to grassing, mulching, setting, watering, and re-seeding on-site and spoil and borrow surfaces. Additionally, Interceptor Ditches at ends of terms will be provided. At those locations, it shall be ensured that erosion during construction will either be eliminated or maintained within acceptable limits. Temporary sedimentation controls include but are not limited to silt fencing, silt dams, traps, barriers, check dams, and appurtenances at the foot of the sloped surfaces to ensure sedimentation pollution will be eliminated or controlled. Temporary erosion and sediment control measures are to remain in place during construction until final controls become effective. All devices are to be constructed per the construction documents and referenced documents.

2. NPDES Work: This section includes the areas of responsibility for compliance with the National Pollution Discharge Elimination System (NPDES) Georgia Permit GAR 100001, Storm Water Discharges Associated with Construction Activities for Standalone Construction Projects.

   The Contractor shall be responsible for the following:

   a. Implementing BMP's to prevent and minimize erosion and sedimentation in disturbed areas before, during, and after construction.
   b. Submitting Notice of Intent (NOI) and Notice of Termination (NOT) in accordance with NPDES Stormwater Permit GAR 100001.
   c. Inspecting and maintaining the installed erosion and sedimentation control devices.
   d. Monitoring site and recording daily rainfall counts.
   e. Monitoring and reporting to the Owner on or before the tenth (10^{th}) of the following month of the Nephelometric Turbidity Unit (NTU) from each sampler for each qualifying event throughout the duration of the Contract.
   f. Furnish all materials and labor necessary for the proper installation, maintenance, documentation, and where applicable, removal of erosion prevention and control measures under this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 10 00 - Site Clearing

B. Section 32 92 00 – Turfs & Grasses

1.03 REFERENCE DOCUMENTS

A. Georgia Soil and Water Conservation Commission - Manual for Erosion and Sedimentation Control in Georgia; 2016.
B. Federal Clean Water Act, as amended (33 USC 1521, et seq.).
C. The Georgia Water Quality Control Act; 2015.
D. Georgia Erosion and Sedimentation Control Act of 1975 (ICGA 12-7 et seq.), as amended.

1.04 SUBMITTALS

A. The Contractor will coordinate with the Engineer to acquire the Contractor's estimated construction schedule to complete the NOI and coordinate the development of the NOI with attachments. The NOI must be submitted to GA EPD at least fourteen (14) days prior to the beginning of any construction activity. The Contractor is responsible for coordination of a timely submittal. No time extension or cost increase will be allowed for failure to comply.

B. Contractor shall submit to the Engineer the proposed schedule for installation, maintenance, and removal of all temporary and permanent erosion and sediment control measures. The schedule shall reflect the Sequence of Construction of Temporary Sediment Control Structures and must show the anticipated starting and completion dates for all land development activities, including:

1. Installation of temporary and permanent sediment control structures
2. Stormwater Management Facilities
3. Timber Salvage Operations
4. Clearing Operations
5. Grubbing Operations
6. Mass Excavation and/or Fill Operations
7. Rough and Finished Grading
8. Pipeline Construction
9. Landscaping – including all seeding and sodding
10. Removal of Temporary Sediment Control Structures

1.05 DEFINITIONS

A. Buffer Zone – Bf: The distance, in feet, from the edge of the normal high water line (or for wetlands, the distance from the boundary of the wetland).

Construction within the Buffer Zone must be approved by the Local Issuing Authority and/or State EPD. Any encroachments must be immediately mulched and/or seeded in accordance with the requirements of the Drawings. All construction within a buffer zone must be complete within 24 hours of initial land disturbance within the buffer.

B. State Waters: Any bodies of surface or subsurface water, natural or artificial, lying within or forming a part of the boundaries of the State, which are not entirely confined and retained completely upon the property of a single individual, partnership, or corporation.

C. Final Stabilization: All soil-disturbing activities at the Site shall be completed. In unpaved areas and areas not covered by permanent structures, 100% of the soil surface shall be uniformly covered in permanent vegetation with a density of 70% or greater or equivalent permanent stabilization measures (use of riprap, gabions, permanent mulches, or geotextiles). Permanent vegetation shall consist of the following: planted trees; shrubs; perennial vines; crop of perennial vegetation appropriate for the time of year and region; or a crop of annual vegetation and a seeding of target crop perennials appropriate for the region. Final stabilization applies to each phase of construction. For infrastructure construction projects on land used for agricultural or sivicultural purposes, final stabilization may be accomplished by stabilizing the disturbed land for its agricultural or sivicultural use.

PART 2 – PRODUCTS

2.01 GENERAL

A. The following generally describes the erosion and sediment control practices employed on a utility construction project. The requirements for these practices, as well as others needed for to achieve erosion control, shall be as specified in the Standards and Specifications for General Land Disturbing Activities of the ‘Manual for Erosion and Sediment Control in Georgia’.

B. The paragraph titles and alphanumeric codes refer to specific structural and vegetative practices included in the aforementioned Standards. All practices are considered temporary erosion and sediment control features, except for channel stabilization and grassing/sodding, which are considered as permanent measures.

2.02 FILTER FABRIC MATERIAL SPECIFICATIONS

A. Filter Fabric Materials must meet the requirements set forth in Section 171 – Temporary Silt Fence, of the State of Georgia Department of Transportation Standard Specifications, Construction of Roads and

Bridges. Contractor shall submit to the Engineer copies of delivery invoices, certifications or other documentation that the filter fabric complies with these Specifications if requested by the Engineer.

2.03 HAY BALES

A. Hay bales shall be wire or nylon bound and of a rectangular shape.

2.04 GEO-TEXTILE UNDERLINER

A. A geotextile underliner, conforming to Section 881.06 – Plastic Filter Fabric, State of Georgia Department of Transportation Standard Specifications, Construction of Roads and Bridges, shall be used in all instances to stabilize and support the pad aggregate.

2.05 CONSTRUCTION EXIT AGGREGATE

A. Aggregate size will conform to the National Stone Association R-2 Classification (1.5-3.5 inch stone) or approved equivalent.

2.06 SEDIMENT BASINS

A. Modified sediment basins shall be constructed according to Contract documents.

2.07 TEMPORARY SOIL STABILIZATION

A. Seed, wood waste, asphaltic emulsion or erosion control matting such as jute, excelsior, are appropriate for temporary soil stabilization. Additionally, see Section 32 90 00 – Planting for grassing and mulching.

B. Asphaltic emulsion shall be CSS-1 as manufactured by Chevron Asphalt Company or its equivalent.

2.08 CHECK DAMS – Cd

A. Barriers composed of stone or hay bales placed across a natural or constructed drainage way to prevent erosion in areas of concentrated flows.

B. Stone check dams shall not be utilized where the drainage exceeds five (5) acres.

2.09 CHANNEL STABILIZATION

A. Consists of structures to stabilize an open channel for water conveyance. Such stabilization is typically applied in the locations where the channel banks and bed have been disturbed by excavation for a pipeline crossing.

B. Channels will be stabilized using a riprap lining. The lining shall consist of filter bedding stone and graded riprap stone. Sizes of stone shall be as classified by either the National Stone Association (NSA) or the Department of Transportation. Riprap stone shall be a maximum of 12-inches in diameter. Filter bedding stone shall be graded stone not exceeding 6-inches in diameter. An appropriate geotextile fabric may be substituted for filter stone.

2.10 CONSTRUCTION EXIT – Co

A. Consists of stone-stabilized pad with a geotextile underliner located at any point where traffic will be leaving a construction site to a public right-of-way, street, sidewalk, or parking area.

B. Construction exits are used to reduce or eliminate transport of mud from the construction area.

C. Construction exits shall consist of graded 1.5-3.5 inch stone, meeting National Stone Association grade R-2. The geotextile underliner shall be a non-woven fabric equal to No. C45NW as manufactured by Contech Construction Products, Inc.

2.11 ROCK FILTER DAM – Rd

A. Shall be installed across small streams and drainageways and are applicable for projects that involve grading activity directly in a stream.

B. Must consist of riprap faced with smaller rock on upstream side for additional filtering affect.

2.12 STREAM BANK RESTORATION – Sb

A. Stream Bank Restoration requires the use of readily available native plant materials to maintain and enhance streambanks or to prevent, restore, and repair small stream bank erosion problems.

B. Revegetation includes seeding and sodding of grasses, seeding in combination with erosion control fabrics, and the planting of woody vegetation (shrubs and trees).

C. Prior to the commencement of any work, a site-specific plan will be submitted by the Contractor and approved by the Owner.

2.13 SEDIMENT BARRIER – STAKED HAY BALES – Sdl, HB

A. Hay bale barriers are placed in a single row on natural ground where the most likely erodible areas are located to restrain sediment particles carried by sheet flow.

2.14 SEDIMENT BARRIER, SILT FENCE

A. Silt fences are temporary measures to retain suspended silt particles carried by sheet flow.

B. Consists of silt fabric, as specified in the Georgia Department of Transportation List (#36); wood or steel posts, and wire or nail fasteners. Silt fence is identified as either sensitive or non-sensitive (if reinforced with woven wire).

2.15 TEMPORARY STREAM CROSSING – Sr

A. A temporary stream crossing is a structure installed across a flowing stream for use by construction equipment.

B. Structures may include bridges, round pipes, and pipe arches. The structure shall be large enough to convey the full bank flow of the stream and be designed to withstand flows from a 2-year and 24-hour frequency storm.

2.16 DISTURBED AREA STABILIZATION (WITH MULCHING ONLY) – Dsl

A. This practice is applicable where disturbed areas, temporarily idol, have not been established to final grade and/or where permanent vegetative cover is delayed for a period not exceeding 6 months.

B. Mulch materials shall consist of dry straw or hay, wood chips, erosion control matting or netting, or polyethylene film.

2.17 DISTURBED AREA STABILIZATION (WITH TEMPORARY SEEDING) – DS2

A. Temporary seeding is a measure consisting of seeding and mulching to reduce erosion. All disturbed areas shall be seeded when and where necessary to reduce erosion.

B. This practice is applicable where disturbed areas, temporarily idle, have not been established to final grade and/or where permanent vegetative cover is delayed for up to 12 months.

C. Temporary seeding consists of a grass or grass-legume mixture suitable to the area and season of the year.

2.18 DISTURBED AREA STABILIZATION (PERMANENT VEGETATION) – Ds3

A. See Section 32 92 00 – Turf & Grasses

2.19 DISTURBED AREA STABILIZATION (SOD) – Ds4

B. A permanent vegetative cover using sods on highly erodible or critically eroded lands.

2.20 RAIN GAUGE

A. A "sight" rain gauge shall be a standard pre-manufactured container with dimensions at least 1 ½ inches in diameter, 5-inches tall, with straight sides and graduations clearly marked to indicate rainfall measured in a minimum of 1/8-inch amounts. The rain gauge will include a funnel-type opening with the area of the container equal to 0.1 times the area of the funnel. The "sight" rain gauge shall be as manufactured by TENITE or its equivalent.

B. An electronic tipping bucket rain gauge with an electronic data logger shall be provided as a back-up rainfall monitor to the "sight" rain gauge.

1. The electronic tipping bucket rain gauge will indicate rainfall in 0.01-inch increments and shall be equal to Davis Weather System Rain Collector, Rainwise Tipping Bucket rain gauge or approved equal.

2. The data logger shall be battery powered event logger capable of time and date stamping each event. The battery life of the logger shall be a minimum of one (1) year. The logger shall be capable of storing a minimum of 8,000 events. The logger shall be a HOBO event logger, in English Units, or its equivalent.

3. The Contractor shall also provide an electronic data transfer device (shuttle) to transfer the data from the data logger to the Owner's computer system. The transfer device shall include all cables, connectors, and software required to transfer the data from the logger to a standard "IBM" type computer system. The "shuttle" shall be a HOBO Shuttle, or its equivalent, that is compatible with both the logger and the Owner's computer system.

2.21 MONITORING EQUIPMENT

A. GAR 100001 allows the collection of stormwater samples through the use of "grab samples". The Contractor shall provide the number of samplers required in the Erosion, Sedimentation, and Pollution Control Plan (ESPCP).

B. Automatic Samplers may be furnished in a watertight case capable of both "on-ground" mounting and "pole-mounting". The Sampler, at minimum, shall include the following:

1. Be programmable for the automatic accumulation of the 24-hour rainfall at the sampler; a rolling 24-hour rainfall total for the purpose of sampling event; recording the date and time of the sample and capability of automatically resetting to the 1-inch event at the end of the month.

2. Have a pumping system capable of drawing a sample from the watercourse to an internal sampling container.

3. Have a minimum of one (1) liter sample bottle.

4. The automatic sampler shall be furnished with an electronic tipping bucket rain gauge and the electronic tipping bucket rain gauge shall be calibrated to the program internal to the automatic sampler.

5. The automatic sampler shall have a solar panel recharging system capable of maintaining the battery voltage within the automatic sample above the minimum battery voltage for a minimum of two (2) weeks.

6. The automatic sampler shall be as manufactured by GLI-Manning, PSB4GA Series, Durham-Geo, TR-3000 Series, PRO-OUTDOORSM SAMPLE PRO Series or its approved equivalent.

PART 3 – EXECUTION

3.01 GENERAL

A. At the Pre-Construction Meeting, the Contractor shall submit a schedule for accomplishment of the temporary erosion control work for specific conditions to be encountered on the Project.

B. The Contractor shall install all erosion and sediment control devices as required by actual field conditions, as shown on the Plans, or as directed by the Owner or agency having jurisdiction local to the project.

C. Before land disturbing activities begin, the Contractor shall install the erosion and sedimentation control devices.

D. The Owner shall direct the Contractor to provide additional and immediate temporary erosion control measures in order to prevent contamination of adjacent water and drainage ways. Additional erosion control measures may be used to correct unforeseen conditions during the design stage or that were needed prior to installation of permanent erosion control plans.

E. The Owner may limit the area if excavation in progress based on the contractor's capability and progress in keeping the finish grading, mulching, and seeding current, as well as in accordance with the accepted schedule. Should seasonal limitations make coordination of temporary erosion control measures unrealistic, including mulching or temporary seeding measures shall be taken immediately to the extent feasible and justified.

F. The Contractor shall incorporate all permanent erosion control features, including grassing and sodding, into the project at the earliest practicable time.

3.02 SEQUENCE OF CONSTRUCTION OF TEMPORARY SEDIMENT CONTROL MEASURES

A. Erosion control measures shall be installed in accordance with the Manual for Erosion and Sediment Control in Georgia, published by the Georgia Soil and Water Conservation Commission.

B. Install all erosion and sediment control structures as specified. Structures shall be shown in the Contract Documents, or as directed by the Engineer as the first item of work within a given drainage area. Construction and installation of all sediment control structures shall begin down gradient of the disturbed area and proceed up gradient. The Contractor shall, at all times, maintain all soil erosion and sediment control structures and practices throughout construction and until permanent grass cover is established.

3.03 SPECIFIC REQUIREMENTS

A. The Contractor shall install and maintain soil erosion and sediment control measures in accordance with the plans and the following criteria.

1. Interceptor, Diversion, and Perimeter Dikes: Install to intercept and prevent stormwater runoff from entering disturbed areas from any other up gradient area, regardless of where area is on or off site. Dikes must divert runoff to a drainage ditch, sediment basin or temporary or permanent channel. Dikes shall remain in place until the disturbed area is permanently stabilized. Construct dikes of earth fill free from all perishable matter and refuse scraps of forms; wire; brush; rocks larger than six (6) inches or any foreign materials. Ash, large stones, muck or other soft materials shall not be used. Compact all dikes using construction equipment. Dikes shall be stabilized immediately after construction with temporary seeding in accordance with Section 3.03.1 to prevent sediment transport to downstream areas.

2. Temporary Interceptor, Diversion, and Perimeter Ditches: Install temporary ditches where shown on the Drawings or as directed by the Engineer. Temporary ditches shall be installed parallel and contiguous to and upslope of temporary dikes. Construct ditches to the lines and cross section shown on the drawings, provided that ditches have a minimum depth of one foot and side slopes have a slope of 2H:1V or flatter. Ditches shall be free of bank projections, trees, brush, stumps, or other objectionable materials or irregularities that will impede normal flows. Downstream outlets of

temporary ditches shall be constructed and stabilized prior to construction of the ditch. The outlet must discharge in such a manner as to not cause an erosion problem.

3. Temporary Sediment Barriers (Silt Fence): Install silt fence where shown on the Drawings or as directed by the Engineer.
   a. Installation: Silt fencing shall be installed on the down gradient side of all disturbed areas, as well as the perimeter of the project site, the Engineer may authorize an exception for a perimeter that is up gradient from all land disturbing activity. All posts used to install silt fence shall comply with the specifications in the Manual for Erosion and Sediment Control in Georgia. Posts must be placed at least 18-inches in the ground and cannot be more than six (6) feet apart from one another. Fence fabric must be inserted below ground, as shown on drawing details and fence fabric must be fastened to posts according to the specifications in the Manual. Silt fence must overlap by 18-inches between rolls or where one roll of material ends and another begins.

   b. Maintenance: In accordance with Section 3.04 below, all silt fencing shall be inspected at least once every seven (7) calendar days and within 24 hours of a rainfall event that has precipitation of 0.5 inches or greater. Maintenance of the silt fence shall be performed if needed within 24 hours of inspection. The silt fence shall be maintained so that it minimizes sediment transport as designed. At the earliest of every 14 calendar days or when sediment reaches a depth of one half the installed fence height. All soil, silt, sediment, and other material captured by the silt fence should be removed and returned up gradient on the construction site. All silt fencing materials, including fabric, posts, and fasteners must be replaced every six months after installation.

4. Temporary Sediment Barriers (Hay Bales): Install hay bales where shown on Drawings or as directed by the Engineer.
   a. Installation: Place the hay bales in a row with ends tightly abutting the adjacent bales. Corner abutment is not acceptable. Embed bales in the soil a minimum of four (4) inches below grade. Build up backfilled soil a minimum of four (4) inches above grade on the uphill side of the barrier and conform to grade on downhill side of the reinforcing bars. The first stakes shall be driven toward the previously laid bale to force the bales together. Stakes shall be 24 inches long and reach a minimum of six (6) inches into the ground.

   b. Maintenance: In accordance with Section 3.04 below, all hay bales shall be inspected at least once every seven (7) days and within every 24 hours of a rainfall event that has precipitation of 0.5 inches or greater. Maintenance shall be performed, as needed, within 24 hours of inspections.

   c. The hay bales shall be maintained so they minimize sediment transport as designed. At the earliest of seven (7) calendar days or when sediment reaches a depth of one-half the original bale height, all soil, silt, sediment and other material captured by the hay bales should be removed and returned up gradient on the construction site. Hay bales must be replaced one month after installation.

5. Construction Exit: Locate construction exits as shown on Drawings or as directed by the Engineer.
   a. Installation: Construction exits should be located at all points where traffic will be leaving the construction site to a public or private right of way, street, alley, or parking area. All construction exits must be fully installed prior to the commencement of timber salvage, clearing, grubbing, grading, or construction operations.

   b. Maintenance: In accordance with Section 3.04 below, all construction exits shall be inspected at least once every seven (7) days and within 24 hours of rainfall event that has a precipitation of 0.5-inches or greater. Maintenance shall be performed, if necessary, within 24 hours if inspection. At the earliest of thirty (30) calendar days since construction exit was installed or last maintained; geotextile under liner is visible; or if construction exit does not conform to

specifications established in this Section 3.03, then the construction exit pad shall be top dressed with NSA R-2 (1.5-inch to 3.5-inch stone) so that under liner is no longer visible and exit pad conforms to Specifications.

6. Check Dam: Install check dams as shown on the Drawings or as directed by the Engineer.
   a. Installation: Install check dams in all ditches, channels, or swales draining disturbed areas of one (1) acre or greater and that are not installed with permanent, non-erodible lining or a vegetative cover, as specified in Section 3.03. The Specifications for the design criteria, materials, installation, and maintenance of check dams are dependent on the upslope drainage area and shall not drain a disturbed area greater than ten (10) acres.

   b. Check Dam for Ditches Draining up to Two (2) Acres: Hay bales may be used if all bales used conform to the Specifications established in Section 3.03.

   c. Check Dam for Ditches Draining up to Five (5) Acres: Install stone check dam in ditches draining up-gradient areas greater than two (2) acres. Construct check dam with graded 5 to 10-inch stone. Check dam shall not substantially impound water. Hand placement may be required to insure complete coverage of entire width of ditch.

   d. Maintenance: In accordance with Section 3.04 below, all check dams shall be inspected at least once every seven (7) calendar days and within 24 hours of a rainfall event that has precipitation of 0.5 inches or greater. Maintenance shall be performed if needed within 24 hours of inspection. Dress dams with appropriate size stone or additional hay bales as necessary to maintain check dams in accordance with these Specifications. At the earliest of every 14 calendar days or when sediment reaches a depth of one-half the original check dam height, all soil, silt, sediment and other material captured by the dam should be removed and returned up gradient on the construction site.

7. Inlet Sediment Trap: Install inlet sediment traps where shown on the Drawings, as directed by the Engineer, and around storm drain drop inlets that receive runoff from disturbed areas.
   a. Installation: Install in accordance with Chapter 6 of the Manual for Erosion and Sediment Control in Georgia. Excavation may only be used in combination with a filtering device such as stone or silt fence. All sediment traps should provide a minimum of 1.5 feet of sediment storage. Sediment traps must be self-draining.

   b. Maintenance: In accordance with this Section, inlet sediment traps shall be inspected at least once every seven (7) calendar days and within 24 hours of rainfall event with precipitation of 0.5 inches or greater. Maintenance shall be performed, as needed, within 24 hours of inspection. Clean and repair traps so that traps meet Specifications of this Section and minimizes sediment transport. Remove sediment as necessary to provide adequate storage volume for subsequent rains.

8. Temporary Sediment Basins and Inlets: Install temporary sediment basins and inlets where shown on the Drawings or as directed by the Engineer.
   a. Installation: Excavation basin and backfill of any adjoining pipe trenches shall be as specified in the excavation section. Construct basin or install pre-cast structure. Set units to grade at locations shown. Set frames and grates at elevations indicated on the Drawings. Frames may be cast in or set in mortar.

   b. Maintenance: In accordance with this Section, temporary sediment basins and inlets shall be inspected at least once every seven (7) calendar days and within 24 hours of a rainfall event that has precipitation of 0.5 inches or greater. Maintenance shall be performed as needed within 24 hours of inspection. Clean and repair basins and inlets so they meet Specifications of this Section and minimize sediment transport. Remove sediment as necessary to provide adequate storage volume for subsequent rains.

9. Temporary Soil Erosion Stabilization (Vegetative): This Section covers work necessary for temporary stabilization of soil to prevent erosion following clearing, grubbing, grading, or other construction activities in the areas identified in the Contract Documents or as directed by the Engineer, except for wetlands. The Owner reserves the right to modify the use, location, and quantities of the areas requiring stabilization as the Engineer considers to be in the best interest of the Owner. During construction, the Engineer will designate the extent of the stabilization used in each location throughout the Project. Temporary stabilization within a buffer zone of a Water of the United States shall meet the requirements of Section 1.05.
    a. General Criteria: the stabilization measures specified herein shall be initiated on all disturbed areas including dikes and ditches within 24 hours of completion to minimize erosion and soil transport. However, if the construction activities will resume on that portion of the Site within fourteen (14) days from the date activities ceased, then the temporary stabilization measures specified do not have to be initiated. For cleared areas that may not receive permanent vegetative or other stabilization measure for six (6) months or less and a suitable growing season is unavailable for seedlings to establish an erosion retardant cover, mulch may be applied according to the Specifications below.

    b. Submittal and Scheduling: Contractor shall submit certificates to the Engineer of inspection of seed by State or Federal Authorities and copies of delivery invoices or other documentation of quantities of mulch and fertilizer. The Contractor shall give at least three (3) days' notice to the Engineer of the time and place of starting operations (delivery of materials, planting of grass, and application).

    c. Planting and seeding shall be performed in accordance to Section 32 92 00.

    d. Soil Preparation: Prior to seeding operations and after surface has been shaped, graded, and compacted, scarify surface to a minimum depth of one (1) inch.

    e. Seeding: All seedbeds shall be a minimum depth of two (2) inches. Seedbeds shall be reviewed by the Engineer prior to seeding. For designated wetlands, reference Seeding Specification in item 2L. After soil has been scarified, apply required seed mix, as specified in this Section, uniformly with a cyclone seeder, drill, cultipacker seeder, or hydroseeder. When hydroseeding is the selected method of seeding, prepare and apply slurry at the rate and proportion specified: Seed Mix 50lbs/acre; Fertilizer 500lbs/acre; water as necessary.

    f. The required fertilizer mix shall be uniformly applied at the time of seeding. Fertilizer shall not be applied to a land area within a buffer zone of a Water of the United States as identified in Section 1.04. Upon completion of seeding operations, apply straw mulch to a reasonably uniform thickness of 1-1/2 inches to 2-2/2 inches in depth. Mulch shall be loose enough to permit penetration of sunlight and air circulation, but dense enough to permit shade ground, reduce evaporation rate, and prevent or materially reduce erosion of underlying soil. Retain straw in place by applying asphaltic emulsion at a rate of 100 gallons per acre or mechanically tack the mulch into the soil to approximately three (3) inches. Equipment used for tacking shall be specially designed for this use.

    g. Application of Mulch Only: In accordance with Section 3.03 for areas to receive mulch only, apply at the following rates, to the depths and according to the following Specifications.
        1. Dry Straw or Hay: Spread at a rate of two and one-half (2 ½) tons per acre. Apply to a depth of two (2) to four (4) inches. Apply uniformly and anchor as necessary.

        2. Wood Waste: Spread at a rate of six (6) to nine (9) tons per acre. Apply to a depth of two to three inches. Apply wood waste only on slopes that are 3:1 or flatter. Anchoring is not necessary.

        3. Jute Matting or Excelsior Netting: Apply in accordance with manufacturer's recommendations.

4. Cutback Asphalt: Apply at a rate of 1200 gallons per acre. Apply uniformly.

h. Maintenance: In accordance with this Section, stabilized areas shall be inspected and maintenance shall be performed if needed within 24 hours of inspection at least once every seven (7) calendar days and within 24 hours of a rainfall event that has precipitation of 0.5 inches or greater. Apply traditional stabilization materials as needed.

3.04 RAINFALL GAUGE

A. Installation: The Contractor shall install the rain gauge in an area that has at least 20-feet diameter open area where buildings and/or foliage will not interfere with the rainfall collection. The rain gauge will be maintained in a working condition to accurately measure the rainfall for the duration of the Contract until the Notice of Termination is processed.

B. Recording Rainfall:
1. The Contractor shall examine the rainfall and record the amount on a daily basis using form provided by the manufacturer or a checklist form provided by the Owner.

2. The daily logging form shall be kept on site and made available for review by the Owner, the Engineer, government agencies that request the information, and any other permittees on the job site. Minimally, the Contractor shall, at the same time each day, record the time and amount of rainfall accumulated in the "sight" rain gauge from the previous twenty-four (24) hours before emptying the rain gauge daily.

3. The data from the electronic data logger shall be transferred to the Owner, at a minimum of twice a month. This data shall be compiled and a print out of the data returned to the Contractor for storage with the on-site rainfall data.

3.05 STORM WATER SAMPLES

A. Sampling
1. The Contractor shall gather samples in accordance with GAR 100001 (Permit).

2. Samples gathered after a qualifying event, as defined in GAR 100001 (Permit), shall be tested in accordance with the requirements of the Permit.

3. Data from test of the samples shall be forwarded to the Owner after test(s) have been performed. Information to be included in the submission to the Owner include the following.

Chain of Custody Forms
Field Notes from the Collection Process
Bench Sheets Showing all Laboratory Reading and Calculations
Completed Summary Report Forms

3.06 INSPECTIONS

A. The design professional who prepared Erosion, Sedimentation, and Pollution Control Plan shall inspect the installation of the erosion control measures (BMPs) that have been designed within seven (7) days after the initial construction activities commence.

B. The Contractor shall designate a qualified person who is knowledgeable, has understanding of erosion and sediment control practices, and has completed certified training courses approved by GA EPD to perform inspections and maintenance required by this Section. Maintenance shall be performed as needed within 24 hours of inspection.

C. Upon completion of installation, the Owner or local government authority shall inspect the erosion and sediment control devices for proper installation, flaws, defects, or other damage. The Contractor shall repair or replace the unacceptable portions as directed by the Owner or local government authority.

D. All erosion and sediment control devices shall be inspected by the Contractor weekly and after each rainfall occurrence.

3.07 MAINTENANCE

A. The Contractor shall maintain the erosion and sediment control devices until the project is completed and all disturbed areas are stabilized. Maintenance of the devices shall include removal and disposal of silt accumulation, replacement of damaged or deteriorated devices, and other additional repairs. Installation of additional devices, should installed devices prove to be inadequate, shall be provided at no additional cost to the Owner.

B. Silt shall be cleaned out before it has accumulated to the maximum levels required in the Manual for Erosion and Sediment Control in Georgia.

3.08 REMOVAL OF TEMPORARY SEDIMENT CONTROL STRUCTURES

A. If temporary erosion and control structures are no longer required under this Section, the Contractor shall notify the Engineer of its intent and schedule for the removal of the temporary structures. The Contractor shall remove as approved the temporary structures and all sediments accumulated at the removed structure shall be returned up gradient. In areas where temporary control structures are removed, the site shall be left in a condition that will restore original drainage. Such areas shall be evenly graded and seeded as specified in Section 3.03 – Seeding.

B. The Contractor is required to coordinate, complete, and submit the Notice of Termination to Georgia EPD once the project has reached Final Stabilization. Final Stabilization consists of all soil disturbing activities at the site have been completed. For unpaved areas not covered by permanent structures, at least 70% of the soil surface is uniformly covered in permanent vegetation or equivalent permanent stabilization measures (use of rip-rap, gabions, permanent mulches or geotextiles) have been employed. Permanent vegetation shall consist of planted trees, shrubs, perennial vines (a crop of perennial vegetation appropriate for the time of year and region), or a crop of annual vegetation and seeding of target crop perennials appropriate for the region within the growing season 70% coverage by perennial vegetation shall be achieved. Final Stabilization applies to each phase of construction. For linear construction projects on land used for agricultural or sivicultural purposes, final stabilization may be accomplished by stabilizing the disturbed land for its agricultural or sivicultural lifestyle. The Contractor may submit NOTs for basins, if allowed by the NPDES stormwater permit requirements, the Owner, and the Engineer.

C. Erosion and sediment devices shall remain in place until a satisfactory stand of grass has been established, unless Owner or local government authority directs earlier removal. Devices that have been removed shall be the property of the Contractor and may be reused at another location if in good condition. Damaged or otherwise unusable devices shall be removed from the Site and disposed of properly.

D. After erosion and sediment device removal, the Contractor shall dress out any disturbed areas in the vicinity of the removed device and grass according to the Specifications in Section 32 92 00.

3.09 NOTICE OF TERMINATION

A. Notice of Termination (NOT), signed in accordance with part VI.G. of the Permit (GAR 100001) must be submitted, following the criteria listed below.

1. Infrastructure Construction Projects submitted by the permittee where the entire project has undergone Final Stabilization and all stormwater discharges associated with construction activity that are authorized by this permit have ceased. However, the permittee may submit a Notice of Termination after a phase(s) of the infrastructure construction project has undergone final stabilization and all stormwater discharges associated with construction activity for that phase(s) that are authorized by this permit have ceased.

2. Shall be submitted by the Owner, Operator, or both if the Owner/Operator of the Site changes. If stormwater discharges continue aft the identity of Owner/Operator has changed, the Permittee, prior to filing the NOT, must notify any subsequent Owner or Operator of the permitted site per requirements of this permit.

END OF SECTION

SECTION 32 11 23

AGGREGATE BASE COURSE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes providing all materials, labor, and equipment necessary for the complete installation of all graded aggregate base course material on a prepared sub-grade. Installation shall be in close conformity with the lines, grades, thickness, and typical cross-sections shown on the plans.

1.02 RELATED WORK SPECIFIED ELSEWHERE

1. Section 31 00 00 – Earthwork

2. Section 31 23 00 – Excavation and Fill

3. Section 32 12 16 - Asphalt Paving

1.02 REFERENCE DOCUMENTS

A. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
B. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))
C. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
D. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
E. ASTM D2940 - Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.
F. State of Georgia Department of Transportation, Standard Specifications for Construction of Roads and Bridges, 2013 Edition.

1.03 SUBMITTALS

A. Manufacturer's Certificate – Certify products meet or exceed specified requirements.

B. Provide work in accordance with State of Georgia Department of Transportation, Standard Specifications for Construction of Roads and Bridges, 2013 Edition.

1.04 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Provide work in accordance with State of Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 2013 Edition.

PART 2 PRODUCTS

2.01 AGGREGATE MATERIALS

A. Subbase Aggregate: Furnish in accordance with State of Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 2013 Edition.

B. Base Aggregate: Furnish in accordance with State of Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 2013 Edition.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted substrate is dry and ready to support paving and imposed loads.
   1. Proof roll substrate with fully loaded, tandem-axled dump truck in minimum two perpendicular passes to identify soft spots.
   2. Remove soft substrate and replace with compacted fill, as specified.

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

3.02 PREPARATION

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

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

3.03 GRADED AGGREGATE BASE (GAB) PLACEMENT

A. Place aggregate equal thickness layers to total compacted thickness as indicated on the drawings.
   1. Maximum Layer Compacted Thickness: 6 inches
   2. Minimum Layer Compacted Thickness: 3 inches

B. Roller compact aggregate to 98 percent maximum dry density as determined by ASTM D1557.

C. Level and contour surfaces to elevations, profiles, and gradients indicated.

D. Add small quantities of fine aggregate to coarse aggregate when required to assist compaction.

E. Maintain moisture content during placement of Aggregate Base Course materials to within 3% of optimum moisture content as determined by ASTM D1557.

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

3.04 TOLERANCES

A. Maximum Variation from Flat Surface: ¼ inch measured with 10 foot straight edge

B. Maximum Variation from Thickness: ¼ inch

C. Maximum Variation from Elevation: ½ inch

3.05 FIELD QUALITY CONTROL

A. Compaction testing will be performed in accordance with ASTM D2922.

B. When tests indicated Work does not meet specified requirements, remove work, replace and retest.

C. Frequency of Tests: One test for every 1,000 square yards compacted aggregate.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work specified in this Section includes total labor, materials, equipment and incidentals necessary to perform Portland Cement Concrete paving. Including complete formwork, stripping, reinforcing, and curing to complete the paving as shown on the drawings.

1.02 RELATED WORK SPECIFIED ELSEHWHERE

A. Section 31 00 00: Earthwork

B. Section 32 16 00: Curbs and Gutters

1.03 REFERENCE DOCUMENTS

A. General Department of Transportation Standard Specifications for Construction of Roads and Bridges, 2013 Edition.
B. ASTM C94/C94M-17a, Standard Specification for Ready-Mixed Concrete; 2017.
C. AASHTO M-31, Standard Specification for Deformed and Plain Carbon and Low-Alloy Steel Bars for Concrete Reinforcement; 2017.
D. AASHTO M55/M55-09, Steel Welded Wire Reinforcement – Plain for Concrete; 2017 Edition.
E. ACI, American Concrete Institute – 306.1 Cold Weather Concreting; 2016.
F. CRSI, Concrete Reinforcing Steel Institute – Standard Manual of Practice; 2017.
G. AASHTO M-85, Standard Specification for Portland Cement; 2017 Edition.
H. AASHTO M-182, Standard Specification for Burlap Cloth made from Jute or Kenaf and Cotton Mats; 2017 Edition.
I. AASHTO C171-16, Standard Specification for Sheet Materials for Curing Concrete; 2016 Edition.
J. ASTM D-1751-18, Standard Specification for Performed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types); 2018.
K. ACI 301-16, American Concrete Institute Specification for Structural Concrete; 2016.
L. ASTM C94, Standard Specification for Ready-Mixed Concrete; 2017.
M. ACI 318, American Concrete Institute – Specifications for Building Code Requirements for Structural Concrete and Commentary; 2014.
N. ACI 304R-00, American Concrete Institute – Guide to Concrete Floor and Slab Construction; 2014.
O. ASTM C172, Standard Practice for Sampling Freshly Mixed Concrete; 2017.
P. ASTM C31, Standard for Making and Curing Concrete Test Specimens in the Field; 2018.
Q. ASTM C143, Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015.

1.04 SUBMITTALS

A. Submit a scaled drawing of the concrete paving, with all joint layouts and types.

B. Quality Control Submittals: Submit the following information related to quality assurance requirements specified:

1. Design data: Submit proposed mix designs and test data before concrete operations begin. Identify for each mix submitted the method that proportions have been selected.

a. For mix designs based on field experience, include individual strength test results, standard deviation, and required average compressive strength f(cr) calculations.

b. For mix designs based on trial mixtures, include trial mix proportions, test results, and graphical analysis and show required average compressive strength f(cr).

c. Indicate quantity of each ingredient per cubic yard of concrete.

2. Certifications: Submit affidavits from an independent testing agency certifying that all materials under this section conform to specifications.

3. Delivery tickets: Submit copies of delivery tickets complying with ASTM C94 for each load of concrete delivered to site.
   a. Include on the tickets the additional information specified in the ASTM document.

4. Cold weather concreting: Submit description of planned protective measures.

1.05 QUALITY ASSURANCE

A. Testing Agency Services: Owner will engage testing agency to conduct tests and perform other services specified for quality control during construction.

B. Source of Materials: Obtain materials of each type from same source for the entire project.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver reinforcement to project site bundled and tagged with metal tags indicating bar size, lengths, and other data corresponding to information shown on placement drawings.

B. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or rust.

C. Store cementitious materials in a dry, weather tight location. Maintain accurate records of shipment and use.

D. Store aggregates to permit free drainage and to avoid contamination with deleterious matter or other aggregates. When stockpiled on ground, discard bottom 6 inches of pile.

E. Handle aggregates to avoid segregation.

1.07 PROJECT CONDITIONS

A. Cold-Weather Concreting: Comply fully with the recommendations of ACI 306.

PART 2 - PRODUCTS

2.01 FORMWORK

A. Pavement Forms: Standard steel paving forms in sections no less than 10 feet in length.
   1. Single piece; depth equal to slab thickness.

   2. Base width at least three-fourths of form depth but no less than 8 inches, unless otherwise approved.

   3. Straightness tolerance: 1/8 inch in 10 feet from true plane surface along top; 1/4 inch in 10 feet along face.

   4. Locking provisions at ends of abutting form sections.

   5. Wood forms complying with the above provisions, including base and locking, may be used only where form of less than 10 feet is required.

6. Wet screeds will not be permitted.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars:
   1. Provide deformed bars complying with the following, except where otherwise indicated.

   2. Grade 60, AASHTO: M31

B. Welded Wire Fabric:
   1. Shall meet the requirements of AASHTO: M55

C. Reinforcing Accessories:
   1. Tie wire: Black annealed type, 16-1/2 gage or heavier.
      A. Galvanized when used with galvanized reinforcing.

   2. Supports: Bar supports conforming to specifications of CRSI "Manual of Standard Practice."

2.03 CONCRETE MATERIALS

A. Portland Cement: Portland Cement is to meet the requirements of AASHTO: M85, Type I

B. Water:
   1. Potable, which shall be clear and free from oil, salt, acid, alkali, organic and other injurious substances.

C. Aggregates:
   1. Normal weight concrete: Size No. 10

   2. Maximum size of coarse aggregates: Class A or B, Crushed Stone or Gravel meeting the requirements of the referenced documents.

2.04 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Burlap: AASHTO M 182, Class 2 jute or kenaf cloth

B. Moisture-Retaining Cover:
   1. ASTM C 171, and as follows:
      a. Waterproof paper

      b. Polyethylene film

      c. White burlap-polyethylene sheeting.

C. Bonding Compound: Non-redispersable acrylic bonding admixture, ASTM C 1059-91, Type II.

2.05 JOINT MATERIAL

A. Backer Rods: Shall be a Type-L, closed-cell expanded polyethylene foam backer rod.

B. Expansion Joint Filler: Non-extruding bituminous type meeting the requirements of ASTM D 1751.

C. Expansion Joint Cap: The expansion joint cap shall be Bo Metals, Inc. Product Number 1120.

2.06 CONCRETE MIX DESIGN

A. Required Average Strength: Establish the required average strength f(cr) of the design

mix on the basis of either field experience or trial mixtures as specified in ACI 301, and proportion mixes accordingly.

B. Specified Compressive Strength f'(c) at 28 Days for Locations as Indicated on Drawings:
   1. Pavement: 4000 psi.

C. Admixtures: Do not use admixtures not specified or approved.

D. Mix Adjustments: Requests for adjustment to approved concrete mixes when circumstances such as changed project conditions, weather, or unfavorable test results occur are allowed if no additional expense to Owner is involved. Include laboratory test data substantiating specified properties with mix adjustment requests.

2.07 CONTROL OF MIX IN THE FIELD

A. Slump: A tolerance of up to 1 inch above approved design mix slump will be permitted for 1 batch in 5 consecutive batches tested. Concrete of lower slump than that specified may be used, provided proper placing and consolidation is obtained.

B. Do not use batches that exceed tolerances.

2.08 CONCRETE MIXING

A. Transit Mixers: Mix concrete materials in transit mixers, complying with requirements of ASTM C 94.

PART 3 - EXECUTION

3.01 CONCRETE FORM PREPARATION

A. General
   1. Comply with requirements of ACI 301 for formwork and as specified. The contractor is responsible for design, engineering, and construction of formwork, and its timely removal.

B. Construction
   1. Construct and brace formwork to accurately achieve results required by contract documents, properly located and accurately aligned. Provide for screeds, bulkheads, anchorages, and other features shown or otherwise required.

3.02 CONNECTION TO EXISTING CONCRETE

A. Preparation
   1. At locations where new concrete is to join existing concrete, prepare existing surface by cleaning with wire brush and applying bonding compound in accordance with manufacturer's instructions.

3.03 PLACING REINFORCEMENT

A. General
   1. Comply with requirements of ACI 301 and as herein specified.

B. Preparation
   1. Clean reinforcement of loose rust and mill scale, soil, and other materials that adversely affect bond with concrete.

C. Placement
   1. Place reinforcement to achieve no less than minimum concrete coverages required for protection. Accurately position, support, and secure reinforcement against displacement. Provide Class C tension lap splices complying with ACI 318 unless otherwise indicated. Do not field-bend partially embedded bars unless otherwise indicated or approved.

2. Use approved bar supports and tie wire, as required. Set wire ties to avoid contact with or penetration of exposed concrete surfaces. Tack welding of reinforcing is not permitted.

3. Wire fabric is to be in maximum lengths possible, lapping adjoining pieces not less than one full mesh. Offset end laps to prevent continuous laps in either direction, and splice laps with tie wire.

D. Welding: Welding of reinforcement is not permitted.

3.04 JOINT CONSTRUCTION

A. General
1. Submit proposed joint layout for concrete paving.

2. Construct joints in adjacent panels in precise alignment. Do not offset joints.

3. Tool slab edges and formed joints with 1/4inch radius jointing tool.

B. Expansion Joints
1. Firm support of filler during placement of concrete to ensure accurate alignment.

2. Expansion joint filler to the full concrete depth.

3. Recess top edge of filler to the depth indicated to accommodate joint sealant. Protect top edge of filler with removable metal channel while concrete is being placed or with removable portion of the required depth.

C. Sawn Contraction Joints
1. Use only wet saws of an approved type.

2. Time sawing to occur before cracking occurs but after concrete has hardened sufficiently to avoid rough joint surfaces.

3. Extend saw cut to full width of concrete section, including adjacent curbs and gutters, if any.

3.05 CONCRETE PLACEMENT

A. Preparation
1. Construct materials necessary to ensure adequate protection of concrete during inclement weather before beginning installation of concrete.

B. Inspection
1. Before beginning concrete placement, inspect formwork, reinforcing steel, and items to be embedded, verifying that all such work has been completed.

C. Placement - General
1. Comply with requirements of ACI 304 and as follows.

2. Schedule continuous placement of concrete to prevent the formation of cold joints.

3. If a section cannot be placed continuously, provide keyed construction joints with tie bars of size and spacing.

4. Deposit concrete as close as possible to its final location, to avoid segregation.

D. Slab Placement
1. Schedule continuous placement and consolidation of concrete within planned construction joints.

2. Thoroughly consolidate concrete without displacing reinforcement or embedded items, using internal vibrators, vibrating screeds, roller pipe screeds.

E. Cold Weather Placement:
1. Comply with recommendations of ACI 306 when air temperatures are expected to drop below 40 degrees F either during concrete placement operations or before concrete has cured.

2. Do not use frozen or ice-laden materials.

3. Do not place concrete on frozen substrates.

3.06 FINISHING PAVEMENTS

A. Finishing Operations-General:
1. Do not directly apply water to slab surface or dust with cement.

2. Use hand or powered equipment only as recommended in ACI 302.1R.

3. Screeding: Strike off to required grade and within surface tolerances indicated. Verify conformance to surface tolerances. Correct deficiencies while concrete is still plastic. Bull Floating: Immediately following screeding, bull float or darby before bleed water appears to eliminate ridges, fill in voids, and embed coarse aggregate. Recheck and correct surface tolerances.

5. Do not perform subsequent finishing until excess moisture or bleed water has disappeared and concrete will support either foot pressure with less than 1/4-inch indentation or weight of power floats without damaging flatness.

6. Final floating: Float to embed coarse aggregate, to eliminate ridges, to compact concrete, to consolidate mortar at surface, and to achieve uniform, sandy texture. Recheck and correct surface tolerances.

B. Broomed Float Finish:
1. After floating and water sheen has practically disappeared, apply uniform transverse corrugations approximately 1/16 inch deep, without tearing surface.

C. Slab Surface Tolerances:
1. Achieve flat, level planes, except where grades are indicated. Slope uniformly to drains.

2. Flatness tolerance: Maximum depression between high spots when measured by placing a 10-foot straightedge on surface at any orientation: 1/4 inch.

D. Repair of Slab Surfaces:
1. Test slab surfaces for smoothness and verification of surface plane to tolerance specified. Repair defects as follows:

a. High areas: Correct by grinding after concrete has cured for not less than 14 days.

b. Low areas: Immediately after completion of surface finishing operations, cut out low areas and replace with fresh concrete. Finish repaired areas to blend with adjacent concrete.

3.07 CONCRETE CURING AND PROTECTION

A. General

1. Prevent premature drying of freshly placed concrete and protect from excessively cold or hot temperatures until concrete has cured.

2. Cure concrete by one of the methods listed and as appropriate to service conditions and type of applied finish in each case.

B. Curing Period
   1. No less than 7 days for standard cements and mixes.

C. Surfaces Not in Contact with Forms:
   1. Start initial curing as soon as free water has disappeared, but before surface is dry.

   2. Keep continuously moist for not less than 24 hours by uninterrupted use of any of the following:
      a. Water ponding

      b. Water-saturated sand

      c. Water-fog spray

      d. Saturated burlap: Four (4") inch minimum overlap at joints

   3. Begin final curing procedures immediately following initial curing and before concrete has dried.
      a. Moisture-retaining cover: Lap not less than 3 inches at edges and ends, and seal with waterproof tape or adhesive. Repair holes or tears during curing period with same tape or adhesive. Maintain covering in intimate contact with concrete surface. Secure to avoid displacement.
         1) Extend covering past slab edges at least twice the thickness of slab.
         2) Do not use plastic sheeting on surfaces which will be exposed to view when in service.

   4. Continue final curing to end of curing period.

D. Avoid rapid drying at end of curing period.

E. Ensure that joints and slab edges receive adequate curing.

F. Ensure that sawn joints receive adequate curing after sawing.

G. During and following curing period, protect concrete from temperature changes of adjacent air in excess of 5 degrees F per hour and 50 degrees F per 24 hours. Progressively adjust protective measures to provide uniform temperature changes over entire concrete surface.

3.08 REMOVAL OF FORMS AND SUPPORTS

A. Remove forms when concrete has hardened sufficiently that it will not be damaged, forms may be removed after concrete has cured at not less than 50 degrees F for 8 hours. Maintain curing and protection operations after form removal.

3.09 QUALITY CONTROL TESTING DURING CONSTRUCTION

1. Composite Sampling, and Making and Curing of Specimens: ASTM C 172/C172M and ASTM C31/C31M-186. Take samples at point of discharge.

2. For pumped concrete, perform sampling and testing at the frequencies specified herein at point of delivery to pump, and perform additional sampling and testing at the same frequency at discharge from line. Results obtained at discharge from line shall be used for acceptance of concrete.

B. Slump: ASTM C 143. One test per batch.
   1. Modify sampling to comply with ASTM C 94.

C. Concrete Temperature:
   1. Test hourly when air temperature is 40°F or below.
   2. Test each time a set of strength test specimens is made.

D. Compressive Strength Tests: ASTM C 39
   1. Compression test specimens: Mold and cure one set of 4 standard cylinders for each compressive strength test required.

   2. Testing for acceptance of potential strength of as-delivered concrete:
      a. Obtain samples on a statistically sound, random basis.
      b. Minimum frequency:
         1) One set per 100 cubic yards or fraction thereof for each day's pour of each concrete class.
         2) One set per 3500 square feet of slab area or fraction thereof for each day's pour of each concrete class.
         3) When the above testing frequency is fewer than 5 strength tests for a given class of concrete during the project, conduct testing from not less than 5 randomly selected batches, or from each batch if fewer than 5.

      c. Test one specimen per set at 7 days for information unless an earlier age is required.

      d. Test 2 specimens per set for acceptance of strength potential; test at 28 days unless other age is specified. The test result shall be the average of the two specimens. If one specimen shows evidence of improper sampling, molding, or testing, the test result is to be the result of the remaining specimen; if both show such evidence, discard the test result and inform the Engineer.

      e. Retain one specimen from each set for later testing, if required.

      f. Strength potential of as-delivered concrete will be considered acceptable if all of the following criteria are met:
         1) No individual test result falls below specified compressive strength by more than 500 psi.
         2) Not more than 10 percent of individual test results fall below specified compressive strength f'(c).
         3) Average of any 3 consecutive strength test results equals or exceeds specified compressive strength f'(c).

   3. Testing for evaluation of field curing:
      a. Frequency: 1 field set of specimens per strength acceptance test.
      b. Mold specimens from same sample used for strength acceptance tests.
      c. Field-cure, and test at same age as for strength acceptance tests.
      d. Evaluate construction and curing procedures and implement corrective action when strength results for field-cured specimens are less than 85 percent of test values for companion laboratory-cured specimens.

E. Test Results:
   1. Testing agency is not report test results in writing to Owner, Architect, Engineer and Contractor within 48 hours of test.

      a. Test reports shall contain the following data:
         1) Project name, number, and other identification
         2) Name of concrete testing agency

3) Date and time of sampling
4) Concrete type and class

b. Location of concrete batch in the completed work

c. All information required by respective ASTM test methods.

2. The testing agency is to make additional tests of in-place concrete as directed by the Engineer when test results indicate that specified strength and other concrete characteristics have not been attained.

a. Testing agency is allowed to conduct tests of cored cylinders complying with ASTM C 42, or other tests as directed.

b. Cost of additional testing shall be borne by the contractor when unacceptable concrete has been verified.

3.10 OPENING PAVEMENTS TO TRAFFIC

A. Do not allow traffic, including construction traffic, on pavements until authorized.

B. Pavements may be opened to traffic only after 7 days have elapsed after placement and pavements have developed at least 85 percent of specified strength.

END OF SECTION

SECTION 32 16 00

CURBS AND GUTTERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work specified in this Section includes complete labor, materials, equipment and incidentals necessary to perform all curb and gutter, sidewalks and other miscellaneous concrete construction. This includes grading, forms and concrete.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 00: Earthwork

B. Section 32 11 23 Aggregate Base Course

C. Section 32 13 13: Concrete Paving

1.03 REFERENCE DOCUMENTS

A. State of Georgia Department of Transportation, Standard Specification, 2013 Edition.

B. ASTM D1751, Standard Specification for Performed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types); 2018.

PART 2 - PRODUCTS

2.01 CONCRETE

A. Concrete is to be 3,000-p.s.i. strength at 28 days. Materials, proportioning, mixing and placing concrete shall be in accordance with Georgia Department of Transportation Standard Specifications Construction of Roads and Bridges, 2013 Edition.

2.02 EXPANSION JOINT MATERIAL

A. Expansion joint of 1/2" thick mineral fiberboard, asphalt impregnated, conforming to ASTM D1751.

2.03 FORMS

A. Forms are to conform to the requirements of the reference documents.

2.04 JOINT SEALANT

A. Shall be as per Section 32 13 13 – Concrete Paving.

PART 3 - EXECUTION

3.01 SUBGRADE

A. Subgrade and undisturbed earth prepared, graded and compacted in accordance with Section 31 00 00 - Earthwork.

3.02 FORMING

A. Curb and gutter formed straight, free from warp and braced to resist springing during concrete placement.

B. Extruded machine applied to size and shape as detailed.

3.03 CONTROL JOINTS

A. Place 1/8" thick steel separators conforming to profile of curb; maximum 10' o.c., install at right angle to alignment; where paving abuts gutters and fixed objects, joints to be opposite and in line with pavement contraction joints.

3.04 REMOVAL

A. Remove separators after concrete has set to preserve width and shape of joints. After separator plates are removed, exposed edges of joints are to be rounded with edging tool having 1/4" radius.

END OF SECTION 32 16 00

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work specified in this section includes parking striping and directional markings on asphaltic concrete and concrete paving, as indicated on the drawings.

1.02 REFERENCE DOCUMENTS

A. Georgia Department of Transportation Standard specifications Construction of Roads and Bridges, 2013 edition.

1.03 SUBMITTALS

A. Product data: Submit for marking paint and thermoplastic. Indicate application methods and rates.

1.04 JOB CONDITIONS

A. Weather limitations

1. Apply pavement marking paint and thermoplastic only when the ambient temperature in the shade is at least 40ºF for 12 hours immediately prior to application.

2. Do not apply when surface is wet or contains moisture.

3. Do not apply paint when wind conditions would result in debris being deposited on painted surfaces.

1.05 WARRANTY

A. Warrant paving marking paint for 1 year against material defects and /or fading.

PART 2 - PRODUCTS

2.01 PAVEMENT MARKING PAINT

A. Site Traffic lane, parking stall and direction arrow marking paint: Type meeting Georgia Department of Transportation Standard Specifications, 2013 Edition.

B. Qualities: Quick drying, colors as shown on the drawings.

C. Thermoplastic shall be per Georgia Department of Transportation Standard Specifications, 2013 Edition.

PART 3 - EXECUTIONS

3.01 MARKING PAVEMENTS:

A. Paint Lines as shown on approved drawings.

B. Cleaning: Sweep surface with power broom, supplemented by hand brooms, to remove loose material and dirt. Do not begin pavement marking until substrate has cured.

C. Apply paint with mechanical equipment to uniform straight lines. All line work not otherwise indicated must be 4" uniform thickness. All directional markings are to be painted using spray equipment and stencils or templates of approved design to prevent overspray. Apply one coat in accord with manufacturer's recommended rates to achieve minimum 15 mils dry film thickness.

D. Apply thermoplastic by an extrusion method wherein one side of the shaping die is the pavement and the other three sides are contained by or are part of suitable equipment for heating and controlling the flow of material, or it must be applied by spray techniques. The application shall be in accordance with Georgia Department of Transportation Standard Specification.

END OF SECTION

SECTION 32 92 00

TURF AND GRASSES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work specified in this Section includes total labor, materials, equipment, and incidentals necessary to perform all seedbed preparation, liming, fertilizing, seeding, and mulching of all newly graded finish earth surfaces, unless indicated otherwise, and all areas inside or outside the limits of construction that are disturbed.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 25 00 Erosion and Sediment Controls

1.03 REFERENCE DOCUMENTS

A. Manual for Erosion and Sediment Control in Georgia, 2016 edition.
B. ASTM 01751, Standard Specification for Performed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types); 2018.
C. ASTM C602-13a, Standard Specification for Agricultural Liming Materials; 2013.

1.04 SUBMITTALS

A. Certificates of Conformance from manufacturers:
    1. Seed
    2. Fertilizer
    3. Lime

1.05 DELIVERY

A. Fertilizer and Lime: Deliver materials to the site in the original, unopened containers bearing the manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. In lieu of containers, furnish fertilizer and lime in bulk with a certificate indicating the above information accompanying each delivery.

B. Seed: Deliver seed to the site in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content and inert material. Label in conformance with USDA Federal Seed Act 53 Stat. Rules and Regulations and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected.

1.06 STORAGE AND HANDLING

A. Store lime, fertilizer, and seed in dry locations away from contaminants. Protect seed from dying out. When handling materials, do not drop or dump from vehicles.

PART 2 - PRODUCTS

2.01 SEED

A. Permanent and temporary seeding are to be in accordance with the Manual for Erosion and Sediment Control in Georgia, 2016 Edition.

Mulch is to be applied to seeded areas within 24 hours after temporary and permanent seeding operations. Mulch must be free of noxious weeds and applied at a rate of approximately 70 lbs/1,000 square feet (3.000 lbs/acre).

On areas where ground surface exceeds approximately five (5%) slopes, the mulch must be tacked using a sufficient amount of binding material to hold mulch in place.

B. SEEDBED PREPARATION

1. Work lime and fertilizer into the soil where conventional equipment can be used. Use disk or similar equipment to prepare to depth of 3-4 inches. Use ripper if necessary.

2. Lime and fertilizer may be applied with seed mixture when hydroseeding is used and where mulch will be applied. Seedbed preparation may not be necessary where hydroseeding equipment is used.

3. Slopes that are too steep for conventional equipment (2:1 or steeper) must be seeded with hydroseeding equipment.

Where hydroseeding equipment is not available for use on steep slopes, scarify the soil surface with a chain harrow, pick chain, grader blades with chisels, hand tools, or other equipment that will pit the soil or make trenches approximately 1-2 inches deep, 6-12 inches apart across the slope so the seed can lodge and germinate.

2.02 LIME

A. ASTM C 602, commercial agricultural limestone containing a minimum of 94 percent of total carbonates, 52 percent calcium, and 42 percent magnesium. Provide the following ASTM E11 gradation: minimum 100 percent passing the No. 20 sieve and 75 percent passing the No. 100 sieve. Application rates shall be as recommended by the Applicable State Soil Conservation District Standards or Local NRCS Office Standards.

2.03 FERTILIZER

A. Commercial grade, free flowing, uniform in composition and bearing the manufacturer's guaranteed statement of analysis. Analysis of fertilizer and application rates shall be as recommended by the Applicable State Soil Conservation District Standards or Local NRCS Office Standards through soil testing procedures and in accordance with the Manual for Erosion and Sediment Control in Georgia, 2016 Edition.

2.04 MULCH

Free from noxious weeds, mold, or other deleterious material. Use wood cellulose fiber when hydroseeding.

A. Straw: Stalks from oats, wheat, rye, barley, or rice. Furnish air-dry condition and of proper consistency for placing with commercial mulch-blowing equipment

B. Wood Cellulose Fiber: Processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of materials application. Composition on air-dry weight basis: 9-15 percent moisture, pH range 3.5 to 5.0.

2.05 WATER

A. Suitable quality for irrigation.

PART 3 – EXECUTION

3.01 SEEDBED PREPARATION

A. Areas required to be seeded is to have been brought to the required subgrade. New areas to be seeded are to be thoroughly tilled to a minimum depth of four (4) inches by scarifying, disk harrowing, or other approved methods. Remove debris and stones larger than one inch remaining on the surface after tillage.

1. Fertilizer and Lime: Apply fertilizer and lime at the rates recommended by Applicable State Soil Conservation District Standards or Local NRCS Office Standards.

2. Drill Seeding for New Seeding: Incorporate fertilizer and lime into the soil to a minimum depth of four (4) inches. Application may be performed as part of the tillage operations.

3. Hydroseeding: Apply liquid fertilizer in amounts recommended by Applicable State Soil Conservation District Standards or Local NRCS Office Standards. Apply lime manually.

3.02 SEEDING

A. Seeding Conditions: Immediately before seeding, restore soil to the proper grade. Do not seed when the ground is muddy or in any unsatisfactory condition for seeding.

B. Seeding Method:
1. Apply seed within 24 hours after seedbed preparation.

2. Sow seed with approved sowing equipment using one or a combination of the following methods.

3. Sow one-half the seed in one direction and sow remainder at right angles to the first sowing.

C. Drill Seeding:
1. Use cultipacker seeders or grass seed drills.

2. Drill seed uniformly to maximum depth of ¼" clay soils and ½" in sandy soils.

3. Cover seed by spike-tooth harrow, cultipacker, or other approved devices.

D. Hydroseeding: Mix seed, fertilizer, and wood cellulose fiber in required amount of water to produce a homogenous slurry. After seed, water, and fertilizer have been thoroughly mixed, add 1,500 pounds of wood cellulose fiber per acre (dry weight) and apply the slurry. Seed is not to remain in water containing fertilizer for more than one (1) hour prior to application and is to be agitated during application.

3.03 PROTECTION OF SEEDED AREAS

A. Immediately after seeding, protect the area against traffic and other use by erecting barricades, as required, and placing approved signs at appropriate intervals until final acceptance.

3.04 RESTORATION

A. Restore to original condition existing lawn areas that have been damaged during seeding operations. Clean paving when work in adjacent areas is complete.

3.05 LAWN

A. Duration: Lawn establishment period will be in effect until final acceptance.

B. Maintenance: During turf establishment period, mow the seeded area to an average height of two (2") inches whenever the average height of grass becomes four (4") inches. Remove excess clippings, eradicate weeds, apply water and/or fertilizer, overseed, and perform other operations necessary to promote turf growth.

3.06 FINAL ACCEPTANCE

A. Final Inspection and Acceptance: At the end of the turf establishment period, final inspection will be made upon written request at least 10 days prior to the anticipated date. Final acceptance will be based upon a satisfactory stand of turf, defined as 95 percent ground cover of the established species.

B. Replanting: In areas which do not have a satisfactory stand of turf, replant as directed.

END OF SECTION

SECTION 33 10 00

WATER UTILITIES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work specified in this Section includes complete labor, materials, equipment and incidentals necessary for the installation of the exterior water distribution system as shown on the drawings and as specified. The Work shall include all necessary concrete work, diking, pumping, bailing, draining, flushing, soil erosion and sedimentation control, and testing. These Specifications cover mains and water service connections complete. The water mains shall be installed in the locations indicated on the Contract Documents.

B. The Contractor shall arrange his work so as to minimize interference with pedestrian and vehicular traffic, and to avoid interruption of service of any existing utilities. The Contractor shall furnish and maintain suitable bridges, footways, or other means of access to or across intercepted streets, alleys, driveways and walkways, where necessary.

C. The Contractor shall be responsible for removing all water from excavations and trenches whether from surface or ground sources.

D. The Contractor shall guarantee all material and workmanship for a period of one (1) year from the date of final acceptance of the Work. If during this period any material or workmanship, proves defective, the Contractor shall repair same at his own cost and expense and to the satisfaction of the Owner.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 00: Earthwork

B. Section 31 10 00: Site Clearing

C. Section 31 23 00: Excavation and Fill

1.03 REFERENCED DOCUMENTS

A. Paulding County Development Regulations, Current Edition.
B. National Fire Protection Association (NFPA)
C. American Water Works Association (AWWA)
D. AWWA C151/A2.51-17, AAWA Standard for Ductile Iron Pipe, Centrifugally Cast; 2017.
E. AWWA C550-90, Protective Expoxy Interior Coatings for Valves and Hydrants; 1990.
F. AWWA C104, AAWA Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings; 2008.
G. AWWA C111/A2.11-17, AWWA Standard for Rubber Gasket Joints for Ductile-Iron Pressure; 2017.
H. ANSI B1.1, ANSI Standard for Unified Inch Screw Thread Series; 2003.
I. ASME B17.2-1967 (Last Revised 2013), Standard for Woodruff Keys and Keyseats; 2013.
J. AWWA C509-15, AWWA Standard for Resilient-Seated Gate Valves for Water Supply Service; 2015.
K. AWWA C502, AWWA Standard for Dry-Barrel Fire Hydrants; 2014.
L. AMES 1013-2011, AMES Standard for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2013.
M. AWWA C600, AWWA Standard for Installation of Ductile Iron Mains and their Appurtenances; 2017.
N. AWWA C651-14, AAWA Standard for Disinfecting Water Mains; 2014.
O. GA Rules for Safe Drinking Water, Chapter 391-3-5.

1.04 QUALITY ASSURANCE

A. The types of valves and appurtenances must be the products of firms fully experienced and qualified in the manufacture of the particular material to be furnished.

B. Additional temporary piping, pumps, and equipment necessary for the successful testing of the system must be furnished. All materials to be incorporated into the work must be new and unused.

C. Total material must meet the requirements of the governing authority.

1.05 SUBMITTALS

A. Submit within thirty (30) days after execution of the contract a list of materials to be furnished, the names of the suppliers, and the date of delivery of materials to the site.

B. Complete shop drawings of entire piping, valves, and appurtenances are required.

C. Submit record drawings of the water lines including but not limited to, locations, materials, and appurtenances labeled.

PART 2 - PRODUCTS

2.01 GENERAL

A. Furnish total pipe fittings, valve tapping sleeves, hydrants, and other material required for the completion of the work as shown on the approved drawings or indicated by these specifications.

2.02 WATER MAIN

A. Ductile Iron Pipe
Ductile Iron Pipe shall conform to AWWA C 151 (ANSI A21.51) and shall be a minimum of pressure class 350 or thickness Class 50 unless otherwise specified or shown on the Standard Details. Sizes will be as shown. All pipes shall be furnished in minimum lengths of 18 feet. Pipe and fittings shall be cement lined in accordance with AWWAC 104. Fittings shall be mechanical joint compact ductile iron and conform to AWWA 153 with rated working pressure of 350 psi or AWWA C 110. Pipe and fittings shall be furnished with a bituminous outside coating.

B. Joints shall be push-on type for pipe and standard mechanical joints for fittings with the exception of hydrant fittings. Fittings for bends and hydrants shall be mechanical joint with retainer glands. Hydrant tees used in lieu of retainer glands and harness rods on fire hydrants shall be equal to ACIPO A10180 or US Pipe U-592. Anchor couplings used in lieu of retainer glands and harness rods on fire hydrant leads shall be American A-10895 or approved equal. Joints shall conform to AWWA C 111. Provide and install the appropriate gaskets, nuts and bolts for mechanical joints. Nuts shall be steel with American Standard Regular hexagonal dimensions, as specified in ANSI B 17.2.

C. All bolts and nuts shall be threaded in accordance with ANSI B. 1.1, Coarse Thread Series, Class 2A and 2B fit.

D. When flanged joints are indicated, provide gaskets for flange joints made of 1/8-inch thick cloth reinforced rubber. Gaskets may be ring type or full-face type.

E. Provide bolts for flange connections. Bolts shall be steel with American Regular unfinished square or hexagonal dimensions, all as specified in ANSI B 17.2. All bolts shall be threaded in accordance with ANSI B 1.1, Coarse Thread Series, Class 2A and 2B fit.

F. When flanged joints are indicated, provide gaskets for flange joints made of 1/8 inch thick cloth reinforced rubber. Gaskets may be ring type or full-face type.

G. Provide bolts for flange connections. Bolts shall be steel with American Regular unfinished square or hexagonal heads. Nuts shall be steel with American Standard Hexagonal dimensions, as specified in ANSI B 17.2. All bolts and nuts shall be threaded in accordance with ANSI B 1.1, Coarse Thread Series, Class 2A and 2B fit.

H. Detection Wire
Provide 14 gauge insulated copper wire for warning and identification of buried water piping.

2.03 VALVES

A. Buried valves must be equipped with cast iron valve boxes. Extension stems will be provided where required. Valves must be manufactured by Mueller, American Flow Control, M & H, or equal as approved by the County.

Valve markers must be installed for each valve excluding fire hydrant valves. Valve markers, where appropriate, must be located at the back of the right-of-way.

Gate Valves

A. Gate valves size 3-inches and larger shall be resilient seat wedge type and shall conform to the Specifications of the American Water Works Association, Designation C509, latest edition rated for 200 psi minimum working pressure. Gate valves shall be equipped with "O" ring stem seals above and below stem thrust collar. Gate valves for use on mechanical joint ends. Gate valve body and bonnet shall be ductile or cast iron and shall be fusion bonded, interior and exterior, with epoxy coating conforming to AWWA C-550, latest edition.

B. Water Mains in which the valves are installed shall be tested as specified and the valve must remain water tight under this pressure in each direction.

C. Valves shall open counter clockwise (no exceptions will be allowed); shall be designed for vertical installation; and shall be the non-rising stem type.

D. Valves shall be equipped with valve boxes. Provide extension stem where required to bring the operating nut to within 36-inches of ground surface and shall have a 24" x 24" x 10" concrete collar poured in place. Trowel level with ground surface.

1. All gate valves shall be manufactured by Mueller or M & H Valve.

2. Gate valves 2-1/2 inches in diameter and smaller shall be bronze, heavy duty, rising stem (2-1/2 inches and smaller only), rated for 200 psi WSP. Valves shall conform to Federal Specification WW-V-54, Class A, Type II, and shall be equal to Crane 428.

E. Valve Boxes
All valve boxes and risers shall be cast or ductile iron. Valve boxes shall be two-piece heavy roadway type with inside diameter barrael of no less than 5-inches. Valve covers shall weigh a minimum of 13 pounds. They shall be the extension type with screw-type adjustment and with flared base. The minimum thickness of metal shall be 3/16 inch. The word "WATER" shall be cast on the cover. The boxes shall be of such length as will be adapted without full extension, to the depth of cover required over the pipe and at the valve location. All valve boxes and valve box risers shall be manufactured in USA only.

F. Post Indicator Valves
Post Indicator Valve shall be non-adjustable indicator post manufactured by Mueller.

2.04 TAPPING VALVES AND SLEEVES

A. Tapping sleeves greater than two (2") inches must be of the split sleeve, mechanical joint type. Valves are to be gate valves in accordance with the specifications shown above,

with flanged connection to the tapping sleeve and mechanical joint connection to the branch pipe. The necessary bolts, glands, and gaskets must be furnished. Tapping sleeves and valves must be cast iron pipe or ductile iron. Pre-fabricated tapping sleeves may be used on PVC and AC Pipe upon approval by the County.

2.04 FIRE HYDRANTS

A. Fire hydrants must be designed for 150 psi working pressure and must be of the compression type opening against and closing with the pressure. Hydrants must be of the dry top construction type with the operating nut and threads completely sealed away from the hydrant barrel with a grease or oil reservoir. Hydrants must be designed so internal working parts can be removed through the top without digging, including the bronze seat ring. The bronze seat ring must screw into a bronze insert in the hydrant base or an annular bronze drain right for each disassembly of the hydrant. Hydrants must have a minimum main valve opening of 5 ¼", be of the traffic model type, with 2-2½" hose nozzles and 1-4½" steamer nozzle and must have a 6" mechanical joint hub inlet for connection to street main. Threads on nozzles and operating nut must be furnished in accordance with the County Standards. Fire hydrants must be Mueller Centurian, M & H Style 129, American Flow Control, or an approved equal. All fire hydrants must be manufactured in accordance with AWWA Specifications C502, latest revision.

2.06 FIRE LINES

A. A double detector check (DDC) and vault are to be installed on all privately owned fire lines.

2.07 METERED SERVICES

A. Service Pipe: Service Pipe must be Copper Typak water service tubing for ¾" and 1" services and Schedule 40 PVC for 2" water services, and must be installed with detection sire.

B. Fittings: Fittings for service tubing must be required sizes and standard brass compression type waterworks fittings. Stiffeners inside pipe are to be plastic and are not to extend beyond the outside end of the packing nut when tightened.

C. Backflow Preventers: Backflow preventers must be reduced pressure zone type, double check and dual check type as determined by the County Specifications. Backflow preventers must be certified by a USC laboratory as conforming to current requirements or ASSE 1013, or USC-FCCC. The installation must meet all applicable State, and AWWA-14, and local codes.

Backflow preventers must be manufactured by Hersey (Becco), Watts Febco, Ames or approved equal.

2.08 MATERIAL INSPECTION AND ACCEPTANCE

A. Acceptance of all water pipe and appurtenances are based on the County inspection and manufacturer's written certification that the pipe was manufactured and tested in accordance with all applicable standards.

B. Each pipe is to be clearly marked as required by the governing ASTM Standard Specifications to show its class, date of manufacture and the name and trademark of the manufacturer.

C. Latitudes in workmanship and finish allowed by the ASTM Specifications notwithstanding, all pipe is to be first quality, have smooth exterior and interior surfaces and be free from cracks, blisters and other imperfections, and true to theoretical shapes and forms throughout each length. All pipe is subject to inspection by the County at the pipe plant, trench and other points of delivery for the purpose of culling and rejecting pipe, independent of laboratory tests. Pipe that does not conform is to be marked as such

by the County and is not be delivered or used in the work. On-the-job repairing of rejected pipe will not be permitted.

D. Any pipe or special items which have been broken, cracked, or otherwise damaged before or after delivery or which have failed to meet the required tests, must be removed from the site of the work and must not be used therein.

PART 3 - EXECUTION

3.01 TRENCHING, BACKFILLING AND COMPACTION

A. Trenching, backfilling and compaction is to be in accordance with applicable requirements of Section 31 23 00.

3.02 PIPE INSTALLATION

A. Proper and suitable tools and appliances for safe and convenient handling and laying of pipe and fittings shall be used. Great care shall be taken to prevent the pipe coating from being damaged particularly cement linings on the inside of the pipes and fittings. Any damage shall be remedied as directed.

B. All pipe and fittings shall be carefully examined by the Contractor for defects just before laying and no pipe or fitting shall be laid which is defective. If any defective pipe or fitting is discovered after having been laid, it shall be removed and replaced in a satisfactory manner with a sound pipe or fitting by the contractor at his own expense.

C. No pipe shall be laid in water. The Contractor will be required to operate pumps, if necessary, to remove water (whether from ground or surface sources) from the trench while pipe is being laid and joints are being made. When work is not in progress the ends of the pipe shall be closed to prevent water or other foreign material from entering the pipe. Valves installed on existing mains shall be kept closed until after the line is tested, disinfected, and accepted for service.

D. Pipe laid in trenches shall be laid true to line and grade on a firm and even bearing for its full length at depths and grades, as indicated. Adequate precautions shall be taken to prevent floatation of pipelines prior to backfilling. Installation of ductile iron pipe in underground pressure piping systems shall conform to the requirements of AWWA C600. Excavation of trenches and backfilling around pipes shall conform to the requirements of the Section titled, “Excavation. Trenching, and Backfilling” of these Regulations.

E. All water mains shall have a minimum of 48-inches of cover above the top of the pipe or 48-inches below edge-of-pavement, whichever is greater.

F. Water mains shall maintain a minimum of 10 feet edge-to-edge horizontal separation from sewer lines, whether gravity or pressure. If the main cannot be installed in the prescribed easement or right-of-way and provide the 10 feet separation, the separation may be reduced provided the bottom of the water main has a minimum vertical separation of 18-inches above the top of the sewer. Should neither of these two separation criteria be possible, the water main shall be installed below the sewer with a minimum vertical separation of 18-inches. Where waterline cross gravity sewer lines, encase sewer line fully in concrete for a distance of at least 10-feet on each side of the crossing. Lay water line which cross sewer force mains and inverted siphons at least 2 feet above; when joints in the sewer line are closer than 3-feet horizontally from the water line, encase these joints in concrete. Do not lay waterline in the same trench with gas lines, fuel lines, or electric wiring. No water main shall pass through or be exposed to any part of a sanitary sewer manhole.

G. All elbows, trees, branches, crosses and reducers in pressure piping systems shall be adequately restrained against thrust. Underground pressure piping containing unharnessed push-on or mechanical joints or expansion joints shall be restrained by thrust

blocks. The Contractor may use forms or earth walls to mold the thrust blocks. When earth walls are used, they shall be cut true to shape and all excess earth removed. The work shall be conducted so that no loose earth will become mixed with concrete. At the end of 24-hours, damp earth may be placed over the concrete to retain moisture.

H. All lumps, blisters, excess coating, dirt, and other objectionable substances shall be removed from the bells and spigots. Bells and spigots shall be wiped clean and dry. Bells shall be centered in the trench and spigots driven home.

I. The Contractor shall keep a transit and appurtenances on the job to be used for laying out the angles required for making bends and other works of this nature.

J. Add casing to all roads with transversing waterlines.

K. Bends, valves, and other points where deemed necessary shall be blocked and harnessed to resist thrust. All forms used to form concrete for blocking shall be removed before backfilling. All fire hydrants shall be harnessed as directed by the Local Jurisdiction Regulations and concrete blocking will be required to resist the thrust on fire hydrants. All stress points and ends of mains shall be inspected before backfilling.

L. Blow-Off Valves shall be installed at terminus of all dead end mains. The Local Jurisdiction shall approve method of installation. Refer to Standard Details for 2-inch blow-off details.

M. Whenever pipe requires cutting to fit the lines or install fittings, the work shall be done in such a manner as to leave a smooth end at right angles to the axis of the pipe. Special care shall be exercised to guard against breaking or splitting the existing piping.

N. All cutting of ductile iron pipe shall be done with a cutting saw. All burrs shall be removed from the inside and outside edges of all cut pipe.

O. Mechanical joints and restrained joints shall be made in strict accordance with the pipe manufacturer's instructions. The gaskets and follower rings shall be kept clean and carefully centered in the bell with the bolts and boltholes always parallel with the centerline of the pipe. The coating and lining of the pipe shall not be damaged. The nuts on all bolts shall be started and tightened evenly around the entire circumference of the pipe. No one nut shall be tightened more than ½ turn tighter than the remainder of the nuts of the joints. When the joint is complete, the follower ring shall be equal distance from (parallel with) the face of the bell. Bolts shall not be over-stressed and shall be tightened just enough to compress the gasket sufficient to prevent leakage. Just prior to assembly, the gasket shall be cleaned of all foreign material and shall be brushed with soapy water just before slipping the gasket over the spigot and into the bells of the pipes. The joints shall be in straight alignment during assembly. Any deflection required shall be made after assembly but before tightening bolts. Bolts shall be tightened with torque wrenches with the following torque loads applied:

Bolt Size	Foot Pounds
5/8	45-50
3/4	75-90
1	100-120
1-1/4	120-150

P. Push-on-Type joints shall be made in strict accordance with the pipe manufacturer's instructions. All joints shall be completely "belled-up" and all spigots shall be "home". The gasket seat in the socket, the gasket and plain end of the pipe to be entered shall be wiped clean before assembly. After the gasket has been inserted into the gasket recess, a thin film of lubricant shall be applied to the inside surface of the gasket and to the outside surface of the spigot end of the pipe to be jointed. After lubricating, the end of the pipe shall not be allowed to touch the bottom or side of the trench causing dirt to adhere to the joint surface. When pipe is cut in the field, the cut end of the pipe shall be beveled with a file or grinder. The joint shall be in straight alignment while pushing the pipe to make assembly. Any deflection required shall be made after the joint is assembled.

Q. Set screw type retainer glands shall be installed in strict accordance with the fitting manufacturer's instructions. After making up the mechanical joint as previously specified, the set screws shall be run down until they are in firm contact with the pipe. The set screws shall then be tightened once completely around the joint to approximately 40 foot-pounds torque. Finally, the set screws shall be tightened twice completely around the joint to the following torques, unless a "break away" torque is used:

3" through 12" glands – 80 foot-pounds
14" through 24" glands – 65 foot-pounds

R. Wedge type retainer glands shall be installed in strict accordance with the manufacturer's instructions. Impact wrenches shall be prohibited for used with "break-away" nuts for final tightening.

S. Retainer gland joints shall be made in straight alignment and any deflection required shall be made before tightening the joint bolts or set screws.

T. Deflection of any pipe at joints for long radius curves for avoiding obstacles shall be permitted in accordance with manufacturer's requirements.

3.03 METERED SERVICES

A. Metered services must be in accordance with the details of the specifications, local codes, and the details.

B. All service pipe is to be installed with detection wire.

C. Meter boxes must be level with ground surface with meter not less than 12" below surface.

D. All service connections are must be made before the new main has been tested and disinfected.

3.04 PRESSURE AND LEAKAGE TESTS

A. After the pipe has been installed, the complete pipeline shall be subjected to a hydrostatic pressure test.

B. Except as hereinafter allowed, the line shall be tested in sections not to exceed the distance from one line valve to the next adjacent line valve. Testing two sections through an open intermediate valve will not be allowed unless adjacent line valves are less than 300 feet apart. In no case will leakage from two or more adjacent sections be "averaged" to determine that the total section meets the leakage test. Each section of line or valved section of the line shall be tested as follows:

1. At all high points, where air release valves or fire hydrants have not been installed, the Contractor shall install corporation cocks to expel the air as the pipe is being slowly filled with water. After the pressure and disinfecting tests have been

completed, the corporation cocks shall be capped with brass caps and left in place. The location of said corporation cocks shall be marked on record Standard Details with dimensions measured from three (3) permanent structures.

2. A test pump shall be installed at the low point of the section being tested and the pipe shall be slowly filled with water.

3. After expelling all air at the high point, the corporation cocks shall be closed and the pressure increased to the required pressure at the test pump location. The test pressure shall be maintained within 5 psi for the duration of the test. All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi or 50 psi in excess of the system working pressure, whichever is greater, and shall maintain that pressure without loss for two hours. This requirement is per NFPA 24 section 10.10.2.2.1 2014 Edition.

4. The volume of water required by the test pump to maintain this excess pressure, which will represent the leakage, shall not exceed 0.14 gallons per hour per inch diameter per 1,000 feet of pipe.

5. Excess pressure and leakage test shall be successfully conducted for no less than 2 consecutive hours. Provide an accurate pressure gage with graduation no greater than 5 psi.
6. The Contractor shall, at his own expense, locate and make repairs as necessary until the leakage is within the specified allowances.
7. All visible leaks shall be repaired regardless of the amount of leakage.

C. The Contractor shall furnish all labor, equipment, and material necessary for to conduct tests, and shall furnish and install all temporary plugs and valves necessary to isolate the test sections. Water for test purposes will be furnished by the Contractor.

D. After completion and testing of the water distribution system provide the Owner with the Contractor's material and Test Certificates required by the National Fire Protection Association Standard 24.

3.05 DISINFECTION OF WATER MAINS

A. After successfully pressure testing each pipeline section, disinfect in accordance with AWWA C 651 for the continuous-feed method and the following Regulations.

B. Disinfection of New Mains
1. Disinfection of new mains and the disposal of the heavily chlorinated water, following the disinfection, must be accomplished in accordance with the latest edition of AWWA Standard C651.

2. Liquid chlorine in the form of sodium hypochlorite is to be used for disinfection. The "tablet method" of disinfection which consists of placing calcium hypochlorite granules or tablets in the water main as it is being installed and then filling the main with potable water when installation is complete is not allowed.

3. Before the main is chlorinated, it is to be filled to eliminate air pockets and be flushed to remove particulates. A flushing velocity of no less than 2.5 feet/second is typically maintained in pipe sizes less than 24 inches in diameter. For larger diameter mains, an alternative to flushing, such as broom-sweeping of the main, is acceptable prior to chlorinating the main.

4. During disinfection of the water mains, an appropriate cross-connection control device, consistent with the degree of hazard, is to be provided for backflow protection of the active distribution system.

5. The quality of water used during the disinfection procedures is to meet the required drinking water standards.

6. The chlorine solution used for disinfection of water mains must have a free chlorine residual concentration no less than 25mg/L. This heavily chlorinated water must be retained in the main for at least 24 hours, during which time all valves and hydrants must be operated to ensure disinfection of the appurtenances. At the end of the 24-hour period, the treated water in all portions of the main must have a residual of no less than 10 mg/L free chlorine. Re-chlorinate if required results are not obtained on all samples.

7. Disposal of Chlorinated Water: Reduce chlorine residual of disinfection water to less than 1 milligram per liter if discharged directly to a body of water, or to less than 2 milligrams per liter if discharged onto the ground prior to disposal. Treat water with sulfur oxide or other reducing chemicals to neutralize chlorine residual. Flush all lines until residual is equal to existing system.

C. Flushing
   1. After completing chlorination, flush the line with potable water and test for the amount of chlorine residual at the point of discharge until the chlorine residual is equal to the chlorine residual of the water used for flushing.

D. Sampling and Bacteriological Testing
   1. After final flushing and before the main is placed into service, the Contractor shall collect samples from the line to have tested for bacteriological quality. Testing shall be performed by the Contractor at a laboratory certified by the State of Georgia. Re-chlorinate lines until the required results are obtained. Contractor shall open all valves being a part of the system being tested upon approval of bacteriological testing.

   2. Two (2) sets of samples are to be collected, at least 24 hours apart, for each 1,200 feet of new main, plus one (1) set from the end of the line and one (1) set from each branch. All samples must be tested for bacteriological quality and must show the absence of coliform organism.

   3. If the initial disinfection tests positive, it is to be retested. Upon positive results from the retesting, the main must be rechlorinated until satisfactory results are obtained.

END OF SECTION

SECTION 33 30 00

SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work specified in this Section includes total labor, materials, equipment and incidentals necessary for the installation of sanitary sewer system. This includes but is not limited to pipe, joints, valves and other appurtenances necessary for a complete system.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 00: Earthwork
C. Section 31 23 00: Excavation and Fill
D. Section 31 25 00: Erosion and Sediment Controls

1.03 REFERENCE DOCUMENTS

A. Paulding County Development Regulations, Current Edition.
B. ASTM A746-18, Standards and Specifications for Ductile Iron Gravity Sewer Pipe; 2018.
C. ASTM C478-18, Standard Specifications for Circular Precast Reinforced Concrete Manhole Sections; 2018.
D. ASTM C443-12 (Revised 2017), Standard Specifications for Joints for Concrete Pipe and Manholes Using Rubber Gaskets; 2017.
E. ASTM C32, Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale); 2017.
F. ASTM D698, ASTM Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3)); 2012.
G. AWWA C110-12, Standard for Ductile-Iron and Gray-Iron Fittings; 2012.
H. AWWA C111/A2.11-17, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings; 2017.
I. AWWA C150/A21.50, Standard for Thickness Design of Ductile Iron Pipe; 2008.

1.04 QUALITY ASSURANCE

A. All appurtenances are to be the products of firms fully experienced and qualified in the manufacturing of the particular material.

B. All additional temporary piping, pumps, and equipment necessary for the successful testing of the system is to be included.

C. All materials to meet the requirements of the governing authority.

1.05 SUBMITTALS

A. Complete shop drawings of all pipes, valves, structures and appurtenances are to be submitted for review.

1.06 PRODUCT STORAGE

A. Storage materials, structures, equipment and appurtenances to be stored on site. Keep clean and free of foreign materials. Any damaged items are to be replaced at no additional cost.

1.07 JOB CONDITIONS

A. All materials, structures, equipment and appurtenances as hereinafter specified, as indicated on drawings and as required for complete outside utility system to a point approximately five feet outside the building, or as indicated on the drawings.

1.08 PROTECTION

A. Seventy-two (72) hours prior to excavation, call U.P.C. (Underground Protection Center) 1-800-282-7411 to locate and protect existing utilities. Any damage to these utilities are to be repaired at no additional cost to Owner. Contractor is responsible for locating all utilities, either private or public.

PART 2 - PRODUCTS

2.01 PIPE

A. GENERAL

1. All materials used in the work including equipment shall be new and unused materials of a reputable U.S. Manufacturer, conforming to the applicable requirements of these Regulations, and no materials shall be used in the Work until they have been approved. Any reference to AWWA, ANSI, ASTM or other such Specification shall mean the latest revision is published.

B. DUCTILE IRON PIPE (DIP)

1. Ductile Iron Pipe shall be designed in accordance with AWWA C150. Minimum wall thickness for 4”-12” diameter pipe shall be Pressure Class 350; minimum wall thickness for 14”-20” diameter pipe shall be Pressure Class 250; minimum wall thickness for 24” pipe shall be Pressure Class 200; minimum wall thickness for pipe larger than 24” in diameter shall be Pressure Class 150. Pipe shall be manufactured in accordance with AWWA C151. Wall thicknesses greater than the minimum call for above may be required due to greater depths or varying bedding requirements.

2. All D.I.P. shall be subject to inspection and approval by the Local Jurisdiction after delivery. No broken, cracked, imperfectly coated, or otherwise damaged or unsatisfactory pipe or fittings shall be used. The pipe interior shall be Polybond, Polyline, polyurethane, or Protecto 401 ceramic epoxy lined with a minimum thickness of 40 mm. The exterior shall be seal coated with an approved bituminous seal coat in accordance with AWWA C151.

3. Joints shall be push-on type for pipe and standard mechanical joints for fittings with the exception of hydrant fittings. Fittings for bends and hydrants shall be mechanical joint with retainer gland. Hydrant tees used in lieu of retainer glands and harness rods on fire hydrants shall be equal to ACIPCO A10180 or US Pipe U-592. Anchor couplings used in lieu of retainer glands and harness rods on fire hydrant leads shall be American A-10895 or approved equal. Joints shall conform to AWWA C 111. Provide and install the appropriate gaskets, nuts, and bolts for mechanical joints. Nuts shall be steel with American Standard Regular hexagonal dimensions, all as specified in ANSI B 17.2.

C. PIPE JOINTS

1. Ductile Iron Sewer Pipe: Flexible rubber gasket compression or mechanical joint type conforming to applicable standards.

2. Transition Joints: The transition between sewer pipes of different materials are to be made by special adapter couplings made for that purpose. Transition couplings are to be Flex Arc Seal by Mission Rubber Company or equal products by JCM or Ford Meter Box Co.

2.02 Polyvinyl Chloride Pressure Rated Pipe (PVC)

A. Pipe and Fittings:

1. All PVC pipe and fittings through 15-inches shall meet the requirements as specified under ASTM D3034. PVC pipe 18-inches in diameter shall meet the requirements of ASTM F679. All pipes and fittings shall be suitable for use as a sanitary sewer conduit. Bell joints shall consists of an integral wall section with elastomeric gasket joint that provides a tight water seal. Standard laying lengths shall be 13.0 – 18.0 feet

(+/- 1 inch). The pipe shall be capable of passing all tests that are detailed in this Specification. Minimum wall thickness for pipe through 15" in diameter shall be as specified under SDR 35 in ASTM D3034. Minimum wall thickness for 18" diameter pipe shall be as specified under T-1 in ASTM F679. PVC sewers with more than 12 feet of cover may require wall thicknesses greater than SDR 35 or T-1. PVC is not allowed for sewers greater than 18 inches in diameter or more than 14 feet of cover or less than six (6) feet of cover.

2. Each length of pipe shall be marked with the manufacturer's name, trade name, nominal size, class, hydrostatic test pressure, manufacturer's standard symbol to signify it was tested, and date of manufacture. Each rubber ring shall be marked with the manufacturer's identification, the size, the year of manufacture, and the classes of pipe with which it can be used.

3. All PVC fittings and accessories shall meet the requirements specified under ASTM D3034 or F679 and shall be manufactured and furnished by the pipe supplier. They shall have bell and/or spigot configurations compatible with that of the pipe and shall have an equivalent wall thickness.

B. Pipe and Fitting Tests: All shipments of pipe and/or fittings shall be tested and certified to by an approved independent testing laboratory. Up to 0.5 percent of the number of pipe of each size furnished shall be tested, except that in no case shall less than two (2) specimens be tested. The Contractor shall be responsible for providing three (3) certified copies of the test results obtained by the testing laboratory under provisions for testing in the applicable test procedures listed below. Testing shall be done at the Contractor's expense and no pipe shall be installed until the test results are approved by the Local Jurisdiction.

C. Pipe Stiffness: Minimum "pipe stiffness" (F/Y) at five percent deflection shall be 46 psi for all sizes, when tested in accordance with ASTM Standard Method of Test D2412, to determine the "External Loading Properties of Plastic Pipe by Parallel Plate Loading". There shall be no evidence of splitting, cracking, or breaking at a deflection of up to 30 percent of the original diameter.

D. Extrusion Quality: There shall be no evidence of flaking, swelling, or disintegration when the pipe material is tested in accordance with ASTM D2152, "Quality of Extruded Poly (Vinyl Chloride) Pipe and Molded Fittings by Acetone Immersion".

E. Joint Tightness: Pipe and fitting joints shall comply with ATM D3212 for "Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals." Joint assemblies shall not leak when subjected to both an internal and external hydrostatic test at equivalent pressures of 10.8 psi gauge for a period of one hour. Pipes shall be tested in straight alignment, axially deflected position, and by shear load test as otherwise defined in paragraphs 7.2, 7.3, and 7.4 of ASTM D3212.

F. Impact Resistance: Pipe shall conform with impact resistance test conducted in accordance with ASTM D2444, "Test for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)".

G. Installation: PVC Pipe will be installed in accordance with ASTM D2321 (latest revision). Class "B" bedding is the minimum bedding requirement for PVC Pipe. In any area where the pipe is below existing ground water level or below the 100-year flood plain level, the contractor will embed PVC pipe in sand or graded gravel.

H. Deflection Limit: Vertical Deflection of installed pipe shall not exceed five (5) percent of the undeflected diameter as defined in ASTM D3034. Upon completion of the pipe laying, and at least 30 days after installation (to allow for settling), the pipe will be tested for final acceptance (subject to the one-year maintenance period). The test shall be performed by the Contractor pulling a mandrel of specified dimensions through the pipeline.

2.03 PRECAST CONCRETE MANHOLES

A. Precast Manholes:

1. Precast Manholes shall be constructed of Portland Cement concrete with a compressive strength of no less than 4000 psi at an age of 28 days. The minimum inside diameter of the manhole shall be as required by the Standard Detail. The wall thickness shall not be less than five (5) inches. Manholes shall be placed on a stable subgrade. Joints in the wall shall be tongue and groove type. Sections shall be joined using O-Ring rubber gaskets, flexible plastic gaskets conforming to the applicable provisions of ASTM Standard Specifications, Serial Designation C443, or an approved bitumastic joint material. Precast concrete manholes shall consist of precast reinforced concrete sections with eccentric (or flat slab for shallow manholes) top section and a base section conforming with the typical manhole details, as shown on the Standard Detail. Flat top manholes will be approved only if a need for such can be demonstrated by the Design Professional.

2. Each section of the precast manhole shall have no more than two holes for the purpose of handling and laying. These holes shall be sealed with cement mortar using one part Portland Cement to two parts clean sand, meeting ASTM Standard Specifications, Serial Designation C144.

3. Holes in precast bases to receive sewer pipe shall be precast at the factory at the required locations and heights. Knocking out of holes in the field will not be permitted; however, holes can be cored in the field with a coring machine. The design, the materials used in, the manufacturing process, and the transportation of precast manhole shall be subject to inspection at any time by the Local Jurisdiction. Materials found defective by the Local Jurisdiction will not be delivered to the job site. Material on the job site that is found defective shall be removed immediately after being notified that such materials are unacceptable. Precast manhole shall conform to ASTM C6478.

4. Pre-Molded rubber boots with stainless steel bands shall be used for connecting sewer pipe to manholes. These may either be the lock-in “Kor-N-Seal” type as manufactured by Interpace Division of Ball Rubber, Inc. or its approved equal. In all cases, the boot shall be sized to suit the outside diameter of the type of pipe being used.

5. The invert of manholes shall be constructed of concrete or brick in accordance with the Standard Details and shall have a cross section of the exact shape of the invert that it connects, changes in size and grade being made gradually and evenly. Changes in the direction of the sewer and entering branch or branches shall have a true curve of as a large radius as the size of the manhole will permit. Inverts shall have a “smooth trowel” finish. The manhole bench shall be sloped 30 degrees from the manhole wall toward the invert. Manholes shall be provided with steps built into the wall as shown on the detailed drawings. Drop manholes will be required where the invert of any incoming line will be higher than two feet from the invert of the outlet pipe. All manholes will be water tight when completely built.

B. Manhole Steps: Manhole steps shall be of #4 steel reinforcing bars covered with Polypropylene Plastic or rubber and shall be supplied with depth rings and other necessary appurtenances. The manhole steps shall conform to the applicable provisions of ASTM Specification C478, and shall be similar to and of equal quality to the “Sure Foot” by Oliver Tire and Rubber Company of Oakland California, or “PSI-PF” by M.A. Industries of Peachtree City, Georgia. The step shall be factory built into precast sections.

C. Manhole Cover and Frame: Manhole covers shall be cast iron with a coat of asphaltic paint applied at the foundry. The frame and cover shall be as shown on the detail drawings. All covers shall have “Sewer” printed on them. Manhole frames and covers shall be as manufactured by Neenah R-1779 (300 lbs) in paved roads, parking lots and driveways, and Neenah R-1779 (300 lbs) for non-traffic areas or approved equal.

Manhole frames shall be cast in the cone if located in non-traffic areas.

D. Waterproof Manhole Frame and Cover: Waterproof manhole covers shall be cast iron with a coat of asphaltic paint applied at the foundry as shown on the Drawings with a "bolted-down" lid. All covers shall have "Sewer" printed on them. Manhole frame and covers shall be as manufactured by Neenah Foundry Company R-1915-F2 (435 lbs) or approved equal. Manhole frames shall be cast in the cone if located in a non-traffic area.

E. Manhole Foundation: The manhole base shall be set on a compacted mat of No. 57 crushed stone graded level at the thickness shown on the Standard Detail Drawings. In wet areas, the crushed stone mat shall be thickened as needed to provide a non-yielding foundation.

F. Brick: Brickwork required to complete the precast concrete manhole shall be constructed to meet ASTM Specifications, Serial Designation C144, thoroughly mixed to a workable plastic mixture. Brickwork shall be constructed in a neat and workmanlike manner. Cement mortar shall be used to grout interior exposed brick joints and faces. No more than three (3) courses of brick with nine (9) inch maximum total depth of bricks may be used to adjust manhole covers.

2.04 CONCRETE MORTAR

A. Concrete shall consist of Portland Cement, a fine aggregate, a coarse aggregate and water Portland Cement shall conform to Fed. Spec. SS-C-19 lb. Fine aggregate shall be a clean, sharp, well graded sand conforming to Fed. Spec. SS-S-51. Coarse aggregate shall be uniformly graded broken stone or gravel, which will pass a 1-1/2 inch screen and be retained on a ¼-inch screen. Aggregate shall be free of clay, loam silt, or organic matter. Water used for concrete shall be clean and free from vegetable, sewage, or organic matter and the total amount used shall not exceed six (6) gallons per sack of cement. Forms may be of wood or metal properly braced to prevent bulging. Concrete shall be thoroughly mixed and well vibrated into forms and around fittings. Exposed surfaces of concrete shall be protected from premature drying by being kept covered and moist for a period of seven (7) days. After the forms have been removed, the voids in the interior surface, if any, shall be properly filled with cement mortar and the whole surface rubbed uniformly with neat cement. All mortar shall be composed of one part Portland Cement to three parts sand, conforming to these Specifications. All concrete shall have a compressive strength no less than 3,000 psi at an age of 28 days.

2.05 BRICK

A. Al brick shall be best grade, hard-burned, common, giving a ringing sound when struck and acceptable to Local Jurisdiction. Only bricks presenting a regular and smooth face shall be used. When submerged in water for 24 hours, they shall not absorb more than 10% of their weight in water. Brick shall be culled when delivered on the ground, and all imperfect brick are to be immediately removed from the work. All salmon, soft or arch brick or brick made of alluvial soil will be rejected. All brick used in the work shall be of uniform size.

2.06 PIPE BEDDING:

A. Pipe bedding for sanitary sewers is to be County standards or greater.

2.07 TRACER WIRE

A. Tracer wire is to be aluminum foil plastic backed tape manufactured specifically for warning and identification of buried sanitary sewer.

2.08 CLEANOUTS

A. All cleanouts are to be as per County Standard Specifications and Details, including concrete collars as shown on the Drawings.

PART 3 - EXECUTION

3.01 GENERAL

A. It shall be expressly understood that these Regulations are for installation of all sanitary sewer mains and appurtenances.

B. All work shall conform to the applicable provisions of Specifications prepared by the AWWA, ANSI, and ASTM of latest revision, expect when otherwise specified.

C. Compliance with applicable safety regulations is the responsibility of each company engaged in the Work. The Local Jurisdiction assumes no responsibility for the actions of others on the job site. It is the responsibility of those installing sanitary sewer lines and appurtenances to conform to OSHA regulations.

3.02 TRENCH AND MANHOLE EXCAVATION

A. Sanitary sewer lines shall normally be installed by open-cut trench excavation. Pipe trenches shall be excavated straight and true to grade and line and in the location shown on the plans. Trenches shall be dug so that the pipe can be laid to the alignment and depth required, and the trench shall be of such width and shall be braced and drained so that the workmen may work safely and efficiently. Chocking under the pipe will not be permitted. All joints shall be as specified. Excavation must be made under the bell of each pipe so that the entire length of the pipe will lie uniformly on the bottom of the trench and the pipe weight shall not rest on the bells. Trenches shall be free of water during the work.

1. Trenches shall have a minimum of width of 12-inches plus the diameter of the outside of the bell of the sewer main and the maximum trench width at the centerline of the pipe shall not be more than the nominal diameter of the pipe plus two (2) feet. In unpaved areas, the trenches may have a greater width that is, beginning at one foot above the top of the pipe and extending to the ground surface, if such width is necessary or desirable. However, in paved areas, the width of the trench from top to bottom shall not exceed the nominal diameter of the pipe plus two feet.

2. In cases where water mains cross above sanitary sewers, there shall be a minimum clearance of 18-inches vertical separation between the water and sewer mains. In cases where a sanitary sewer crosses above a water main, there shall be a minimum clearance of 18-inches vertical separation between the mains, plus the sanitary sewer main shall be encased in concrete. Both mains shall be Ductile Iron Pipe. At crossings, one full length of sewer pipe must be located so that both joints are as far from the water main as possible. In cases where sanitary sewer mains parallel water mains, there shall be minimum of ten (10) feet horizontal separation maintained between the mains. These distances are measured edge to edge.

3. No excavation shall be made under highways, streets, or alleys or private property until satisfactory arrangements have been made with the State, City, County or Owners of the property to be crossed. All excavated material shall be placed so as to not interfere with public travel on the streets and highways along which the lines are laid. No more than 100-feet of trench shall be opened on any line in advance of pipe laying.

4. When possible, all crossings of paved highways or driveways by pipe line shall be made by boring or jacking the pipe under the pavement and shall be done in such a manner as not to damage the pavement or foundation, unless the casing or pipe is in solid rock, in which case the crossing shall be made by the open cut method or or by tunneling.

5. Wherever streets, roads, or driveways are cut, they shall be immediately backfilled and compacted after the pipe is laid and shall be maintained in first-class condition as passable at all times until repaved.

6. Backfilling, compaction, dressing, and clean-up shall be kept as close to the line laying crew as is practical, and negligence in this feature of the work will not be tolerated.

7. In excavation and backfilling and laying pipe, care must be taken not to remove or injure any water, sewer, gas or other pipes, conduits or other structures without permission from the Local Jurisdiction. When obstruction is encountered, the Contractor shall notify the Designer who will have the Owner of the obstruction adjust same or make necessary changes in grade and/or alignment to avoid such obstruction. Any house connection, drains, or other structures damaged by the Contractor shall be repaired or replaced immediately.

8. All excavation materials shall be placed on one side of the trench, unless permission is given by the Local Jurisdiction to place it on both sides. Excavation materials shall be so placed as not to endanger the work and so that free access may be had at all times to all parts of the trench and to all fire hydrants or water valve boxes, etc. All shade trees, shrubs, etc. shall be protected.

9. The excavation for manholes shall extend to a firm, acceptable foundation and not leave less than 24-inches in the clear between their exterior surface and the embankment or retaining structure that may be used to protect it.

10. The Contractor shall furnish, install, and maintain such sheathing, bracing, etc. as may be required to support the sides of the excavation and to prevent any movement that might injure the pipe or cause sloughing of the street or trench, or otherwise injure or delay the work or interference with adjoining structures.

11. Construction occurring around active sanitary sewerage systems shall be done in such a way to prevent the spillage of sewage.

B. All materials shall be considered as rock that cannot be excavated except by drilling, blasting, or wedging. It shall consist of undecomposed stone in solid layers or of boulders of no less than one-half cubic yard. Where rock is encountered in the excavation, it shall be removed by suitable means. If blasting is used for removal of rock, the Contractor shall take all proper safety precautions. He shall comply with all rules and regulations for the protection of life and property that may be imposed by a public body having jurisdiction relative to the handling, storing, and use of explosives. He is fully responsible for filing for and acquiring any blasting permits that may be required by those agencies having jurisdiction. Before blasting, the Contractor shall cover the excavation with heavy timbers and mats in such a manner as to prevent damage to persons or the adjacent property. Rock excavation near existing pipelines or other structures shall be conducted with the utmost care to avoid damage. The Contractor shall be wholly responsible for any damage resulting from blasting, and any inquiry or damage to structures or property shall be promptly repaired by the Contractor to the satisfaction of the Local Jurisdiction and property owner.

C. Rocks in trenches shall be excavated over the horizontal limits of excavation and to depths as follows:

Size of Pipeline	Depth of Excavation Below Bottom of Pipe
4 to 6 inches	6 inches
8 to 18 inches	8 inches
18 to 30 inches	10 inches
Over 30 inches	12 inches

1. The undercut space shall then be brought up to grade by backfilling with subgrade stabilizer stone.

2. In rock excavation, the backfill from the bottom of the trench to one (1) foot above the top of the pipe shall be finely pulverized soil, free from rocks and stones. The rest of the backfill shall not contain over 75% broken stone, and the maximum sized stone placed in the trench shall not weigh over 50 pounds. Excess rock and fragments of rock weighing more than 50 pounds shall be loaded and hauled to disposal. If it is necessary, in order to comply with these Specifications, selected backfill shall be borrowed and hauled to the trenches in rock excavation.

3. Sides of trench shall be trimmed of projecting rock that will interfere with backfilling operations. Rock excavation by blasting shall be at least 75 feet in advance of pipe laying.

3.03 SANITARY SEWERS

A. Installation of Sanitary Sewer

1. Construction stake-out will be required prior to construction of sanitary sewer lines. At a minimum, the horizontal alignment will be staked at 100-foot intervals and each manhole will be located with a centerline stake and two offset hubs. “Cuts” to invert elevations will be shown for each manhole entry and exit pipe. A copy of the stake-out notes will be provided by the Local Jurisdiction.

2. Pipe and accessories shall at all times be handled with care to avoid damage. Whether moved by hand, skidways or hoists, material shall not be dropped or bumped. The interior of all pipe shall be kept free from dirt and foreign matter at all times. Each joint of pipe shall be unloaded opposite or near the place where it is to be laid in the trench. All such materials that are defective in manufacture or has been damaged in transit or after delivery shall be removed from the job site.

3. All pipe and appurtenances shall be of the dimensions and laid to the line and grade as shown on the plans and as established by the Design Professional and as approved by the Local Jurisdiction. Wyes and/or service connections and stubs from manholes shall be placed where shown on plans and as approved by the Local Jurisdiction. All such connections shall be blanked off with suitable stopper and made watertight with jute and cement mortar.

4. The preferred order of construction is to connect to existing sanitary sewers after all other construction is complete and conditionally accepted by Local Jurisdiction. Connections to existing sanitary sewers can be done at the beginning of construction; however, the new main shall be plugged where it enters either the existing manhole or the new doghouse manhole over an existing sanitary sewer, and the plug shall remain in place until the project is conditionally accepted.

5. Sanitary sewer pipes shall be joined by “push-on” joints using elastomeric gaskets to affect the pressure seal. The ends of the pipe to be joined and the gaskets shall be cleaned immediately before assembly, and the assembly shall be made as recommended by the pipe manufacturer. Lubricant used must be non-toxic and supplied or approved for use by the manufacturer. Sanitary sewer pipes shall be laid in the uphill direction with the bells pointing upgrade. Any variation from this procedure shall require the approval from Local Jurisdiction.

6. Bell holes shall be provided of sufficient size to allow ample room for making the pipe joints without putting any load on the bell of the pipe. The bottom of the trench between bell holes shall be carefully graded so that the pipe barrel will rest on a solid foundation for its entire length as shown on the plans. Pipe shall be laid with joints close and even, butting all around, so that it will form a close concentric joint with adjoining pipe with no sagging at the hub and so that a true surface is given to the

invert throughout the entire length of the sewers. After the pipe is laid, backfilling shall be completed as directed in these Regulations.

7. The Contractor shall be required to provide and operate any equipment necessary to keep the trenches free from water while pipe is being laid and the joints made. The installed pipe shall not be used for draining water from the ditch.
8. Pipe grades shall be obtained by use of a laser and double checked with a surveying level and rod.
9. Completed sewers shall be tested between manholes with lanterns or reflected light and shall show the full circle of the pipe from manhole to manhole without obstruction.
10. Sewers shall be laid tight and the rate of infiltration in any section of line between adjacent manholes shall not exceed 100 G.P.D. per diameter of pipe per mile of line when the trenches are saturated with water.

All openings along the line of the sewers shall be securely closed at night, during suspension of work, and at the end of each work period with a watertight stopper. No length of pipe shall be laid until one proceeding it shall have sufficient quantity of fine Earth tamped around it to hold it firmly in place.

B. MAKING OF JOINTS

1. When joining gravity sewer pipe, both the spigot end and the bell end of the pipe shall be perfectly clean and free from dirt, oil, grease, or other foreign matter. The spigot end shall be lightly coated with the lubricant recommended and furnished by the manufacturer, and the pipe then shall be securely and firmly seated in the bell end of the adjoining pipe. In making the joint, the spigot end of the pipe, after being cleaned and coated with lubricant, shall not be allowed to touch the sides or bottom of the trench before being inserted in the bell end of adjoining pipe. In addition to the above, joints shall be made in strict accordance with the Specifications and recommendations of the manufacturer.

2. A description of Class “A”, “B”, and “C” bedding is as follows:
   a. Class “A” Bedding: Refers to bedding with concrete cradle, arch, or encasement. The Contractor shall conform to details shown in the detailed drawings when Class “A” Bedding is required.

   b. Class “B” Bedding: The pipe shall be bedded in crushed granite material, conforming to the section of these Regulations on “Subgrade Stabilizer” or other materials approved by Local Jurisdiction. The bedding shall be placed on a flat trench bottom with a minimum thickness beneath the pipe of one-eighth the outside pipe diameter, but not less than six (6) inches (150 mm) and sliced under the haunches of the pipe with a shovel or other suitable tools to height of one-half the outside pipe diameter, or to the horizontal centerline. The initial backfill shall be hand placed to a level of 12 inches (300 mm) over the top of the pipe and shall consist of finely divided materials free from debris, organic material, and large rock or stone.

   c. The pipe shall be bedded in subgrade stabilizer stone placed on a flat trench bottom. The bedding material shall have a minimum thickness beneath the pipe of six (6) inches (150 mm) or one-eighth of the outside diameter of the pipe, whichever is greater, and sliced under the haunches of the pipe with a shovel or other suitable tool to a height of one-sixth the outside diameter of the pipe. The initial backfill shall be hand placed to a level of 12 inches (300 mm) over the top of the pipe and shall consist of finely divided materials free from debris, organic material and large rocks or stones. Bedding materials shall be as described in the section of these Regulations on “Subgrade Stabilizer Stone”.

d. Special Bedding for PVC Pipe: The pipe shall be bedded in crushed granite material, conforming to the Section of these Regulations on "Subgrade Stabilizer Stone", or other materials approved by Local Jurisdiction. The bedding shall be placed on a flat trench bottom with a minimum thickness beneath the pipe of one-fourth the outside pipe diameter, but no less than six (6) inches (150 mm) and sliced under the haunches of the pipe with a shovel or other suitable tool to height of two-thirds the outside pipe diameter. The initial backfill shall be hand placed to a level of 12 inches (300 mm) over the top of the pipe and shall consist of finely divided materials free from debris, organic material, and large rocks or stones.

C. DEWATERING TRENCHES

A. The Contractor shall do all necessary pumping or bailing, build all drains and do all other necessary work at his own expense to keep the trenches clear of water during the progress of the work. No structure shall be built or pipe shall be laid in water, and water shall not be allowed to flow over or rise upon any concrete, masonry, or pipe until the same has been inspected and the concrete or joint material has thoroughly set. All water pumped, bailed or otherwise removed from the trench or other excavation shall be conveyed in a proper manner to a suitable place of discharge where it will not cause injury to the public health or to public or private property or to work completed or in progress, or to the surface of the streets or cause any interference with the use if same by the Public.

D. SEPARATION OF DISIMILAR PIPE MATERIAL

A. Parallel Installation:

1. Normal conditions:
   a. Sanitary Sewer to be laid at least 10 feet horizontally from water mains, storm sewers, and manholes, whenever possible; distance to be measured edge-to-edge.

2. Unusual conditions - When local conditions prevent horizontal separation of 10 feet, sanitary sewer may be laid closer to storm or sanitary sewer provided that:
   a. Bottom of water main is at least 18 inches above top of sewer.

   b. Where this vertical separation cannot be obtained, sanitary sewer to be encased in 6" of concrete around pipe, full length that 10' separation not furnished.

2. Crossings:
   a. Normal conditions
      1. Sanitary sewer crossing water mains, and storm sewers to be laid to provide separation of at least 18 inches between bottom of water main and top of sewer, whenever possible.

   b. Unusual conditions:
      1. When local conditions prevent a vertical separation as described above, the following construction to be used:
         a. Sewers passing over or under water mains to be constructed are to be concrete encased. Concrete encasement is to extend 10' on both sides of crossing.

3.04 BACKFILLING

A. After the pipe has been laid, backfilling shall be done in two (2) distinct operations. In general, all backfill beneath, around, and to a depth of 12 inches above the top of the pipe shall be placed by hand in four inch layers for the full width of the trench and thoroughly compacted by hand with vibratory equipment. The remainder of the backfill shall be placed within six-inch layers and compacted to the top of the trench, either by pneumatic hand tamps, hydro-tamps, or other approved methods. Care shall be taken so that the pipe is not laterally displaced during backfilling operations. The backfill lifts shall be placed

by an approved method in accordance with that hereinafter specified. Backfill materials shall be the excavated materials without bricks, stone, foreign or corrosive material, where not otherwise specified or indicated on the plans.

B. Backfill under permanent concrete or bituminous pavement and elsewhere specified or indicated on the Plans shall be approved bank-run sand or gravel or crushed stone free from large stones and containing no more than ten (10) percent by weight of loam or clay. This backfill shall be compacted to 100 percent as determined by the Modified Proctor test for the top two (2) feet of trench and ninety-five (95) percent by the Modified Proctor Test from pipe bedding to two (2) feet below trench top. Mechanical vibrating equipment shall be used to achieve the required compaction. Pavement shall be replaced immediately after backfilling operation is completed.

C. Backfill under gravel or crushed stone surfaced roadways shall be the approved suitable excavated material placed in six inch layers thoroughly compacted for the full depth and width of the trench, conforming to the compaction, density compaction method, and materials as specified in the immediately preceding paragraph.

D. Backfill in unpaved areas shall be compacted with mechanical vibrating equipment to 90 percent as determined against the Modified Proctor Test. Backfill material from pipe bedding to ground surface shall be excavated earth free from large stones and other debris.

E. The Contractor shall fully restore and replace all pavement, sidewalks, landscapes, surface structures, etc., removed or disturbed as part of the Work to a condition equal to or better than before the work began to the satisfaction of the Local Jurisdiction.

F. Where sheeting is used in connection with the Work, it is in no case to be withdrawn before the trench is sufficiently filled to prevent damage to banks, road surfaces, adjacent pipes, adjacent structures or adjacent properties, public or private.

3.05 STREAM CROSSINGS

A. The preferred method of crossing a river, stream, creek impoundment, or wet weather ditch is with a minimum of two (2) feet of cover between the lowest point in the stream and the top of outside diameter of the pipe. Ductile iron pipe is required for all stream crossings and shall extend a minimum of ten (10) feet beyond the top of the bank on each side. Concrete Collars or encasement must be provided at all joints for ductile iron pipe with less than three (3) feet of cover.

B. The stream bed and banks at the crossing site shall be protected from erosion with the use of rip-rap, as defined and sized in the *Manual for Erosion and Sediment Control in Georgia, Appendix C (Construction Materials), Latest Edition.*

C. Aerial crossings will require detailed plans and will be allowed only when, in the Department's opinion, there is no reasonable alternative.

D. Erosion control measures shall be installed prior to installing pipe across any stream. All work should be performed when stream flows are at their lowest, and all work should be performed as quickly and safely as possible. As soon as conditions permit, the streambed shall be cleared of all false work, debris, and other obstructions placed therein or caused by the construction operations.

E. Erosion control measures can include, but are not limited to, the following items:
1. Silt fencing, types A, B, and/or C

2. Erosion Control Checkdams

3. Channel Diversion through temporary storm drain pipe

4. Rock Filter Dams

The construction and installation of these various structures are detailed in the *Manual for Erosion and Sediment Control in Georgia* or the Georgia DOT Standards and Construction Details, both of which are available for purchase to the Contractor.

3.06 CASING FOR SANITARY SEWERS

A. Where pipe is required to be installed under railroads, highways, streets, or other facilities by jacking or boring methods, construction shall be done in a manner that will not interfere with the operation of the utility, and shall not weaken the roadbed or structure.

B. Casing pipe shall be installed at the locations shown on the plans. Unless directed otherwise, the installation procedure shall be the dry bore method. The hole is to be mechanically bored and cased through the soil by a cutting head on a continuous auger mounted inside the casing pipe. The installation of the casing and boring of the hole shall be done simultaneously by jacking. The diameter of the bore shall conform to the outside diameter and circumference of the casing pipe as closely as practical. Any voids that develop during the installation operation shall be pressure grouted. Each segment of the casing pipe shall be welded (full circumference butt weld) to the adjoining segment. The completed casing shall have no sags or crowns that cause the grade for any segment to be less than the minimum slope for the size pipe being installed.

C. Excavation material will be removed and placed at the top of the working pit. Backfill material and methods of backfilling and tamping shall be as previously outlined in this Article. Carrier pipe shall be DIP and shall be inserted within the casing by use of approved casing spacers. Inside of casings, the sewer main joints shall be slip joint restrained by using US Pipe “Field Lok” gaskets or approved equal.

D. The annular space between carrier pipe and the casing shall be pressure grouted after the carrier pipe is sufficiently secured on grade to prevent floating during grouting. The carrier pipe should be filled with water prior to grouting to aid in the prevention of floating. At each end of the casing pipe, the void between the carrier pipe and casing shall be sealed with brick and mortar.

3.07 SEWER SERVICE LATERALS

A. A sewer service shall be provided for every existing or proposed lot or building. All services must be shown on the Construction Drawings. All service laterals shall be a minimum of six (6) inches in diameter. A common service shall not be allowed for two or more buildings. The service shall extend to property line of the lot being served and normally be within ten (10) feet of the lower corner of the lot. The Contractor shall install a cleanout at the right-of-way and extend the PVC cleanout to a height of three (3) feet above the finished grade. The Contractor shall place a 4”x4” pre-treated wood post painted green above the end of the service lateral to enable the builder to locate the service. All service laterals shall have six (6) feet of cover at the right-of-way. Where six (6) feet of cover cannot be achieved, services shall be ductile iron.

B. Six (6) inch services shall be laid at a minimum grade of one (1) percent. Service laterals tied directly to manholes shall enter the manholes through cored holes and shall be provided with a pre-molded rubber boot. Laterals shall enter the manhole no higher than 6” above the table and shall be provided with a concrete flume to slope the flow into the manhole invert.

3.08 BRACING, SHEETING, SHORING

A. Whenever the condition of the ground is such that it is necessary to protect the work, the street, or the roadway or workmen, the sides of the trench shall be supported with suitable bracing, sheeting, and/or shoring to be furnished by the Contractor at his own expense.

3.09 LOCATION AND PROTECTION OF EXISTING UNDERGROUND UTILITIES

A. It is the responsibility of the Contractor to locate the underground utilities and to protect same. Utility lines or services damaged by the Contractor shall be repaired by the Contractor at his own expense.

3.10 CONNECTION TO COUNTY'S EXISTING SANITARY SEWER SYSTEM

A. The Developer's private contractor shall make all required connections to the County's sewer system. The Local Jurisdiction's inspectors will supervise the connection and all associated work. The Contractor shall give Local Jurisdiction a minimum of 48 hours' notice prior to any sewer system work.

B. The Contractor will provide proper traffic control devices and certified personnel to direct traffic, if required.

C. All connections to existing manholes shall be properly cored with a coring machine. "Knocking-out" of a hole in the manhole for a connection is not permitted.

D. The timing of a Developer's connection to the County's system shall be pre-arranged with Local Jurisdiction.

3.11 CLEAN-UP

A. The Contractor shall remove all unused materials, excess rock and earth, and all other debris from the Construction Site as closely behind the work as practicable. All trenches shall be backfilled and tamped before the end of each day's work.

B. Prior to requesting the final inspection, the Contractor shall do the following:

1. Remove and dispose of in an acceptable manner all shipping timbers, shipping bands, excess materials, broken material, crates, boxes, and any other material brought to the job site.

2. Repair and replace any work damaged by the sewer line construction.

3. Regrade and smooth all shoulder areas disturbed by the sewer line construction.

4. All easement areas shall be cleared of trees, stumps, and other debris and left in a condition such that the easement can be maintained by bush-hog equipment.

5. All shoulders, ditches, culverts, and other areas impacted by the sanitary sewer construction shall be a the proper grades and smooth in appearance.

6. All manhole covers shall be brought to grade.

7. A uniform stand of grass or mulch for erosion protection, as defined in the *Manual for Erosion and Sediment Control in Georgia* is required over all construction easements and sanitary sewer easements prior to the Local Jurisdiction's acceptance of the sanitary sewer.

3.12 BARRICADES

A. The Contractor shall provide, erect, and maintain all necessary barricades, suitable and sufficient red lights, danger signals, and necessary precautions for the protection of the Work and the safety of the public. Streets closed to traffic shall be protected by effective barricades on which shall be placed acceptable warning signs. Barricades shall extend completely across the street that is to be closed, and shall be illuminated at night by lights no farther than five (5) feet apart, and lights shall be kept burning from sunrise to sunset.

3.13 GRASSING

A. All areas outside structures along pipelines where the earth is disturbed shall be grassed. After the soil has been properly prepared, the seed shall be planted. After the seeds have been planted, the moisture content of the soil shall be maintained at the optimum amount

to insure germination of the seed and growth of the grass.

B. Immediately after the initial watering of seeded areas, the Contractor shall apply a mat of hay or rye, wheat or oat straw over the area at a uniform rate of no less than 1-1/2 ton of mat to the acre. The minimum depth of the straw shall be two inches and the maximum depth three inches. After placing the mat, hay, or straw, emulsified asphalt shall be sprayed over the mat at a uniform rate of 0.15 gallon per square yard. After the grass has shown satisfactory growth (approximately 30 days after the planting), nitrate of soda shall be applied at a uniform rate of 100 pounds per acre, followed by sufficient water to dissolve the fertilizer.

C. The Contractor shall do all maintenance work necessary to keep all planted areas in satisfactory condition until the work is finally accepted. This shall include moving, repairing washed that occurred, reseeding, and water as required to produce a healthy and growing stand of grass. Mowing will be required to remove tall and obnoxious weeds before they go to seed.

D. It is the intent of these Specifications to produce a stand of grass that is alive and growing, without any bare spots larger than one square foot. The Contractor shall repeat all work, including any plowing, fertilizing, watering and seeding as necessary to produce a satisfactory stand.

3.14 TESTING

A. Minimum Tests: All new gravity sewer lines will be tested for infiltration, exfiltration, and deflection. Flexible pipe sewers (PVC) shall be subjected to the Mandrel Test. The sewer lines may be televised if the Department's inspectors cannot see through the line properly or suspects that the joints may be offset or broken. Force mains will be subjected to a pressure/leakage test. Slopes of sewer mains that are close to minimum grade will be checked to insure cleansing velocity. The Department may require manholes to be subjected to a vacuum test to check potential infiltration. The backfill in the trench above the pipeline will be subjected to compaction tests as detailed below. Any defects located during testing must be corrected before construction of the project may proceed. All costs associated with testing will be paid by the developer. Tests will be performed as follows:

1. Measurement of Infiltration: The contractor shall furnish an adequate number of plugs of the proper size and acceptable weirs to measure infiltration into the system. Measurements of the flow shall be performed on any lines with a visible flow of water.

2. In no case will an infiltration rate of greater than 100 GPD per inch diameter per mile of pipe be allowed. Also, any visible or audible leak must be dug up and repaired. Any increase in flow between two adjacent manholes must also be corrected.

B. Exfiltration Test (Low Air Pressure Test): After completing backfill of a gravity sewer line section, conduct a low pressure air test of all pipe constructed, using methods and devices acceptable to the Department. Perform such test using the following general procedures:

1. Temporarily plug line segment between two manholes using plugs having air tight fittings through which low air pressure can be introduced into the pipe segment being tested.

2. Introduce low pressure air into the test pipe segment until the internal air pressure reaches 4.5 psig above ground water pressure, if any. Wait at least two minutes for air temperature in the test segment to stabilize whole internal air pressure remains no less than 3.5 psig above ground water pressure, if any.

3. Wait at least two minutes for air temperature in the test segment to stabilize

while internal air pressure remains no less than 3.5 psig above ground water pressure.

4. Bleed internal air pressure exactly 3.5 psig above ground water pressure.

5. Accurately determine the elapsed time for internal pressure to drop to 2.5 psig above the ground water pressure.

6. The air test is acceptable if elapsed time is no less than shown by the following table:

Piper Diameter (in inches)	Seconds per 100 feet of Pipe	Pipe Diameter (in inches)	Seconds per 100 feet of Pipe
6	17	30	85
8	23	36	102
10	28	42	119
12	34	48	136
15	43	54	153
18	51	60	170
21	60	66	187
24	68	72	204

7. Air leakage is based on pipe being damp. If pipe and joints are dry, dampen line if helpful in meeting air test time requirement.

8. Permanently correct excessive leakage determined by air testing, and repeat operations until the inspector witnesses a successful test on each line segment.

C. Deflection Test: Every section of sewer line shall be visibly checked for deflection. A passing section shall show a full circle when observed from one end. This may be done using mirrors to reflect sunlight or by using lamps. Any section that fails this visual test shall be further checked as follows:

The section shall have water run though it sufficient to fill any sags that may exist. Then it shall have a television camera pulled through it to check for sags. Any sag holding more than one inch of water will require that the pipe be removed and replaced to proper grade after which the section shall be televised again to verify correction.

D. Mandrel Test for Flexible Pipe (PVC):

1. All PVC gravity sewer mains shall be subjected to the Mandrel Test. The procedure for testing flexible pipe for maximum allowable deflection shall be generally as follows. See ASTM Specifications for mandrel dimensions and more details.

2. Completely flush the line, making sure the pipe is clean of any mud or trash that would hinder the passage of the mandrel.

3. During the final flushing of the line, attach a floating block or ball to the end of the mandrel pull rope and float the rope through the line. (A Nylon ski rope is recommended.).

4. After the rope is threaded through the line, connect the pull rope to the mandrel land place in the entrance of the pipe.

5. Connect a second rope to the back of the mandrel. This will enable the mandrel to be retrieved if excessive deflection is encountered.

6. Draw the mandrel through the sanitary sewer line.

7. An increasing resistance to pull is an indication of excessive deflection. If this occurs, mark the rope to note the location. Televise the sanitary sewer section to identify the extent of the problem and develop a plan, subject to Department approval, for correcting the problem.

8. Retest after correcting the problem.

E. T.V. Inspection: In the event that the inspector cannot see through the line properly or conditions cause him to suspect that the line may be settled or broken, or that joints may not be made properly, he may direct that a T.V. camera passed through the line. A video tape of the inspection will be made. Any discrepancies noted such as sagged pipes, broken pipes, bad joints, etc., will be dug up and corrected. Internal grouting to repair new lines will not be allowed. After connection of the discrepancies, the line will be reinspected.

F. Compaction Testing

1. Compaction Testing will be required for sanitary sewers constructed in paved areas or where pavement is planned. A minimum of five tests per 1,000 feet of sanitary sewer shall be conducted at varying depths.

2. The Department may require additional compaction tests be conducted if any other areas where the Department's inspectors suspect the backfill has not been compacted in accordance with these Regulations. If any of these tests show failing results, then the failing backfill will be removed, re-compacted and retested, and one additional area will be tested as well.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work specified in this Section includes total labor, materials, equipment and incidentals necessary for the installation of storm drainage system. Including, but not limited to pipe, joints, manholes, structure, and other appurtenances necessary for a complete system.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A Section 31 00 00: Earthwork

C. Section 31 23 00: Excavation and Fill

D. Section 31 25 00: Erosion and Sediment Control

1.03 REFERENCE DOCUMENTS

A. Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 2013 Edition.
B. ASTM C443-12, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; Revised 2017.
C. ASTM C32-13, Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale); Revised 2017.
D. ASTM D698-12e2, Standard Test Materials for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3)); 2012.

1.04 QUALITY ASSURANCE

A. All appurtenances are to be the products of firms fully experienced and qualified in the manufacturing of the particular material.

B. All additional temporary piping, pumps, and equipment necessary for the successful testing of the system is to be provided.

C. All materials to meet the requirements of the governing authority and the referenced documents.

1.05 SUBMITTALS

A. Submit within thirty (30) days after execution of the contract manufacturer's certificate of compliance or certified analysis in accordance with applicable standards for each shipment of materials.

B. Complete shop drawings of all pipes, valves, structures and appurtenances must be submitted for review.

1.06 PRODUCT STORAGE

A Storage materials, structures, equipment and appurtenances to be stored on site. Keep clean and free of foreign materials. Any damaged items are to be replaced at no additional cost.

1.07 JOB CONDITIONS

A. Provide materials, structures, equipment and appurtenances as hereinafter specified, as indicated on drawings and as required for complete outside utility system to a point approximately five feet outside the building, or as indicated on the drawings.

1.08 PROTECTION:

A. Seventy-two (72) hours prior to excavation, call U.P.C. (Underground Protection Center) 1-800-282-7411 to locate and protect existing utilities. Any damage to these utilities are to be repaired at no additional cost to Owner. Contractor is responsible for locating all utilities, either private or public.

PART 2 - PRODUCTS

2.01 STORM DRAINAGE PIPING:

A. All storm drain piping is to be as shown on the drawings. The materials shall be as specified herein and in accordance with referenced documents.

B. Reinforced Concrete Pipe (RCP):

1. All reinforced concrete pipe is to meet the requirements of ASTM C76 and Georgia Department of Transportation Standard Specifications and Standard Details 1030-D for class as per the depth of pipe. The joint types are to be round "O-Ring" gaskets and shall conform to the ASTM C443 specifications for joint for circular sewer and culvert pipes using rubber gaskets. Pipe shall be installed per the requirements of ASTM C1479 and AASHTO Section 27.

C. Spiral Corrugated Metal Pipe per AASHTO M36 and ASTM A760 with a spiral rib profile (Manning's coefficient of 0.012). Coating shall be aluminized type 2 per AASHTO M274 and ASTM 929. Pipe diameters 18" through 48" shall be 14 gauge minimum, 54" through 84" shall be 12 gauge minimum. Pipe to be installed per the requirements of ASTM A798 and AASHTO Section 26.

D. High Density Polyethylene (HPDE) pipe per the requirements of AASHTO M294, Type S and AASHTO M252 Type S (smooth interior, corrugated exterior). Pipe to be installed per the requirements of ASTM AD2321 and AASHTO Section 30. ASTM F2648 pipe is not an acceptable substitution.

2.02 STORM DRAIN STRUCTURES

A. All storm drainage structures are to be as indicated and detailed on the Contract Documents.

B. All structures are to be in accordance with the Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges and the local governing authority, whichever is strictest.

2.03 BRICK

A. Brick for sewer manhole construction shall be hard NO. 1 building brick manufactured from clay or shale. Brick is to be uniform standard commercial sizes with straight, parallel edges with square corners burned uniformly through, and uniform color with uniform abrasive resistance. All brick must conform to the latest version of ASTM C32. Brick for manhole inverts is to be grade SM; brick for manhole construction shall be grade MM.

PART 3 - EXECUTION

3.01 GENERAL

A. Excavation and backfilling in accordance with Section 31 23 00 – Excavation and Fill:

1. Trench width (measured at 2 feet above top of pipe).

2. Not less than 12 inches, not more than 16 inches plus outside diameter of pipe, up to 33 inch diameter pipe.
3. 24 inches plus outside diameter of pipe, for pipes greater than 33 inches.

B. Existing underground utilities, which are to be abandoned, are to be capped off and are to remain in place. Where they are within the new building area, or come in conflict with new construction, they are to be completely removed.

3.02 STORM SEWERS:

A. Laying Pipe:
1. Lay true to line and grade indicated on drawings.

2. Form close concentric joints, avoid sudden offsets of flow line.

3. When applicable laying to proceed upgrade with tongue or spigot ends pointing in direction of flow.

4. Shape bottom of trench by hand for circumferential support to bottom 1/4 of pipe.

5. Clean interior of pipe as work progresses.

6. Keep trenches free of water until joints have set and trench backfilled.

7. Sanitary sewer to be encased in concrete a minimum of 6 inches beyond outside diameter and extending a minimum of 10 feet on each side of crossings above potable water lines.

B. Joints:
1. All joints are to be per the manufacturer's instructions for the particular type of pipe. All gaskets, O-Ring seals, bands, and clamps are to be installed.

C. Connection to Existing Manholes:
1. Finished connection to requirements for new manholes.

D. Wye Branches:
1. Where indicated on plans. Cutting into existing pipe for connection not permitted.

E. Pipe Plugs:
1. Wye branches: Manufactured stopper installed in accordance with provisions for jointing.

2. Sewer Pipe: Manufacturer stopper or concrete masonry minimum 4 inches thick.

3. Plugs to permanently seal pipe but capable of removal without damaging pipe.

F. Separation of Water Mains and Sewers:
1. Parallel Installation:
a. Normal conditions - water mains to be laid at least 10 feet horizontally from sanitary sewer, storm sewer or sewer manhole, whenever possible; distance to be measured edge-to-edge.

b. Unusual conditions - When local conditions prevent horizontal separation of 10 feet, water main may be laid closer to storm or sanitary sewer provided that:
1) Bottom of water main is at least 18 inches above top of sewer.

2) Where this vertical separation cannot be obtained, sewer to be encased in 6" of concrete around pipe, full length that 10' separation not furnished.

2. Crossings:
a. Normal conditions - Water mains crossing house sewers, storm sewers or sanitary sewers to be laid to provide separation of at least 18 inches between bottom of water main and top of sewer, whenever possible.

b. Unusual conditions - When local conditions prevent a vertical separation as described the following construction to be used:
   1) Sewers passing over or under water mains to be encased in concrete. Concrete encasement is to extend 10' on both sides of crossing.

   3) Bedding: bedding shall be per manufacturers requirements based on trench soil conditions.

G. Tests:
   1. The conductors and the building storm drain shall be tested in accordance with IPC section 312.
   2. All other storm shall be inspected in accordance with GDOT section 550.3.06.
   3. Video inspection will be required on projects that have more than 500 linear feet of storm drain pipe.

3.03 BACKFILL

A. Around Pipe:
   1. Suitable material haunches in 6 inch layers and thoroughly compact.

   2. Compact backfill to at least 95% maximum density at optimum moisture content per ASTM D698 to minimum cover.

   3. Backfill simultaneously on both sides of pipe.

B. Remainder of Trench:
   1. Backfill in layers not exceeding 8 inches and compact to 95% maximum density per ASTM D698.

   2. Top one foot of backfill under paving base of subgrade compacted to 98% maximum density per ASTM D698.

C. Repair of Pavement, Curb, Gutter and Sidewalks:
   1. Where necessary to cut pavement, sidewalks or other permanent surfaces the cuts shall be made with neat lines at least 1 foot wider than the trench. Cut materials to be disposed of by the Contractor.

   2. The surfaces that are cut shall be restored to its original condition.

3.04 STORM SEWER CLEANING

A. The contractor is to clean the storm sewer system after all other construction has been completed.

END OF SECTION