STANDARD
WATER SPECIFICATIONS

FOR THE

LANCASTER COUNTY WATER & SEWER DISTRICT
(LCWSD)

Revised December 2011
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District Engineer

STANDARD WATER SPECIFICATIONS

For the

LANCASTER COUNTY WATER & SEWER DISTRICT

SECTION 1

WATER MAIN CONSTRUCTION

GENERAL INFORMATION AND DESIGN

1. GENERAL:

All material shall be of the best commercial quality for the purpose specified and shall be free from defects that might impair the strength and durability. All materials in relation to the water infrastructure are subject to inspection by personnel of Lancaster County Water and Sewer District (LCWSD) at the project site, at the plant or manufacturer, and/or other points of delivery for approval or rejection. Any material that does not conform to LCWSD standards shall not be used within the project. Repairing of rejected materials on project grounds is not permitted or acceptable.

All materials used that will come into contact with drinking water during its distribution shall not adversely affect drinking water quality and the public health and must be certified for conformance with American National Standards Institute/National Sanitation Foundation Standard 61.

Where two (2) or more materials are specified as acceptable for the same service and where proposals are requested from the bidders for each material, LCWSD reserves the right to select the material to be used and to award the contract on either low prices or other construction that LCWSD determines to be in its best interest. This right is further extended to allow LCWSD to award a contract on the basis of using one material in a portion of the contract, or under one set of conditions, and an alternate material in another portion of the contract, or under another set of conditions if such a division is recommended by the Engineer and is determined to be in LCWSD's best interest.

2. DESIGN STANDARDS:

Any water distribution system additions to the LCWSD water system shall be designed to conform to, or exceed, the requirements set forth in the State Primary Drinking Water Regulation: R.61-58 of South Carolina, June 2008 (or the most recent revision), LCWSD Developer Policy, and the LCWSD Water Specifications. This specifically includes:

1. Sizing and design of blow-offs, fire flows for water lines and fire hydrants.
2. Separation of water mains to existing or proposed sanitary sewer and storm sewer utilities.

3. SUBMITTALS:

The Engineer shall submit to LCWSD three (3) copies of all material submittal data for review and/or approval. Water submittals for the proposed project should include, at a minimum and if applicable to the project, the following: Pipe (Ductile Iron, PVC, HDPE), Mechanical Joint Fittings, Mega Lugs, valves, valve boxes, valve concrete protector wheel, concrete valve marker pole, fire hydrants, tapping saddles, corporation stops, instatite fittings, water service pipe (blue in color), copper setter, meter box, turf box, tracer wire, and mechanical thrust restraints. Each submittal shall include at a minimum: (1) the manufacturer's name, (2), type of material, (3), ASTM, ANSI, AWWA or other quality standard, (4), pressure class, (5), Certificate of Inspection and (6), transmittal cover page per submittal. If the materials do not meet the standards specified within these specifications, SCDHEC specifications, and in LCWSD's Water Details, the submittals will be rejected. The Contractor must obtain approval of all materials prior to commencing construction.

4. MATERIALS HANDLING

A. Unloading

All related equipment and facilities for unloading, hauling, distributing, and storing all materials shall be furnished and supplied by the Contractor and shall at all times be available for use in unloading materials. Any delays in unloading materials (i.e., truck waiting charges, etc.) shall be at the expense of the Contractor.

B. Handling

Pipe, fittings, valves, marker poles, meter boxes, and all other construction materials shall be carefully handled so as to prevent any breaking and/or damages. Pipe may be unloaded individually by hand but shall not be unloaded by rolling or dropping off the transportation vehicle. Preferred unloading of materials shall be using mechanical equipment, such as forklifts, cherry pickers, front end loaders with forks, or any other approved LCWSD equipment. If forklift equipment is not available for use on the construction site or the unloading area, materials may be unloaded with the use of a spreader bar on top and nylon strips or cushioned rubber hose sleeve cables looped under the material being handled.

C. Distributing

Materials shall be distributed and placed so as to least interfere with traffic. If traffic patterns must be disturbed to distribute the construction materials, all authorities (SCDOT, Lancaster County Sheriff and/or Public Works, City of Lancaster (if within City Limits), etc.) must be contacted. The designated authority must give the proper permission to allow any road closing or to permit a different traffic pattern than the existing traffic pattern. The Contractor is also responsible to provide proper warning signs and obstruction lights for the protection of traffic along highways, streets and roadways upon which material distributed. No materials shall be placed in drainage ditches for storage.

D. Storage

If the Contractor cannot store materials in the permanent and temporary easements or in development project limits already obtained for the project, the Contractor is then required to make his own arrangements for the use of storage areas for all pipe, fittings, and other materials,

Pipe must be stockpiled on level ground. If pipe is unloaded individually by hand, timbers must be used under the pipe for a base and spaced the same as it was factory loaded, with stop blocks nailed at both ends of the unloaded pipe. Stockpiling within the storage areas must be built up in the same manner as it was stocked for shipment.

If pipe is unloaded in units, the units must be placed on level ground and shall not be stacked more than two (2) units high. Units must be protected by dunnage in the same way they were protected while loaded on the truck or car. The dunnage must support the weight of all units so that pipe lengths do not carry the weight of the above units.

All PVC pipe that will be stored outside and exposed to sunlight for a number of months shall be protected from the sunlight. The covering shall be loose enough to allow for air circulation. Clear plastic sheets are unacceptable.

All materials must be protected from the outdoor elements as required per the manufacturer recommendations. If any material is damaged during the unloading, handling, distributing, and storage of the materials, then it is at the cost of the Contractor to repair or replace.

5. CONSTRUCTION WATER USE

All construction water use at the construction site during the project must be purchased from LCWSD. The purchase of water may be maintained by the Contractor installing a meter and backflow preventer (sized by the Contractor, Developer, or Developer's Engineer). The meter and backflow preventer is the responsibility of the Contractor or Developer to purchase and install. The Contractor or Developer will then be billed based on the meter size and current LCWSD water rates either monthly or at the completion of the project. LCWSD Inspector has the authority to review all construction water usage logs throughout the project. The Contractor may also purchase a hydrant meter from LCWSD if that appears to be a better option per the project's requirements. The LCWSD Warehouse Manager issues the hydrant meter once the Contractor has completed the required paper work and paid all necessary deposit fees accordingly. The hydrant meter water use is billed according to the most recent LCWSD water rates.

6. ORDER OF WORK

LCWSD may require certain portions of the project to be completed or constructed prior to other portions of the project dependent on how or if the project affects the LCWSD water system or if the work is considered be in the public's interest.

7. INSPECTION:

The LCWSD Inspector, an authorized representative of LCWSD, is subject to inspect all work done and materials furnished by the Contractor. Any work or material that does not meet LCWSD specifications, approved plans, or SCDHEC standards will be rejected, and must be reconstructed, removed, and/or replaced so all standards are met.

8. AS-BUILT DRAWINGS AND SPECIFICATIONS AT THE JOB SITE:

The Contractor shall maintain, in readable condition at the job site, one complete set of working drawings and specifications for the project, including shop drawings. Such drawings and specifications shall be available for LCWSD and/or a LCWSD representative at all times. This working set shall be noted accurately in order to reflect as-built conditions. Upon completion of the project, the complete set of marked drawings, specifications, or notes, showing the as-built conditions, shall be returned to the LCWSD Engineering Department for review. After the as-builts are approved by LCWSD personnel, the LCWSD shall be given two (2) sets of approved as-built drawings for filing. One (1) set of as-builts shall be a mylar set and the other set a CD of the As-Builts in a PDF.

The LCWSD GIS Department shall locate all valves, hydrants, water meters, air release valves, or any other water appurtenance via a GIS back pack unit at a cost to the Developer. The Engineering Department will bill the Developer accordingly prior to project acceptance by LCWSD.

9. LCWSD ACCEPTANCE OF PROJECT:

LCWSD will issue a Service Authorization Letter upon final acceptance of work. Work will be accepted when all requirements have been met by the LCWSD Developer Policy, LCWSD specifications, approved plans, and SCDHEC specifications.

10. WARRANTY

When LCWSD has granted final acceptance of the project (at the issuance of a Service Authorization Letter), the Developer and/or Contractor shall warrant the fitness and soundness of all work done and materials and equipment put in place for a period of one (1) year, at a minimum. For developer driven projects, the Contractor Warranty must be completed (Appendix 8 of the Developer Policy). The one (1) year warranty start date will begin once the Permit to Operate has been issued from SCDHEC. The Developer and/or Contractor shall guarantee the equipment to be free from defects in workmanship, design, and materials for a period of one (1) year from final acceptance and shall replace any defective equipment or any equipment showing abnormal wear. The Contractor and/or Developer shall replace any equipment, parts, work or material at no charge to LCWSD within the one (1) year warranty period. The one (1) year

warranty also includes any landscaping, permanent grassing, final clean-up, erosion control devices removal, etc. The Developer and/or Contractor shall correct any defects in the project and pay for any damage to other work resulting from the project, within the one (1) year period. LCWSD will give the Developer and/or Contractor notice of any observed defects, and LCWSD expects the Developer and/or Contractor to address noted defects promptly and at no cost to LCWSD.

11. METERS AND MXU'S

All water meters shall be installed by LCWSD personnel only, at the expense of others. Prior to setting any meter, all required fees must be paid in full, a Permit to Operate on the water system issued, and any, if any, unresolved item resolved.

SECTION 2

WATER MAIN CONSTRUCTION

PIPE FOR WATER MAINS

1. SCOPE:

This section shall include the furnishing of all types of pipe and other incidentals required for the construction of a complete water system as shown on the drawings and as specified herein.

Unless otherwise noted, the materials listed below are acceptable to LCWSD for use in our water distribution systems. The pipe shall be ductile iron, C-900 PVC, and SDR 21. Should the Contractor desire to use other materials not listed in these specifications, written permission must be obtained from the LCWSD, after the requested material submittal is reviewed. All materials/products that contact potable water must be third party certified as meeting the specifications of ANSI/NSF Standard 61, most recent revision.

All pipe materials shall be free from defects impairing strength and durability and be of the best commercial quality for the purposes specified. It shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail. All pipe, ductile iron and PVC, shall only be made in the USA, unless otherwise approved by LCWSD.

2. PIPE DELIVERY, STORAGE AND HANDLING:

Please refer to Section 1 – General Information and Design, the Materials Handling portion, for greater detail on Pipe Delivery, Storage and Handling. Units shall be delivered, handled, and maintained in a manner to avoid damage to the pipe. The pipe shall be stored in an open area on higher elevated, well drained land not subject to flooding, mud or other means of contamination. During shipment, PVC piping shall be covered with a tarp on front of trailer to prevent contamination during transportation (i.e., diesel fumes from truck, etc.). Any PVC piping shipped uncovered will not be accepted.

3. DUCTILE IRON PIPE:

Ductile iron pipe, where called for on the drawings, shall conform to the most recent revisions of the ASTM/ANSI/AWWA standards, which are the following:

- ANSI A 21.51 (AWWA C-151), latest revision, as approved by Sect. Comm. A 21, American National Standards Institute.
- Pipe dimensions shall conform to Federal Specifications WW-P-41c, Type II, push-on joints; Type III, mechanical joints.
- Each joint of pipe shall be conspicuously marked on the outside of the barrel to readily identify it from cast iron. Please refer to the marking section within the Ductile Iron Pipe Section.
- Cement lined in accordance with ANSI/AWWA C 104/A21.4
- Thickness class shall be as required by ANSI A 21.51, latest revision, assuming Type 1 laying conditions. The minimum thickness class for each size pipe shall be as follows: 3" & 4" - Class 51; 6" through 24" - Class 50. (Class 350 may only be used with the approval of the LCWSD). The judgement of the class of ductile iron pipe is the determination of LCWSD and each judgement will be determined due to the amount of potential water pressure on the ductile iron piping.
- Rubber gasket joints shall conform to ANSI/AWWA C111/A21.1
- Fittings shall be cast from ductile iron and shall conform to ANSI Specifications A 21.53 (AWWA C-153) or ANSI/AWWA A21.10/C-110, as revised to date. All fittings shall have standard mechanical joints. Fittings for pipe sizes through 24-inch shall be Pressure Class 350 and for fittings from 24-inch through 48 –inch shall be Pressure Class 250.

- Domestic ductile iron pipe is the only acceptable pipe for LCWSD, unless otherwise approved by LCWSD.

A. Joints:

1. Mechanical Joints:
ANSI Specification A 21.11 (AWWA C-111), latest revision, for three inch pipe and larger, and CIPRA Specification 3-54 and 4-54 for two inch pipe. Bolted mechanical joints shall be used at canal creek crossings, railroad crossings and where specifically called for on the plans or in the Schedule of Bid Items.

2. Push-on Joints:
Single gasket push-on type joints shall conform with ANSI A 21.11 (AWWA C-111), latest revision. Push-on joints may be used where mechanical joints are not specifically called for on the plans or specified above. No solvent weld will be permitted on any size piping.

3. Flanged Joints:
Flanged joints shall be constructed of ductile iron pipe conforming to ANSI A 21.6 (AWWA C-106) screwed into flanges drilled and faced per ANSI B 16.1 for both 125 Lb. or 250 Lb. working pressure. The pipe shall extend completely through the screwed-on flange. The flange face shall be flat and perpendicular to the pipe centerline.

B. Pipe Lining: Cement mortar lining shall conform with ANSI A 21.5 (AWWA C-104), latest revision and shall be sealed with a bituminous coating.

C. Exterior Coating: The pipe shall have an outside pipe coating of bituminous material in accordance with the manufacturer's specifications. The final coat shall be continuous and smooth being neither brittle when subjected to low temperatures nor sticky when exposed to hot sun. The coating shall be strongly adherent to the pipe at all temperatures.

D Marking: The class designations for the various classes of pipe shall be casted or stamped on the outside of each joint of pipe. Weights of the pipe (which shall conform strictly to ANSI regulations) shall also be stamped clearly and easily seen on the outside of each joint of pipe.

4. RESTRAINED JOINT PIPING AND FITTINGS:

When restrained joint piping and fittings are specified within the approved Plans, the restrained joint piping and fittings must meet the ductile iron pipe and fitting specifications as mentioned within these specifications, and also meet the following requirements:

- Restrained joint piping having a diameter of 4-inch to 12-inch may be restrained using US Pipe Field Lok Gaskets, American Fast Grip Gaskets, or approved equal. Restrained joint piping having a diameter of 14-inch to 42-inch shall be Flex Ring by American Cast Iron Pipe Company, TR Flex by US Pipe, or approved equal.
- Mechanical joint restraint device shall be EBAA Iron, Inc., MEGALUG or approved equal, and shall have a minimum safety factor of 2:1, with at least a minimum working pressure of 250 psi.

5. THINWALL PVC PIPE:

PVC pipe shall be SDR 21 for class 200 as called for on the plans or scheduled in the bid items. The pipe shall be plainly marked with the following information: manufacturer's name, size, material (PVC) type and grade or compound, NSF Seal, pressure rating and reference to appropriate product standards.

PVC Pipe used for construction shall comply to the latest revision of the following standards:

A.	Standard dimension ratio:	ASTM D-2241
	200 psi pipe	SDR 21
B.	Material:	
	Grade 1 PVC Compound Material	ASTM D-1784
C.	Rubber Coupling Rings:	ASTM D-1869
D.	Burst Pressure Test:	
	200 psi, SDR-21 minimum quick burst pressure 800 psi	
E.	Impact Strength:	ASTM D-2444

6. THICKWALL PVC PIPE C-900:

Thickwall PVC pipe shall conform with the latest revision of the AWWA C-900 (Pressure Class 200), for polyvinyl chloride pressure pipe sizes for 4-inch through 12-inch. Pipe shall be furnished in ductile iron pipe equivalent outside diameters with rubber-gasketed separate couplings or push-on joints. Pipe and couplings shall not fail when subjected to the following tests; (1) sustained pressure (2) burst pressure (3) flattening and extrusion quality. Tests shall be conducted as outlined in AWWA C-900. Each length of PVC pipe shall pass a hydrostatic integrity test at the factory 4 times the pressure class of the pipe for 5 seconds. The LCWSD, at its own discretion, may request the Developer and/or Engineer to install ductile iron piping instead of C-900 or any other PVC piping if it appears that another material is best suited for the proposed design.

8. HIGH DENSITY POLYETHYLENE PIPE:

A. General:

Materials used for the manufacturing of polyethylene pipe and fittings shall be PE 3408 High Density Polyethylene (HDPE) meeting the most recent revisions of ASTM D3350 cell classification of 345434C.

High Density Polyethylene Pipe (HDPE) and fittings will be used in accordance with the materials specifications. All additional appurtenances such as tees, gaskets, flange adaptors, etc. will meet the material specifications. The Contractor will supply the pipe and fittings and will include its price in the bid. All pipe installed by guided boring will be joined by an approved butt fusion or electrofusion technique according to the manufacturers specifications.

HDPE pipe shall be produced from resins with a material designation PE3408, and a cell classification PE334434 as specified within the latest revision of ASTM D3350, and dimensions and workmanship as specified by the latest revision of ASTM F714. It will also meet the requirements of AWWA ASTM D3350. Pipe will be legibly marked at intervals of no more than five feet with the manufacturer's name, trademark, pipe size, HDPE cell classification, appropriate legend such as SDR 11, ASTM D3035, AWWA C901 or C906, date of manufacture and point of origin. Pipe not marked as indicated above will be rejected.

The material used in the production of potable water pipe shall be approved by the National Sanitation Foundation (NSF).

B. Pipe Thickness:
The material shall have a minimum Hydrostatic Design Basis (HDB) of 1600 psi at 73°F when tested in accordance with PPI TR-3 and shall be listed in the name of the pipe and fitting manufacturer in PPI TR-4.

Polyethylene pipe shall be manufactured in accordance with the latest revision of the AWWA C906 for sizes 4" through 54".

Permanent identification of piping service shall be provided by co-extruding longitudinal blue stripes into the pipes outside surface. The striping material shall be the same material as the pipe material except for color.

C. Joints:
Butt fusion or Electrofusion welded in accordance with the latest revision ASTM D3261.

D. Marking:
The net weight, pressure class or nominal thickness, sampling period and manufacturer shall be marked on each pipe.

7. PIPE JOINTS:

In general, pipe joints shall be slip joint gasket type, unless otherwise specified on the Drawings and/or Bid/Contract Documents. No solvent weld will be permitted on any size pipe. Lubricants which will support microbiological growth shall not be used for slip-on joints. Vegetable shortening shall not be used to lubricate joints. Natural rubber or other material which will support microbiological growth may not be used for any gaskets, O-rings, and other products used for jointing, pipes, setting meters or valves or other water appurtenances which will expose the material to the water.

8. DETECTION COATED WIRE

All pipe shall be provided with coated 12 gauge detection wire, installed specifically for location of buried water utility lines. Detection wire shall be LCWSD approved and installed for detection by a metal detector when buried up to three (3) feet deep. All coated wire shall be installed by duct taping the wire to the top of pipe at intervals not exceeding ten (10) feet in length. All coated wire shall be extended into and to the top of all valve boxes, air release valves, etc. so that the LCWSD Locator can attach to the coated wire and trace the pipeline under the ground. If there is not a water appurtenance (i.e., valve boxes, air release valves, etc.) within a 1,000 feet of pipe, a "dummy" valve needs to be installed.

9. PIPE INSTALLATION:

Pipe shall be installed in accordance with the manufacture's recommendations and as specified in Section 7 of these specifications. Disinfection and pressure testing shall meet the requirements in Section 7. Each length of pipe shall pass a hydrostatic integrity test at the factory 4 times the pressure class of the pipe for 5 seconds.

Pipe shall be furnished in 20 ft. laying lengths. Random lengths shall be a minimum of 10 feet long and shall comprise no more than 15 percent of the length of the piping system. Pipe shall be furnished in factory packaged units, with each joint plainly marked with the manufacturer's name, pressure class, size, etc.

10. METHOD OF MEASUREMENT:

Pipe shall be measured from the bell or connection at the beginning to the bell or connection at the end, per linear foot, complete in place and accepted, including the furnishing of all labor, tools, materials, and equipment necessary for trenching, laying, jointing, testing, sterilizing, backfilling, connections to existing mains, and all other necessary incidentals.

SECTION 3

WATER MAIN CONSTRUCTION

FITTINGS AND COUPLINGS FOR WATER DISTRIBUTION

1. SCOPE:

This section shall include the furnishing of all types of fittings and couplings and all other incidentals required for the construction of a complete water system as shown on the drawings and as specified herein. Unless otherwise noted, the materials listed below are acceptable to the LCWSD for use in its water distribution system. Should the Developer/Engineer/Contractor desire to use other materials not listed in these specifications, material submittal approval must be obtained from the LCWSD.

All material shall be free from defects impairing strength and durability and be of the best commercial quality for the purposes specified. It shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail. All pipe and appurtenances shall only be made domestically, unless otherwise approved by LCWSD.

Valves supplied shall be of the designation and description indicated on the plans or described herein.

2. SUBMITTALS:

Refer to Section 1 on submittal requirements.

3. DELIVERY, STORAGE AND HANDLING OF FITTINGS AND COUPLINGS:

Units shall be delivered, handled and maintained in a manner to avoid damage to the fittings. The material shall be stored in an open area on high, well drained land not subject to flooding, mud or other means of contamination. Refer to Section 1 for any additional requirements.

4. DUCTILE IRON FITTINGS:

Ductile iron fittings shall conform with ANSI A 21.10 (AWWA C-110), latest revision, with the manufacturer's required design dimensions and thickness. Rubber gaskets shall conform to the latest revision of ANSI A21.11 (AWWA C-111). Fittings shall have a working pressure rating of 350 psi for fittings, 24 inch and under, and 250 psi for fittings above 24 inch. Manufacturer of ductile iron fittings shall be approved and at the discretion of the LCWSD. All fittings shall be restrained with Mechanical Thrust Restraints as listed, unless otherwise approved.

A. Thickness Design:
Nominal thickness of the fittings shall be equal to Class 51 ductile iron pipe as specified in ANSI A 21.51 (AWWA C-151).

B. Lining:
Fittings shall have a cement mortar lining and seal coating conforming to the latest revision of ANSI A 21.4 (AWWA C-104).

C. Exterior Coating:
Fittings shall have an outside coating of bituminous material in accordance with the manufacturer's specifications. The final coat shall be continuous and smooth being neither brittle when subjected to low temperatures nor sticky when exposed to hot sun. The coating shall be strongly adherent to the pipe at all temperatures.

D. Joints:
Fittings shall have mechanical or flanged joints as specified herein. Each fitting must come with the required accessory kits and packing glands.

1. Mechanical Joint:
ANSI Specification A 21.11 (AWWA C-111), latest revision, for 3-inch pipe and larger. All fittings should have standard mechanical joints, unless otherwise approved by the LCWSD. Bolted mechanical joint fittings shall be used with ductile iron pipe, PVC pipe, hydrant tees, and where specifically shown on the approved construction plans.

2. Push-on Joints:
Single gasket push-on type joints shall conform to ANSI A 21.11 (AWWA C-111), latest revision. Push-on joint fittings may be used on PVC pipe (if approved during submittal review) or where shown specifically on the approved construction plans.

3. Flanged Joint:
Flanged fittings shall be constructed of ductile iron with flanges drilled and faced per ANSI B 16.1 for both 125 Lb. or 250 Lb. working pressure.

5. PVC FITTINGS:

PVC fittings are not acceptable for water mains 3-inches or greater. Fittings for PVC pipe less than 3-inches shall be solvent weld schedule 40 PVC.

6. COUPLINGS:

Couplings may be used where applicable for completion of the work. Couplings supplied shall conform to the following:

A. Compression Sleeve Coupling:
Units shall be Dresser style 38, Smith-Blair No. 441, HYMAX (4” in diameter and greater) or equal.

B. Victaulic Couplings:
Units shall be Victaulic Co., style 31, 41, or 44 or equal.

C. Flanged Adaptors:
Units shall be Dresser style 128, Smith-Blair No. 913 or equal.

7. MECHANICAL THRUST RESTRAINTS:

All turns, fittings, etc., that induce pressure, which would cause separation of pipe, breakage, etc., shall be mechanically restrained in such a manner that the pressure to be exerted at the point of restraint is transferred to the pipeline for a distance sufficient to prevent separation, breakage, etc.. MJ fittings shall be restrained with restraints such as Sigma, Romac Grip Ring, or Ebba Iron Megalug restraints. Pipe joints shall be restrained with harness or bell restraints such as Ebba Iron Series 800 for slip joint DIP or Series 1500 and Series 1100 HV for PVC. Romac Grip Ring and Ebba Iron Megalug restraints are approved for use on DIP piping or PVC. Romac Grip Ring is for use with only PVC piping and Ebba Iron Megalug for DIP piping.

Please refer to Section 2 for information on additional approved measures for restraining ductile iron pipe and ductile iron fittings.

8. METHOD OF MEASUREMENT:

A. Ductile Iron Fittings:
Ductile iron fittings shall be measured on a per unit basis.

B. PVC Fittings:
PVC fittings are considered an incidental part of the pipe construction and shall be included in the price per linear foot of pipe.

SECTION 4

WATER MAIN CONSTRUCTION

¾ INCH AND LARGER SERVICES FOR WATER DISTRIBUTION

1. SCOPE:

This section shall include the furnishing of all materials and all other incidentals required for the installation of a complete water service connection as shown on the approved detailed drawings and as specified herein. Unless otherwise noted, the materials listed below are acceptable to LCWSD. Should the Developer/Engineer/Contractor desire to use other materials not listed in these specifications, written permission must be obtained from the District.

All material shall be free from defects impairing strength and durability and be of the best commercial quality for the purposes specified. It shall have structural properties sufficient to safely sustain or withstand strains or stresses to which it is normally subjected and be true to detail.

Materials supplied shall be of the designations and description indicated on the plans or described herein.

2. SUBMITTALS:

Please refer to Section 1 of these specifications.

3. DELIVERY, STORAGE AND HANDLING OF MATERIALS:

Materials shall be delivered, handled and maintained in a manner to avoid damage due to breakage or contamination. Please refer to Section 1 of these specifications for additional information.

4. TAPPING SADDLES:

Tapping saddles shall provide full support around the circumference of the pipe with a designed in safeguard against over-tightening to prevent deformation of the pipe. All parts of the saddle shall be constructed of corrosive resistant bronze including bolts and nuts required to assemble. Only saddles designed specifically for the type of water main pipe used shall be allowed. Threads shall be AWWA Standard CC tapered. Tapping saddles shall be Ford S70, Mueller 513000 or approved equal for tapping PVC piping. Tapping saddles shall be Smith Blair 313 or approved equal for tapping DIP piping

5. CORPORATION STOPS:

Corporation stops shall be of bronze construction and a minimum size of 3/4" (inlet and outlet). Inlet threads shall be AWWA Standard Taper CC. Outlets will be IP threads with a brass compression fitting adapter for the appropriate water service pipe size. Corporation stops shall be Ford F400-3, Mueller H-996 and H-15005, Romac 202 U, or approved equal.

6. PIPE FOR SERVICE LINES:

Pipe for service lines shall be polyethylene conforming to all applicable requirements, in the latest revisions, of the following standards:

A. AWWA C-901: Standard for polyethylene (PE) pressure pipe 1/2" through 3" for water.

B. ASTM D-1248: Standard for polyethylene molding and extrusion materials.

C. ASTM D-2239:
Standard for polyethylene (PE) Plastic pipe (SDR-7). (IPS-I.D. Polyethylene extrusion compound from which the polyethylene pipe is extruded shall comply with the applicable requirements for PE-3406 high density, ultra high molecular weight polyethylene material as described in ASTM D-1248, latest revision. The PE pipe shall be rated for use with water at 73.4 degrees F. at a hydrostatic design stress of 630 psi and a maximum working pressure of 200 psi and blue in color and shall be manufactured by Endot Industries, Silver Line Plastics Corporation, or approved equal.

Dimensions and tolerances shall comply with ASTM D-2239 (IPS, SDR-7).

D. Marking: The following data shall be clearly marked on all service pipe installed:

(1) Nominal size

(2) Operating pressure @ 73.4 degrees F

(3) Type of pipe, i.e. "water service pipe"

(4) Material designation code, "PE-3408" or “PE 3608”

(5) Date code: Month, year and day

(6) Manufacturer's brand name

(7) National Sanitation Foundation logo (indicating approval for potable water and compliance with ASTM Specifications)

(8) ASTM Specification - "ASTM D-2239"

(9) Plant location code

(10) AWWA C901

NOTE: Typical house service shall be 3/4" "IPS" as shown on plans.

E. Lead free pipe, solder, or flux:
All pipe material, solder, and flux shall be lead free (less than 0.2 percent in solder and flux and less than 8.0 percent in pipes and fittings).

7. COPPERSETTERS:

All meter coppersetters are to be designed and installed to be a complete ready made meter setting. All coppersetters are to be installed for the correct height needed so that they can be installed in an approved concrete meter box. The coppersetters shall be manufactured of brass and copper to provide a lifetime of service. All coppersetters are to be manufactured of lead free solder. An angle lockable inverted key shall be supplied with the coppersetter so that a LCWSD approved locking device shall be inserted by LCWSD personnel to shut off service. A dual check valve assembly shall be supplied as part of the coppersetter on the outlet side of the meter. Inlets shall have a brass adapter as required for a compression fitting to "IPS" water service pipe. Outlets shall be male threads with a brass swivel meter nut. All coppersetters shall be manufactured by Ford with the model number of VBHC 72-9W-MM-33 5/8” or VBHH72-7W-MM-33, Mueller Relocator with the model number of 203H1446-2 or 236b2434-r6c21, and Ay McDonald with the model number 28-207wdpp33. All coppersetters are to be installed 7” from the top of the coppersetter to the bottom of the meter box lid and/or deep enough inside of the meter box to allow for the placement of the water

meter to the coppersetter and installation of the MXU situated above the meter inside of the meter box. All meter box lids shall fit into their designed location in the meter box without the lid raised or unlevel. Please refer to the approved LCWSD meter installation detail.

8. BARREL LOCKS:

All barrel locks shall be “F” Series with the Product Number 8509910 manufactured by E. J. Brooks Utility or approved equal. The locks shall be constructed in a two-piece body.

9. SERVICE LINE FITTINGS:

Service line fittings shall be Mueller "Insta-tite", or an approved equal.

10. METER BOXES:

Meter boxes shall be supplied with each service connection. The boxes shall be of the concrete type only with a brass Ford, Mueller, or Ay McDonald meter coppersetter for 5/8” X 3/4” meters supplied in each box. All lids will have a metal door in the center of the concrete lid for access. These meter boxes will be set on the property line between two customers unless otherwise noted. The bottom of this box is completely open to allow for drainage into the soil. All boxes shall be set on a minimum of 1’ of 57 stone.

11. CUSTOMER CUT-OFF (GATE VALVE):

Customer cut-off shall be a ¾” female threaded branch brass gate valve. The inlet of the valve shall be connected to the meter coppersetter by a ¾” X 8” long brass nipple.

12. VALVE BOXES FOR CUSTOMER CUT-OFF:

Valve boxes for customer cut-off shall be of #70 turf boxes with plastic cover or equal.

13. TEFLON TAPE:

Teflon tape or pipe compound shall be used on all threaded connections to reduce the possibility of leaking joints.

14. CHECK VALVES:

The Contractor shall supply on each coppersetter a check valve assembly as described herein.

A. Check Valves 3/4" and 1":
Check valves shall have spring-assisted seating, and the seat shall be of Buna-N-Rubber. All other parts shall be red brass or stainless steel. Valve inlets shall be meter nut and outlets shall be male iron pipe.

B. Check Valves 1-1/4" Through 2":
Check valves shall be gravity swing type of brass or stainless construction. Valve inlets shall be flanged or have a flanged adapting nipple, outlets shall be male iron pipe.

All check valves supplied under these specifications shall be manufactured by "Ford" or approved equal.

15. PRESSURE REDUCING VALVES:

If the water main static pressure is exceedingly high, a pressure reducing valve may be installed by and at the expense of the home owner/Developer/Contractor. The pressure reducing valve must be

on the property owner side of the water meter box in a separate box for locating purposes. The valve shall automatically reduce a higher inlet pressure to a steady lower downstream pressure. The valves shall be constructed of bronze, copper or stainless steel and be equal to the size of the water service line. LCWSD is not responsible for any cost of installation associated with the pressure reducing valve. The customer is responsible to maintain, own and operate their pressure reducing valve to the customer's desired pressure setting.

16. WATER METERS:

All water meters are to be provided by LCWSD, at the expense of others, and installed (when requested) by LCWSD personnel only. Sensus water meters are the only water meters approved and accepted by LCWSD. Water meters will not be set until all necessary fees have been paid and with proper SCDHEC permitting and LCWSD approval. All water meters 1" and larger shall have test ports supplied with the initial purchase of the meter. Meters shall be of the displacement type and shall conform with AWWA C-700, latest revision. Meter accuracy shall not be less than 98.5 percent or more than 101.5 percent of actual water passed through the meter. Approved water meters are the following:

A. Sensus SRII Positive Displacement Water Meter:
The SRII Water Meter is used, normally, for a ¾" water meter to a 1" water meter in size. The SRII meter is used for domestic and/or irrigation use. This meter is typically used for residential or small retail/commercial use.

B. Sensus Omni C2 Water Meter:
The Omni C2 meter is predominantly used for domestic and/or irrigation use within the LCWSD water infrastructure. LCWSD, in most circumstances, does not recommend this meter for fire flow use. The Omni C2 Meter is normally recommended for 1 ½", 2", 3", 4", 6", 8" and 10" sizes, and is commonly used for a typical commercial and industrial application. This meter is intended where a wide flow range is anticipated with critical billing applications. The Omni C2 meter exceeds all requirements of ANSI/AWWA Standard C701 and C702 for Class II compound and turbine meter assemblies. Meter assembly shall be performance tested to ensure compliance, and shall operate properly without leakage, damage, or malfunction up to a maximum working pressure of 200 pounds per square inch.

C. Sensus Omni F2 Water Meter:
The Omni F2 meter package meets or exceeds all requirements of ANSI/AWWA Standard C703 for Class II. The configuration is to capture a wide range of both domestic and fire flow, without the requirement of an automatic valve. The Omni F2 Meter is recommended for 4", 6", 8" and 10" meter sizes and is typically used for commercial and industrial applications. The meter is intended where a wide flow range is anticipated with critical billing applications. The meter assembly shall be performance tested to ensure compliance, and shall operate properly without leakage, damage or malfunction up to a maximum working pressure of 175 pounds per square inch.

17. LARGE WATER METER (2" & LARGER) INSTALLATION:
Large water meters are to be provided by LCWSD, at the expense of others, and only installed when requested by the meter purchaser. Sensus Omni water meters will only be accepted by LCWSD for large meters. Meters, pre-cast concrete vaults, etc. will not be set by LCWSD or the LCWSD Contractor until all necessary fees have been paid in full, water infrastructure has been properly permitted by SCDHEC, and approval for water meter has been granted by LCWSD. All water meters 4" and larger shall have test ports supplied with the initial purchase of the meter and shall be installed in a pre-cast concrete vault with a concrete slab top which incorporates an aluminum hatch large enough to remove the meter through it without having to disassemble the hatch, concrete slab, and/or concrete block structure. The installation of the meter, vault, etc. will only be installed by LCWSD personnel or a LCWSD Contractor.

A double check valve backflow prevention device is also required behind each large meter installation. The backflow prevention device is at the expense and responsibility of the Owner and/or Developer to install. The Owner of the backflow device must get the backflow prevention tested and serviced annually and prior to the large meter going into service. The certifications must be given to the LCWSD Quality Control Department according to LCWSDs Cross Connection Program. LCWSD approved backflow devices are Watts, FEBCO or approved equal. A Reduced Pressure Principle Backflow Assembly is required for high hazard applications. An above ground vault or a vault with proper drainage is required when a RPZ is installed in a vault.

When installing Omni meter, the manufacturer instructions must be followed to guarantee that the meter will function as designed.

18. AUTOMATIC METER READING SYSTEM:

To be provided by LCWSD, at the expense of others, and installed by LCWSD personnel only. At the time of construction, the contractor shall install all coppersetters and meter boxes (per developer driven projects and below 2" in size) adjacent to property lines next to the road right-of-way. A 22 gauge, 3 conductor for TR/AMR, coated wire is to be installed from one meter box to another meter box inside a conduit with a minimum of 3' stubbed inside each meter box to enable LCWSD personnel to connect 3 to 16 meters to one MXU such as townhome, apartment, or other similar installations as decided by LCWSD. Under normal single family residential settings, this will not apply.

19. METHOD OF MEASUREMENT:

Services shall be measured as a unit and shall include labor, materials, equipment and all incidentals required to install the following:

A. Tapping saddle

B. Corporation stop

C. Service pipe and casing pipe if bored under road

D. Coppersetter

E. Meter Box with wash stone for drainage

F. Meter and MXU

G. Customer cut off assembly and turf box

All pressure reducing valves that are needed shall be purchased, owned, and operated by the customer.

SECTION 5

WATER MAIN CONSTRUCTION

BORING UNDER HIGHWAYS AND RAILROADS

1. SCOPE:

This section shall include furnishing all labor, tools, equipment and other incidentals required to bore casing pipe under highways or railroads.

2. BORINGS:

Procedures for boring shall be in accordance with all of the most recent boring requirements set forth by the South Carolina Department of Transportation (SCDOT) and/or Lancaster County, the best accepted methods of construction, as shown on the plans, and as detailed in these specifications.

A. Boring Under Highways:
Lines installed under highways shall be bored as shown on the detail descriptions contained in these specifications. Casings will be installed of the type, size, and thickness as specified herein or on the detail drawings. The Contractor shall be responsible for notifying the South Carolina Department of Transportation as required prior to any contemplated work and for securing any required permits prior to performing the work. All work shall be accomplished under the supervision of the Engineer, LCWSD, and the District Engineer of the South Carolina Department of Transportation or an authorized representative.

1. Carrier Pipe:
Carrier pipe used under highways shall be of an approved material and installed to the satisfaction of LCWSD and the District Engineer of the South Carolina Department of Transportation.

2. Casing Pipe:
The inside diameter of the casing pipe shall not be less than 2" greater than the largest outside diameter of the joints and couplings for carrier pipe less than 6" O.D., and 4" greater for carrier pipe 6" and larger. Casing pipe shall, in all cases, be great enough in diameter to easily remove carrier pipe and casing spiders without disturbing the casing pipe. Casing spiders shall have a stainless steel band in material, unless otherwise approved by LCWSD, and shall be installed to keep carrier piping center inside of the casing pipe.

(a) Pipe Size 8" & Smaller:
Schedule 40 wrought steel or wrought iron pipe having a wall thickness as shown below may be used for casing pipe 8" and smaller.

DIAMETER OF PIPE INCHES	**WROUGHT STEEL WALL THICKNESS INCHES**	**WROUGHT IRON WALL THICKNESSI INCHES**
2-1/2	.203	.208
3	.216	.221
3-1/2	.226	.231
4	.237	.242
5	.258	.263
6	.280	.286
8	.322	.329

(b) Pipe Sizes 8" and Larger:
Casing pipe for 10" and larger shall be manufactured from steel having a minimum yield strength of 35,000 psi with the minimum wall thickness as shown below:

DIAMETER INCHES	MINIMUM WALL THICKNESS INCHES
10"	.188
12"	.188
16"	.250
18"	.250
20"	.250
24"	.250
30"	.312
36"	.375
42”	.531

3. Installation:
The minimum depth from the roadway surface to the top of the casing pipe at its closest point shall be 3'. The casing pipe ends shall be protected from the entrance of foreign material. The casing pipe shall extend from ditch line to ditch line or toe to toe of fill unless otherwise noted on the plans or specified herein.

Contractors shall be required to provide shoring of boring pits and trenches more than 5' deep in accordance with the South Carolina Department of Transportation and Federal Occupational Safety and Health Act.

B. Borings Under Railroads:
All work on railroad rights of way shall be done under the supervision of LCWSD and the Chief Engineer of the railroad or authorized representative, who shall be notified as required before construction begins. No methods shall be used that, in the opinion of the Chief Engineer or authorized representative, could be hazardous to the railway.

1. Carrier Pipe:
Carrier line pipe and joints shall be of the material shown on the details of the railroad encroachment agreements or as approved by the Chief Engineer of the railroad or his authorized representative.

2. Casing Pipe:
The inside diameter of the casing pipe shall not be less than 2" greater than the largest outside diameter of the joints and couplings for the carrier pipe less than 6" O.D. and 4" greater for carrier pipe 6" and larger. It shall, in all cases, be great enough to easily remove carrier pipe without disturbing the casing pipe. Casing spiders shall be installed to keep carrier piping center inside of the casing pipe.

Steel pipe manufactured from steel having a minimum yield strength of 35,000 psi and having a minimum permissible wall thickness as listed below shall be used as casing pipe.

DIAMETER OF PIPE INCHES	MINIMUM WALL THICKNESS INCHES
10"	.188
12"	.251
16"	.312
18"	.313
20"	.375
24"	.407
30"	.469
36”	.532
42”	.550

3. Installation:
Any utility construction and/or bore within the railroad right-of-way must be designed and constructed to the current standards and regulations set forth by the railroad entity. The depth from the base of the railway rail to the top of the casing at the

closest point shall not be less than 5-1/2'. Also, there should not be less than 3' from the bottom of the side ditches to the top of the casing pipe. The casing pipe ends shall be protected from the entrance of foreign materials. The casing shall extend either side of the centerline of the railroad track to outside of the railroad right-of-way. Contractors shall be required to shore all pits used for boring if it is over 5' deep as required by the railway, the South Carolina Department of Transportation, and the Federal Occupational Safety and Health Act.

The railroad permit must be submitted to LCWSD prior to the Contractor beginning any utility construction that involves any construction under or within the railroad right-of-way.

4. Work in the railroad rights-of-way:
Permits for all construction within the rights-of-way of railroads shall be obtained by the Contractor and/or Design Engineer and shall be approved by the railroad before commencing work in these areas. All construction of utility lines shall be installed with full compliance, including any special conditions, set forth in the approved permit, and to the approved satisfaction and inspections of the Railroad Company, including the carrier pipe and encasement. The Contractor shall notify the railway in advance prior to commencing in construction. The Contractor is required to provide any and all required warning and protective measures and special provisions required by the Railroad Company and permit.

3. METHOD OF MEASUREMENT:

Bores shall be measured in linear feet from end to end of casing pipe installed and accepted. This item shall include casing pipe and other materials, tools, equipment, labor and incidentals required to bore and install casing as shown on the details and as directed by the highway or railroad district engineer and/or resident engineer and/or LCWSD.

SECTION 6

WATER MAIN CONSTRUCTION

EARTHWORK

1. GENERAL:
This section shall include all excavation, shoring, de-watering, filling, back-filling, and compacting as indicated on the drawings, and specified herein, and directed by LCWSD. Provisions of this section shall apply to all pipe work within streets or public rights-of-way, and any pipe work that will be added to LCWSD's water system.

2. CHARACTER OF EXCAVATION MATERIAL:
Since soils may vary widely within the project area, the Contractor shall satisfy himself as to the nature of material that will be encountered during the course of the project. **All excavation shall be considered unclassified regardless of the material encountered.** The Contractor shall follow all Federal Occupational Safety and Health Administration (OSHA) requirements with all aspects of excavation.

3. EXISTING UNDERGROUND UTILITIES:
The Contractor shall be responsible for locating all underground utilities and structures along the construction boundaries in order to avoid conflict and costly repair of damaged utilities. It shall be the responsibility of the Contractor to repair or replace any utility or structure if damaged during construction.

4. CONFLICTS:
Where it is impossible to avoid conflict with existing utilities, the new construction shall be performed in a manner that will cause the least amount of disturbance to the existing facility. Any damage to existing facilities shall be repaired immediately according to the directions of the owner of such facilities, and it is the Contractor’s responsibility to reimburse any cost to repair the damage of existing facility, if damage was done by the Contractor.

5. TEMPORARY DRAINAGE:
Pumping equipment shall be provided and employed to promptly remove any water that accumulates in the excavation. The area of excavation shall be limited to that which can properly be de-watered by the equipment in use. The excavation shall be maintained in a dry condition while construction is in progress. Surface water shall be diverted from the excavation by sloping the ground away from the ditch.

   A. Disposal of Water:
   The water from the excavation shall be disposed of in such a manner that the natural drainage of the area shall not be disturbed. All gutters, drains, sewers, and culverts shall be kept clean for surface drainage.

6. SHORING:
Shoring will be provided by the Contractor when the excavation will endanger existing structures, utilities, pavements and banks, and when necessary to protect workmen. The shoring shall be constructed of adequate size members and the arrangement of members shall be suitable to withstand the earth pressure expected. Shoring, sheeting, and bracing that are utilized above the invert of the pipe shall be removed carefully during the back-filling process in order to prevent caving that might displace the pipe. When and where directed by the Engineer, sheeting may be left in place in the backfill with adequate braces to provide lateral support. The Contractor shall follow all Federal Occupational Safety and Health Act requirements for any shoring.

7. EXCAVATION (General):
Trenches shall be excavated by open cut to the line and grade given by the Engineer. Vertical cuts shall be used whenever possible, but in unstable soils, trenches may be sloped from the top of the excavation to a point 3.0 feet above the top of the pipe with the width of the trench from this depth to the bottom of the ditch governed by Section A below. The bottom 4" of the excavation shall be excavated by hand. Bell holes shall be excavated by hand to insure that the pipe is properly supported for its entire length. The Contractor shall follow all Federal Occupational Safety and Health Act requirements for any excavation.

A. Trench Width:
The maximum width of the trench shall be 24" plus the outside diameter of the pipe. This width shall also apply to sloped trenches for the last 3' above the top of the proposed pipe.

B. Excavated Material:
Material excavated from the ditch shall be placed at least two (2) linear feet back from the top of the ditch wall and in organized piles along the side of the trench. When it is necessary to stockpile excavated material, it shall be the Contractor's responsibility to secure the stockpile areas. No excavated material shall be placed on private property without the consent of the property owner.

C. **All excavation shall be considered unclassified regardless of nature of material encountered.**

D. Whenever the bottom of the trench is unstable or is comprised of rocks or other sharp debris, the Contractor shall remove such part as may be necessary and replace with suitable material from the surface to make a good foundation without extra compensation.

E. Under exceptional conditions where ground water and unstable soil are such that it is not possible to obtain a suitable foundation with material on the trench bank, the Engineer will determine the method to be followed and the Contractor will be compensated for extra foundation material delivered on the trench. On account of the difficulty in determining extra labor involved, no extra compensation will be allowed for placing it, but it will be held to be included in the unit price bid per linear foot of pipe.

F. Excavation for gate valves, air relief valves and manholes, fire hydrants and other water appurtenances shall be sufficiently large enough to leave at least 12" clear between their outer surfaces and in the line of the excavation or supporting structure.

G. Any unauthorized excavation below the pipe or structure shall be filled with sand, gravel, or concrete, as approved by the LCWSD Inspector, at the expense of the Contractor.

H. Where sheathing or bracing is used, no extra compensation will be allowed, except where the Engineer directs that it be left in place. Payment reimbursement will be per LCWSD discretion and also approved by the Project Engineer. (Payment reimbursement pertains to projects by LCWSD).

8. BACKFILLING:
Back-filling shall progress as rapidly as the pipe laying and testing permits. The trench shall be back-filled with approved material free from large clods or stones. The initial backfill shall be carefully placed on both sides of the pipe at the same time and thoroughly tamped around the barrel of the pipe until enough material has been placed to provide 2' of cover above the top of the pipe. The remainder of the backfill shall be placed in well compacted, one foot layers using approved mechanical tampers. In no case shall the backfill material be placed in unequal layers on one side of the pipe that might cause pipe displacement. In existing streets, roads or alleys, and booster pump stations, the backfill shall be compacted to a density of 95% as determined by ASTM A-695 using approved mechanical tampers in 6" layers to the top of the trench. Contractor should provide at least

two (2) borings with standard penetration tests and required lab testing to provide certification that backfill was placed in accordance with the LCWSD specifications. Tests to be performed adjacent to the existing building as near as possible for representative results for backfill placed on the site. In all other areas, the density shall be 90% as determined by ASTM A-695. When construction of water infrastructure is within County or State roads boundaries, then compaction and construction procedures must meet the standards and regulations set forth by the respective delegated authority. The top elevation of the trench shall be graded to the original grade that existed before excavation. In no case shall material such as old pavement, curbs, bricks or blocks be placed in the backfill. Compaction shall be attained by the use of mechanical tamps only. Heavy rollers, vehicles, or other equipment shall not be used for compacting pipeline and structure backfill nor allowed to cross over completed work except at points adjudged capable of adequately protecting the pipeline. Pneumatic tamps, gasoline ram type tamps or vibrating tamps with sheepsfoot rollers will be required to meet the specifications of “Mechanical Tamp”. The Contractor is responsible for having all compaction tests carried out and delivered to LCWSD a copy of the tests results.

A. De-watering:
De-watering, when required, shall be continued during construction including the pipe laying and the back-filling process. Adequate equipment shall be used and maintained by the Contractor to insure a dry trench.

B. Rock Cut:
If rock is encountered in excavation, rock shall be removed to a depth of 8" below the bottom of the pipe. This 8" shall be refilled with select material.

C. Muck:
Muck may be used in the backfill after at least 2.0 feet of approved material has been placed above the bell of the pipe. Muck shall not be used in the backfill in any street, road or alley. When it is encountered, approved backfill material shall be hauled in by the Contractor at the Contractor’s expense.

D. Sheeting:
When sheeting is removed from the backfill, all cavities shall be properly filled and compacted.

9. EXCESS MATERIAL:
Excess material and material that is suitable for backfill shall be disposed of at sites obtained by the Contractor at the Contractor’s expense.

10. BORROW:
When the material excavated is not sufficient to meet the requirements for fill material, borrow shall be obtained by the Contractor at the Contractor’s expense. Borrow material shall be approved by LCWSD prior to placement. Borrow shall be paid for under this bid item for Select Material.

SECTION 7

WATER MAIN CONSTRUCTION

CONSTRUCTION METHODS

1. SCOPE:

This section shall include furnishing all labor, tools, equipment and other incidentals required for the construction of the water distribution system as shown on the construction drawings and as specified herein. The work shall include, at a minimum, laying pipe and setting fittings, valves, hydrants, and services, pressure testing and sterilization of the water distribution system. Materials shall be as specified in previous sections of these specifications.

2. PIPE AND FITTINGS:

Pipe and fittings shall be installed as directed by LCWSD, and located as shown on the drawings, unless otherwise approved by LCWSD personnel. Any changes from the LCWSD and SCDHEC approved drawings must be approved by the LCWSD staff and documented accordingly on the record drawings.

A. Pipe Laying:
Water pipe shall be laid in conformance with the most recent and up to date standards set forth by AWWAC-600. All water pipe shall be laid by experienced workers with straight lines, even grades, and all joints shall be perfectly fitted. All pipe fittings, valves, hydrants, and accessories shall be carefully lowered into the trench with suitable equipment in a manner that will prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench. Pipe and accessories shall be inspected for defects prior to them being lowered into the trench. Any defective, damaged or unsound material shall be replaced as directed by the LCWSD, and only repaired. All foreign matter or dirt shall be removed from the interior and ends of the pipe and accessories before it is lowered into position in the trench. Pipe shall be kept clean by means approved by the LCWSD, during and after laying. All water mains and services will have LCWSD approved 12 gauge stranded coated tracing wire duct taped to the top of all of the pipe in the trench. The tracer wire shall be extended into and to the top of all valve boxes, air release valve boxes, or any other structure LCWSD requests.

(1). Jointing Mechanical Joint Pipe:

(a) Joining Existing Bell and Spigot to New Mechanical Joint:
Due to the difficulty that may be encountered in attempts to make such a connection of this type, an adapter having a fitting bell and a M.J. socket may be used by the Contractor. The adaptor must be submitted and approved by LCWSD prior to installing.

(b) Cleaning and Assembling Joints:
Clean last 8" outside the spigot, and the inside of the bell of mechanical joint pipe to remove oil, grit, tar (other than standard coating) and other foreign matter from the joint and then paint area clean with an approved non-toxic vegetable soap. The ductile iron gland shall then be slipped on the spigot end of the pipe with the extension of the gland toward the socket or bell end. The rubber gasket shall be painted with the soap solution and placed on the spigot end with thick edge toward the gland.

(c) Bolting of Joints:
Push entire section of pipe forward to seat spigot end in the bell. Press gasket into place within the bell, being careful to have the gasket evenly

located around the entire joint. Move ductile iron gland along the pipe into position for bolting, insert all bolts, and screw nuts up tightly with fingers. Tighten all nuts with a suitable (preferably torque-limiting) wrench. Tighten nuts that are spaced 180 degrees apart alternately in order to produce equal pressure on all parts of the gland.

(2) Jointing Rubber Gasket Pipe (Bell Tite, Tyton, or Equivalent):

(a) Cleaning Joint and Gasket:
Clean gasket and spigot and inside of bell thoroughly to remove all dirt and other foreign matter.

(b) Inserting Gasket:
Insert gasket furnished by the pipe manufacturer into the gasket seat in the bell. Gasket shall be properly seated in the grooves provided in the pipe bell.

(c) Lubricating Gasket and Pipe Spigot:
Using a non-toxic vegetable soap, apply a film by hand to the inside surface of the gasket that comes into contact with the entering pipe and to the first 1" of the spigot end of the entering pipe. Use only lubricant specified by the pipe manufacturer.

(d) Final Assembling of Joint:
Align entering pipe with the bell to which it is to be joined. Enter the spigot end into the bell until it just makes contact with the gasket. Apply sufficient pressure to force the spigot end past the gasket as required by the pipe manufacturer.

(e) Field Cutting Pipe:
When it is necessary to field cut the pipe, chamfer the cut end 1/8 inch x 30 degrees before inserting into a rubber gasket bell.

(f) Fittings:
Fittings shall be installed where and as shown on the plans or as directed by the Engineer. All bends (1/16 to 1/4), y-branches, plugs and all other fittings requiring such shall be sufficiently backed, blocked, or braced to preclude the possibility of their blowing off the main.

3. HDPE – GUIDED BORING INSTALLATION:

A. Scope: This section includes the installation of the water main by guided boring. The contractor will furnish all labor, components, materials, tools, and appurtenances necessary or proper for the performance and completion of the contract.

B. General Description of Method: Guided boring is a method of trenchless construction using a surface launched steerable drilling tool controlled from a mobile drilling frame, and includes a field power unit, mud mixing system, and mobile spoils extraction system. The drilling frame is sited and aligned to bore a pilot borehole that conforms to the planned installation of the main. The drilling frame is set back from an access pit that has been dug (typically at the location of the proposed water main or other appurtenances) and a high-pressure fluidjet toolhead that uses a mixture of bentonite clay and water is launched. Pits are normally dug at the start point and endpoint of the proposed pipe installation and are used to align the toolhead, attach other equipment, and to collect and remove excess spoils. Using an electronic guidance system, the toolhead is guided through the soil to create a pilot borehole. Upon reaching the endpoint joint, the toolhead is removed and a reamer with the product pipe

attached is joined to the drill string and pulled back through the borehole. In large diameter installations, pre-reaming of the borehole will usually be done prior to attaching the product pipe for the final pullback. A vacuum spoils extraction system removes any excess spoils generated during the installation. The connections or other water appurtenances are then completed at both the start point and endpoint locations and the surface restored to its original condition.

C. Qualifications:

(1) Guided boring contractors shall have actively engaged in the installation of pipe using guided boring for a minimum of three (3) years.

(2) Field supervisory personnel employed by the guided boring contractor must have at least three (3) years experience in the performance of the work and tasks as stated in the contract document.

D. Submittals:

(1) Submit documentation showing three (3) years of guided boring experience. Information must include, but not be limited to; date and duration of work, location, pipe information (i.e., length, diameter, depth of installation, pipe material, etc.), project owner information, (i.e., name, address, telephone number, contact person), and the contents handled by the pipeline (water, wastewater, etc.).

(2) Submit a list of field supervisory personnel and their experience with guided boring operations. At least one (1) of the field supervisors listed must be at the site and be responsible for all work at all times when guided boring operations are in progress. Guided boring operations will not proceed until the resume(s) of the contractor's field supervisory personnel have been received and reviewed by the Project Engineer and LCWSD.

(3) Submit the following drawings and documents:

(a) Working drawings and written procedure describing in detail the proposed method of installation. This will include, but not be limited to; size, capacity and setup requirements of equipment, location and siting of drilling and receiving pits, dewatering if applicable, method of fusion and type of equipment for joining pipe, type of cutting tool head, and method of monitoring and controlling line and depth. If the contractor determines that modifications to the method and equipment as stated in the submittal is necessary during construction, the contractor will submit a plan describing such modifications, including the reasons for the modification.

(b) Bentonite drilling mud products information (MSDS); special precautions necessary; method of mixing and application; and method of removing spoils.

E. Site Conditions:

(1) Drilling operations must not interfere with, interrupt or endanger surface and activity upon the surface.

(2) Contractor must comply with all applicable jurisdictional codes and OSHA requirements.

(3) The contractor shall conduct pre-bid and pre-drill investigations of each individual site and make a determination as to the existing conditions.

(4) When rock stratum, boulders, underground obstructions, or other soil conditions that impede the progress of drilling operations are encountered, the contractor shall change from a conventional drilling bit to one suitable for drilling in rock formations. This change in equipment shall be at no additional cost to LCWSD.

F. HDPE – Drilling Fluid:

(1) Drilling fluid will be a mixture of water and bentonite clay. The fluid will be inert. The fluid should remain in the tunnel to ensure the stability of the tunnel, reduce drag on the pulled pipe, and provide backfill with the annulus of the pipe and tunnel.

(2) Disposal of excess drilling fluid and spoils will be the responsibility of the contractor who must comply with all relevant regulations, right-of-way, work space, and permit agreements unless otherwise agreed upon before hand with LCWSD personnel. Excess drilling fluid and spoils will be disposed at an approved location.

(3) The contractor is responsible for transporting all excess drilling fluid and spoils to the disposal site and paying any disposal costs. Excess drilling fluid and spoils will be transported in a manner that prevents accidental spillage onto roadways. Excess drilling fluid and spoils will not be discharged into sanitary or storm drain systems, ditches, or waterways.

(4) Drilling fluid returns (caused by fracturing of formations) at locations other than the entry and exit points will be minimized. The contractor will immediately clean up any drilling fluid which surfaces through fracturing.

(5) Mobile spoils removal equipment capable of quickly removing spoils from entry or exit pits and areas with returns caused by fracturing will be present during drilling operations to fulfill the requirements of paragraphs b and c above.

(6) The contractor will be responsible for making provisions for a clean water supply for the mixing of drilling fluid.

G. HDPE – Installation:

(1) General:

(a) The Engineer shall be notified immediately if any obstruction is encountered that stops the forward progress of drilling operations.

(b) The type of dewatering method will be at the option of the contractor. However, the dewatering of pits and excavations must meet all requirements of OSHA and the general conditions, special provisions, and specifications of LCWSD. When water is encountered, the contractor, unless otherwise agreed upon beforehand, must provide a dewatering system of sufficient capacity to remove water, keeping any excavations free of water until the backfill operation is in progress. Dewatering shall be performed in a manner that removal of soil particles is held to a minimum.

(2) Preparation:

(a) Excavate required pits in accordance with the working drawings.

(b) The drilling procedures and equipment shall provide protection of workers, particularly against electrical shock. As a minimum, grounding mats, grounded equipment, hot boots, hot gloves, safety glasses, and hard hats shall be used by crewmembers. The drilling equipment shall have an audible alarm system capable of detecting electrical current.

(c) Removal of trees, landscaping, pavement or concrete shall be performed by the contractor unless otherwise agreed upon beforehand.

H. Guided Boring Operations:

(1). Equipment:

(a) The drilling equipment must be capable of placing the pipe within the limits indicated on the contract plans.

(b) Guided boring equipment shall consist of a surface launched steerable drilling tool controlled from a mobile drilling frame, and include a field power unit, mud mixing system and mobile spoils extraction system.

(c) The number of access pits shall be kept to a minimum and the equipment must be capable of boring the following lengths in a single bore. The guided boring system will have the capacity of boring and installing a continuous run without intermediate pits of a minimum distance for the following pipe diameters:

Product Pipe Size	Minimum Boring Distance
1 – 1 ½ inches	500 feet
2 – 4 inches	450 feet
6 inches	400 feet
8 inches	350 feet
10-16 inches	300 feet

(d) The guidance system shall have the capability of measuring vertical (depth) position, horizontal position and roll. The guidance system must meet the following specifications in soft homogenous soils:

	Accuracy	
Vertical position:	± 1 inch at	18-96 inches of depth
	± 2 inches at	97-144 inches of depth
	± 4 inches at	145-180inches of depth
	± 6 inches at	181-300inches of depth
	± 10 inches at	301-480inches of depth
Horizontal position:	± 2 inches at	18-96 inches of depth
	± 4 inches at	97-144 inches of depth
	± 6 inches at	145-180 inches of depth
	± 12 inches at	181-300inches of depth
	± 24 inches at	301-480inches of depth

(e) Equipment set-up requirements shall be prepared by the contractor and submitted to the Engineer per the requirements as stated under “Submittals.”

(f) Required Safety Equipment: **During drilling operations all equipment shall be effectively grounded and incorporate a system that protects operating personnel from electrical hazards. The system shall be equipped with an audible alarm that can sense if contact is made with an energized electric cable. Proper operation of the alarm system will be confirmed prior to the drilling of each tunnel. All equipment will be connected to ground with a copper conductor capable of handling the maximum anticipated fault current. Crew members operating drilling equipment and handling rods will do so**

while standing on grounded wire mesh mats, ensuring that all equipment is grounded, and wearing hot boots, hot gloves, safety glasses and hard hats. Crew members operating handheld locating equipment will wear hot boots.

(2) Pit Hole Boring:

(a) The entry angle of the pilot hole and the boring process will maintain a curvature that does not exceed the allowable bending radii of the product pipe.

(b) Alignment Adjustments and Restarts:

(1) The contractor shall follow the pipeline alignment as shown on the drawings, within the specifications stated. If adjustments are required, the contractor shall notify the engineer for approval prior to making the adjustments.

(3) Installing Product Pipe:

(a) After the pilot hole is completed, the contractor shall install a swivel to the reamer and commence pullback operations. Pre-reaming of the tunnel may be necessary and is at the option of the contractor.

(b) Reaming diameter will not exceed 1.5 times the diameter of the product pipe being installed.

(c) The product pipe being pulled into the tunnel will be protected and supported so that it moves freely and is not damaged by stones and debris on the ground during installation.

(d) Pullback forces will not exceed the allowable pulling forces for the product pipe.

(e) The contractor shall allow sufficient lengths of product pipe to extend past the termination point to allow connections to the diffuser assembly. Pulled pipe will be allowed 24 hours of stabilization prior to making tie-ins. The length of extra product pipe will be at the contractor's discretion.

4. CLEAN-UP:

The Contractor shall maintain the work site in a neat and orderly condition throughout the period of work and after completing the work. At each site, remove debris, surplus material and temporary structures erected by the Contractor. The site shall be restored to a condition equal to the existing condition prior to being disturbed or better.

5. EROSION CONTROL:

Siltation and erosion control shall be controlled by the Contractor using permanent erosion control measures, temporary erosion control measures and supplemental measures such as, mulches and quick growing grasses, slope drains and other pollution control devices as necessary. ALL projects which will involve land-disturbing activities are required to comply with the requirements set forth by Lancaster County and the South Carolina Department of Health and Environmental Control (SCDHEC). All permits must be secured prior to the beginning of any construction.

All erosion control measures (temporary or permanent) shall be first class quality and approved by the SCDHEC or Lancaster County.

During construction, protective structures and measures shall be implemented and maintained by the Contractor to minimize erosion and sedimentation as a result of the construction work being performed. All disturbed areas along the pipeline shall be grassed as soon as possible after backfilling operations have been completed. The Contractor is responsible to remove all protective erosion control structures once the grass has been re-established and the site has been approved by SCDHEC.

6. CONSTRUCTION IN RIVERS, STREAMS, AND IMPOUNDMENTS

Construction operations in rivers, streams and impoundments shall be restricted to those areas which must be entered for the construction of temporary or permanent structures. The Army Corps of Engineers must permit, if applicable, the construction, and a copy of the permit must be given to LCWSD if requested. Frequent fording of live streams with construction equipment will not be permitted; therefore, temporary bridges or other structures shall be used wherever an appreciable number of stream crossing are necessary during water main construction.

7. CLEARING:

The Contractor shall perform all clearing necessary for installation of the complete work. Clearing shall consist of removing all trees, stumps, roots, brush, debris, etc in the way of the work. If the Contractor opts to burn any debris, it must be approved by LCWSD and all designated burning permits must be acquired by Lancaster County.

Trees and shrubs designated to be left in place, and those outside of the construction limits, shall not be damaged. If any trees or shrubs that are not supposed to be damaged are damaged, then the Contractor is responsible for replacing the planting with a similar planting at no cost to LCWSD.

Please refer to Section 8 of these specifications for additional information.

8. FIRE HYDRANTS AND VALVES:

Fire hydrants and valves shall be set as directed by the Engineer and located as shown on the drawings. LCWSD and/or the Engineer will require concrete blocking behind all fire hydrants and valves.

A. Fire Hydrants:

Fire hydrants shall be set where shown on the plans or as directed by the Engineer and/or LCWSD. If the fire hydrant is moved due to existing site conditions, it must be approved by the LCWSD inspector and LCWSD engineer, and any changes to the plans must be documented accordingly on the As-Builts. The hydrants shall be set upon a bed of compacted crushed stone at least thirty (30) inches square by ten (10) inches in depth. There shall be furnished and installed concrete blocking and an approved tie rod assembly to securely anchor the hydrant to the main line as shown on the detail contained in these specifications. The cost for the tie rod assembly and concrete blocking shall be included in the unit price for hydrants. When the hydrant is backfilled, crushed stone or gravel shall be placed around the hydrant to a point just above the drain holes of the hydrant.

Fire hydrants shall meet or exceed the requirements of the latest revision of AWWA Specification C-502. LCWSD approved 3-way fire hydrants are manufactured by Mueller and American Flow Control, unless otherwise approved by LCWSD. All new hydrants shall be furnished with “Storz” nozzles having ¼ turn cap and hose connection fittings a the streamer nozzle location. Each Storz nozzle shall include a Storz blind cap with suction seal and aircraft cable. Storz nozzles are manufactured by Harrington, Inc. Tnemec and Sherwin Williams Polane SP Polyurethane Enamel paint are the approved coatings for fire hydrants. All other paints must be approved by LCWSD.

B. Valves:

Valves shall be set and anchored with steel bars and concrete as shown on the detail sheet contained in the plans and/or specifications. All valves set by the Contractor shall include a cast iron or ductile iron valve box set to grade or as directed by LCWSD. All valves boxes shall have a concrete protector ring installed around the box with a concrete marker pole installed with the letters "MV" pointing towards the valve location. If the valve is moved and is not located per the plans, at the approval of the LCWSD Inspector and/or Engineer, then it must be documented on the As-Builts.

(1) Gate Valves:

Gate valves must be manufactured by American Flow Control and Mueller, or approved equal, and have the following specifications. Any conditions that are not included in these specifications must be approved by LCWSD personnel.

- Any valve which is installed on pipe having a depth of cover more than 5 feet shall be provided with a permanently installed valve stem extension.
- Conform to the latest revision of AWWA-C509
- Be resilient seated valves
- Have non-rising stem with "O" ring seals.
- Have cast iron, bronze mounted bodies.
- Have rubber-covered gates.
- Open to the left.
- Have MJ type connections.

(2) Butterfly Valves:

Butterfly valves will only be approved by LCWSD under special conditions. If a butterfly valve is approved, then it must meet the following conditions.

- Shall be rubber seated (natural rubber or synthetic rubber compound) with rubber seats securely fastened to the body and shall conform to the latest revision of AWWA C504
- Designated for 150 psig operating pressure, unless noted otherwise on the approved Drawings and shall be bubble tight at rated pressures.
- Hydrostatic and leakage tested in accordance with AWWA C504.
- Have cast iron bodies with MJ type connections.
- Open to the left.
- Operators shall be of the totally enclosed, oil bath lubricated, gear reduction type.

(3) Tapping Sleeves and Valves:

The Contractor is responsible to furnish and install tapping sleeves and valves suitable for connections to the existing water mains at the locations indicated in the drawings. Please refer to Tapping Saddles in Section 4 of these Water Specifications.

Tapping valves shall be furnished in accordance with the above specifications for Gate Valves. The valves shall have a flanges connection to the tapping sleeve and a mechanical joint connection to the branch pipe. The mating valve flange to the tapping sleeve outlet must have a raised male face, conforming to MSS SP-60, to ensure true alignment of the valve and tapping sleeve.

(4) Air Release Valves:

Air release valves shall be installed as detailed on the approved Drawings. Air release valves are designed to permit automatic escape of large quantities of air from a pipeline when the line is being filled. It also allows air to escape while the line is in operation and under pressure. This shall be accomplished with a float and

compound lever system functioning in conjunction with a large and small orifice in one integral body casting.

The body of the valve shall be all stainless steel conforming to ASTM specification A126.CL.B. Valve levers, float, float rod, valve plunger and other internal metal parts shall be stainless steel. Air and vacuum seats shall be Bun-N-Rubber.

The valve shall be UL series model manufactured by Crispin Valve or equal. The valve must be in accordance with the AWWA Specification C-512, latest revision. The valve must be appropriately sized for the length and diameter of the water main into which it is to be installed and shall be designed for a minimum working pressure of 200 psi.

(5) Backflow Prevention Devices:
Backflow prevention devices shall be approved and installed, at the Owner's expense, as required by LCWSD, SCDHEC, and as set forth in the LCWSD's Cross Connection Program. All large water meters (i.e., industrial, office, commercial, schools, and any other location as determined by LCWSD), shall require a double-check backflow prevention assembly as detailed in the Drawings. The backflow device must be manufactured by FEBCO, Watts or approved equal by LCWSD. Reduced Pressure Principle Backflow assembly to be required for high hazard applications

(6) Valve Marker Poles:
A concrete marker pole must be installed for all valves, air release valves, and buried blow off valves, which shall indicate the direction of the valve. Markers shall indicated the following:

- MV = Main Valve
- ARV = Air Release Valve
- BO = Blow Off Valve
- PC = Permanently Closed

All markers shall be in the style and number as determined by LCWSD. For location purposes, if concrete curbing is located near the infrastructure to be identified, the marker may be substituted by an etching in the curbing via a power saw with the initials as noted in the above list.

(7) Valve Boxes:
Valve boxes shall be of close-grained gray cast iron. They should be the two (2) piece screw type and the cover shall have cast on the upper surface in raised letters the word "LCWSD WATER". The boxes shall be coated with a protective bituminous paint prior to being shipped from the factory. Valve boxes shall be installed with the valve operating nut centered in the box so the operating nut can be easily accessed.

9. CONNECTIONS TO EXISTING MAINS:

Only LCWSD personnel or LCWSD's Contractor (unless otherwise approved by LCWSD) shall make connection to the existing water mains when and as directed by the LCWSD Inspector at the contractor's expense. If approved by LCWSD for the Contractor to make any tie in, then it must be under the inspection of the LCWSD inspector. In no case shall the Contractor shut off the water or operate the fire hydrants or gate valves of the existing distribution system without the expressed permission of the LCWSD Inspector. In case it becomes necessary to delay the cut-off, such instructions shall be given and obeyed without recourse.

In making connections to the old distribution system, valves shall be set as shown on the plan, or at such designated place as the Engineer may direct. If due to unforeseen conditions, these locations have to be changed or additional valves or fittings added, the Contractor shall install the valves or fittings at the new locations.

10. CONCRETE BLOCKING:

All turns, fittings, fire hydrant connections, etc., that induce pressure which would cause separation of pipe, breakage, etc., shall be blocked with 3,000 psi concrete. Blocking shall be formed and placed in such a manner that the pressure to be exerted at the point of blocking shall be transferred to firm, undisturbed earth at a maximum load of 2,000 lbs, per square foot. The Contractor shall insure that blocking at all tees, bends, plugs, etc., shall be sufficient to contain all pressure exerted by the pipe up to a pressure of 200 lbs. per square inch hydraulic pressure within the pipe, i.e. pressure at plug = 200 x (area of pipe in inches). The Contractor shall also be responsible for any damage or repairs caused by blowouts of any insufficiently blocked pipe. The contractor shall wrap all fittings, fire hydrant connections, etc. with LCWSD approved plastic wrap before any and all concrete pouring is started.

11. PRESSURE TESTING:

A. General:
All branches of the new water distribution system shall be pressure tested and disinfected by chlorination by the Contractor before acceptance of work by the owner. Disinfection of water lines and the disposal of heavily chlorinated water following disinfection must be accomplished in accordance with AWWA Standard C651 (latest revision) and the guidelines established by SCDHEC. The Contractor shall notify LCWSD at least 72 hours prior to disinfecting and testing of any part of the system and shall provide all necessary supplies, equipment, labor and apparatus for conduction of the tests. The LCWSD inspector and Project Engineer must be present during the flushing and pressure testing.

B. Leakage and Pressure Test:
Ductile iron and PVC pressure lines shall be filled with water, air completely exhausted, and a leakage test made. The Contractor is responsible to furnish all materials (i.e., a test pump, means for accurate measurement of water introduced into a line during testing, and install the necessary corporation stops in the line as required for blowing lines free from air and at the test pump location). No corporation stops will be allowed in PVC lines without tapping saddles.

The Contractor is responsible to furnish, install, and remove all temporary bulkheads, flanges or plug, to permit the required pressure tests, and shall furnish all equipment and labor to properly carry out such tests and to replace defective material. Test pressure shall be 150 psi or 1.5 times the maximum working pressure of the pipe, whichever is higher, as measured at the lowest point of elevation of the section of line being tested.

Pressure testing shall be performed in accordance with the requirements set forth by AWWA C600 (for ductile iron piping) and AWWA CS605 (for PVC pipe). Leakage shall be determined by the following formula:

$L = (NxDxP^{1/2})/K$
L=Allowable leakage in gallons per hour
N=Length of pipe tested, in feet (ductile iron pipe) in number of joints (PVC pipe)
D=Nominal diameter of the pipe in inches
P=Average test pressure during the leakage test, in pounds per square inch
K=133,200 for ductile iron pipe and 7,400 for PVC pipe.

Minimum test period shall be 24 hours to test blocking and/or restrained joints plus two (2) hours of pressure leakage testing. The Contractor shall maintain the 24 hour test pressure ±5 psi for 24 hours.

Any cracked or broken pipe shall be removed and replaced with sound pieces. Joints which leak shall be carefully replaced. Replaced material shall be re-tested under the same conditions of operation. All pipe considered to be defective must be replaced or remade until it passes all required tests. It is at the discretion of LCWSD if it appears more testing may be required. All tests and results must be witnessed by the LCWSD Inspector and the Project Engineer.

12. FLUSHING:

The pipe segment shall be flushed by means of a fire hydrant or a flush point for the purpose of removing debris from the pipe. The pipe shall be flushed at a velocity of 2.5 feet per second. All flushing shall be metered with a LCWSD approved and/or supplied meter with an approved backflow prevention device. The meter is important so LCWSD can account for water loss as required by SCDHEC. Please refer to Section 1-4 on Construction Water Use. Contractor should coordinate with the LCWSD Inspector concerning any and all flushing so as to allow LCWSD Inspector to be present and issue any approval and regulation for flushing.

13. BLOW-OFF ASSEMBLY:

A blow-off assembly may be required for all water mains under (6) inches in diameter. A blow-off assembly shall consist of a 2" or 2 ½" valve, a 90 degree elbow the same size as the valve, and a 2" or 2 ½" female adapter stubbed up for connection to a LCWSD approved stand pipe. The valve, 90 degree elbow, and female adapter shall be brass or PVC (no galvanized pipe or fittings) and installed in a LCWSD approved concrete meter box. All blow-off assemblies shall have a concrete marker pole at each blow-off assembly. All blow-off assemblies shall be adequately blocked.

14. DISINFECTION:

Disinfection of all new water mains shall be in accordance with current American Water Works Association (AWWA) Standard C651 for the disinfection of water mains. In general one approved method referred to as "continuous feed method" is as follows: Before being placed in service, all new mains shall be thoroughly flushed then chlorinated with not less than twenty-five (25) milligrams per liter of available chlorine. Water from the existing distribution system or other source of supply shall be controlled so as to flow slowly into the newly laid pipeline during the application of chlorine. The solution shall be retained in the pipeline for not less than twenty-four (24) hours and then flushed thoroughly with a potable water of satisfactory bacteriological quality before starting the sampling program. The LCWSD Inspector shall be present when all disinfection shall take place. Samples are to be pulled by a South Carolina certified lab with a South Carolina License identification.

The contractor shall collect a minimum of two (2) samples from each sampling site for total coliform analysis. The number of sites depends on the amount of new construction but must include all dead-end lines and be representative of the water in the newly constructed mains. Prior to sampling, the chlorine residual must be reduced to South Carolina Department of Health and Environmental Control current regulations. These samples must be collected at least twenty-four (24) hours apart and must show the water line to be absent of total coliform bacteria. The chlorine residual must also be measured and reported. If the membrane filter method of analysis is used for the coliform analysis, non-coliform growth must be reported. All samples must be analyzed by a certified laboratory at the contractor's expense with LCWSD to receive a copy of all approved samples. DHEC may request that heterotrophic plate count analyses be conducted on a case-by-case basis where disinfection problems are suspected. If the presence of coliform bacteria is detected in the water samples, the section of pipe shall be disinfected and additional samples shall be taken.

The contractor shall provide a means by which the water used during the disinfection process can be de-chlorinated to a residual of less than 2 ppm prior to discharging into wetlands or other sensitive areas. The method for de-chlorination shall be submitted for approval.

The sampling location for this test shall be from a tap placed in the top or the pipe in locations approved by the engineer. No hoses or hydrants will be used in collecting samples.

15. METHOD OF MEASUREMENT:

The cost of laying pipe including connection of existing mains, pressure testing, sterilization, and bacteriological testing shall be included in the unit price per foot of pipe measured as previously specified. The cost of setting valves, fittings, water services, etc. shall be included in the cost per unit of the respective item measured as specified.

Blocking for fittings shall be measured by the cubic yard of concrete. This item shall include all labor, materials, equipment, and incidentals necessary to properly block all fittings and bends according to the detailed drawings contained herein.

SECTION 8

WATER MAIN CONSTRUCTION

SITEWORK

1. SCOPE:

This section includes all of the required sitework (i.e., clearing, grubbing, disposal of materials, site preparation, clean-up, etc) within the construction area of the proposed water infrastructure.

2. SITE PREPARATION:

A. Existing Facilities:

The Contractor shall provide protection for all existing structures, buildings, and utilities against all construction activity. The Contractor is at fault for any construction activities that harm any existing facilities and is responsible to repair or replace any existing facility that has been damaged. Therefore, since LCWSD is not at fault, the Contractor will preserve and hold LCWSD harmless against damage and claims resulting from these activities.

B. Streets and Highways:

Effective barricades, danger signals and signs on all streets and in other locations where required for the protection of the work and the safety of the public, shall be provided, erected and maintained by the Contractor. Barricades and obstructions that encroach on, or are adjacent to, public rights-of-way shall be properly lighted between the hours of sunset and sunrise. The Contractor shall conform to all city, state and local laws and regulations in the use of streets and highways. The Contractor shall be responsible for all damages occurring due to neglect or failure to meet these requirements. When dictated by conditions that might endanger the public, a watchman shall be provided to fulfill the requirements stated herein. The contractor or engineer shall secure an approved Department of Transportation Encroachment Permit before any work is to be done on road right-of-way. LCWSD shall receive a copy of this permit for its file prior to work beginning.

C. Traffic Flow and Continuance of Services:

The work shall be arranged in a manner that will cause a minimum of disturbance to vehicular and pedestrian traffic. Adequate ingress and egress to both private and public property shall be provided to the Contractor before and during all stages of construction. All easements shall be transferred to LCWSD for LCWSD to own, operate, and maintain before all approval is excepted from the Contractor. Without written approval from the District, existing services shall not be interrupted by the construction work. All work shall conform to Department of Transportation guidelines.

3. PRELIMINARY WORK:

A. Rights-of-Way:

Adequate working space shall be cleared along the pipelines and space shall be provided for control stakes and hubs. Trees and permanent structures not located within the right-of-way of new streets shall be removed only as directed. All right-of-ways shall be obtained from the property owner before any construction takes place. Before any final approval is accepted from LCWSD, all permanent right-of-ways shall be transferred to the LCWSD for the LCWSD to own, operate, and maintain.

B. Valuable Trees and Shrubs:

When the construction work involves the removal of valuable trees and shrubs on existing public rights-of-way, the work shall be done in cooperation with the city, county, or state.

C. Protection of Private Property:

The Contractor shall provide protection for privately owned trees and shrubs bordering the right-of-way and shall take full responsibility for any damage that occurs to them during construction.

4. CLEARING AND GRUBBING:

Clearing and grubbing shall be performed in areas indicated and where required for construction. It shall include the complete removal and disposal of all brush, weeds, timber, stumps, rubbish and all other obstructions. All such material shall be removed to a depth of at least one-foot below finished grade. In clearing and grubbing areas where excavation is done, all timber, roots, or stumps removed that are exposed by said excavation shall be removed to a depth of one foot below the excavated surface.

5. DISPOSAL OF CLEARED AND GRUBBED MATERIAL:

All refuse from the clearing and grubbing operation shall be disposed of either by burning or removal to a dump area that is approved by the property owner. The Contractor shall obtain a burning permit from the nearest burning official before any burning is started. Burning, if approved, shall be done in such a manner that does not create hazards such as damage to existing structures, trees and vegetation, interference with traffic and construction in progress. When the construction site is outside the city limits and burning is required, proper permits shall be obtained from the city, county or state officials. All disposal by burning shall be kept under constant supervision until all fires have been extinguished. All burning shall comply with all state and local laws relative to the building of fires.

6. PAVEMENT REMOVAL AND REPLACEMENT:

A. Removal:

When pipe is to be laid in existing paved streets, the pavement shall be saw cut to true and neat lines as approved by Lancaster County or SCDOT and directed by the LCWSD Inspector. Power driven cutting saws are preferred; however, pavement breakers driven by air compressors are acceptable if approved by the LCWSD Inspector. All broken pavement shall be removed before trenching is started.

B. Replacement:

The pipe trench shall be backfilled according to approved methods within the specifications of the SCDOT or Lancaster County. The SCDOT will require all SCDOT roads to be filled with an approved flowable fill within 10 inches of the final grade of the road and then capped with two layers of approved asphalt overlay. The specifications for a Lancaster County road may require the trench to be filled with granular select material to within 10 inches of the pavement surface. All specifications from the SCDOT or Lancaster County must be followed when working within the road right-of-way. Prior to construction, all road open- cuts and road bores must be approved from the correct entity.

Until the trench is capped with asphalt, the trench shall then be filled with ABC stone to the surface of the trench and sufficiently compacted or steel plates must be secured to the pavement until the asphalt overlay has been replaced. The stone fill shall be maintained in a

workmanlike manner until the asphalt surface has been replaced. The edges of the asphalt shall be neatly trimmed to a new face and mopped with asphalt cement. The asphalt surface shall be placed and thoroughly rolled to a smooth, dense surface true to adjacent areas of the street. The asphalt surface course shall consist of Type I-2 bituminous concrete surface course in accordance with South Carolina Department of Transportation Specifications.

Cut areas shall be maintained by the Contractor in a safe, passable condition until paved. Should the area create a dusty condition, the Contractor shall remedy this condition by the use of water or calcium chloride. Special care shall be given to the areas cut in traffic lanes and intersections by placing crushed stone and maintaining in a smooth condition at the Contractor's expense.

C. Sidewalk, Driveway and Curb and Gutter Replacement:

Existing sidewalks and paved driveways, including curb and gutters removed, disturbed or destroyed by construction, shall be replaced or repaired. The finished work shall be equal in all respects to the original.

D. State Highway Crossings:

All construction related to state highway crossings shall be in full compliance with all requirements of the Department of Transportation Encroachment Permit and to the satisfaction of the S.C. Department of Transportation.

7. WORK IN RAILROAD RIGHTS-OF-WAY:

Permits for all construction within the rights-of-way of railroads shall be obtained by the Engineer and approved by the railroad before commencing work in these areas. The proper prior notification to the railroad authority shall be given in the proper time frame.

Utility lines shall be installed in full compliance with all requirements of the railroad and to their satisfaction, including any carrier pipe and encasement pipe. The Contractor shall provide all warning and protective measures required by the railroad company. The Contractor shall pay for any and all necessary application, processing, and encroachment fees before any and all work is started.

8. RELATION OF WATER MAINS TO SEWERS:

A. Lateral Separation of Sewers and Water Mains:

Water mains shall be laid at a minimum of 10 feet horizontally, from existing or proposed sewers, unless local conditions or barriers prevent a 10-foot lateral separation in which case:

1. The water main is laid in a separate trench with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
2. Per LCWSD review, ductile iron pipe may be utilized.

B. Crossing a Water Main Over a Sewer:

Whenever it is necessary for a water main to cross over a sewer, the water main shall be laid at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer, unless local conditions or barriers prevent an 18 inch vertical separation - in which case both the water main and sewer shall be constructed of ferrous materials and with joints that are equivalent to water main standards for a distance of 10 feet on each side of the point of crossing.

C. Crossing a Water Main Under a Sewer:

Whenever it is necessary for a water main to cross under a sewer, both the water main and the sewer shall be constructed of ferrous materials and with joints equivalent to water main standards for a distance of 10 feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

SECTION 9

WATER MAIN CONSTRUCTION

SEEDING AND MULCHING

1. SCOPE:
This section shall include the furnishing of all labor, materials, equipment, and incidental items to seed and establish a turf on all areas disturbed by the pipe laying operation.

All materials shall be of the best commercial quality available for the purposes specified.

2. SEEDING:
Seed shall be furnished and sowed at the rates per acre as follows:

80 Lbs. Kentucky 31
65 Lbs. Pensacola Bahia Grass
5 Lbs. Centipede

Thus, giving a total of one-hundred fifty pounds (150 lbs.) of seed per acre. Winter planting, from November 1 until March 1, shall include 50 lbs/acre of Rye grass.

Quantities stated are in terms of total seed of the specified quantity.

3. LIME:
Applying Lime - Lime shall be applied at the rate of 4,000 lbs. per acre.

4. FERTILIZER:
Applying Fertilizer - Fertilizer shall be distributed at the rate to provide 1,200 Lbs. per acre (complete mix fertilizer - 8 parts nitrogen, 8 parts phosphoric acid and 8 parts potash) and thoroughly mixed immediately before planting.

5. MULCH:
Straw mulch shall be threshed plant residue of oats, wheat, barley, rye, or rice from which grain seed has been removed. The mulch shall be applied at a rate of 1-1/2 tons per acre and shall be tacked or otherwise sufficiently held in place.

6. SOWING SEED:
All sowing of seed shall be completed within the periods specified in the seeding schedule authorized by the Engineers. All seed shall be covered to an average depth of 1/4".

7. ESTABLISHING TURF:
The establishment period shall continue for six (6) months from the date of seeding. The Contractor shall be responsible for maintenance, protection, repairing and resulting reseeding and re-fertilization for six (6) months after initial seeding. No direct payment will be made for this work. The cost, therefore, will be included in the contract price of Liming, Fertilizer and Sowing Seed, etc., under the pay item Seeding and Mulching.

8. MOWING:
Proposed right-of-way maintenance, which may include mowing, will be the Contractor's responsibility until project completion and right-of-way has been dedicated to LCWSD.

9. REFERTILIZING:
If it appears re-fertilizing may be required due to lack of permanent turf growth, fertilizer shall be reapplied at the rate to provide 1,200 Lbs. per acre (complete mix fertilizer - 8 parts nitrogen, 8 parts

phosphoric acid and 8 parts potash), eight to ten (8-10) weeks after initial seeding as directed by the Engineers.

10.. EROSION CONTROL: Please refer to Section 7-5, Erosion Control, for requirements on erosion control procedures.

11. METHOD OF MEASUREMENT:
The area of seeding to be paid for shall be all disturbed areas due to construction and the proposed right-of-way dedicated to LCWSD. All areas shall be prepared, limed, fertilized, seeded, re-fertilized, re-seeded, repaired, turf established and accepted as directed by the Engineer, LCWSD, and/or the Developer.