SECTION 02316 - TRENCHING, BACKFILLING AND COMPACTION

PART 1 - GENERAL

1.1 Section Includes: Trenching, excavation of all materials encountered, including rock and unsuitable materials; disposal of excess and unsuitable materials; sheeting and shoring; pumping and de-watering; bedding; backfilling; and compaction for installation of pipe, piped utilities, underground conduits, and appurtenances thereto, which are 5 feet outside building lines.

1.2 Related Sections:

A. SECTION 02370 - EROSION CONTROL
B. SECTION 02920 - GRASSING AND LANDSCAPING

1.3 Quality Assurance:

A. Contractor shall employ an independent testing laboratory, acceptable to the City for performing all specified field and laboratory quality control testing and inspection specified herein at Contractor's expense.

B. Imported fill material, if required, shall be subject to approval by the City Engineer.

C. Fill material which settles shall be removed and replaced with suitable material at no cost to the Owner. Structures, paving, landscaping, and other improvements damaged by settlement shall be removed and replaced, or reworked with suitable material at no cost to the Owner.

1.4 Reference Standards:

A. ASTM C33-03 Concrete Aggregates

B. ASTM C136-01 Test Method of Analysis of Fine and Course Aggregates

C. ASTM D698-00, Laboratory Compaction Characteristics of Soil Using Standard Effort (Standard Proctor).

D. ASTM D1556-00, Density and Unit Weight of Soil in Place by the Sand-Cone Method.

E. ASTM D2321-05, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

F. ASTM D2487-00, Test Method Classification of Soils for Engineering Purposes.

G. NEPA 495, Code for the Manufacture, Transportation, Storage and Use of Explosives.

H. "Standard Specifications for Construction of Transportation Systems, 2001 Edition," Georgia Department of Transportation. Referred to herein as the “DOT Specifications.”

I. City of Emerson Water & Sewer Standard Detail Drawings, latest revision.

1.5 Site Conditions:

A. All construction shall comply with the Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 126, latest edition. Trenching and backfilling operations shall conform to Subpart P, Excavations.

B. Maintain access to the existing facilities and private property at all times.

C. Perform operations with special care in the vicinity of existing facilities. Protect above or below-ground utilities which are to remain. If any damage is done to these facilities, repair immediately.

D. Conduct all work required on public rights-of-way in strict conformance with rules and regulations of governing bodies having jurisdiction over the rights-of-way.

E. Provide traffic protection by means of suitable signs, barricades, lights, and flaggers.

F. Protect existing underground and overhead utility pipes, poles, lines, services, structures, etc. from damage or interruption of service by the conduct of construction operations. Furnish and have available at all times an electronic pipe detector in working order, and use to survey the proposed path of trenching prior to excavation. The approximate position of known utilities is shown on the Contract Drawings for the Contractor's information. The utilities shown on the Contract Drawings were located during an above-ground investigation and may not be accurate or complete. Location and protection of all underground and overhead utilities and structures in the construction area is the responsibility of the Contractor.

G. All unsuitable excavated material must be properly disposed of in a manner acceptable to the Owner and in a manner that will not adversely impact the environment.

PART 2 - PRODUCTS

2.1 General: Bedding and backfill material shall be subject to approval of the City Engineer. For approval of imported backfill or bedding material, give at least five (5) working day's advance notice of intent to import material and designate the proposed borrow area. Allow the Owner's testing laboratory to sample as necessary from the borrow area for the purpose of making acceptance tests to prove the quality of the material.

2.2 Native Material Suitable for Backfill: Soils excavated on site which do not contain "Unsuitable Material" as defined herein may be approved for general backfill. Excessively wet or dry soils may not be used until moisture is adjusted to optimum level to permit proper compaction.

2.3 Granular Material for Bedding and Embedding or Initial Backfill: An approved manufactured aggregate or coarse-grained, clean soil which are classified as Class IA, IB, or II soils per ASTM D2321. Acceptable materials which may be approved include sand, chert, crushed stone, gravel, or mixture of these, all of which meets the requirements of ASTM C33 for coarse aggregate, or Graded Size No. 57 stone, all free of Unsuitable Material, may be acceptable for bedding, embedment or initial backfill.

2.4 Stone (Crushed Stone or GAB) for Trench Bottom Stabilization or Backfill under Pavement Areas: Sound, durable "crusher run" rock, all of which passes a 1½ inch sieve, free of Unsuitable Material, graded 1-1/2” down per DOT Specification standard gradation, Section 815 for Graded Aggregate. Graded Size No. 57 stone is not an acceptable alternative to “crusher

run rock."

2.5 Unsuitable Material: Any fine-grained soil, Group PT, OH, OL, CH, ML or MH, classified per ASTM D 2487, silt, highly organic soil, topsoil, roots, vegetable matter, trash, debris, asphalt, frozen or excessively wet soil, and stone or gravel larger than 3 inch in maximum dimension. Unsuitable Material shall include any material with greater than 5% passing No. 200 sieve.

2.6 Rock Definition for Trenching: Any material which cannot be excavated with a backhoe having a bucket curling force rated at not less than 33,000 pounds (Caterpillar 225B or equivalent).

PART 3 - EXECUTION

3.1 Preparation: Prior to excavation activities:

A. Prior to starting any excavation or construction contact the Utilities Protection Center, "Call Before You Dig," telephone number 1-800-282-7411.

B. Install erosion and sediment control measures. The installation of erosion and sedimentation control measures and practices shall occur prior to, or concurrent with, land-disturbing activities.

C. Perform demolition, clearing and grubbing as required.

D. Strip and properly stockpile all sod and topsoil suitable for reuse in restoration. Protect until use.

E. Remove pavement only as necessary for excavating the trench and installing the pipelines and appurtenances. Cut all asphalt pavement in straight, uniform lines by means of a jack hammer or suitable pavement cutter. Cut all concrete pavements to a depth of at least 2 inches along the cut line with a rotary saw, after which the pavement may be broken with a jack hammer or suitable pavement cutter.

F. Determine location of existing utilities (underground and overhead utility lines, poles, pipes, services, structures, etc.) and mark them in advance of trenching operations. Furnish and have available at all times an electronic pipe detector in working order, and use said detector to survey the proposed path of excavation. Excavate and expose underground utilities in test pits to verify the locations, depths, materials of construction. Notify Engineer of potential conflicts and presence of cathodic protected facilities. No extra compensation will be given for manual excavation required to locate, protect or restore underground utilities.

3.2 Trench Excavation:

A. Excavate all subsurface material within the trenching limits specified regardless of the material encountered, including rock. Excavated materials satisfying the requirements of this Section for Native Material Suitable for Backfill may be used for final backfill. Remove surplus excavated material and Unsuitable Materials from the job site.

B. Do not excavate in areas of excessive groundwater until sufficient dewatering equipment, in good working order, is available at the site. In all cases, continuously remove water accumulated in trenches prior to installing bedding or laying pipes. Provide de-watering by pumping or well-pointing, as determined by the Contractor, as required to achieve dry ditches and continuously maintain a water level two feet below the trench

bottom. All water pumped, bailed, or otherwise removed from the excavation shall be conveyed to a suitable discharge point and disposed in a manner that neither violates regulatory requirements nor causes injury to public health, property, work completed, work in progress, or creates a public nuisance of any type.

C. Excavate the banks of trenches vertical from bottom of trench to 1 foot above the top of the pipe or conduit.

D. Keep the trench width within the limits specified below, However OSHA safety requirements shall supersede the requirements stated herein whenever applicable and shall be followed:

(1) Maximum trench width at top of pipe = Pipe outside diameter (O.D.) plus 24 inches. If the maximum trench width is exceeded, the required bedding must be upgraded to the next higher class, at Contractor's expense, for that part of trench that exceeds the maximum allowable width.

(2) Minimum width of trench = O.D. of bell or coupling plus 16 inches. (This minimum applies to all trenches including those in rock excavation.)

E. Place excavated material (spoil) sufficiently back from the edge of trench to prevent caving of the trench wall and to permit safe access along the trench. Provide at least 3 ft. clear from toe of spoil bank on at least one side of trench for access. Do not endanger the workers, the public, or obstruct roadways or sidewalks. Comply with OSHA trench safety standards at all times.

F. Do not excavate more than 400 feet in advance of pipe laying. Unless prior approval is obtained from the Owner, limit the length of open trench to that which can be completed in one working day.

G. Do not leave trenches open overnight unless there are extenuating circumstances *approved by the Owner*, and the excavations are fully protected by safe and effective barricades, fencing and lights. Provide precast concrete barriers equal to those specified by Georgia DOT Standard Specifications, Section 622.

H. Where necessary, and as required by OSHA regulations, provide and install sufficient and suitably sized movable trench boxes, shields, sheeting, shoring and/or bracing which shall remain in place until the backfill has proceeded to a point where it can be removed safely. When damage is liable to result from withdrawing sheeting, it shall remain in place. Movable shields, sheeting, shoring, bracing, etc. are considered as an integral part of the Work and no extra payment will be allowed.

I. Where necessary to place excavated material or spoil on paved streets or parking lots, first provide a thick underlayment of straw matting on the pavement to receive excavated material or spoil. Sweep the pavement clean upon removal of the excavated material or spoil.

J. Remove rock encountered in trench excavation for the specified minimum width of the trench (but not less than 30 inches width) and to a depth of 6 inches below the invert of the pipe.

K. Obtain all required permits for handling explosives and performing blasting. Conduct blasting operations in strict accordance with all existing ordinances and regulations and only with the prior approval of the Owner. Carefully protect all exposed structures from

the effects of blast and cover all blasts with heavy timbers, mats or other suitable protection. Blasting shall be done only by licensed personnel. Use very light charges to prevent damage to adjacent structures. Promptly repair any damage. Store all blasting supplies in accordance with local ordinances. In no case shall caps or other explosives be kept at the place where dynamite or other explosives are stored.

L. As trenching approaches existing underground utilities, perform excavation with extreme care. Perform necessary removals, relocations, or relaying of pipes, utility lines, and appurtenances which will obstruct the Work. Provide temporary support, adequate protection, and maintenance of all underground and surface utilities, drains, structures, or other obstructions encountered.

M. Promptly correct damage to existing utilities or structures caused by construction activities. Promptly restore disrupted utility service and provide a condition at least equal to the original condition before the damage occurred. Should the Contractor fail to promptly restore service or correct damage, the Owner or utility companies may correct the damage and back-charge the Contractor for costs incurred for the required corrective work.

N. Where existing storm drains or culverts are damaged or destroyed by removal to facilitate trenching and pipe laying, replace the damaged or destroyed drains or culverts with new reinforced concrete pipe meeting the requirements of ASTM Designation C76-04, Class II. Drain pipe shall be equal to that removed except sizes smaller than 12 inches which shall be replaced with 12 inch pipe.

O. If trench sub-grade is found to contain unsuitable or potentially corrosive material, such as ashes, cinders, refuse, petroleum contaminated soil or organic matter, immediately stop trenching and pipe installation until further notice and notify the Engineer. PVC pipe will not be suitable where susceptible to permeation by certain organic contaminants and shall be replaced by ductile iron pipe. Undercut and remove all unsuitable or potentially corrosive material at least 6 inches below the trench bottom and replace with Granular Bedding Material.

3.3 Bedding and Embedment:

A. Bedding and embedment shall conform to the individual requirements for the pipe or conduit material being used. Refer to the Drawings for Bedding/Embedment Details. Unless otherwise specified or shown on the Drawings, bedding shall be:

1.	PVC Sanitary Sewers:	Class B
2.	DIP Sanitary Sewers:	Class C
3.	PVC Water Pipe:	Class C
4.	DIP Water Pipe:	Class D
5.	Plastic Storm Sewer:	Class C
6.	RCP or CMP Storm Sewer:	Class D

B. Grade the trench bottom to provide a firm, uniform, and continuous bearing all along the entire length of the barrel of the pipe. Excavate bell holes no larger than necessary to allow joint assembly and to ensure that the pipe barrel will lie flat on the trench bottom. Pipe bells or couplings shall not support any load. Where trench excavation is carried below or beyond required limits, backfill the over-excavated space with specified bedding material.

C. In areas of rock excavation, and where needed in other areas, provide compacted Granular Bedding Material cushion across the full width of the excavation to a minimum 6 inch depth under the pipe, fittings, valves, manholes, or other structures.

D. Whenever the subgrade is unstable or too soft to provide a satisfactory foundation for any pipe, de-water and undercut as necessary and stabilize with Stone. Compact and bring the trench bottom to proper grade to create a firm, unyielding stabilized subgrade for bedding material and/or pipe.

3.4 Backfill:

A. General - Backfill and compact all trenches and excavations immediately after the pipe or appurtenance has been installed.

B. Initial Backfill and Embedment - Place select backfill around haunches of the pipe and appurtenance by hand placement and compaction, from the trench bottom up to the springline of the pipe. Place embedment materials by methods that will not disturb or damage the pipe. Continue initial embedment of the pipe to at least 6 inches above the pipe crown or to the dimensions shown on the Bedding Detail. Use no stone larger than 3/4 inches maximum dimension in the embedment. Compact the initial backfill and embedment firmly and evenly, but without use of mechanical compactors.

C. Remaining or Final Backfill - Unless otherwise specified or shown on the Drawings, use excavated Native Material Suitable for Backfill for the final, or general backfilling. If sufficient suitable Native Material Suitable for general backfill is not available on site, furnish sufficient and suitable borrow material from an approved source. Place backfill from top of Initial Backfill up to the trench surface as described herein. Do not place rocks larger than 12 inches in maximum dimension in the upper layer of backfill unless otherwise approved by the Engineer.

(1) **Trenches in streets, pavements, driveways (paved or unpaved), in areas to be paved, and in areas beneath proposed structures:** Backfill above the Initial Backfill with crusher run stone. Place the stone backfill to achieve 6 inch compacted layers at 95% Standard Proctor Density. Use mechanical tamping to achieve the required compaction. In paved roadways also install and compact the specified pavement base material to the required thickness as shown on the Pavement Replacement Detail. Install a temporary traffic surface at grade consisting of 2 inches compacted depth of crushed stone or pug mix. Leave backfilled trench open to traffic and maintain the surface at a uniform grade by refilling with stone and re-compacting as necessary to remedy any settlement. Continue such maintenance, including dust control, until surface paving is authorized by the Engineer.

(2) **Trenches in drainage ditches or other areas subject to erosion:** Unless otherwise specified, backfill trenches with Native Material Suitable for Backfill and mechanically compact in 6 inch layers to achieve 95% Standard Proctor Density per ASTM D698. Refill and re-compact eroded or settled trenches as often as necessary to restore and maintain the surface at the required finished grade. Immediately stabilize the surface against erosion.

(3) **Trenches in areas to be grassed or landscaped:** Unless otherwise specified, backfill trenches with Native Material Suitable for Backfill and compact by methods of Contractor's choice to achieve at least 85% Standard Proctor Density

per ASTM D698. However, if the trench is on DOT or Railroad rights-of-way, compact to the density specified in the applicable permit. Refill and re-compact settled trenches as often as necessary to restore and maintain the trench surface at the required finished grade.

3.5 Field Quality Control:

A. Perform routine quality control compaction testing at a frequency sufficient to ensure adequate compaction throughout the trenching and backfilling.

B. In streets, paved areas, or areas to be paved, perform compaction testing of the underlying backfill prior to placing pavement base material.

C. Notify the testing laboratory and the City Engineer 24 hours prior to need for testing.

D. When any tests indicate the density, moisture content, or compaction does not meet requirements specified herein, as determined by the City Engineer, rework until the required density has been obtained and approved by the City Engineer.

END OF SECTION