



RELIABLE. LOCAL. COMMITTED.

GAFFNEY BOARD OF PUBLIC WORKS

STANDARD WATER SPECIFICATIONS

GAFFNEY, SOUTH CAROLINA

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SECTION 02221

TRENCHING, BACKFILLING FOR UTILITIES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included: Trench, backfill, and compact as specified herein and as needed for installation of underground utilities associated with the Work.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division I of these Specifications.

2. Section 02660 – Water Distribution System

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

1.3 JOB CONDITIONS

A. Existing Utilities:

1. There now exists in the construction areas, waterworks, storm drainage, sanitary sewers, street paving, gas mains and other utilities.

2. Approximate location of certain underground lines and structures are shown on the plans for information only, other underground lines or structures are not shown.

3. Locate these and other possible unknown utility lines using electronic pipe finder, or other approved means.

4. Locate, excavate and expose all existing underground lines in advance of trenching operations.

5. The Contractor will be held responsible for the workmanlike repair of any damage done to any of these utilities in the execution of his work under this Section.
6. The Contractor shall familiarize himself with the existing conditions and be prepared to adequately care for and safeguard himself and the Owner from damage.

B. Notification of intent to excavate:

1. South Carolina Underground Utility Damage Prevention Act (S.C. Code Ann, 58-35-10, CT-SEQ, Supp. 1978) requires persons to ascertain the location of underground public utility property prior to excavation or demolition in certain situations. The Act also requires such persons to give timely notice of intent to excavate or demolish prior to commencing such operations. Failure to comply could subject the violator to a civil penalty of up to one thousand dollars (\$1,000) for each violation of the Act.
2. Notification of intent to excavate may be given by calling this toll free number: 1-888-721-7877.

C. Protecting trees, shrubbery and lawns:

1. Trees and shrubbery in developed areas and along the trench line shall not be disturbed unless absolutely necessary, and subject to the approval of the Engineer.
 - a. Any such trees and shrubbery necessary to be removed shall be heeled in and replanted.
2. Where trenches cross private property through established lawns, sod shall be cut removed, stacked and maintained in suitable condition until replacement is approved by the Engineer.
 - a. Topsoil underlying lawn areas shall be removed and kept separate from general excavated materials.

D. Clearing:

1. Perform all clearing necessary for installation of the complete work.
2. Clearing shall consist of removing all trees, stumps, roots, brush and debris in the rights-of-way obtained for the work.

3. All timber of merchantable size shall remain the property of the Owner and shall be trimmed and cut in such lengths as directed and stacked along the edge of the right-of-way.
4. All other material, including trimmings from above, shall be completely disposed of in a satisfactory manner.

E. Removing and resetting fences:

1. Where existing fences must be removed to permit construction of utilities:
 - a. Remove such fences and, as the work progresses, reset the fences in their original location and condition.
 - b. Provide temporary fencing or other safeguards as required to prevent stock and cattle from wandering to other lands.

F. Restoration of disturbed areas:

1. Restore all areas disturbed by, during or as a result of construction activities to their existing or better condition.
 - a. For existing areas with sod type grasses, replace with new sod. Existing sod may be reused where properly removed and stored.
2. Do not interpret this as requiring replacement of trees and undergrowth in undeveloped sections of the rights-of-way.

G. Minimizing silting and bank erosion during construction:

1. During construction, protective measures shall be taken and maintained to minimize silting and bank erosion of creeks and rivers adjacent to the work being performed during construction.

H. Blasting:

1. Store all explosives in a secure manner, complying with all laws, ordinances, and regulations.
2. Contractor shall be responsible for damage caused by blasting operations.

PART 2 – PRODUCTS

2.1 EXCAVATED MATERIALS

- A. Perform all excavation of every description and of whatever substances encountered to depths indicated or specified.
- B. Pile material suitable for backfilling in an orderly manner at safe distance from banks or trenches to avoid overloading and to prevent slides or cave-ins.
- C. Remove and deposit unsuitable or excess materials as directed by the Engineer.

2.2 BACKFILL MATERIALS

- A. Provide from materials excavated for installation of utility.
 - 1. Select soil material free from organic matter and deleterious substances, containing no rocks or lumps over 2" in greatest dimension for backfill up to 12" above top of utility being covered.
 - 2. Do not permit rocks larger than 2" in greatest dimension in top 6" of backfill.

2.3 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.
- B. Should the quantity of suitable on-site material be insufficient to complete the work, provide suitable borrow material as approved by the Engineer at no additional expense to the Owner.
- C. Provide select materials from on-site if acceptable material as approved by the Engineer is available on-site. Otherwise, provide approved select material from an off-site source.

PART 3 – EXECUTION

3.1 PROCEDURES

A. Existing utilities:

1. Unless shown to be removed, protect active utility lines shown on the drawings or otherwise made known to the Contractor prior to trenching. If damaged, repair or replace at no additional cost to the Owner.
2. If active utility lines are encountered and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Engineer and secure his instructions.
5. Do not proceed with permanent relocation of utilities until written instructions are received from the engineer.

B. Locations within streets or highways:

1. Comply with South Carolina Department of Transportation's (SCDOT) "Encroachment Permit" issued for the Work, and the South Carolina Department of Transportation's (SCDOT) "A Policy for Accommodating Utilities on Highway Rights-of-Way".
2. Take all precautions and comply with all requirements as may be necessary to protect the improvements, including barricades for protection of traffic.
3. Keep a minimum of one lane open to traffic at all times where utility crosses street or highway.

C. Protection of persons and property:

1. Barricade open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or with public access.

2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout and other hazards created by operations under this Section.

D. Dewatering:

1. Remove all surface and subsurface waters from excavations and maintain the excavation in a dry condition during construction operations.
2. Maintain the ground water level a minimum of 3-feet below the trench bottom during excavation, installation and backfilling.
 - a. Material disturbed below the invert elevation due to improper dewatering shall be removed and replaced with crushed stone or lean concrete at no expense to the Owner.
 - b. Use sumps, pumps, drains, trenching, wells, vacuum or well point system as necessary to maintain the ground water level a minimum of 3-feet below the trench bottom and maintain a dry excavation.
 - c. Dewatering by trench pumping will not be permitted if migration of fine grained natural material (running sand) from bottom, side walls or bedding material will occur.
 - d. Provide monitoring wells sufficient in size, location, number and depth to monitor the ground water level in the construction area during excavation and backfill operations.
 - e. Maintain dewatering operations until backfilling and compaction operations are complete.
3. Dispose of water pumped from excavations in storm drains having capacity, canals, trenches or other approved locations.
 - a. Contractor is responsible for acquiring all permits required to discharge the water and shall protect waterways from turbidity during the operation.
 - b. Prevent flooding of streets, roadways, or private property.

- c. Provide engines driving dewatering pumps with residential type mufflers.
- E. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.
- F. Maintain access to adjacent areas at all times.

3.2 TRENCH EXCAVATION (Classified)

- A. Remove all materials of whatever substance encountered, additional payment to be made for rock excavation as hereinafter defined and specified.
 - 1. Rock excavation to consist of the removal and disposal of the following materials:
 - a. Boulders $\frac{1}{2}$ cubic yard or more in volume.
 - b. Solid rock.
 - c. Materials that cannot be removed without systematic drilling and blasting, such as rock material in ledges or aggregate conglomerate deposits that are so firmly cemented as to possess the characteristics of solid rock.
 - d. Concrete and masonry structures exceeding $\frac{1}{2}$ cubic yard in volume except sidewalks and paving.
 - 2. Rock excavation does not include:
 - a. Boulders, concrete masonry structures less than $\frac{1}{2}$ cubic yard in volume.
 - b. Hard and compact materials such as cemented gravel and relatively soft or disintegrated rock that can be removed without continuous and systematic drilling and blasting.
 - c. Material removed by intermittent drilling and blasting performed to increase production.
 - 3. Do not remove material claimed as rock until the Engineer has classified and cross-sectioned same.

B. Where trenching occurs in existing lawns, remove turf in sections and keep damp. Replace turf upon completion of the backfilling.

C. Open cut:

1. Excavate for utilities by open cut.
2. If conditions at the site prevent such open cut, and if approved by the Engineer, tunneling may be used.
3. Short sections of a trench may be tunneled if, in the opinion of the Engineer, the conductor can be installed safely and backfill can be compacted properly into such tunnel.
4. Remove boulders and other interfering objects, and backfill voids left by such removals, at no additional cost to the Owner.
5. Remove wet or otherwise unstable soil incapable of properly supporting the utility, as determined by the Engineer, to depth required and backfill to proper grade with stone bedding material, at no additional cost to the Owner.
6. Excavating for appurtenances:
 - a. Excavate for manholes and similar structures to a distance sufficient to leave at least 12" clear between outer surfaces and the embankment or shoring that may be used to hold and protect the banks.
 - b. Overdepth excavation beyond such appurtenances that has not been directed will be considered unauthorized. Fill with sand, gravel, or lean concrete as directed by the Engineer, and at no additional cost to the Owner.

D. Trench to the minimum width necessary for protection of the Work and for the safety of personnel.

E. Provide sheeting and shoring necessary for protection of the Work and for the safety of personnel.

1. Remove in units when level of backfilling has reached the elevation necessary to protect the utility work and adjacent property.

2. Sheet piling at the bottom of trenches over 10' deep for sewers 15" and larger in size, shall remain in place and be cut off no less than 2" above the top of the pipe, at no additional cost to the Owner.

F. Depressions:

1. Dig bell holes and depressions for joints after the trench has been graded. Provide uniform bearing for the pipe on prepared bottom of the trench.
2. Except where rock is encountered, do not excavate below the depth indicated or specified.
3. Where rock is encountered, excavate rock to a minimum overdepth of 4" below the trench depth indicated or specified, and to provide 6" clearance in any horizontal direction from all parts of the utility and appurtenances.

G. Special requirements relating to excavation for specific types of utilities shall comply with the following:

1. Sanitary or storm sewer lines:
 - a. Comply with requirement of Section 02730.
 - b. Do not excavate trench more than 200' ahead of pipe laying, unless permitted by Engineer.
 - c. Maintain trench sides vertical to point not less than 2' above top of pipe.
 - d. Upper portion of trench may be sloped to any with which will not cause damage to adjoining structures, utilities, pavements or private property.

H. Comply with pertinent OSHA regulations in regards to the excavation of utilities.

3.3 BACKFILLING

A. General:

1. Backfill trenches and excavations immediately after the pipes are laid, unless other protection is directed or indicated.

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2. Select and deposit backfill materials with special reference to the future safety of the pipes.
3. Reopen trenches which have been improperly backfilled, to a depth as required for proper compaction. Refill and compact as specified, or otherwise correct to the approval of the Engineer.
4. Surplus material shall be deposited of as directed by the Engineer.
5. Original surface shall be restored to the approval of the Engineer.
6. Maintain proper dewatering during backfill and compaction operations.

B. Lower portion of trench:

1. Deposit approved backfill and bedding material in layers of 6" maximum thickness, and compact with suitable tampers to the density of the adjacent soil until there is a cover of not less than 24" over sewers and 12" over other utility lines.
2. Take special care in backfilling and bedding operations not to damage pipe and pipe coatings.

C. Remainder of trench:

1. Except for special materials for pavements, backfill the remainder of the trench with material free from stones larger than 6" or $\frac{1}{2}$ the layered thickness, whichever is smaller, in any dimension.
2. Deposit backfill material in layers not exceeding the thickness specified, and compact each layer to the minimum density directed by the soil engineer.

D. Adjacent to buildings: Mechanically compact backfill in 6" layers within ten (10') feet of buildings.

E. Under roads, streets and other paved areas:

1. Mechanically tamp in 6" layers using heavy duty pneumatic tampers or equal.
2. Tamp each layer to a density equivalent of not less than 100% of an ASTM D 698 Proctor Curve.

3. Provide additional compaction by leaving the backfilled trench open to traffic while maintaining the surface with crushed stone.
4. Refill any settlement with crushed stone and continue such maintenance until replacement of pavement is authorized by the Engineer.

F. Undeveloped areas:

1. Backfill in wooded, swampy or undeveloped areas shall be accomplished to maintain not less than 90% of an ASTM D 698 Proctor Curve.

3.4 EXCAVATION BY JACKING-BORING

- A. Install casings where indicated by jacking and boring.
- B. Comply with Section 02601.

SECTION 02222

ROCK EXCAVATION

PART 1: GENERAL

1.1 SCOPE OF WORK

- A. The work covered by this section consists of the blasting and excavation of rock material in cut areas. Rock excavation shall be classified material which cannot be removed with normal construction equipment such as hydraulic excavators, bulldozers with “rippers” and requires the construction practice of blasting.

1.2 DEFINITIONS

- A. Rock is defined as being sandstone, limestone, flint, graphite, quartzite, slate, hard shale, or similar material that cannot be excavated without systematic drilling and blasting.
- B. Should rock be encountered in two or more ledges, each ledge being not less than 3” thick and with interlying strata of earth, clay or gravel not more than 12” thick in each stratum, the entire volume between the top of the top ledge and the bottom of the bottom ledge will be classified as rock.

PART 2: EXCUTION

2.1 CONSTRUCTION REQUIREMENTS

- A. Hydraulic Hammer: Removal of rock by hydraulic means is the Owner’s preferred method of rock excavation.
- B. Blasting: The use of explosives shall conform to be strict accordance with all Federal, State, County and local regulations and only after the approval of the Engineer. The Contractor shall be responsible for all damage caused by blasting operations. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of excavation of trench.
- C. When rock is encountered, all lines and grades will be held in accordance with the plans or adjusted only after approval of the engineer.
- D. When rock is encountered within the limits of construction, the Contractor shall notify the Engineer prior to any removal. Upon the Engineer’s authorization, the Contractor shall remove the rock. The Contractor shall not be paid for rock removed without prior approval from the Engineer.
- E. All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed.

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SECTION 02601

BORE AND ENCASEMENT

PART 1 – GENERAL

1.1 Scope of Work

- A. The work under this section consists of furnishing all materials, labor, equipment and services required for the complete installation of sewer line encasement and carrier pipes under highways and railroads by boring and jacking as shown on the drawings and specified herein.
- B. All work in connection with construction encasement pipes under highways and railroads shall comply with all current requirements of governing highway and railroad agencies. The Contractor shall be familiar with these requirements.
- C. The Contractor shall inspect the locations at the proposed crossings and shall familiarize himself with the conditions under which the work will be performed, and with all necessary details and the suitability of his equipment and methods for the work required.

PART 2 – PRODUCTS

2.1 Materials

- A. Steel encasement pipes shall be smooth wall welded steel pipe conforming to ASTM Designation A139, Grade B. Minimum pipe wall thickness shall be as follows:

	Pipe-Nominal Diameter Inches		Wall Thickness Inches		
	14" and Under		0.188		
	16"		0.25		
	20"		0.25		
	24"		0.25		
	30"		0.312		
	36"		0.500		

- B. The minimum inside diameter of the encasement pipe shall be:

1. 2" greater than the largest outside diameter of the carrier pipe, joints and couplings for carrier pipe less than 6" in diameter.

PART 3 – EXECUTION

3.1 Installation

- A. Encasements shall be installed by boring and jacking unless field conditions require otherwise. It shall be the Contractor's responsibility to notify the Engineer immediately if conditions do not permit a jack and bore installation.
- B. The encasement pipe shall be of the diameter indicated on the drawings.
- C. Installation of encasement pipe shall include all related work and services such as mobilization of equipment, constructing and maintaining working pits, right-of-way maintenance and restoration, traffic maintenance, mining, excavations, dewatering, sheeting, shoring, bracing for embankments, operating pits, and as elsewhere required shall be placed and maintained in order that work may proceed safely and expeditiously.
- D. Installation of the casing pipe shall be carried out without disturbance of the embankment, pavement, tracks, or other railroad or highway facilities and without obstructing the passage of traffic at any time.
- E. The driven portions of the casing shall be advanced from the lower end of the casing unless specific permission to do otherwise is obtained by the Contractor from the Engineer.
- F. The alignment and grade shall be carefully maintained and the encasement pipe installed in a straight line.
- G. The space outside the encasement and the ground shall be filled with grout, sand or pea gravel, as directed by the Engineer. The Engineer will direct that this space be filled if the space is large enough to cause any earth settling.
- H. Before the pipe is installed in the casing, bolt-on metal skids painted with bitumastic paint shall be rigidly fastened to the barrel of the pipe. After completion of the casing, the Contractor shall insert the pipeline in pre-jointed segments. No contact will be permitted between casing and the carrier pipeline.

SECTION 02615
REMOVING AND REPLACING PAVEMENTS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Work included: Removal and replacement of existing pavements for installation of utility lines, as specified herein, and as needed for a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.
 - 2. Section 02221 – Trenching, Backfilling for Utilities.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods for proper performance of the work of the Section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provision of Section 01640.

1.5 WARRANTY

- A. All removed and replaced pavement work within the South Carolina Department of Transportation (SCDOT) rights-of-way shall be warranted for two years beginning on the date to acceptance by the SCDOT.
- B. All removed and replaced pavement work within individual county road rights-of-way shall be warranted for two years beginning on the date of acceptance by the individual county.

PART 2 – PRODUCTS

2.1 CONCRETE

- A. Comply with Section 03300, using strength specified herein.

2.2 ASPHALTIC CONCRETE

- A. Use Types 1 and 2 complying with South Carolina Department of Transportation Standard Specifications, Section 403.

2.3 AGGREGATE BASE COURSE WITH PRIME

- A. Comply with applicable portions of South Carolina Department of Transportation Standard Specifications, Section 306.

PART 3 – EXECUTION

3.1 GENERAL

- A. Remove to neat lines and dispose of as directed.
- B. Replace with bases and pavements similar to type removed, unless otherwise indicated.

3.2 CUTTING

- A. Concrete pavement or base:
 - 1. Cut on straight and true lines, to a minimum depth of 2", using powered concrete saw.
 - 2. Shear off remaining depth with pneumatic tools.
- B. Concrete sidewalks shall be removed back to the nearest joint on each side of the crossing.
- C. Asphaltic concrete pavements: Cut to straight and true lines with powered concrete saw.

3.3 REPLACEMENT

- A. Concrete pavements:
 - 1. Use 300 psi concrete.
 - 2. Replace to 6' below existing slab and undercut each edge 6" to form shelf.
 - 3. Finish surface to match existing surface.
- B. Concrete sidewalks:
 - 1. Replace with 3000 psi concrete.
 - 2. Depth shall be equal to existing section removed, but not less than 4".
 - 3. Finish surface to match existing sidewalk.

- C. Flexible pavements (Ditch Line) – Secondary and Primary Roads:

1. Compact subgrade thoroughly.
2. Undercut each edge 6" to form a shelf.
3. Place 8" 2500 psi concrete leaving surface rough and depressed 2".
4. Top with 2" of asphaltic concrete.

D. Flexible Pavements (Ditch Line) – Driveways:

1. Compact subgrade thoroughly.
2. Place 8" deep aggregate base course with prime.
3. Top with 2" of asphaltic concrete.

E. Flexible pavements (Resurfacing):

1. In some instances where utilities are installed within existing pavements, resurfacing of the entire width of the original pavement will be required.
2. Replace pavement in ditch line as specified above.
3. Prime and resurface with 1 ½" of asphaltic concrete.
4. Taper resurfacing to existing pavement evenly for a distance of 50 feet beyond repaired area.
5. Comply with Section 02513.

SECTION 02660
WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide water distribution system as shown on the Drawings, specified herein, and needed for a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Part I of these specifications.
 - 2. Section 02221 – Trenching Backfilling for Utilities.
 - 3. Section 02615 - Removing and Replacing Pavements.
 - 4. Section 02780 – Casing Pipes for Utilities.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. All materials in this Section are to be manufactured in the United States.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 10 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section;
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.
- B. Storage of PVC pipe:
 1. Store in unit packages as received from manufacturer until just prior to use.
 2. Stack units in such manner as to prevent deformation to pipe barrel and bells.
 3. Protect from direct sunlight by covering with opaque material if storage period will exceed six weeks.
- C. Avoid severe impact blows, gouging or cutting by metal surfaces or rocks.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Use any pipe material and associated fittings as specified herein, except where use of a particular material is indicated on the plans, or specified herein.

2.2 PIPE AND FITTINGS

- A. General:
 1. Pipe sizes 6" and larger: Use ductile iron unless otherwise indicated.
 2. Pipe less than 6" size: Use plastic pipe.
 3. No asbestos cement pipe allowed. Thermoplastic pipe should not be used above grade.

4. Installation of water mains and appurtenances shall be conducted in accordance with Section C of the AWWA Standards and/or manufacturer's recommended installation procedures
5. Any pipe, solder, or flux used shall be lead free (lead free is defined as less than 0.2% lead in solder or flux and less than 8.0% lead in pipes and fittings).
6. All pipe be National Sanitary Foundation (NSF) approved and shall be third party certified as meeting the specifications of ANSI/NSF Standard 61.
7. All materials and products that contact potable water shall be third party certified as meeting the specifications on ANSI/NSF Standard 61.
8. All chemical or products added to the public water supply must be third party certified as meeting the specifications of ANSI/NSF Standard 60.
9. For valves cast all markings integral on the valve body with the size of valve, year of manufacture and the class working pressure.
 - a. Certifications to rate a 150B valve body to a Class 250 valve will not be acceptable.
10. For valves spray coat all interior wetted ferrous surfaces with two-component epoxy applied to a nominal thickness of 3 to 4 mils.
 - a. Coating material to be AWWA and U.S. Food and Drug Administration approved for use with potable water.
11. Exterior Coatings: For ductile iron pipe
 - a. For buried service provide bituminous coating.
 - b. For exposed locations comply with Section 09900.

B. Pipe:

1. Ductile iron pipe (DIP):
 - a. Comply with ANSI/AWWA C150/A21.50 or AWWA C151/A21.51, latest revision.
 - b. The class or nominal thickness, new weight without lining, and casting period shall be clearly marked on each length of pipe.

Additionally, the manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "Ductile" shall be cast or stamped on the pipe.

- c. Wall thickness in accordance with Table 50.5 of ANSI/AWWA C150/A21.50, depth of cover indicated and Type 3 bedding conditions, minimum Pressure Class 350.
- d. Use cement mortar lining complying with ANSI/AWWA C104/A21.4, standard thickness.

2. Plastic Pipe (PVC):

a. General:

- 1) Marked with National Sanitation Foundation approval at 18" intervals.
- 2) Gaskets are to be factory installed and integral to the pipe and comply with ASTM F 477.
 - a) Natural rubber gaskets are not acceptable.

- b. Plastic pipe 3" and smaller: Comply with ASTM D 2241 for PVC 1120, SDR 21.3" and below.

3. Polyethylene (PE) pipe:

- a. Comply with AWWA C-906, DR 9 and working pressure of 200 psi.
- b. The pipe supplied under this Specification shall be SDR high performance, high molecular weight, high density polyethylene pipe, and shall conform to ASTM D 1248 (Type III C, Category 5, P34). Minimum cell classifications values shall be 345434C as referenced in ASTM D 3350 – latest edition. All pipe resin shall be manufactured by the same company that manufactures the pipe itself, in accordance with these specifications to ensure complete resin compatibility and total product accountability.

The fittings supplied in this specification shall be molded or manufactured from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe. To ensure compatibility of polyethylene resins, all fitting supplied under this specification shall be of the same manufacture as the pipe being supplied.

c. Physical Properties:

1) The pipe shall conform to the physical properties as described herein.

2) Typical pipe physical properties:

Property	Test Method	Unit	Value
Density	ASTM Method	gms/cc	0.955
Melt Index	ASTM D-1238 (190/2.16)	gms/10 min	
Environmental Stress Cracking Resistance:			
Condition A, B, & C, F-0	ASTM D 1693	hrs	>5000**
Compressed Ring, F-60	ASTM F 1248	hrs	>1500
Tensile Strength			
Yield	ASTM D 638	psi	3200
Type IV Speciment	(2"/min)		
Elongation at Break	ASTM D 638	%	>750
Victate Softening Temp	ASTM D 1525	°F	257
Brittleness Temp	ASTM D 746	°F	<-180
Flexural Modulus	ASTM D 790	psi	135,000
Modulus of Elasticity	ASTM D 638	psi	130,000
Hardness	ASTM D 2240	Shore D	65
Linear Thermal Expansion Coef.	ASTM D 696	in./in./°F	1.2x10-4
Thermal Conductivity	Dynatech-Colora BTU	In./Thermoconductor ft./2 hrs./°F	2.7
Long Term Strength:			
73° F	ASTM D 2837	psi	1600
UV Stabilizer	ASTM D 1603	%C	2.5
Material Cell Classification	ASTM D 1248		345434C
Material Description	PPI Recommendation		PE 3408

d. Quality Control: The resin used for manufacture of the pipe shall be manufactured by the pipe manufacturer, thus maintaining complete control of the pipe quality. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious

defects and shall be identical in color, density, melt index, and other physical properties. The polyethylene resin used shall have all ingredients pre-compound prior to extrusion of pipe, in plant blending is not acceptable. Owner may request, as part of the quality control records submit, certification that the pipe produced is represented by the quality assurance testing. Additionally, test results from manufacturer's testing or random sampling by the Engineer that do not meet appropriate ASTM standards or manufacturer's representation, may be cause for rejection of pipe represented by the testing. These tests may include density and flow rate measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM D 3350, 10.1.9. Certified lab data may be requested to verify the physical properties of the materials supplied under this specification or may take random samples and have them tested by an independent laboratory.

- e. Rejection: The Owner reserves the right to reject any polyethylene pipe and fittings failing to meet any of the requirements of this specification.
- f. Pipe Dimensions: Pipe supplied under this specification shall have a nominal DIP (ductile iron pipe) size O.D. unless otherwise specified. The DR (Dimension Ratio) of the pipe supplied shall be as specified.

C. Joints:

1. Ductile iron pipe:

- a. Manufacturer shall be US Pipe or McWane Ductile
- b. Use mechanical or push-on joints complying with ANSI/AWWA C111/A21.11 as modified by ANSI/AWWA C151/A21.51.
- c. Use gaskets and lubricant complying with ANSI/AWWA C111/A21.11. Natural rubber gaskets are not acceptable.
- d. Lubricants shall be compatible with pipe and gasket materials, shall not support bacteria growth and shall not adversely affect potable quality of line contents. Vegetable shortening shall not be used to lubricate joints. They shall be NSF approved.
- e. Exposed pipe:

- 1) Class 53 Minimum.

2) Use flanged joints complying with ANSI/AWWA C115/A21.11, latest revision; and

- i. Flanges to be solid type
- ii. Use full face, red rubber, factory cut, 1/16" thick for pipe up to 10" diameter and 1/8" thick for larger sizes.
- iii. Bolts and nuts shall be standard carbon steel machine bolts, hex head complying with ANSI A21.11/AWWA C111.

2. Plastic pipe:

- a. Use integral bell or coupling type with elastomeric gaskets.
- b. Integral bells to comply with ASTM D2672.
- c. Couplings to comply with ANSI/AWWA C900.
- d. Gaskets to comply with ASTM F477.

1) Natural rubber gaskets are not acceptable.

- e. Lubricants shall be compatible with pipe and gasket materials, shall not support bacteria growth and shall not adversely affect potable quality of line contents. Vegetable shortening shall not be used to lubricate joints. They shall be NSF approved.

3. Polyethylene pipe joining:

- a. Sections of polyethylene pipe should be joined into continuous lengths on the job site above ground. The joining method shall be the butt fusion method and shall be performed by the manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements, alignment, and fusion pressures. Prior approval of equipment and personnel shall be obtained before fusion begins. The completed pipe joints shall be guaranteed for five years in writing to the Owner and its Contractor.

- b. End Connections: Special restrained joint mechanical joint adapters may be required for each end of the P.E. pipeline. The price quoted shall include any special end configuration and polyethylene ring to hold a standard mechanical joint.
- c. Provide restrained joint mechanical joint adapters for each end of the P.E. pipeline.
 - 1) Include any special end configuration and polyethylene ring to hold a standard mechanical joint.
- d. Expansion joint: Provide one on each end of the polyethylene pipeline.
 - 1) Ductile iron conforming to ANSI/AWWA C153/A21.53.
 - 2) Minimum 15 mil fusion bonded epoxy lining meeting ANSI/AWWA C213 and C550.
 - 3) Restrained mechanical joint.
 - 4) Minimum pressure rating of 350 psi.
 - 5) Provide minimum of 8" of expansion capability for expansion joint.
 - 6) Provide Ex-Tend 200 by EBBA Iron Sales, Inc.

D. Fittings and specials:

1. Ductile Iron Pipe:

- a. Use 350 psi pressure rated ductile iron fittings or specials unless otherwise indicated, complying with ANSI/AWWA C110/A21.10.
- b. Compact fittings for piping 3"-16" may be provided in accordance with ANSI/AWWA C153/A21.53.88.b.
- c. Fittings for use with push-on joint pipe, comply with ANSI/AWWA C111/A21.11.
- d. Use cement mortar lining complying with ANSI/AWWA C104/A21.4, standard thickness.
- e. The maximum phosphorous level in the casting will be 0.08%.

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- f. The fitting surface finish will conform to MSS SP-112 Quality Standard for Evaluation of Cast Surface Finishes.
- g. The manufacturer shall be ISO 9000 certified.
- h. Markings: Each fitting shall have the following markings cast integrally to the fitting:
 - 1. Manufacturer's Name or Logo
 - 2. "MJ"
 - 3. Country or origin
 - 4. Manufacturer's Foundry Mark
 - 5. AWWA C-153 or C110
 - 6. Pressure Rating
 - 7. Nominal Diameter (each leg)
 - 8. "DI" or "Ductile"
 - 9. No. of Degrees (bends)

- 2. Plastic pipe 3" and smaller: Use brass flanged or threaded fittings, joint design to conform to pipe type.

E. Couplings:

- 1. Provide couplings where needed to make piping connections and where located on the plans.
- 2. Provide mechanical joint ductile iron sleeve, full length, minimum 12".
- 3. Provide cutting-in sleeve where installing fittings in an existing line.
 - a. Provide ductile iron with mechanical joint.
- 4. Provide restrained joint couplings where restrained joints are indicated on the plans.

F. Restrained joint pipe and fittings:

- 1. Provide restrained joint pipe and fittings on all piping at each fitting, including valve and fire hydrant connections, and on the pipe joints to a distance of 18' each side of the fitting for 12" piping and smaller.
 - a. Provide one of the following for push on pipe:

- 1) Field Lok by U.S. Pipe or equivalent .

b. Ductile iron pipe, fittings, valves and hydrants:

- 1) Provide retainer glands for use with mechanical point pipe and fittings.
- 2) Provide wedge type.
- 3) Provide ductile iron gland conforming to ASTM A 536-80. Provide split gland where standard gland cannot be installed.
- 4) Provide ductile iron set screws, heat-treated to a minimum hardness of 370 BHN with twist-off nuts and permanent standard hex head remaining.
- 5) Provide for the following rated pressure with minimum 2 to 1 safety factor; 3"-16" 350 psi, 18"-48" 250 psi.
- 6) Provide tee-head bolts conforming to ANSI/AWWA C111/A21.11 latest revision.
- 7) Provide "MEGSLUG" series 1100 or series 1200 as manufactured by EBAA Iron, Inc. of Eastland, Texas or approved equal.

G. Tee head bolts: Provide Cor-Ten steel tee head bolts for use on mechanical joints complying with ASTM A242.

H. Plus or caps:

1. Provide at all pipe ends and unused branches of fittings.
2. All plugs and caps shall be tapped 2" and provided with 2" plug.
3. Plugs and caps to the restrained joint.

2.3 LINE DETECTION TAPE

A. Provide 2" wide metallic detection tape on all buried PVC piping.

1. Provide 5.0 mil overall thickness with no less than a 50 gauge solid aluminum foil core.
2. Foil to be visible from both sides.
3. No inks or printing extended to the edges of the tape.
4. Encase printing to avoid ink rub-off.
5. Tensile strength – 28 lbs./inch.
6. Use heat set mylar inks.
7. Locate 12" below ground surface in pipe trench.
8. Color to be Safety Precaution Blue.
9. Wording on tape to indicate "Potable Water" at no greater than 24" on center.

2.4 COPPER TRACER WIRE

- A. Provide a continuous 12 gauge blue insulated copper tracer wire when PVC or polyethylene pipe is used.
- B. Tracer wire to be approved for direct burial by the manufacturer.
- C. Locate tracer wire a minimum of 6-inch above top of water main.
- D. Terminate tracer wire at each valve and meter and make provisions to allow for connection of testing apparatus without interfering with the proper operation of valves and meters.
- E. Connect to the water line with duct tape at every bell connection or every 20' to ensure that the wire is directly over the top of the pipe.
- F. Place in the trench with all service lines.
- G. Splice at each service lateral and tee connection with an approved copper compression lug.

2.5 GATE VALVES

- A. General:
 - 1. 1-1/2-inch and smaller: Use gate valves or ball valves.
 - 2. 2-inch through 12-inch: Use gate valves.
 - 3. 14-inch and larger: Use gate valve or butterfly valve.
 - 4. Open by turning counterclockwise.
 - 5. End connections as required for the piping in which they are installed.
 - 6. Two inch metal operating nut with arrow indicating direction of opening.
 - 7. Use valves designed for a working pressure of not less than 200 psi.

8. Provide stem extensions on all valves where the top of the operator nut is located greater than 36 inches below the top of the valve box.
 9. Fully coat all internal ferrous meter surfaces with two part thermosetting epoxy.
 10. Design for external stem failure when excessive closing torque is applied with no failure of the pressure retaining parts.
 11. Provide double disc gate valves with bevel gears, grease case, and other necessary appurtenances of horizontal installation.
 12. Provide two-part thermosetting epoxy coating on valve exterior.
 13. Provide stainless steel bolting.
 14. Valves to be manufactured by Muller.
 15. Provide all wetted rubber compounds of synthetic rubber.
- B. Gate Valves 1-1/2-Inch and Smaller:
1. Use all bronze ball valves, ¼ turn with stop, 2-inch square nut operator.
 2. Provide Ford Model B11-QT67 or equal.
- C. Gate Valves 2-inch through 12-inch:
1. Use resilient seated wedge valves complying with ANSI/AWWA C509.
 2. Provide integrally cast bronze stem nut on resilient seated wedge valves.
 3. Suitable for working pressure of not less than 250 psi.
 4. Design for external stem failure outside of the valve body or bonnet when excessive closing torque is applied with no failure of the pressure retaining parts per AWWA Section 3.2.
 - a. Factory test with no leakage from either side of the disc.

- b. Test shell to 500 psig.
- 5. Provide certified to NSF 61.
- 6. Resilient wedge valves:
 - a. Completely encapsulate resilient iron wedge by an elastomer, without thin spots or voids.
 - b. Provide polymer wedge guide bearing caps bearing surface between the encapsulated wedge and the interior epoxy coating, lowering operation torque and extending service life of the valve.
 - c. The manufacturing plant to have ISO9001 certification.

2.4 HYDRANTS

A. Fire Hydrants

- 1. Comply with ANSI/AWWA C502.
- 2. Waterway valve opening, 5-1/4-inch.
- 3. Six inch bell connection, two 2-1/2-inch hose connections, one 4-1/2-inch steamer connection with cap chain on all connections.
- 4. National Standard screw threads on outlet nozzles. Open by turning counterclockwise, cast in top indicating direction of opening.
- 5. Two part breakable safety flange shall be an integral part of barrel casting.
- 6. Depth of bury, 3'6 inches.
- 7. Finish coat with industrial enamel, OSHA safety yellow.
- 8. Provide one hydrant wrench for each ten hydrants.
- 9. Provide Mueller Super Centurion 250 only.

B. Reflector:

1. Provide industry standard blue hydrant reflector for paved roadway.

C. Offset Fitting:

1. Provide an offset fitting at slope areas where required for the hydrant connections to be located 1'4 inches above finished grade.
2. Locate between the shut-off valve and each hydrant with a 12-inch offset.
3. Provide ductile iron per AWWA C153, compact design, coated per AWWA C104.
4. Provide Grade Lok as manufactured by Assured Flow Sales, Inc., or approved equal.

2.6 VALVE BOX

- A. Provide at each buried valve.
- B. Cast iron extension type, suitable for minimum cover of 3'6 inches over the pipe.
- C. Minimum inside diameter at the top of 5-inch, minimum wall thickness 3/16-inch.
- D. Have the word WATER cast into the cover.
- E. Provide Tyler Series 6850.
- F. Where depth requires more than a two piece box use adjustable cast iron extensions.
- G. Coat box and cover with two (2) shop coats of bitumastic paint.

2.7 VALVE BOX PROTECTION RING

- A. Provide at each valve box a pre-cast concrete protection ring.
- B. Provide two rings of No. 3 reinforcing steel, one 14-inch in diameter, and one 23-inch in diameter.
- C. Inside dimensions to be 9-1/4 inches.

- D. Outside diameter to be 27 inches.
- E. Provide 5-inch thickness at interior with a continuous slope to 2-inch thickness at the outside.
- F. Minimum weight of 100 pounds.

2.8 SERVICE SADDLE

- A. Provide the following materials:
 - 1. Body – Ductile Iron ASTM-A536.
 - 2. Bales and Strips – Type 304 stainless steel.
 - 3. Studs – Type 304L stainless steel.
 - 4. Hardware – Type 304 stainless steel.

2.9 TAPPING SLEEVE AND VALVE

- A. Tapping Sleeve:
 - 1. Provide Type 304L stainless steel per ASTM A240.
 - 2. Provide rolled thread stainless steel bolts per ASTM A153, Type 304.
 - 3. Provide Type 304 stainless steel hex head nuts, coated to prevent galling.
 - 4. Virgin SBR gaskets, compounded for water and wastewater service.
 - 5. Provide ¾" NPT stainless steel test plug.
 - 6. Maximum working pressure of 200 psi.
 - 7. Provide ROMAC Industries Model SST or approved equal.
- B. Tapping Valve:
 - 1. Construct of material compatible with tapping sleeve.
 - 2. Valve to conform to Paragraph 2.3 above.

3. Joints – Flange to tapping sleeve, push-on (**mechanical joint**) (**restrained joint**) for pipe end.

C. Tie Rods:

1. Provide steel rods complying with ASTM Designation A242, galvanized in accordance with ASTM Designation A123.
2. Acceptable Products: Super Star Tie-rod Figure No. SS12 and Tie-bolt Figure No. SST7 as manufactured by Star National Products or approved equal.

2.8 AIR RELEASE VALVES (Not Applicable)

2.9 INSERTION VALVE

A. General

1. Equipment shall be capable of installation, without shutdown of distribution main for pipe ranges from 4" to 14". The valve shall completely stop the flow through the pipe.
2. Valve shall be capable of pressure tight assembly to exterior of the pipe in which flow is to be stopped at a working pressure not to exceed 250 psi.
3. Valve shall be constructed of two piece, ductile iron casting, to be bolted together.
4. Valve shall meet or exceed AWWA specification C509 for resilient seal valve suitable for potable water service.
5. The ductile iron gate shall have a resilient rubber seal 360 degrees around the gate and is expandable to the inside diameter of the pipe.
6. The valve stem shall be stainless steel or equal with a tensile strength of 60,000 psi.
7. Valve operator shall be the industry standard 2" square operating nut.
8. The valve body shall have an epoxy coating of no less than 8 mills.

9. The valve shall use stainless steel fasteners joining the valve bonnet to the valve top casting, unless noted in assembly drawing.
10. Chips created by the cutting process shall be flushed outside the pipe through the chip flushing hose attached to the valve body.

3.0 MISCELLANEOUS PARTS AND ACCESSORIES

- A. Use standard commercial grade suitable for the type of installation or system involved, and conforming to the applicable standards and specifications of the AWWA.

PART 3 – EXECUTION

3.1 HANDLING

- A. Handle pipe accessories so as to ensure delivery to the trench in sound, undamaged condition:
 1. Carry pipe into position – do not drag.
 2. Use pinch bars or tongs for aligning or turning the pipe only on the flare end of the pipe.
 3. Use care not to injure pipe linings.
 4. Do not damage pipe with chokers or lifting equipment.
- B. Thoroughly clean interior of pipe and accessories before lowering pipe into trench. Keep clean during laying operations by plugging or other method approved by the Engineer.
- C. Before installation, inspect each piece of pipe and each fitting for defects.
 1. Material found to be defective before or after laying: Replace with sound material meeting the specified requirements, and without additional cost to the Owner.
- D. Rubber Gaskets: Store in a cool dark place until just prior to time of installation.

3.2 PIPE CUTTING

- A. Cut pipe neatly and without damage to the pipe.
- B. Unless otherwise recommended by the pipe manufacturer, and authorized by the Engineer, cut pipe with mechanical cutter only.
 - 1. Use wheel cutters when practicable.
 - 2. Cut plastic pipe square and remove all burrs, and grind bevel on end.

3.3 LOCATING

- A. Where possible, locate water line at least ten feet away, horizontally, from sewer pipes.
- B. Should ten foot separation not be practical, then the water main may be located closer with South Carolina Department of Health and Environmental Control (SCDHEC) approval provided:
 - 1. It is laid in a separate trench.
 - 2. It is laid in the same trench with the water main located at one side on a bench of undisturbed earth.
 - 3. In either of the above cases, crown elevation of the sewer shall be at least 18" below invert elevation of water line.
- C. Where water lines cross over sewers, maintain 18" minimum clearance between crown of sewer and invert of water line.
- D. Where water lines cross under sewers, each line shall be cast iron or ductile iron.
 - 1. A full length of water line shall be located over the sewer so that joints will be as far from each other as possible.
 - 2. Where a new water main crosses a new sewer line, a full length of pipe shall be used for both the water main and sewer line and the crossing shall be arranged so that the joints of each line will be as far as possible from the point of crossing each other

- E. Potable water lines shall not be laid less than 25 feet horizontally from any portion of a wastewater tile field or spray field.
- F. Water lines shall not be laid within 25' horizontally from any portion of a wastewater tile or spray field.
- G. Water lines shall be located outside all contaminated areas, unless using pipe materials that will protect the water supply.
- H. No flushing device or drain directly connected to any type of sewer is allowed.
- I. No cross connections between water lines and any pipes, valves, tanks or pumps that are not part of the potable water system are allowed.
- J. Water lines may come in contact with storm sewers or catch basins if there are no other practical alternatives provided that ductile iron is used and no joints of the water line are within the storm sewer or catch basin, and provided that the joints are located as far as possible from the storm sewer or catch basin.
- K. Structures containing valves, blow-offs, meters, air release valves, etc., shall not be connected directly to any storm drainage or sewer system.

3.4 EXCAVATION AND BACKFILLING

- A. Comply with pertinent provisions of Section 02221 and Section 02615 of these Specifications.
- B. For P.E. Pipe, comply with manufacturer's recommendations.
- C. All water mains shall be provided with a minimum of 30 inches of cover, unless pipe material is steel, concrete, DIP, or other approved material

3.5 BEDDING

- A. A continuous and uniform bedding shall be provided in the trench for all buried pipe.
- B. Back-fill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe.

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- C. Stones, other than crushed bedding, shall not come in contact with the pipe and shall not be within 6 inches of the pipe.

3.6 ALIGNMENT OF PIPE

- A. Pipe lines intended to be straight shall be so laid.
- B. Where vertical or horizontal alignment requires deflection from straight line or grade, such deflection shall not exceed maximum deflection recommended by the pipe manufacturer.
- C. If alignment required deflection exceeding recommended limits, furnish special bends or a sufficient number of shorter lengths of pipe to provide angular deflections within the allowable limits.

3.7 PLACING AND LAYING

- A. General:
 - 1. Lower pipe and accessories into trench by means of derrick, ropes, belt slings, or other equipment approved by the Engineer.
 - 2. Do not dump or drop any of the materials of this Section into the trench.
 - 3. Except where necessary in making connections to other lines, lay pipe with the bells facing in the direction of laying.
 - 4. Rest the full length of each section of pipe solidly on the pipe bed, with recesses excavated to accommodate bells, couplings, and joints.
 - 5. Take up and relay pipe that has the grade or joint disturbed after laying.
 - 6. Do not lay pipe in water, or when trench conditions are unsuitable for the work; keep water out of the trench until jointing is completed.
 - 7. Securely close open ends of pipe, fittings, and valves when work is not in progress.

8. Where any part of coating or lining is damaged, repair to the approval of the Engineer and at no additional cost to the Owner.
9. Structures containing valves, blow-offs, meters, air release valves, etc., shall not be connected to any storm drain or sewer system.

B. Ductile Iron Pipe:

1. Mechanical, push on and flanged joints, install in accordance with ANSI/AWWA C600.
2. Gaskets: Handle, lubricate where necessary and install in strict accordance with manufacturer's recommendations.

C. Plastic Pipe:

1. Clean gasket, bell or coupling interior, especially groove area.
2. Lubricate and insert gasket as recommended by manufacturer.
3. Align spigot to bell, insert spigot into bell until it contacts gasket uniformly.
4. Bell pipe using manufacturer's approved leverage bar.
 - a. Do not use machinery to push pipe "home".
5. Push pipe "home" until reference mark is at proper location and clearly visible.
6. Follow all pipe manufacturers' installation instructions.

D. Flanged joints:

1. Provide true face flanges, field clean and fit with one full face gasket and make bolts up finger tight.
2. Use torque wrench to alternately tighten bolts 180° apart until full gasket flow and seal are secured.

3. Bias cut or unusual refacing of any flange will not be acceptable.

E. Restrained joints:

1. Install in accordance with manufacturer's instructions.
2. Tighten set screws to the manufacturer's rated torque using a torque wrench.
3. If twist-off nuts are provided, tighten screws until nut breaks loose.

F. HDPE pipe:

1. Install in accordance with manufacturer's recommendation and ASTM D 2321.
2. Provide factory-trained personnel to conduct effusion joint work.

G. Polyethylene Encasement: Comply with AWWA A105.

3.8 SETTING VALVES AND VALVE BOXES

A. General:

1. Center valve boxes on the valves, setting plumb.
2. Tamp earth fill around each valve box to a distance of four feet on all sides, or to the undisturbed trench face if less than four feet.
3. Install shaft extensions plumb without any binding.
4. Fully open and close each valve to assure that all parts are in working condition.
5. Place valve box protection ring around top of valve box as indicated on the plans.

- a. Install ring level with top 1" above finished grade.
- b. Top of ring to be level with or no more than 1" above the top of the valve box.

3.9 INSTALLATION OF HYDRANTS

A. General:

1. Inspect carefully, insuring that all foreign material is removed from the barrel.
2. Set plumb and at such elevation that connecting pipe and distribution main have same depth of cover.
3. Install stone drainage bed and thrust blocking as indicated.
4. No connection or location of hydrant drains within 10' of sewer systems is allowed.
5. Hydrant leads to be a minimum of 6" in diameter and to include an auxiliary gate valve.
6. Fully open and close each hydrant to assure that all parts are in working condition.
7. Install blue hydrant reflector on centerline of paved roadway marking the perpendicular location of hydrant with reference to the road centerline.

3.10 THRUST BLOCKS

A. General:

1. Provide thrust blocks, or metal tie rods and clamps or lugs, on plugs, caps, tees, hydrants and bends deflecting 11-1/4° or more either vertically or horizontally, and on water lines 4" in diameter or larger. Thrust blocking is not required where restrained joints are indicated.
2. Provide concrete thrust blocking with a compressive strength of 3000 psi in 28 days.
3. Size of the blocking will be determined by the Engineer, based on soil bearing capacity.

4. Provide 8 mil. Polyethylene film between the thrust block and fitting.
5. Thrust blocking should not block hydrant drain(weep) holes

B. Installation:

1. Locate thrust blocking between solid ground and the fitting to be anchored.
2. Unless otherwise shown or directed by the Engineer, place the base and thrust bearing sides of thrust blocking directly against undisturbed earth.
3. Sides of thrust blocking not subject to thrust may be placed against forms.
4. Place thrust blocking so the fitting joints will be accessible for repair.
5. Protect steel rods and clamps by hot dipped galvanizing.

3.11 HYDROSTATIC TESTING

A. General:

1. Pressure and leakage testing must be conducted in accordance with AWWA Standards C600.
2. Clean and flush line of air, dirt and foreign material.
3. Do not perform hydrostatic tests until at least five days after installation of concrete thrust blocking.
4. Test pump, pipe connection, pressure gauges, measuring devices and all other necessary appurtenances to conduct tests are to be provided by the contractor.

5. Install brass corporation cocks at all high points that do not have permanent air vents. Corporation cocks are to be left in place and all costs for providing such cocks are to be borne by the Contractor.
6. Conduct tests on each line or valved section of line.
7. Test pressures to be 150 psi, or 1.5 times the maximum working pressure, whichever is greater, based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge.
8. Do not test pipe at pressures exceeding manufacturer's recommendations.
9. The Contractor must provide documentation of the pressure and leakage tests. Documentation must include length of lines, diameter of pipe(s), amount of water required to fill line after test was performed, and amount of allowable leakage.
10. The witness to the hydrostatic testing is to be someone other than the Contractor or the utility installing the lines.

B. Pressure tests:

1. After the pipe is laid, the joints completed, and the trench backfilled, subject the newly laid piping and valved sections of the piping to the test pressure specified in Part A above.
2. Open and close each valve within the section being tested several times during the test period.
3. Replace and remake joints showing leakage.
 - a. Remove cracked pipe, defective pipe, and cracked or defective joints, fittings and valves. Replace with sound material and repeat the test until results are satisfactory.
 - b. Make repair and replacement without additional cost to the Owner.

C. Leakage test:

1. Conduct leakage test after the pressure test has been completed satisfactorily.

2. Duration of each leakage test: At least two hours.
3. During the test, subject water lines to the test pressure specified in Part A above.
4. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.
 - a. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula(s):

1) Ductile Iron piping:

$L = S \times D \times \sqrt{P} / 133,200$; where
L = allowable leakage in gallons per hour;
S = length of pipe tested in feet;
D = nominal diameter of pipe in inches; and
P = average test pressure psi gauge.

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2) PVC piping:

$L = N \times D \times \sqrt{P} / 7,400$; where

L = allowable leakage in gallons per hour;
N = number of joints in pipeline being tested;
D = nominal diameter of pipe in inches; and
P = average test pressure psi gauge.

- b. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gallons per hour per inch of nominal valve size will be allowed.

- 1) Should any test of pipe disclose leakage greater than that specified above, locate and repair the defective joint or joints until the leakage is within

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the specified allowance, and at no additional cost to the Owner.

- 2) Repair all visible leaks regardless of test results.

3.12 STERILIZATION

A. General:

1. Upon completion of testing, sterilize all water lines to meet requirements of the South Carolina Department of Health and Environmental Control.
2. Newly laid valves or other appurtenances shall be operated several times while line is filled with chlorinating agent.
3. Should initial treatment fail to meet results specified, repeat procedures until satisfactory results are obtained, at no additional cost to the Owner.
4. All pipe taps, feeders, chemicals, etc., for sterilization shall be provided by the Contractor.

B. Procedure:

1. Flush line to extent possible with available pressure and outlets, prior to sterilization.
2. Hydrant openings required to produce flushing velocity at 40 psi are:

Pipe Size (Inches)	Hydrant Openings
4 through 12	One 2-1/2"
14 through 18	Two 2-1/2"
20	One 4-1/2"

3. Comply with the latest revision of AWWA C651 and the following:

- a. Apply chlorine as liquid chlorine or chlorine compound such as calcium hypochlorite with known chlorine content.
- b. Apply through corporation cock in top of main located no greater than ten (10) sections from the beginning of section being sterilized.
- c. Control water flow to a slow flow into the line.
- d. Use proper feeder and flow regulator to introduce chlorinating agent.
- e. Application rate shall be not less than 25 ppm and no greater than 50 ppm.
- f. Retain chlorinated water in main not less than 24 hours.
- g. At the end of the retention period, at least 10 ppm of chlorine shall remain in the water at the extreme end of section.
- h. Dechlorinate and flush line thoroughly.

C. Acceptance:

- 1. Provide two separate samples for each sample location, taken at 24-hour intervals, free from coliform bacteria.
 - a. If the membrane filter method of analysis is used for the coliform analysis, non-coliform growth must also be reported.
 - b. If the non-coliform growth is greater than eighty (80) colonies per one hundred (100) milliliters, the sample result is invalid and must be repeated.
 - c. Contractor to take 1st and 2nd samples, deliver to South Carolina Department of Health and Environmental

Control (SCDHEC) approved laboratory for testing.

d. The first and second sample results shall include the free chlorine residual at the time the samples were collected.

e. Notify SCDHEC to take a 3rd sample.

2. At a minimum, sample locations shall be as required by SCDHEC and the following:

a. The tie-in location of new and existing water lines.

b. The end of all dead end lines.

c. At the intervals of no more than 1,200' for all new lines longer than 1,200' in length.

3. All sample locations are to be given an identifying label and a corresponding identification label is to be included on the record drawings indicating each sample location.

3.13 DECHLORINATION OF CHLORINTED STERILIZATION WATER

A. Dechlorinate the chlorinated water used for sterilizing water lines.

B. Apply dechlorinating agent as liquid sulfur dioxide or sulfite salts.

C. Prepare a mixing chamber using a 55-gallon tank. Feed the discharge and dechlorinating agent at the bottom of the tank with overflow at the top.

D. Discharge total chlorine residual to be less than 0.5 milligrams per liter.

END OF SECTION

SECTION 02661

WATER SERVICE CONNECTIONS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Work included: Provide water service connections, including service pipe, and other appurtenances as shown on the drawings, specified herein, and needed for a complete and proper installation.
 - 1. Service connections include connection to the distribution main, service line between main and the Board of Public Works water meter.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. All materials in this Section are to be manufactured in the United States.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.

PART 2 – PRODUCTS

2.1 SERVICE SADDLES:

- A. Provide service saddles suitable for use on Pipe specified in the plans.
- B. Provide service saddles by ROMAC or equivalent equal.

2.2 CORPORATION STOPS:

- A. Provide ball type corporation valves suitable for system operating pressures of 175 psi and maximum valve working pressure of 300 psig.
- B. Valves shall be manufactured and tested to comply with ANSI/AWWA C800 standard.
- C. Valve to be supplied with double o-ring seals supported in precision machined grooves to provide secure, leak-tight sealing.
- D. Heavy brass components shall be constructed of 85-5-5-5 ASTM B62 brass.
- E. Ball shall be PTFE coated to ensure smooth, easy turning operation. Rotation of ball shall be 360 degrees.
- F. Outlet connection shall be compression type connection.
- G. Corporation stop and valve shall be Ford #F600-3.

2.3 SERVICE PIPE:

- A. $\frac{3}{4}$ -inch copper tubing with a minimum working pressure of 250 psi.

2.4 WATER SERVICE METER:

- A. New water service meters will be provided by the contractor and installed by Gaffney BPW, as shown on the Plans and Details.

2.5 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 – EXECUTION

3.1 GENERAL

- A. Install service lines from the distribution main to the new meter, or at each location indicated or directed by the Engineer.
- B. Depth of the service connection shall be no less than the top of main connection.
- C. Install insulating couplings between ferrous and non-ferrous pipe, fittings, etc. of such shape to effectively prevent metal-to-metal contact between the dissimilar metals.

3.2 EXCAVATION AND BACKFILLING

- A. Comply with pertinent provisions of Section 02221, except as otherwise specified herein.
- B. Under paved areas install service lines dry boring, unless otherwise directed by the Engineer.

3.3 INSTALLATION – SERVICE LINES

- A. Install flexible service lines in one continuous piece from main to service meter and from meter to (LMI) residence's plumbing.

3.4 FLUSHING

- A. Flush each service line thoroughly after installation to clear of sand, dirt, or other construction debris.

SECTION 02930

GRASSING

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Work included: Provide grassing of the areas specified herein, or as indicated, for a complete and proper installation.
 - 1. Sanitary sewer easements, including highway and street shoulders: All areas disturbed by the construction operation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in Part 1 of these Specifications.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Seed: Conform to all State laws and to all requirements and regulations of the South Carolina Department of Agriculture.
 - 1. Deliver to site each variety of seed individually packaged and tagged to show name, net weight, original and lot number.
- C. Fertilizer: Conform to State fertilizer law.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.

- B. Product data: Within 60 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

- 1. Complete materials list of items proposed to be provided under this Section.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01640.
- B. At time of delivery, furnish the Engineer invoices of all materials received in order that application rates may be determined.
- C. Immediately remove from the site materials which do not comply with the specified requirements, and promptly replace with materials meeting the specified requirements.

PART 2 – PRODUCTS

2.1 FERTILIZER

- A. Provide commercial balanced 16-4-12 or 12-4-8 fertilizer delivered to the site in bags labeled with the manufacturer's guaranteed analysis.

2.2 GRASS SEED

- A. Provide grass seed which is:
 - 1. Free from noxious weed seeds, and recleaned;
 - 2. Grade A recent crop seed;
 - 3. Treated with appropriate fungicide at time of mixing;
 - 4. Delivered to the site in sealed containers with dealer's guaranteed analysis.

2.2 LIME

- A. Provide agricultural grade, standard ground limestone conforming to current "Rules, Regulations and Standards of the Fertilizer Board of Control" issued at Clemson University.

- B. Bag tags or delivery slip for bulk loads shall indicate brand or trade name, calcium carbonate equivalent, and other pertinent data to identify the lime.

2.4 EMULSIFIED ASPHALT (ANIONIC)

- A. Provide Grade EA-P meeting the requirements of South Carolina Highway Department Specifications Subsection 406.5, Edition of 1986.
- B. If necessary for satisfactory spraying, material shall be diluted at the manufacturing plant with water.

2.5 WOOD CELULOSE FIBER (Not Applicable)

2.6 STRAW MULCH

- A. Provide straw or hay material.
 - 1. Straw to be stalks of wheat, rye, barley or oats.
 - 2. Hay to be timothy, peavine, alfalfa, or coastal bermuda.
- B. Material to be reasonably dry and reasonably free from mature seed bearing stalks, roots, or bulblets or Johnson Grass, Nutgrass, Wild Onion and other noxious weeds.

2.7 EXCELSIOR FIBER MULCH (Not Applicable)

PART 3 – EXECUTION

3.1 GENERAL

- A. Seed these areas immediately upon completion of grading or construction and clean-up operations.
 - 1. Slopes greater than four horizontal to one vertical.
 - 2. Utility rights-of-way adjacent to stream banks.
- B. Areas ready for planting between August 16 and February 28 shall be planted with a temporary cover of Schedule No. 2. At the acceptable seasons for plant Schedule No. 1, the turf shall be

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destroyed by reworking the soil, and Schedule No. 1 seeding established as specified herein.

- C. Use Rate A pounds per 1000 sq. ft. on slopes over 5' horizontal to 1' vertical in height and use Rate B pounds per 1000 sq. ft. on slopes less than 5' horizontal to 1' vertical.

3.2 SEEDING SCHEDULE

A. TEMPORARY GRASS

JAN 1 – MAY 1

Rye (Grain)	120 lb/Acre
Annual Lespedeza	50 lb/Acre
Mulch (Straw)	4000 lb/Acre
Agricultural Limestone	2000 lb/Acre
Fertilizer 10-10-10	500 lb/Acre

MAY 1 – AUG 15

German Millet	40 lb/Acre
Mulch (Straw)	4000 lb/Acre
Agricultural Limestone	2000 lb/Acre
Fertilizer 10-10-10	500 lb/Acre

AUG 15 – DEC 30

Rye (Grain)	120 lb/Acre
Mulch (Straw)	4000 lb/Acre
Agricultural Limestone	2000 lb/Acre
Fertilizer 10-10-10	500 lb/Acre

B. PERMANENT GRASS

A. February 1–March 31, August 20 – October 25

Grass shall be provided for all disturbed areas. Fertilizer shall be commercial Type 10-10-10. Lime shall be agricultural grade ground limestone, containing at least 34% magnesium carbonate. Seed shall be Bermuda, minimum 90% purity and 80% germination. Areas to be grassed shall be scarified cultivated to a depth of 3-inches with all clods or clumps broken up and foreign material and debris removed. Fertilizer shall be applied at a minimum rate of 1,000 lb/acre. Lime shall be applied at a minimum rate of 3000 lbs/acre. Fertilizer and

lime shall be thoroughly worked into the soil and the surface raked smooth before applying seed. Seed shall be applied evenly at the minimum rate of 130 lb/acre and raked in lightly. Seeded areas shall be dressed smooth, then mulch (straw) applied at 4000 lbs/acre. Areas shall be sprayed with emulsion to bind seed and prevent erosion immediately after seeding.

3.3 GROUND PREPARATION

- A. Bring all areas to proper line, grade and cross section indicated on the plans.
- B. Repair erosion damage prior to commencing seeding operations.
- C. Loosen seed bed to minimum depth of 3 inches.
- D. Remove all roots, clods, stones larger than 2 inches in any dimension, and other debris.
- E. Conduct soil test to determine pH factor.
 - 1. If pH is not in the range of 6.0 to 6.5, adjust.

3.4 APPLICATION OF FERTILIZER

- A. Spread uniformly over areas to be seeded.
 - 1. Use approved mechanical spreaders.
- B. Mix with soil to depth of approximately 3 inches.

3.5 SOWING METHODS

- A. General:
 - 1. Perform seeding during the periods and at the rates specified in the seeding schedules.

2. Do not conduct seeding work when ground is frozen or excessively wet.
 3. Produce satisfactory stand of grass regardless of period of the year the Work is performed.
- B. Seeding, slopes less than four horizontal to one vertical:
1. Shall conform to Methods EA, WF or WCF as specified hereinafter.
 2. Method EA (Emulsified Asphalt):
 - a. Sow seed not more than 24 hours after application of fertilizer.
 - b. Use mechanical seed drills on accessible areas, rotary hand seeders, power sprayers, etc. may be used on steep slopes or areas not accessible to seed drills.
 - c. Cover seed and lightly compact with cultipacker if seed drill does not.
 - d. Within 24 hours following compaction of seeded areas, uniformly apply 0.2 gallons per square yard of emulsified asphalt over the seeded area.
 3. Method WF:
 - a. Sow seed as specified for Method EA.
 - b. Within 24 hours following covering of seeds, uniformly apply excelsion fiber at the rate of 100 pounds per 1000 square feet.
 - c. Material may be applied hydraulically or dry. If applied dry, it shall be thoroughly wetted immediately following placing.
 - d. Seeded areas to be lightly rolled to form a tight mat of the excelsion fibers.

4. Method WCF:

- a. Apply seed, fertilizer and wood fiber mulch using hydraulic equipment.
- b. Equipment to have built-in agitation system with capacity to agitate, suspend and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed and water.
- c. Minimum capacity of slurry tank: 1000 gallons.
- d. Apply fiber mulch at rate of 345 pounds per 1000 square foot.
- e. Regulate slurry mixture so that amounts and rates of application will result in uniform application of all materials at not less than the specified amounts.
- f. Apply slurry in a sweeping motion, in an arched stream, so as to fall like rain, allowing the wood fibers to build upon each other.
- g. Use color of wood pulp as guide, spraying the prepared seed bed until a uniform visible coat is obtained.

c. Seeding, slopes greater than four horizontal to one vertical:

1. Sow seed as specified for Method EA, unmulched.
2. Apply straw or hay mulch at the rate of 100 pounds per 1000 square feet uniformly to the seeded area. Mulch may be applied by hand, by mechanical spreaders, or by blowers.
3. Hold mulch in place with a tack coat of emulsified asphalt, applied at the rate of 0.2 gallon per square yard.

3.6 SECOND APPLICATION OF FERTILIZER

- A. When plants are established and showing satisfactory growth, apply nitrogen at the rate of 1.0 pound per 1000 square feet.

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- B. Apply in dry form unless otherwise directed by the Engineer.
- C. Do not apply to stands of temporary grasses.

3.6 MAINTENANCE

- A. Maintain all seeded areas in satisfactory condition until final acceptance of the work.
- B. Areas not showing satisfactory evidence of germination within six weeks of the seeding date shall be immediately reseeded, fertilized and/or mulched.
- C. Repair any eroded areas.
- D. Mow as necessary to maintain healthy growth rate until final acceptance of the work.

3.7 ACCEPTANCE

- A. Permanently seeded areas (Schedule "B") will be accepted when the grass attains a height of two inches.
- B. No acceptance will be made of temporary seeded areas (Schedule "A"); Rework and seed with Schedule "B".