02510 - WATER DISTRIBUTION

(Last revised 7/24//06)

SELECTED LINKS TO SECTIONS WITHIN THIS SPECIFICATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the General Requirements and Supplementary Conditions apply to this specification.

B. Division 02275 – TRENCHING, BACKFILLING AND COMPACTION OF UTILITIES.

1.2 SUMMARY

This section includes all equipment, labor, material, and services required for complete installation of water distribution piping and specialties for municipal water and fire-service mains and services.

1.3 DEFINITIONS

For the purposes of this specification, the following definitions refer to water distribution systems that come under the authority of the City of Jacksonville as specified within this and other sections of this manual.

A. **Fire Service**: Exterior fire fighting/suppression water piping.

B. **The City's Engineer**: The Project Engineer or his or her authorized representative.

C. **The Public Services Director**: The Public Services Director or his or her authorized representative

D. **Water Main**: Exterior water systems for both domestic water and fire suppression needs.

E. **Water Service**: Exterior water piping used to provide water for domestic purposes.

The following are industry abbreviation for various pipe materials:

A. **AC**: Asbestos Cement Pipe
B. **CI**: Cast Iron Pipe
C. **DIP**: Ductile Iron Pipe
D. **HDPE**: High Density Polyethylene Pipe
E. **RCP**: Reinforced Concrete Pipe
F. **PVC**: Poly Vinyl Chloride Plastic Pipe

1.4 SUBMITTALS

A. Submit product data for the following:

1) Pipe and Fittings
2) Valves and accessories.
3) Water meters and accessories.
4) Detector Check Valves
5) Backflow preventers and assemblies.
6) Fire Hydrants.
7) Fire Department Connections.

B. Submit shop drawings for:

1) Precast concrete vaults including frames and covers, drains, access hatches, wall sleeves, valve support stands, prefabricated above ground vaults, and backflow prevention devices.

2) Upon request, valve manufacturers shall furnish certified copies of test reports.

3) Any product submitted as an “or approved equal” that is not specifically specified in this specification.

1.5 QUALITY ASSURANCE

A. Materials and operations shall comply with the latest revision of all applicable Codes and Standards.

B. Piping materials shall be marked clearly and legibly.

1) Ductile Iron Pipe shall show identification marks on or near bell as follows:
   a. Weight,
   b. Class or nominal thickness,
   c. The letters “DI” or “Ductile,”
   d. Manufacturer’s identifying mark,
   e. Year in which pipe was made,
   f. Casting period.

2) Steel pipe shall be marked as follows. Each length of pipe and each special section shall be legibly marked by paint stenciling, die stamping, or hot-roll marking to show the following:
   a. Manufacturer's name or mark,
   b. Size and weight of the pipe or special section,
   c. The type of steel from which the pipe or special section was made.

3) PVC Pipe shall show proper marking of pipe as required in the applicable product specification and shall remain legible during normal handling, storage, and installation. The manufacture date of the pipe must be within 1 year of the proposed date of installation. Marking of PVC pipe commonly includes:
   a. Manufacturer's Name,
   b. Nominal Pipe Size and Size Base,
   c. PVC Cell Classification or Material Code,
   d. Dimension Ratio or Standard Dimension Ratio,
   e. Product Type, Pressure Class or Pressure Rating,
   f. Standard Specification Designation,
   g. Production Record Code.

C. Comply with Factory Mutual's *"Approval Guide*" and Underwriters Laboratories, Inc. "*Fire Protection Equipment Directory*" for fire-service main products.

D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, and flushing and valve and hydrant supervision for fire mains.

E. Comply with NSF 61 for materials for water service piping and specialties for domestic water.

F. Comply with all applicable AWWA and ANSI standards.

1.6 QUALITY STANDARDS

A. Materials and operations shall comply with the latest revision of the Codes and Standards listed below. The use of ASTM standard specification references without a year designation implies the most current applicable specification.

AASHTO	American Association of State Highway Transportation Officials.
ANSI	American National Standards Institute
AREA	American Railway Engineers Association
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
FM	Factory Mutual System
FS	Federal Specifications

MSDS	Material Safety Data Sheets
NSF	National Sanitation Federation International
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
UL	Underwriters Laboratories, Inc.
NCDENR	North Carolina Department of Environment and Natural Resources
NCDOT	North Carolina Department of Transportation

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

Materials used for the construction of water mains and appurtenances in the City of Jacksonville's water distribution system shall be new, free of defects, and meet the highest standards set forth. An authorized City representative must inspect, review, and approve all materials to be used for water lines and appurtenances prior to installation. At the option of the City of Jacksonville, any material installed without inspection will have to be sufficiently removed for inspection and review. Any additions, deletions, or changes from the City of Jacksonville approved plan set must be submitted to the Public Services Director for approval, prior to making changes in the field.

A. **Pipe Conditions/Pipe Examination**:

1) **New pipe inspection upon arrival**: Inspect each truckload of materials thoroughly upon arrival at the site. Examine material for damage and to ensure that the right pipe has been delivered to the site. Pipe shall be protected during handling against impact shocks and free fall. Care shall be taken when unloading pipe to avoid damaging the pipe lining. Pipe that has been damaged either in transit or during unloading shall be plainly marked and shall not be used in the construction of the utility. Pipe shall be kept clean at all times, and no pipe shall be used in the work that does not conform to the appropriate ASTM specifications.

2) **Prior to laying pipe**: Prior to being installed, each section of the pipe shall be carefully examined for damage and conformity with these specifications. All pipes in which spigots and bells cannot be made to fit properly, or pipes that have chipped bells or spigots, will be rejected. All pipes damaged or deemed not to conform to these specifications, shall be plainly marked and shall not be used in the construction of the utility. The faces of all spigot ends and all shoulders on the bells must be true, without lumps or rough edges, and be brought in fair contact. Examine bell and spigot for uniformity and smoothness of liner and barrel.

B. Inspect fittings and structures thoroughly upon arrival for damage. Remove damaged or rejected materials from site.

C. Observe manufacturer's directions for handling, delivery, and storage of materials and accessories.

D. Protect pipe coating during handling using methods recommended by the manufacturer. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is not permitted.

E. Protect stored piping from entry of water or dirt into pipe. Store pipe on shoulders and not in ditch lines. String out no more pipe than can be installed in a day. Also, protect bells and flanges of special fittings from entry of moisture and dirt. If pipe is provided with end protectors, do not remove protectors until ready for installation or for inspection. Once inspected, replace protectors.

F. Support pipe to prevent sagging or bending.

G. Use slings to handle valves and fire hydrants if size requires handling by crane or other type of lift. Do not use handwheels or stems to lift or for rigging points.

H. Store fire hydrants and valves in such a way as to prevent entry of water and dirt into openings. Support on skids or pallets off the ground or pavement. If fire hydrants or valves are provided with end protectors, do not remove protectors until ready for installation or for inspection. Once inspected, replace protectors. Protect valves against damage to threaded ends or flanges.

1.8 PRODUCT SUBSTITUTIONS

The Public Services Director will approve materials not specified but deemed equal, on a case-by-case basis. Submit documentation and samples of materials. New materials approved for the water distribution system will be incorporated into these specifications after approval.

1.9 PROJECT CONDITIONS

1.9.1 Separation of water and sanitary and/or combined sewers.

A. Follow the NCDENR standards for separation of water mains and sanitary sewers lines.

B. **Parallel Installations**:

1) **Preferred/Normal Condition** – Water lines shall be constructed at least 10 feet horizontally from a sewer or sewer manhole whenever possible. The distance shall be measured edge-to-edge.

2) **Unusual Conditions** – When local conditions prevent a horizontal separation of at least 10 feet, the water line may be Ductile Iron and laid up to within 3’ of a sewer or sanitary sewer manhole as determined by the Public Services Director on a case by case basis provided that:

a. The water main shall be placed in a separate trench, with elevation of the bottom of the water line at least 18 inches above the top of the sewer; or

b. The water main shall be placed in the same trench as the sewer, and located to one side, on a bench of undisturbed earth, and the elevation of the bottom of the water main shall be at least 18 inches above the top of the sewer; or

c. Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved Ductile Iron Pipe. The sewer manhole shall be of watertight construction and tested in place.

C. **Water Mains Crossing <u>Above</u> Sanitary Sewers and Storm Sewers**:

1) **Preferred/Normal Condition** – water lines shall be constructed to cross over sanitary sewers and storm sewers whenever possible and shall be laid to provide a vertical separation of at least 18 inches between the bottom elevation of the water line and the top of the sanitary sewer or storm sewer.**

2) **Unusual Conditions** – when local conditions prevent an 18 inch vertical separation as described in *Crossing,* Preferred/*Normal Conditions* (paragraph above), the following construction shall be used:

a. Both the sanitary sewer crossing above water line and the water line itself shall be constructed of AWWA approved Ductile Iron Pipe with joints that are equivalent to water main standards for a distance of 10 feet on each side of the point of crossing.

b. The water line crossing over a storm sewer shall be constructed of AWWA approved Ductile Iron Pipe that shall be centered over the storm sewer with 10 feet on each side of the crossing.**

**Special consideration shall be given to crossings in areas of new construction to allow for the undercut of the subgrade for street construction. Water mains shall not be installed at depths that would place them in a position to be damaged by construction.

D. **Water Mains Crossing <u>Below</u> Sanitary Sewers and Storm Sewers**:

1) **Unusual Conditions** – when local conditions prevent an 18 inch vertical separation, as described in paragraph C, *Water Mains Crossing Above Sewers, Preferred/Normal Conditions*, above, the following construction shall apply:

a. That the section of the water pipe is centered at the point of the sanitary sewer or storm sewer crossing so that water pipe joints shall be equidistant and as far as possible from the sewer such that, for a 90 degree crossing, the water line joints are a minimum of 10 feet on each side of the point of crossing.

b. Provide adequate structural support for the sewers to prevent excessive deflection of the joints, which can result in settling on and/or the breaking the water line.

E. **Water Mains and Other Utilities**

1) **Horizontal Separation; Preferred/Normal Condition** – water lines shall be constructed to provide at least 3 feet of horizontal separation from other utilities whenever possible. The distance shall be measured edge-to-edge. For Asbestos Cement lines, provide a minimum of 5 feet of clear horizontal separation.

2) **Vertical Separation – Preferred/Normal Condition**: whenever it is necessary for another utility to cross a water main, a 12-inch vertical separation shall be maintained between the lines. When local conditions prevent a 12-inch vertical separation, the following construction shall apply:

a. Provide adequate structural support for the utility to prevent excessive deflection of the joints, which can result in settling on and/or breaking the water line.

F. **Sanitary Sewer Manholes** – no water mains shall pass through or come in contact with any part of a sewer manhole. A minimum of 3 feet of horizontal separation shall be maintained between water mains and sanitary, storm, or combined sewer manholes if the applicable provisions of paragraph B, *Parallel Installations, Unusual Conditions*, above, are also met.

G. **New Utilities and Existing Water Mains** – when installing a new utility adjacent to or in close proximity to an *existing* water main, the new utility line shall be installed to provide the minimum horizontal and vertical clearances specified in paragraph 1.9 E, *Water Mains and other Utilities*.

1.10 LOCATING SERVICES

A. Contact the City of Jacksonville Public Services Department to coordinate interruption of service, operation of valves, line cut-ins, or placement of a tapping sleeve and valve. If interruption is necessary, the interruption shall be arranged to occur at such a time to cause the least disruption and minimize loss of service. At the direction of the Public Services Director, temporary service may be required to be provided. Provide a minimum of 48 hours notice of the proposed utility interruption or necessary operation of valves.

1.11 COORDINATION

A. Coordinate tie-in to municipal water mains with the Public Services Director. Except as needed for fire suppression purposes, the City of Jacksonville will be the sole operator of all valves and hydrants on the City of Jacksonville water distribution system. Adequate notifications to water customers will be given by the Contractor prior to any interruption of service. Service is to be continuously maintained to customers in the project areas except for the minimum amount of time required to make connections with the existing system. Only in the case of an emergency may a Contractor close a valve. Records shall be kept of any valves closed during an emergency and the Public Services Department shall be notified of the specific valves closed at the earliest reasonable time following such valve closure.

Before shutting off any main, residents are to be notified by City of Jacksonville representative in writing at least 24 hours in advance of cut off. The Contractor shall assist the City of Jacksonville in notification distribution. The City of Jacksonville shall be notified at least 48 hours in advance of request for operation of valves and making either a wet tap or cut-in.

B. Contact ***"NC One Call"*** 1-800-632-4949 before digging. Call the City of Jacksonville Public Services Department at 910-938-6500 for water/sewer location services.

PART 2 – PRODUCTS

2.1 PIPE AND FITTINGS

2.1.1 DUCTILE IRON PIPE

Ductile iron pipe shall be manufactured in accordance with all applicable requirements of AWWA C151/ ANSI A21.51 for 4-inch and larger diameter pipe, pressure class rated, Class 350, minimum (See Design Section) and shall be in 18 or 20-foot lengths. The thickness of Ductile Iron Pipe shall be determined by considering trench load and internal pressure *(the pressure zone and variances in which the pipe will be used)* separately in accordance with AWWA C150/ANSI A21.50.

The interior of the ductile iron pipe shall be cement mortar lined in accordance with AWWA C104/ANSI 21.4. The outside coat shall be a minimum of 1-mil coal tar varnish according to AWWA C151/ANSI A21.51 Section 51-8.1. Pipe shall be stamped as required by AWWA C151.

Each joint of ductile iron pipe shall be hydrostatically tested before the outside coating and inside lining are applied at the point of manufacturer to 500 psi. Testing may be performed prior to machining bell and spigot. Failure of ductile iron pipe shall be defined as any rupture or leakage of the pipe wall.

All materials used in production of the pipe are to be tested in accordance with AWWA C151 for their adequacy within the design of the pipe, and certified test results are to be provided to the City of Jacksonville upon request. All certified tests, hydrostatic and material are to be performed by an independent testing laboratory at the expense of the pipe manufacturer.

Push-on and mechanical joint pipe shall be as manufactured by the American Cast Iron Pipe Company, United States Pipe and Foundry Company, or Griffin Pipe Products Company.

Pipe shall be furnished complete with accessories per AWWA C111/ANSI A21.11.

A. **Ductile Iron Joints**

Pipe joints may be either mechanical joint or push-on pipe sizes 6 inches through 48 inches. Acceptable types of pipe joints are as follows:

1) **Push-on Joint, Ductile Iron Pipe** shall conform to AWWA C151/ANSI A21.51 (such as "Fastite," "Tyton," or "Bell-Tite."). The dimensions of the bell, socket, and plain end shall be in accordance with the manufacturer's standard design dimensions and tolerances. The gasket shall be of such size and shape to provide an adequate compressive force against the plain end and socket after assembly to affect a positive seal. Gaskets shall be vulcanized natural or vulcanized synthetic rubber, and comply with AWWA C111/ANSI A21.11.

2) **Mechanical Joint, Ductile Iron Pipe** shall be used only at the specific locations indicated on the drawings or as approved by the Public Services Director.

   a. The mechanical joint shall consist of:

      i) A bell cast integrally with the pipe or fitting and provided with an exterior flange having cored or drilled bolt holes and interior annular recesses for the sealing gasket and the spigot of the pipe or fitting;

      ii) A pipe or fitting spigot;

      iii) Plain rubber (Styrene Butadiene [SBR]) per AWWA C110/ANSI A21.11 sealing gasket;

      iv) Separate ductile iron follower gland having cored or drilled bolt holes; and

      v) Alloy steel Tee Head bolts and hexagon nuts. All threads are Coarse-Thread Series Class 2A, External and Class 2B, Internal, per ANSI B1.1. Nuts to be furnished in accordance with ASTM A563, *Standard Specification for Carbon and Alloy Steel Nuts*.

   b. The joint shall be designed to permit normal expansion, contraction, and deflection of the pipe or fitting while maintaining a leak proof joint connection. The mechanical joint shall conform to the requirements of Federal Specification WW-P-421, AWWA C111/ANSI A21.11, and ASTM A 53 Standard Specification of Ductile Iron Castings.

   c. Mechanical Joint Bolt Torque

      See section 3.1.1 below, paragraph B, item a, *Installing Mechanical Joint Pipe*.

3) **Mechanical Joint Restraint**: Acceptable types of joint restraints shall be:

   a. Restrained Joints shall consist of the use of a mechanical joint restraint system, using Megalug series 1100 mechanical joint restraint by EBAA Iron Sales, Inc., Ford wedge action restrainer gland UFR Series 1400, or approved equal. Bolt heads are to be “auto-torque” twist off. See **standard detail 512.02** for figure of Megalug.

   b. Restrained Joint Pipe shall be TR Flex or Lok Tyte as manufactured by United States Pipe and Foundry Company, Lok-Fast or Lok-Ring as manufactured by American Cast Iron Pipe Company, Snap-lok as manufactured by Griffin Pipe Products Company. The Public Services Director may, on a case by case basis, approve the use of Field Lok 350 Gaskets with Tyton Joint pipe or fittings as manufactured by United States Pipe.

4) **Flanged Joints** shall be firmly bolted with machine bolts; however, where valves or special fittings are attached to a flange pipe, stud or tap bolts may be used, providing the number used and diameter for each joint is the same for each respective size of pipe or special, or valve, as recommended by the

latest AWWA Standard for flanged drilling. Bolts are specified in ANSI B18.2.1 and nuts are specified in ANSI B18.2.2 except that bolts and nuts are to be cold-worked 304 stainless steel meeting ASTM F593 *Standard Specification for Stainless Steel Bolts*, *Hex Cap Screws and Studs for sizes up to 1.5 inches*. Stainless steel bolts and nuts shall have a minimum yield strength of 50,000 psi. For high strength applications, use 304L stainless steel bolts. Bolts shall be of sufficient length to pass through two flanges and the nut threads shall be accurately cut, close fitting, and the prevailing standard. Bolt heads shall be cut square and nuts hexagon in shape, both the heads and nuts being chamfered. Gaskets to be of 1/8-inch thick plain rubber (Styrene Butadiene [SBR]) per AWWA C110/ANSI A21.11 or equal as approved by the Public Services Director.

B. Ductile Iron Fittings

Fittings shall be ductile iron, grade 70-50-05, and shall conform to AWWA C110/ANSI A21.10 or AWWA C153/ANSI 21.53 for compact fittings, pipe sizes 4 inches through 48 inches with the exception of manufacturer's proprietary design dimensions and thicknesses for iron, in accordance with AWWA C110/ANSI A21.10. All ductile iron fittings shall have a minimum working pressure rating of 350 psi and shall be cement mortar lined and bituminous coated (minimum 1-millimeter), in accordance with AWWA C104/ANSI A 21.4. The fittings shall be tested and the manufacturer shall provide certified test results when requested by the City of Jacksonville. This testing shall include hydrostatic proof testing of fittings. Glands, gaskets, and bolts shall conform to AWWA C111/ANSI A 21.11. The use of push on fittings is not permitted. Acceptable manufacturers are: American Cast Iron Pipe Company, U. S. Pipe & Foundry Company, Griffin Pipe Company, Sigma Corporation, Star Pipe Products, Napac, and Union Foundry. Acceptable types of fittings are:

1) **Full Body Mechanical Joint Fittings:** Full body ductile iron mechanical joint fittings shall be minimum class 250 and shall conform to AWWA C110/ANSI A21.10. Glands, Gaskets and Bolts shall conform to AWWA C111/ANSI A21.11.

2) **Mechanical Joint Fittings – Compact:** Compact fittings shall be minimum class 350 and shall comply with AWWA C 153/ANSI A21.53, pipe sizes 4 inches through 48 inches. Glands, Gaskets and Bolts shall conform to AWWA C111/ANSI A21.11.

3) **Mechanical Joint Restraints:** Joint restraints shall consist of the use of a Megalug joint restraint system using Megalug series 1100 mechanical joint restraint by EBAA Iron Sales, Inc., Ford wedge action restrainer gland UFR Series 1400, Sigma One-Lok, or approved equal. Bolt heads are to be "auto-torque" twist off. See **standard detail 512.02** for figure.

2.1.2 COPPER TUBE SERVICE PIPE

Copper pipe shall meet ASTM B88 *Standard Specification for Seamless Copper Water Tube*, Type K, water tube annealed temper soft drawn for use with flare type (brass) fittings for 1-inch and 2-inch below ground services. Any solder used in connection with water service lines shall contain less than 0.2% lead.

2.1.3 HIGH DENSITY POLYETHYLENE SERVICE PIPE

High density polyethylene pipe shall be PE 3408 pipe meeting ASTM D2737 *Standard Specification for Polyethylene (PE) Plastic Tubing* or ASTM D2239 Standard *Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter*, NSF-14, and AWWA C901 *Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2" through 3" for Water Service*, 160 psi pressure rating, SDR 9 for 1 inch through 2 inch pipe. Joints shall be compression fittings with solid stainless steel inserts. Pipe shall be UV stabilized for protection from sunlight deterioration and shall have a minimum life expectancy of 50 years.

2.1.4 PVC PIPE – 2-INCH

PVC water pipe meeting ASTM D2241 *Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series),* SDR 21, class 200 minimum for pipe 2-inches in diameter and smaller with integral bell and spigot end. Pipe shall also conform to ASTM D1784, D3139, F477, D2122, D1599, and D2152. Pipe shall be furnished with elastomeric gaskets and bear the seal of the National Sanitation Foundation for potable water pipe. Pipe design shall also meet AWWA M23, latest revision. Lubricant and gaskets are to be supplied by the manufacturer of the pipe. Joints in 2-inch pipe shall be bell-end with gasket. Absolutely no galvanized fittings or PVC glued or threaded fittings will be permitted.

2.1.5 PVC PIPE – C900 (6" THROUGH 12" MAINS)

PVC pressure pipe, 6-inch through 12-inch, with bell end with gasket and spigot end shall comply with AWWA C900, Pressure Class 150, DR 18 and shall bear the seal of the National Sanitation Foundation for potable water pipe. Pipe OD shall be equivalent to ductile iron pipe of the same nominal size. Pipe joints shall include elastomeric gaskets and shall be integral bell type coupling. Lubricant and gaskets are to be supplied with the pipe by the manufacturer of the pipe. C-900 pipe shall be used with ductile iron fittings (restrained joint).

Fusible C900 pipe may used for directional drilling only.

2.1.6 STEEL CASING PIPE

A. **Steel Casing Pipe**: Pipe shall be high strength steel, spiral welded or smooth-wall seamless manufactured in accordance with ASTM A139 *Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)* and ASTM A283/A283M-93a *Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates* and consisting of grade "B" steel with a minimum yield strength of 35,000 psi. All encasement pipes shall meet the applicable NCDOT, Municipal, or AREA specifications but shall be no less than 6 inches larger than the outside diameter of the carrier pipe bell. The steel pipe shall be capable of withstanding the design load. No interior lining and exterior coating shall be required except that all exposed metal is to be coated with epoxy or asphaltic material. The pipe shall have welded joints and be in at least 18-foot lengths. Casing pipe shall include pipe carriers (Spiders) to support carrier pipe. The steel encasement pipe shall be of leak proof construction and shall include end caps.

B. **Spiders/Skids for Encasement Pipes**: Spiders shall be placed at the bell of each carrier pipe within a steel encasement. Steel Spiders/Skids shall be as manufactured by ITT Grinnell, Charlotte, NC; Spider Manufacturing, Durham, NC; Advanced Products & Systems (APS) model SSI with EPDM skids, Lafayette, LA, or approved equal. See **standard detail C07.01**. For bolted connections, bolts shall be either galvanized or stainless steel.

C. **Steel Casing End Seals**: Casing end seals shall be 1/8" thick synthetic rubber seamless pull-on end seals with T-304 stainless steel banding with 100% non-magnetic worm gear mechanism. End seals shall permit pipe movement while maintaining a seal. Acceptable manufacturers are: Advance Products & Systems, Inc., Lafayette, LA, or equal.

2.1.7 TUNNEL LINERS AND APPURTENANCES

A. Grout mix for filling voids in between carrier pipe and tunnel shall consist of the following materials properly mixed in proportions by weight.

1) 1.0 Part Cement.

2) 3.0 Parts Fine Sand, 100 Percent Shall Pass No. 16 Sieve.

3) 0.5 to 0.6 Part Water.

B. Tunnel lining construction shall comply with the "Specification for Steel Tunnel Liner Plates" in the American Railway Engineering Association Manual for Railway Engineering. The design and shape of the liner plates shall be such that erection and assembly of the liner plate structure can be completely and readily effected from inside the tunnel. Plates shall be accurately curved to suit the tunnel cross section, and all dimensions shall be of the size and accuracy that plates of similar curvature shall be interchangeable. All plates shall be connected by bolts on both longitudinal and circumferential joints.

C. The steel lining shall consist of plates 16, 18, or 24 inches wide. Each circumferential ring shall be composed of the number and length plates necessary to complete the required shape shown on the drawings. The nominal tunnel diameter shall be of sufficient size to install the carrier pipe.

D. Plates shall be one-piece steel meeting the requirements of ASTM A 569, ASTM A 570, or ASTM A 611. Plates shall have an ultimate tensile strength of at least 42,000 psi and yield strength of 28,000 psi. Gage thickness shall be a minimum of 8 gage. The liner plate and bolts shall be galvanized in accordance with ASTM A153. In addition, the liner plates shall be asphalt coated to meet AREA 1-14-13. For two flange plates, the minimum thickness shall be 0.135 inches. Plates shall be manufactured by Armco Steel Corporation, Commercial Shearing, Incorporated, Republic Steel Corporation, or equal.

E. Grout holes 1½ inches or 2 inches (or larger) in diameter shall be provided in each ring to permit grouting as the erection of the tunnel liner plates progresses. Grout hole screw plugs shall be provided in plates.

F. Stainless steel bolts and nuts shall be cold-worked 304 stainless steel meeting ASTM F593 Standard Specification for Stainless Steel Bolts, Hex Cap Screws

and Studs for sizes up to 1.5 inches. Stainless steel bolts and nuts shall have a minimum yield strength of 50,000 psi. For high strength applications, use 304L stainless steel bolts.

G. Steel casing pipe for boring through soil shall be grade B, meet requirements of ASTM A 139, and have wall thickness to meet AREA Specifications. No interior lining and exterior coating shall be required.

2.1.8 CARRIER PIPE FOR CASINGS AND TUNNELS

Carrier pipe shall be ductile iron pipe of the class indicated on the drawings.

2.2 VALVES AND FIRE HYDRANTS

2.2.1 GATE VALVES

A. **Gate Valves, Resilient Wedge (2 inches through 12 inches)**: All gate valves shall be vertical, iron body of the resilient wedge type complying with AWWA C509 and shall be UL listed and FM approved for a working pressure of 200 psi. All internal parts shall be accessible without removing the body from the line. The wedge shall be of cast iron completely encapsulated with resilient material. The resilient sealing material shall be permanently bonded to the cast iron wedge with a rubber-tearing bond to meet ASTM D429 Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates and AWWA C550.

Non-Rising Stems (NRS) shall be cast bronze with internal collars in compliance with AWWA. OS&Y stems shall be bronze. The NRS stuffing box shall have two "O"-Ring seals above the thrust collar. These rings shall be field replaceable without removing the valve from service.

Each valve shall be hydrostatically tested at 400 PSI to the requirements of both AWWA and UL/FM.

All gate valves 6 through 12 inches shall be of the mechanical joint type. 2-inch gate valves shall be iron pipe threads.

All bolts and nuts shall be stainless steel.

Valves shall open counter-clockwise (left) and shall be equipped with a 2-inch square AWWA operating nut.

The valve body and bonnet shall be coated interior and exterior with fusion bonded thermosetting plastic or epoxy. Internal painting shall conform to AWWA 550.

Acceptable gate valves, sizes 6-inch through 12 inches, shall be:

Manufacturer	Model
American Flow Control	**Series 2500SS**
Clow (M&H)	**F-6100**
Mueller	**A-2360-20**
Kennedy	**Kenseal II**

All resilient seat gate valves furnished for a project shall be from the same manufacturer.

B. **Gate Valves, Resilient Wedge (16 inches and larger)**: Valves shall be iron body of the resilient wedge type complying with AWWA C509 and shall be UL listed and FM approved for a working pressure of 250 psi. Valves shall meet or exceed the requirements of AWWA C515. Valve body, bonnet, wedge, and operating nut shall be constructed of ductile iron. The exterior of the ductile iron wedge shall be fully encapsulated with rubber. The resilient sealing material shall be permanently bonded to the ductile iron wedge with a rubber-tearing bond to meet ASTM D429 Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates and AWWA C550. Non-buried valves shall have all internal and external surfaces of the valve body and bonnet shall have a fusion-bonded epoxy coating complying with AWWA C550, applied electrostatically prior to assembly. Buried valves shall be bituminous or asphalt coated.

Non-Rising Stems (NRS) shall be cast bronze with internal collars in compliance with AWWA. Stem and stem nut shall be high-strength bronze. Stem shall be sealed by three O-rings. The NRS stuffing box shall have the top two O-ring seals shall be replaceable with valve fully open and while subject to full rated working pressure. O-rings set in a cartridge shall not be allowed. Valve shall have thrust washers located with one above and one below the thrust collar to ensure trouble-free operation of the valve.

Each valve shall be hydrostatically tested at 500 PSI to the requirements of both AWWA and UL/FM.

All gate valves shall be of the mechanical joint type.

Valves shall open counter-clockwise (left) and shall be equipped with a 2-inch square AWWA operating nut.

The valve body and bonnet shall be coated interior and exterior with fusion bonded thermosetting plastic or epoxy. Internal painting shall conform to AWWA 550.

Acceptable gate valves, sizes 16 inches and larger, shall be:

Manufacturer	Model
American Flow Control	**Series 2500SS**
Mueller	**Style A-2361**
Clow (M&H)	**Style 67-01**

All resilient seat gate valves furnished for a project shall be from the same manufacturer.

C. **Inserting Valves**: Inserting valves shall meet requirements of gate valves specified above for valve mechanism and AWWA C110/ANSI A21.10 for the sleeve for pressure ratings shown on the drawings.

D. **Valves on 2-inch lines and blow off mains**: Curb stops, Mueller Oriseal Mark II curb valve or approved equal.

E. **Brass Plumbing Gate Valve**: Brass plumbing gate valves used (for air relief valves) shall be non-rising stem with an ASTM B584 cast brass body, threaded

ends, integral seat, ASTM B584 cast brass threaded bonnet, adjustable packing nut, ASTM B584 cast brass solid wedge disc, and ASTM A48 Class 35 cast iron handwheel. Valve shall be non-shock cold water rated for 200-psi. Acceptable brass gate valves are the Hammond Valve model IB 646 or approved equal.

2.2.2 AIR RELEASE VALVE

Air release valves shall be either 1-inch or 2-inch Crispin, G. A. Industries, Val-Matic, or approved equal Pressure Air Release Valves with cast iron bodies, type 302 stainless steel floats, bronze trim and buna-n seats. Air release valves shall also meet ASTM C512. Size and location shall be as indicated on the drawings. Valves shall be rated for working and corresponding test pressure as indicated on the drawings. These valves shall be suitable for a minimum 200 psi working pressure but shall be no less than the working pressure indicated on the drawings. The valves are to be designed to allow air to escape automatically while the main is in service and under pressure. The valves are to relieve large volumes of air as the lines are filled and also release small quantities of entrained air under pressure. Acceptable manufacturers are:

Size	**Manufacturer**	**Model**
1-inch	Crispin	**Type "N" PL10**
2-inch	Crispin	**Type "N" PL20**
1-inch	G. A. Industries	**Fig. 910**
2-inch	G. A. Industries	**Fig. 920**
1-inch	Val-Matic	**Models 15 or 22**
2-inch	Val-Matic	**Model 38**

Manhole units shall consist of standard modular precast riser sections, modular riser sections, and a doghouse base. Eccentric precast reinforced concrete flat tops are to be used. See **standard detail 513.05**.

2.2.3 BUTTERFLY VALVES

Not permitted unless approved by the Public Services Director.

2.2.4 CHECK VALVES

All swing check valves and lever and weight check valves used for pressure zone separation shall be iron body; with a disc of extra heavy cast iron, ASTM A126 *Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings* construction, bronze mounted with either mechanical joint or flanged ends as noted on the drawings. Standard mechanical joint ends shall be furnished with bolts, glands, and rubber gaskets. Flanged ends shall be provided with bolts and gaskets. The shaft shall be of 304 stainless steel and the seat ring shall be of bronze with an easily replaceable resilient disc seat. The valve shall be tight seating.

Check valves shall be non-slamming (shock absorber) type. Check valves shall be equipped with an outside lever and weight with an external bronze cushion chamber, air operated, unless otherwise noted on the drawings. Valves 16" to 24" shall have a minimum non-shock cold-water pressure rating of 250 psi.

Flanged check valves shall meet the dimensional requirement of ANSI B16.1 and meet or exceed the requirements of ANSI/AWWA C-508.

When more positive control is needed a lever-and-spring may be specified.

When check valves are used in vault applications, a ball drip valve is to be provided.

All check valves shall be furnished with an arrow cast into the body indicating the direction of flow during system operation.

Acceptable manufacturers are G. A. Industries Model 250-U, Mueller Models A-2600-6 or A-2600-6-1, Clow Styles 106 or 106LW, or approved equal.

2.2.5 CROSS-CONNECTION CONTROL

Refer to the City of Jacksonville *Water System Cross-Connection Control Ordinance,* Article VI of the City Code, latest revision for hazard classification and type backflow device requirements.

2.2.6 TAPPING SLEEVES AND VALVES

The tapping sleeve and valve shall be suitable for wet installation without interrupting water service.

Stainless Steel Tapping Sleeve: Sleeve body, flange, bolts, nuts, test plug, and any other structural components shall be constructed of Grade 18-8 Type 304 stainless steel. The sleeve and gasket shall provide full wrap-around (360 degree) pipe coverage. Sleeve to be provided with a full gasket of girded virgin SBR compounded for water service per ASTM D2000. Outlet gasket to be girded virgin Buna-N compounded for water service per ASTM D2000. The Public Services Director must approve use of ductile iron tapping sleeves. Acceptable manufacturers are Ford, Romac or Mueller “Stainless Steel Tapping Sleeve” or approved equal. See **standard detail 513.02**.

Tapping Valves: Resilient seat tapping valves shall be epoxy coated (minimum 10 mil thickness) and otherwise meet the requirements of Part 2- PRODUCTS, *Gate Valves*, paragraph 2.2.1 except that the seat openings shall be larger than nominal size with a raised alignment ring on the flange. Valve ends shall be mechanical joint by flange. Valves shall open counter-clockwise (left) and shall have a 2-inch operator nut. See **standard detail 513.02**.

All bolts and nuts are to be stainless steel.

Tapping valves shall be "O" ring type a mechanical joint end conforming to AWWA non-rising stem construction. Inlet flange end shall be Class 125 (ANSI B16.1). Acceptable resilient seat tapping valves are listed below:

Manufacturer	Model
American Flow Control	**2500 TM**
Clow	**F-6114**
Mueller	**T-2360**
Kennedy	**Kenseal II**

2.2.7 FIRE HYDRANTS

See standard details 514.01 and **514.02**. Fire hydrants shall comply with ANSI/AWWA C502, latest revision, UL 246 and FM1510. Hydrants shall be hub end, triple nozzle, improved AWWA type. Interior coating to be in accordance with AWWA C550. Minimum working pressure shall be 150 psi except use 250 working pressure in high-pressure zones. Hydrants shall consist of the following:

a. Two 2½-inch fire nozzles and one 4½-inch steamer nozzle (with a screw-on 5-inch Storz adaptor with locking cap), National Standard hose threads.
b. All nozzles shall be provided with caps and chains.
c. The hydrant valve opening shall be 5¼ inches.
d. Hydrant to be dry top with lubrication reservoir.
e. Bronze to bronze threads shall be provided between the hydrant seat or seat ring and the seating attaching assembly. Seat ring to shoe shall be bronze to bronze.
f. All hydrants must include cast or ductile epoxy lined shoe (minimum 4 mils), rubber drain seals and positive protective valve stop device.
g. Hydrants shall open counter-clockwise (left) and shall have a National Standard pentagon-type operating nut (1 ½" point to flat). The operating nut shall be of one-piece bronze construction. A thrust washer shall be supplied between the operating nut and stem lock nut. The valve stem shall have a safety flange and a safety coupling.
h. Hydrants shall have a 6-inch hub-end or mechanical joint elbow.
i. The hydrant barrel shall be of sufficient length to provide a minimum bury of 3 feet.
j. Hydrants shall be of the compression type closing with line pressure and shall be of the traffic model breakaway type.
k. Hydrant cap and stuffing box shall be of unitized, one-piece design creating a watertight cavity without the use of gaskets. The combination of O-Rings to a crimped brass ferrule around the stem shall seal the cavity from contact with water. Hydrant caps shall have a means for providing periodic lubrication of the operating threads.
l. The main valve shall be of synthetic rubber reinforced with steel. The seat shall be of a bronze ring threaded to a bronze insert in the hydrant shoe, with O-Rings to seal the drain way and barrel from leakage of water in the shoe.
m. The hydrant drain hole shall momentarily force flush with each operation.
n. All hydrant extension kits, flange kits, stems, couplings or other repair parts must be of the original hydrant manufacturer. Only one 24-inch extension kit is allowed.
o. Hydrants are to be painted with two coats of Sherwin Williams or approved equal paint in accordance with **standard details 514.01** and **514.02**. Barrels are to be painted federal safety red with the caps. The City will paint bonnets in colors coordinated with operating pressure.
p. If line is to be pressurized within 7 days of setting hydrant, then 4000-psi high early strength concrete shall be used.

Approved fire hydrants including model and manufacturer are listed below:

Manufacturer	Model	Suitable for High Pressure Applications
Clow (M&H)	**F-2545 Medallion**	**-**
Mueller	**A-423 Super Centurion 250**	**X**
American Darling	**Mark 73**	**-**
Kennedy	**Guardian**	**-**

All hydrants furnished for a project shall be from the same manufacturer.

See paragraph 3.2.4, Fire Hydrants for installation requirements.

2.2.8 BLOW OFFS

General: Blow-off should be sized to provide 2 to 4 fps flushing velocity in the main to which the blow-off is attached.

Blow-Off Assembly for Future Extension: Blow-off assemblies for future extensions shall consist of two standard slip type valve boxes, one for a curb valve and one for a brass pipe riser (see **standard detail 514.05**), a thrust collar, a plug tapped for 2-inches or 4-inches (determined by main size), a 2-inch or 4-inch brass pipe riser with a 2-inch or 4-inch threaded male threaded plug. A gate valve shall be placed at the upstream end of the last joint of DIP with thrust collar to permit both extending and testing of the section to be extended. In unpaved areas, concrete collars may be used for valve boxes or 4 inch x 2 ft. x 2 ft concrete pads placed over each valve box.

Permanent Blow-Off Assembly: Permanent blow-off assemblies shall consist of a standard valve box (see **standard detail 513.01**) with a concrete stabilizing pad (in unpaved areas only), an NRS gate valve or curb valve as applicable, a mechanical joint reducer as applicable, thrust collar, a riser with elbow and blocking, and if applicable, a flange 90 degree elbow placed above grade. See **standard details 514.05 and 514.06**.

2.2.9 CORPORATION STOPS

Flared Fittings: Corporation stops for 1-inch through 2-inch taps only shall be all bronze CC tapered threaded inlet by flare copper outlet, as manufactured by Ford or Mueller. Acceptable corporation stops shall be the Ford F600 Series or the Mueller H-15000 Series. See **standard details 513.03 and 513.04**.

Compression Fittings: Corporation stops for 1-inch through 2-inch taps only shall be all bronze CC tapered threaded inlet by Mueller 110 Conductive Compression Connection for CTS OD tubing outlet, as manufactured by Ford or Mueller. Acceptable corporation stops shall be the Ford F1000 Series or the Mueller H-15008. See **standard details 513.03 and 513.04**.

2.3 MISCELLANEOUS APPURTENANCES

2.3.8 BEDDING

Bedding material, when specified, shall be clean coarse aggregate No. 57 or No. 67 and shall meet the requirements of Table 1005-1, *Aggregate Gradation, Coarse Aggregate* of the *NCDOT Standard Specifications for Roads and Structures*, latest revision.

2.3.9 CAST STRAIGHT AND TRANSITION COUPLINGS

Couplings shall be of a gasketed, sleeve type. Each coupling shall consist of a ductile iron middle ring, two ductile iron followers, two rubber compounded wedge section gaskets and sufficient track head stainless steel bolts to properly compress the gaskets. Couplings shall be of the type to match piping on which installed. Couplings shall be Smith-Blair Type 441 and 461, Ford FC-1 and FC-2A, JCM 212, 215 and 216 models, or Romac 501.

2.3.10 DETECTOR TAPE

Non-metallic underground warning tape: Non-metallic underground warning tape shall be lead free virgin grade rot resistant polyethylene manufactured in accordance with ESI 12-23. Minimum elongation shall be 350% in the machine direction and 300% in the transverse direction. Soil tolerance range to be pH 2.5 to pH 11.0. Minimum tape thickness shall be 0.1mm with a base color of blue. Minimum width to be 2 inches. The text shall include the wording “CAUTION WATER LINE BELOW” repeated along the length of the tape. Underground warning tape is to be placed 8 to 12 inches below the finished grade directly above PVC lines during backfill procedure.

2.3.11 DUCTILE IRON TRANSITION COUPLINGS

Transition couplings shall be ANSI/NSF Standard 61 Certified, fusion bonded powder epoxy coating and constructed of ASTM A-536, grade 65-45-12 ductile iron flanges and middle ring. Coupling to be rated at a minimum of 200 psi working pressure per AWWA C219, and -20ºF to 212º F. Gaskets shall be specially compounded new rubber polymer suitable for use on water and sewage. Bolts are to be stainless steel 18-8 Type 304. Transition couplings are to accommodate IPS PVC, C-900 PVC, Ductile Iron Pipe, Cast Iron, and Asbestos Cement Classes 100/150/200. Acceptable couplings are Smith-Blair Type 441 and 461, JCM 240 for line sizes 3-inch through 12-inch and the Dresser Style 253 Modular Cast Coupling (2-inch through 16-inch), Ford Style FC2W Ultra-Flex Ductile Iron Wide Range Coupling (4-inch through 12-inch).

2.3.12 FIRE HYDRANT PAVEMENT MARKERS

A permanent raised bidirectional one color (blue and blue) pavement marker shall be of the glass or plastic face lens with prismatic reflector consisting of a high impact plastic shell that may be filled with a mixture of inert thermosetting compound filler material. Plastic lenses must be scratch resistant. The shell must contain two prismatic reflective lenses. The minimum reflective area of the lens face is 2.0 square inches. All raised pavement marker reflective lenses must be in close conformance with the Federal Standard No. 595 Colors when viewed at night. Use sand or inert granulars embedded in the surface of the inert thermosetting compound and filler material prior to its curing to provide a surface which will readily bond to the adhesive. Use shells made of molded

methyl methacrylate conforming to Federal Specification L-P-380C, Type I, Class – 3.

Epoxy must meet the requirements of Section 1081, *Epoxy and Adhesives* of the NCDOT Specification for Roads and Structures. The two types of epoxy adhesives which may be used are Type 6A (Standard Setting), and Type 6C (Rapid Setting). Use Type 6A when the pavement temperature is above 60ºF. Use Type 6C when the pavement temperature is between 50ºF and 60ºF or when a very fast set is desirable.

2.3.13 MANHOLE FRAME AND COVERS

Manhole frames and covers shall meet ASTM A48 *Standard Specification for Gray Iron Castings*, Class 35B, traffic frame and cover as manufactured by Capitol Foundry, US Foundry, Sigma Corporation, or Vulcan (East Jordan Iron Works). Cover shall read "WATER" in the center. See **standard details C06.01 and C06.02**. Provide four 1-inch diameter holes in the top at each compass point.

Weights shall not vary more than 5% +/- of the weight shown on **standard details C06.01 and C06.02**.

Acceptable Manufacturers and models are:

Manufacturer	Standard	Watertight
Capitol Foundry	-	**MH-2001-WT**
US Foundry	**700-KL**	**669-KL-BWT**
Sigma Corporation	**2001**	
East Jordan Iron Works	-	**V-2384-3 Bolt Down**

2.3.14 MISCELLANEOUS CONCRETE WORK

Concrete classes (NCDOT) to Design compressive Strength at 28 days (f'c):

Class	28-day Compressive Strength (f'c)
AA	4500 psi
A	3000 psi
B	2500 psi

Concrete shall be constructed of a minimum of 3000 psi concrete at 28 days. Ready mixed concrete shall comply with ASTM C94, *Standard Specification for Ready-Mixed Concrete.* This applies to concrete blocking, valve box stabilizing pads, thrust collars, concrete encasement, and Fire Hydrant setting and thrust blocks. Exposed concrete shall be air entrained.

2.3.15 PRECAST CONCRETE MANHOLE STRUCTURES

A. Structures of precast reinforced concrete manholes shall be designed and manufactured in accordance with ASTM C478, *Standard Specification for Precast Reinforced Concrete Manhole Sections*, latest revision ("O" ring joints), or AASHTO M-199 (gasketed joints). The standard joint shall be sealed with plastic cement putty meeting Federal Specification SS-C-153. Either an "O" ring

joint conforming to the requirements of AASHTO M198 and ASTM C443 *Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets* or joints conforming to AASHTO M199 and ASTM C990 *Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants* may be used. Type Concrete used in the construction of the manholes shall have a minimum 28-day compressive strength of 4000-psi air entrained (with 4 to 6 percent air) conforming to ASTM C33 *Standard Specification for Concrete Aggregates* and ASTM C94 *Standard Specification for Ready-Mixed Concrete*. Manholes shall have monolithic base and eccentric cone flattop as applicable. See **standard detail 513.05**. Acceptable manufacturers are: Carolina Precast Concrete, Inc., Oldcastle Precast, N. C. Products Concrete Corporation, or Stay-Right Tank.

Manhole Size Determination:

1) Unless shown otherwise, the minimum diameter of manholes shall be 4 feet.
2) Manholes with 12-inch diameter or larger pipe shall be a minimum of 6-foot diameter.
3) Manhole size shall also be determined by the number and angle of connections.

2.3.16 PRECAST UNDERGROUND CONCRETE UTILITY STRUCTURES

Structures of precast reinforced concrete shall be designed and manufactured in accordance with ASTM C858, *Standard Specification for Underground Precast Concrete Utility Structures*, latest revision with preformed butyl rubber joint sealant meeting ASTM C990, *Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed flexible Joint Sealants*, latest revision. Type Concrete used in the construction of the Utility Structures shall have a minimum 28-day compressive strength of 4000-psi air entrained (with 4 to 6 percent air) conforming to ASTM C33 *Standard Specification for Concrete Aggregates* and ASTM C94 *Standard Specification for Ready-Mixed Concrete*. Unless shown otherwise on the drawings, structures are not to have steps. Steel reinforcing shall conform to the requirements of ASTM C857, *Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures,* latest revision. Structures shall be designed for an H20-44 loading in traffic areas. Acceptable manufacturers are: Carolina Precast Concrete, Inc., Oldcastle Precast, N. C. Products Concrete Corporation, or Stay-Right Tank.

2.3.17 PREFORMED PLASTIC GASKETS (JOINT SEALER)

Preformed plastic gaskets shall meet federal specification SS-S-00210. Sag or flow resistance and chemical resistance shall meet ASTM C990. Preformed butyl gaskets shall be used with structures meeting ASTM C478, ASTM C990 and AASHTO M199. Preformed plastic gaskets shall equal or exceed “Ram-Nek” as manufactured by the Henry Company, Sealants Division, Houston, TX.

2.3.18 PIPE SADDLE SUPPORT - ADJUSTABLE

Adjustable Pipe Saddle Support - For Dry Conditions 2½-inch through 36-inch pipe: Material to be cast iron saddle formed to ductile iron pipe, with lock nut, and special cast iron reducer. Vertical adjustment range to be from 0 up to 4½ inches. Adjustable pipe saddle supports shall comply with Federal Specification WW-H-171E (Type 39). Saddle strap to meet ASTM A36/A36M

Standard Specification for Carbon Structural Steel. Collar and base cups ASTM A53 *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless* D.O.M. tubing. Thread Stud to meet ASTM A36/A36M, rolled thread, grade ASTM A307 *Standard Specification for Carbon Steel Bolts and Studs, 60,000-PSI Tensile Strength*. Base Plate to meet ASTM A36/A36M sheet steel, 0.25-inch. Pipe saddle supports shall equal or exceed the *Standon* Model S92, as manufactured by Material Resources, Inc., Hillsboro, OR., or Grinnell Figure 259.

Adjustable Pipe Saddle Support for Wet or harsh corrosive conditions 2-inch through 24-inch pipe: Material to be steel saddle formed to ductile iron pipe, lock nut, and special steel reducer. Vertical adjustment range to be from 0 up to 4½ inches. Material to be 100% 304 stainless steel with saddles formed of ductile iron pipe. Pipe saddle support shall equal or exceed the *Standon* Model S92 but all stainless steel, as manufactured by Material Resources, Inc., Hillsboro, OR, or approved equal.

2.3.19 SERVICES

A. **Small Services: 1-inch Water Services**:

Copper Service: Type K Copper, soft drawn; comply with ASTM B-88, *Standard Specification for Seamless Copper Water Tube*, FS WW-T-799 (2-inch and smaller pipe). Services shall be 1-inch and shall be one continuous run from main to meter with no joints or couplings in between. *3/4" services are not permitted.* On these water services, the fittings shall be brass AWWA C-800, flared copper type fittings. See **standard detail 515.01**.

PE Service: High density polyethylene pipe shall be PE 3408 pipe meeting ASTM D2737 or ASTM D2239, NSF-14, and AWWA C901, 160 psi pressure rating, SDR 9 for 1 inch pipe. Fittings shall be bronze AWWA C-800 compression fittings with solid stainless steel inserts. Services shall be 1-inch and shall be one continuous run from main to meter with no joints or couplings in between. See **standard detail 515.01**.

Taps shall be either direct tap or with a service saddle.

Service Saddles: Service saddles shall be used with all taps to ASTM D2241 PVC pipe and with certain taps to AWWA C900 PVC pipe. Saddles to match OD of pipe size and material being tapped. When a service saddle is required, saddles shall be all bronze saddle with a single bronze strap and a grade 60 neoprene "O" ring gasket attached to the body suitable for a 200-psi working pressure. Gaskets shall be cemented in place and confined in a retaining groove. The saddle casting, straps, and nuts shall be water works bronze 85-5-5-5 and meet all applicable parts of ANSI/AWWA C800 and shall be NSF 61 certified (hardware shall be bronze or stainless steel). The saddle shall have CC flared corporation stop threads. See **standard detail 513.03**. Acceptable service saddles are:

Manufacturer	Model
Ford	**101B Series** **S-90 Series**
Mueller	**BR1B** **H1300 Series**

1-inch x 3/4-inch meter setter/yoke: 1-inch x 3/4-inch meter setters/yokes shall conform to AWWA C800 and be factory tested for water-tightness before shipping. Setters shall be comprised of all brass and copper padlock wing stop inlet ball valve (lockable cut-off), angle double check outlet valve, with inlet and outlet copper connections. 1" meters shall have a 10" riser height. Meter setters shall have a 1" inch CTS compression connection inlet and a 3/4" inch double purpose FIP outlet end. In areas where the service line is already installed at shallow depth or where shallow depth is justified because of field conditions, the Public Services Director may approve the use of horizontal inlets and outlets. Otherwise, the setter is to have a vertical inlet with a horizontal outlet. See **Standard Detail 515.01**. Acceptable meter setters/yokes are:

Size	Manufacturer	Model
1-inch x 3/4-inch	Ford	**VB72-82W4143G**
	Mueller	**H-2404-2A & two H-14222 couplings**

Meter boxes, **Standard Cast Iron**: Meter boxes shall be 12-inch deep cast iron boxes having the same approximate weight as, and lids interchangeable with, the MBX-1 as manufactured by Capitol Foundry for 1-inch meters. Meter boxes shall be supported on six standard clay bricks, which shall in turn be supported by a minimum of 6 inches of fine graded sand. One standard solid brick shall be placed vertically on each end of the box over the inlet/outlet slot. Boxes shall be set in such a manner that the top connection of the meter yoke shall be 8 to 10 inches below the top of the box and shall provide adequate clearance for the meter. All meter boxes shall also be backfilled and supported outside the box with fine graded sand. The City will not set water meters until meter setters and boxes are set to proper grade. Unless a traffic model box is used, meter boxes shall not be installed in driveways, roads of closer than 3 feet to a fire hydrant and shall not be installed in parking lots or sidewalks unless shown on the plan or prior approvals are obtained from the Public Services Director's. See "Meter Boxes, Traffic Bearing" below.

Meter Boxes, Traffic Bearing: If meter box must be located in driveway, a traffic rated box and cover shall be used equal to or exceeding the "BCF" series rectangular meter box with ductile iron top and reader hatch as manufactured by Mid-States Plastics, Inc. Sterling, KY part number MSBCF1118-12 or approved equal. The meter box shall be high-density Polyethylene one-piece molded construction, ultraviolet light and chemical resistant as well as unaffected by freezing and moisture. The box, with ductile iron cover, shall be able to bear a 20,000 lb load in a wheel load (H-20) style test. The box shall be black on the exterior to prevent UV degradation and bright white on the interior to reflect light and permit ease of meter reading and service. The box shall have removable pre-cut pipe entry areas located on the center of each end (short side) of the box for single meter installations. The box shall be designed in a way to be securely stackable.

B. **1 ½-inch and 2-Inch Water Services:**

Copper Service: Type K Copper, hard drawn; comply with ASTM B-88, *Standard Specification for Seamless Copper Water Tube*, FS WW-T-799. Water service pipe for 1½-inch and 2-inch connections shall be type "K" soft copper with brass AWWA C-800, flared copper type fittings and shall be one continuous run from main to meter with no joints or couplings in between. On these water services, the fittings shall be threaded type brass fittings. See **standard details 515.02 and 515.03**.

PE Service: High-density polyethylene pipe shall be PE 3406 pipe meeting ASTM D2737 or ASTM D2239, NSF-14, and AWWA C901, 160 psi pressure rating, SDR 9 for 1 1/2 inch through 2-inch pipe. Fittings shall be bronze AWWA C-800 compression fittings with solid stainless steel inserts. Services shall be one continuous run from main to meter with no joints or couplings in between. See **standard details 515.02 and 515.03**.

The service line for a 1 ½-inch or 2-inch service/meter shall consist of either type K copper or SDR 9 PE pipe, a swing check valve, Mueller Mark II Oriseal Corporation Stops, a 1" locking by-pass with corporation stop, and (iron pipe thread) brass nipples.

Service saddles: Service saddles, when required, shall be all bronze saddle with double bronze straps and with a grade 60 neoprene "O" ring gasket attached to the body suitable for a 200-psi working pressure. The saddle casting, straps, and nuts shall be water works bronze 85-5-5-5 and meet all applicable parts of ANSI/AWWA C800 and shall be NSF 61 certified. The saddle shall have 2-inch iron pipe threads. See **standard detail 513.04**. Acceptable service saddles are:

Manufacturer	Model
Ford	**202B Series** **S-90 Series**
Mueller	**BR2B** **H1300 Series**

1 1/2-inch meter setter/yoke: Meter setters shall be constructed as shown on **standard detail 515.02** using a meter setter with by-pass and horizontal inlet and outlet. Setter shall be Ford VBH76-12B-11-66 or approved equal.

2-inch meter setter/yoke: Meter setters shall be constructed as shown on **standard detail 515.03**. Setter shall be Ford LSVB811-77-9547601 or approved equal with a locking 1-inch bypass ball valve with pack joint coupling ends, two 2-inch ball valves (flange X 2 inch female IP threaded inlet and outlet X 1 inch pack joint coupling ends) for connection to a 2-inch meter, an in-line check valve on the service main, and Mueller Mark II Oriseal 110 corporation stop (Inside IP threads x compression connection (end may vary according to whether connecting to copper or PE pipe). Setter shall be constructed from 85-5-5-5 Brass meeting AWWA C800 and copper tubing.

Meter Boxes, Standard Cast Iron: Meter boxes shall be cast iron boxes having the same approximate weight as, and lids interchangeable with, the MBX-5A as manufactured by Capitol Foundry for 1 1/2 inch and 2 inch meters. Meter boxes

shall be supported by standard concrete bricks, which shall in turn be supported by a minimum of 4 inches of fine graded sand. The City will not set water meters until meter setters and boxes are set to proper grade. Unless a traffic model box is used, meter boxes shall not be installed in driveways, roads of closer than 3 feet to a fire hydrant and shall not be installed in parking lots or sidewalks unless shown on the plan or prior approvals are obtained from the Public Services Director's. See paragraph 2.3.19 A, Meter Boxes, Traffic Bearing, above. The model comparable to the cast iron MBX-5A box is Mid-States Plastics, Inc. part number MSBCF1730-18XL with ductile iron cover.

C. **Polyethylene Service Tube Stiffeners**

A solid stainless steel insert shall be installed with each compression connection made with plastic tubing. Stiffener shall be Mueller soild stainless steel insert.

D. **Large Meter Services (3-inch and larger)**

General: Large meter boxes are to be furnished and installed by the Contractor.

Piping: For services greater than 2 inches, the water service pipe shall be 4, 6, 8, 10, or 12 inches in diameter and shall be constructed of ductile iron pipe. 3-inch meters shall be served by a 4-inch tap and 4-inch service line. Ductile iron fittings shall be used on these services. 3 and 4-inch diameter pipe is not allowed in the City of Jacksonville distribution system. All taps will be made by using the appropriate size tapping sleeve and valve. On a dry line, the connection may be made with a tee and valve.

Large Meter Vaults: Meter vaults for 3-inch and larger meters shall be constructed of precast concrete except that 3-inch meters may use a Capitol Foundry MBX-5A meter box with an external bypass. Meter vaults shall have aluminum, cast-in-place double leaf, and spring-loaded doors with slam locks. Provide ladder in vault. Doors are to be rated at 300 psf in pedestrian areas and rated H-20 in traffic areas. The vault doors shall be located over the water meter. See specification Section 2.3.23, *Vault Access Hatch*, below. Acceptable meter vault doors are the Bilco JD-4AL or approved equal.

Precast meter vaults shall be as manufactured by Old Castle Concrete or Stay-Rite Tank Company. Tanks shall be set on a minimum of 6 inches of #57 stone. See 02275 – *Trenching, Backfilling and Compaction of Utilities*, paragraph 3.3.2 E for other bedding requirements for Structures. Meter vaults shall be sized to provide the minimum clearances and minimum dimensions shown on **standard detail 515.04**.

Combinations Vaults: Combination vaults shall be designed and constructed to provide the following minimum clearances between the pipe, fittings or vault walls:

Conflict	Minimum Clearance (inches)
Vault side wall to side of pipe, valve or meter	24
Vault end wall to nearest bolted connection	12
Pipe to pipe, fitting or valve	12
Top of OS&Y valve stem (fully opened) to vault ceiling	6

E. **Meters**

Contractor is required to purchase all meters from the City of Jacksonville. For 3 inch and larger meters, Contractor is required to pick up and install meters under supervision of the City of Jacksonville. Appropriate lead-time for supplying meters shall be given to the City of Jacksonville by the Contractor or Owner requesting the water meter. No meters will be installed until "Tentative Acceptance" of the lines has been granted and the appropriate fees paid.

Meters 2-inch and smaller shall be installed by the City of Jacksonville. Meters larger than 2-inches are to be provided with remote read out meter reading capabilities.

2.3.20 TIE-RODS

Tie rods shall be stainless steel or cold-dipped galvanized. Duck lugs or eyebolts shall be used. See **standard detail 512.07**.

2.3.21 TRACER WIRE

Ten gauge single strand bare copper wire shall be installed along the top of all non-metallic pipe. Electrical conductivity along the pipe shall be continuous and uninterrupted between valve boxes. Clamps used to bond wire to conductor to metal (in instances where both PVC and ductile iron are used in the same run of pipe) shall be heavy-duty stainless steel approved by the Public Services Director. A sufficient excess length of wire shall be left in each valve box to provide at least a 2-foot length of wire above finished grade.

2.3.22 VALVE BOXES

Adjustable valve boxes shall be US made gray cast iron of the dimensions shown in **standard detail 513.01** *(Standard Slip Type Valve Box Detail)* of these specifications. Lids shall be heavy-duty traffic weight with the word "water" cast into the lid. Provide cast-iron telescoping slip type top section of length required for depth of burial of valve and bottom section with base of size to fit over valve. Valve boxes shall be coated inside and out with asphalt. Acceptable valve boxes are: Sigma Corporation Model V-8459, Capitol Foundry of Virginia, Inc. Model VB-FCWA-#3435.

2.3.23 VAULT ACCESS HATCH

A. **Non-Traffic Areas**: The aluminum access frames and covers are manufactured with 1/4-inch thick, one-piece aluminum extruded frame, with a continuous concrete anchor as part of the one-piece extrusion. The door panels are 1/4-inch thick aluminum diamond plates, to withstand a live load of 300 lbs. per square foot, with a safety factor of times 1.5. The doors are provided with stainless steel hinges with tamper-proof fasteners. All hardware is stainless steel. The doors open to 90 degrees and lock automatically in that position with a stainless steel positive locking arm and a stainless steel release handle. Doors are provided with a stainless steel lifting handle, stainless steel locking bar, or stainless steel snap-lock with removable key handle. Two key handles shall be provided with each door. The doors will close flush with the top of the frame, resting on a 1/2-inch wide lip around the entire inside of the frame for added support.

B. **Traffic Areas** (Low Density Traffic H-20 Loading – 12,000 lb. wheel load on an 8 1/2-inch x 20 1/2-inch wheel area): The aluminum access frames and covers are provided with a 1/4-inch thick structural grade aluminum channel frame with the flanges acting as a continuous concrete anchor. The inside of the frame has a continuous door support angle that must have a full bed of Class "A" concrete under both the frame and support angle. Door leaves shall be a minimum of 1/4-inch thick aluminum diamond plate with structural grade aluminum. Door reinforcing shall withstand an H-20 live load designation. The doors also have lifting aids of aluminum tubular construction with compression springs to assist in opening and closing of the doors. The doors are provided with heavy-duty stainless steel hinges with tamper-proof fasteners. All hardware is to be stainless steel. The doors open to 90 degrees and lock automatically in that position with a stainless steel positive locking arm and a stainless steel release handle. Doors are provided with a stainless steel lifting handle, stainless steel snap-lock with removable key handle. Two key handles shall be provided with each door. The door leaves extend to the outside perimeter of the frame for added support.

C. **Guarantee and Manufacturer**: The aluminum access frames and covers shall carry a 10-year guarantee against defects in materials and workmanship. The frame and cover shall equal or exceed the units manufactured by Halliday Products, Inc. or The Bilco Company.

PART 3 – EXECUTION

INSTALLATION – PIPE AND FITTINGS

3.1 PIPE & FITTINGS

Refer to Division 02275 - *Trenching, Backfilling And Compaction Of Utilities*.

3.1.1 DUCTILE IRON PIPE

A. **DIP Installation**

1) **Trenching & Bedding**: Refer to Division 02275 - *Trenching, Backfilling, and Compaction of Utilities*.

2) **Installation of DIP Water Mains**: Comply with AWWA C600, *Installation of Ductile Iron Water Mains and Their Appurtenances*.

3) **Pipe Laying - Separation**: The Contractor shall comply with the NCDENR standards for separation of water mains from sanitary sewers or storm drainage lines. See Part 1 – GENERAL, Section 1.9 – *Project Conditions* of this specification.

4) **Materials, Storage, and Handling:** See paragraph 1.7 – *Product Delivery, Storage and Handling*.

B. **Construction:**

1) **Construction**: Water mains and fittings shall be installed with approved tools in accordance with the requirements of ANSI/AWWA Standard Specification C600, *Installation of Ductile Iron Water Mains and Their Appurtenances*, which is herein made part of the specification by reference.

Construct piping to accurate lines and grades avoiding localized high points and support as required on drawings or described in specifications. When temporary supports are used, insure that sufficient rigidity is provided to prevent shifting or distortion of pipe.

Pipe shall be laid with bell ends upgrade and facing the direction of laying.

Due care shall be taken in the storing and handling of pipes, fittings and valves to avoid contamination with the ground and prevent foreign matter from entering pipe and fittings. String out no more pipe than can be installed in a day. Gaskets shall be lubricated as per manufacturer's recommendations.

Pipe, fittings, and valves shall be carefully handled and lowered into the trench. Under no circumstances shall any pipe or fitting be dumped or rolled into the trench, or be allowed to drop against the pipe or fitting already in the trench. Great care shall be taken to prevent the pipe lining and coating from being damaged, and the Contractor shall not install any damaged pipe. The Contractor shall be responsible for removal and disposal of damaged pipe.

Prior to being lowered in to the trench, all pipes shall be carefully inspected to see that each pipe is clean. If necessary, pipes shall be fitted together to ensure sufficient opening for the gasket or joint compound and smooth inside flow line.

Special care shall be taken to insure that the pipe is well bedded on a solid foundation, and any defects due to settlement shall be made good by the Contractor at his own expense. Bell holes shall be dug sufficiently large to insure the making of proper joints. Special precautions shall be exercised to prevent any pipe barrel or bell from resting on rock. A minimum of 6 inches is required between rock and the bottom of pipe (see paragraph 3.2.5 B – *Cushioning Pipe in Rock*, of Section 02275 – *Trenching, Backfilling, and Compaction of Utilities*). If the bed formed in the bottom of the trench is too low, the pipe shall be removed, clean stone placed in the bottom, and a new bed prepared for the pipe. In no case shall the pipe be brought to grade by

blocking under the barrel of the pipe. A uniform support shall be provided for the entire length of the pipe.

Whenever a pipe requires cutting, to fit in the line or to bring it to the required location, the work shall be done in a satisfactory manner with an approved cutting tool or tools that will leave a smooth end at right angles to the axis of the pipe, and not otherwise damage the pipe or liner. When the cut end is to be assembled in a *Fastite* bell, an adequately smooth (without sharp edges) bevel should be ground or filed on the cut edge to prevent damage to or dislodgement of the gasket during assembly. Generous bevels are advantageous in the assembly of field prepared ends. The approved methods of cutting pipe are: rotary type, abrasive wheel, and snapcutter on DIP. No welding, flame cutting or flame tapping will be allowed.

Mains shall be installed to the depth as directed by the City of Jacksonville's Public Services Director, but in no case with a cover of less than 36 inches below finished grade. In the event site conditions prevent adherence to minimum cover requirements, approval of an alternate design by the Public Services Director is required. See Table 2275.1 of Division 02275 – *Trenching, Backfilling, and Compaction of Utilities*.

The Contractor shall be required at the end of the day's work to keep the end of the line, under construction, plugged to prevent foreign matter from entering pipe and fittings. A watertight plug shall be placed in the bell of the last joint of pipe laid. The pipe shall not be used as a means of draining ground water from the area.

Maximum horizontal deflections for ductile iron pipe shall meet AWWA C600, latest revision.

Allowable Joint Deflection

Size (inches)	Nominal Laying Length (feet)	Maximum Allowable Deflection	
		Offset per Length (inches)	Deflection Angle (degrees/radius,ft)
4	18	19	5°/205
6	18	19	5°/205
8	18	19	5°/205
12	18	19	5°/205
16	18	11	3°/340
20	18	11	3°/340
24	18	11	3°/340
30	18	11	3°/340
36	18	11	3°/340
42	18	11	3°/340
48	20	12	3°/380

a. **Installing Mechanical Joint Pipe**

i) Gaskets shall not be exposed to oil, grease, ozone, extensive heat, sunlight, or other elements that would degrade the gasket. Store gasket in a cool dark place until installation in accordance with manufacturer's recommendations.

ii) Clean socket and plain end thoroughly, removing mud, oil, gravel, or any other foreign matter. Gaskets shall be lubricated. Paint the bell and the spigot with soap solution recommended by the manufacturer. Slip ductile iron gland on spigot end with the lip extension of the gland toward the end of the pipe. Paint rubber gasket with or dip into the soap solution and place on the spigot end with thick edge toward the gland.

iii) Push the spigot end forward to seat in the bell. Then, press the gasket into the bell so that it is located evenly around the joint. Move the gland into position, insert bolts, and screw nuts up finger tight. Then tighten all nuts to torque listed below (excerpted from Table 2 of AWWA C600-99):

Bolt Size (Inches)	Torque (Ft. – Lbs)
5/8	45-60
3/4	75-90
1	100-120
1 1/4	120-150

Tighten nuts on alternate side of the gland until pressure on the gland is equally distributed.

iv) Permissible deflection in mechanical joint pipe shall not be greater than listed in Table 4 of AWWA C600-99.

Allowable Joint Deflection			
Size (inches)	Nominal Laying Length (feet)	Maximum Allowable Deflection	
		Offset per Length (inches)	Deflection Angle (degrees/radius,ft)
4	18	31	8°-18'/125
6	18	27	7°-07'/145
8	18	20	5°-21'/195
12	18	20	5°-21'/195
16	18	13.5	3°-35'/285
20	18	11	3°-00'/340
24	18	9	2°-23'/450

b. **Installing Push on pipe**

i) Gaskets shall not be exposed to oil, grease, ozone, extensive heat, sunlight, or other elements that would degrade the gasket. Store gasket in a cool dark place until installation in accordance with manufacturer's recommendations.

ii) Clean the socket and 8 inches of the outside of the plain end thoroughly, removing mud, gravel, or any other matter that might cause the front of the gasket to protrude into the path of the entering spigot. Flex rubber gasket and apply lubricant supplied with the pipe to the plain end and to the inside surface of the gasket before assembly. Start the spigot end of the pipe in to the socket with care. The circumferential stripe on the plain end provides a visual indication

for checking the proper insertion of the joint. Insert gasket fully in the gasket recess of the socket, large end of the gasket entering first. For assurance of proper gasket positioning, a thin automotive, blade-type feeler gauge can be used for quick and easy probing to confirm a properly installed gasket position around the joint. Then complete the joint by forcing the plain end to the bottom of the socket with a forked tool or jack-type device.

2) **Cutting Pavement/Driveways**

Where the water line is in an existing paved area, the edges of the pavement for the water line shall be cut in a straight line, parallel to the pipe on each side. Trenches cut in existing or proposed pavement areas shall not exceed a maximum width of 3'-6" at the top of the trench. Perform cutting operations prior to installation of water line to avoid excessive removal of asphalt. Care shall also be taken during installation of pipe to avoid damage to adjoining paved surfaces. Refer to the applicable Municipal or NCDOT standard pavement repair details pavement width and patching requirements. Driveway crossings shall be completed within 48 hours after the initial cutting of the pavement.

3) **Protection of Pavement**

Whenever the water line is to be placed in or near a paved street, the Contractor shall provide pads or take necessary precautions to protect the pavement from damage by construction equipment. Pavement damage by cleats or tracked equipment, or by any other means, shall be repaired by the Contractor.

C. **Connections to Existing Mains**

The Contractor shall furnish all materials for connection to existing water mains. The City of Jacksonville shall be the sole operator of all valves and fire hydrants.

In making connections to the existing distribution system, valves shall be set as shown on the plans.

See paragraph 1.11 *Coordination* for limitations on valve operation and system shut down.

If the connection to the existing mains requires a wet tap, such tap shall be done by a firm licensed by the State of North Carolina for Utility work, experienced, and equipped to do this type of work. All materials and labor shall be provided by the Contractor to include, but not necessary limited to the sleeve, valve, tapping machine, accessories, installation, and testing of such materials to complete the work. The City of Jacksonville shall have the right to approve the firm or crew performing the work.

Work shall be scheduled at least one week in advance through the City of Jacksonville's Inspector who shall be present during the operation. After installation of the tapping sleeve and valve and prior to performing the tap, the assembly shall be hydrostatically tested at a pressure of 80 psi. Such pressure shall be maintained with no loss for a minimum time of 15 minutes. *Tapping sleeves shall not be air tested*.

D. **Removal of Asbestos Cement Pipe**

The Contractor is hereby advised that some of the pipe within the City of Jacksonville distribution system may contain asbestos. Removal, handling, and disposal of asbestos cement pipe shall be performed in accordance with applicable EPA and OSHA regulations and applicable Federal, State and local regulations. Documentation and paperwork as well as a chain of custody are to be provided to the City of Jacksonville.

E. **Utility Protection**

Take necessary precautions to protect existing utilities from damage due to any construction activity. The Contractor shall locate existing utilities, culverts, and structures (above or below ground), before any excavation starts and coordinate work with utility companies. Protect, maintain in service, and prevent damage to utilities not designated to be removed. Omission from or inclusion of located utility items on plans does not constitute non-existent or definite location. Secure and examine local utility surveyor records for available location data including building service lines. Contact underground damage protection services by contacting **NC One Call Center** at least 48 hours before you dig at 1.800.632.4949 and the City of Jacksonville at 1.910.938.5233.

The Contractor shall protect, maintain in service, and prevent damage to utilities not designated to be removed. When utilities are encountered and are not shown on drawings or when locations differ from those shown on drawings, notify Project Engineer for instruction before proceeding. In the event that a gas line, water line, power cable or conduit, or telephone cable or conduit is broken or damaged, the Contractor shall give immediate notice to the proper authorities and shall be responsible for any damage to persons or property caused by such breaks. If a service pipe supplying water or gas to an adjoining house is broken, the Contractor shall repair it at once. The City of Jacksonville may, at the Contractor's expense, repair any such service without prior notice to Contractor.

Should it become necessary to move the position of any underground structure, the Contractor may be required to do such work.

The Contractor shall be responsible for protecting all existing utilities from damage by excavation near the proposed line. Trench boxes may be necessary to prevent sloughing, etc., as well as to protect workers, the motoring public, and the pavement. Failure to use a box, which subsequently results in damage to an existing line or other public improvements, shall be cause for liability against the Contractor for the repair costs.

F. **Surface or Ground Water in Trenches/Pipe**

When ground water is encountered, the Contractor shall pump, or otherwise remove any water that accumulates in the trenches and shall perform all work necessary to keep the trenches clear from water while pipe is being laid. No pipe shall be constructed in water and water shall not be allowed to drain through the pipe. At the end of the day, the open end of the pipe shall be kept closed by placing a watertight fitting plug into the bell end to prevent washing of any foreign matter into the line. All water removed from the trench shall be conveyed in a proper manner to a suitable point of discharge and shall comply

with the applicable erosion and sedimentation laws. See also paragraph 3.1.7, *Dewatering* of Division 02275 – *Trenching, Backfilling, and Compaction of Utilities*.

G. **Abandoning of Existing Water Services/Mains**

Removal of Lines from Service: The Contractor shall remove abandoned lines from active service upon approval of the Public Services Director and completion of replacement line, and/or after transfer of service to a replacement line. Under circumstances where the line to be abandoned is 2 inches or less in diameter and threaded galvanized pipe is screwed into a mechanical joint plug, the line may be deleted from active service through removal of the galvanized line from the mechanical joint plug and replaced with a threaded brass plug. Under circumstances where the line to be abandoned is connected to a lead joint cross or tee, the section of line being intercepted which contains the lead joint cross or tee shall be replaced with mechanical joint fittings or straight pipe using mechanical joint sleeves. All plastic fittings shall be replaced with ductile iron or other fittings approved by the Public Services Director.

Services: When abandoning services 2-inch or less in diameter, the line shall be cut at the corporation stop on the main or as close to the main as possible and a one-foot segment of the line removed.

Mains: When an existing water main is replaced with a new water main, abandonment of the existing line is required once it is no longer in service. All mains are to be abandoned at source, valve removed, and the "tee" or tapping sleeve plugged with a mechanical plug.

3.1.2 STEEL ENCASEMENT PIPE – DRY BORING & JACKING OR OPEN CUT

A. **General**: Where required, steel encasement pipe shall meet the length as shown on the plans and the thickness and diameter as shown on **standard detail C07.01**. Boring across roads and railways shall be performed by dry boring and jacking a steel encasement pipe under the pavement or rail. The encasement shall be located in an area that is relatively free from material such as rock and stone that may hamper the boring operation.

Construction shall be executed in such a manner as to prevent settlement of the ground surface above the pipeline. The installation of the pipeline shall follow the heading or tunneling excavation as closely as possible.

All operations of the Contractor shall be subordinate to the free and unobstructed use of the right of way of the passage of traffic without delay or danger to life, equipment, or property. Installation shall be in accordance with of the *NCDOT Standard Specifications for Roads and Bridges, latest revision* or AREA, as applicable.

The pipe shall be plain end, mill beveled for field butt welding, unwrapped steel pipe and prepared for field welding at the circumferential joints. Joining of steel casing pipe shall meet the requirements of AWWA C206, AWWA *Standard for Field Welding of Steel Water Pipe*. Field welded joints shall be performed by AWS D.1.1 certified welders and shall be full penetration single vee groove, butt type welds around the entire circumference of the pipe. The pipe shall be in at

least 18-foot lengths. Casing shall be installed by either dry boring and jacking or open cut, as indicated on the drawings.

Encasement ends shall be enclosed as shown on **standard detail C07.01**. The steel encasement pipe shall be of leak proof construction. All exposed metal is to be coated with epoxy or asphaltic material.

All carrier piping shall be slip joint ductile iron pipe supported by spiders.

Manufactured Spiders: The spiders necessary to support the carrier pipe inside of the steel encasement pipe shall conform to both the shape and dimensions of **standard detail C07.01** and shall be in accordance with *paragraph 2.1.6 B, Spiders/Skids for Encasement Pipes*. Unless otherwise shown on the drawings, one spider shall be placed at each bell as well as at each end of the encasement pipe (see **standard detail C07.01** for location of spiders).

3.1.3 TUNNELING METHOD

A. **General**:

1) The Contractor shall submit shop drawings to the Public Services Director for approval prior to construction. All liner plates and ribs used in the tunnel shall be of one type. All material removed shall be disposed of off the site by the Contractor.

2) All operations of the Contractor shall be subordinate to the free and unobstructed use of the rights of way for passage of traffic without delay or danger to life, equipment, or property. The Contractor shall provide all necessary bracing, bulkheads, and shields to ensure complete safety to all traffic at all times. The Contractor shall provide all traffic control devices as necessary and as shown on the approved traffic control plan at no additional cost.

B. **Tunneling (Boring Method):**

1) Commence boring operation from a pit, with the bottom excavated to grade, and sheeted or shored if necessary. Boring through soil shall have a steel pipe jacked in place as a casing pipe. Boring through rock shall be oversized to allow installation of carrier pipe but no casing pipe shall be required unless liner plate is necessary for safety reasons.

2) Smoothly pave the bottom of the tunnel with concrete. Pull the carrier pipe in place a joint at a time. Securely block each section in place.

C. **Tunneling (Hand Mining)**

1) Commence tunneling operation from a pit, with the bottom excavated to plan grade, and sheeted or shored if necessary.

2) Trim the periphery of the tunnel smoothly to fit the outside of the steel liner plate as nearly as practical. All blasting shall conform to requirements for blasting in Section 02275 – *Trenching, Backfilling and Compaction of Utilities*.

3) Install the steel liner plates immediately after the excavated material has been removed, and remove the material not more than 24 inches ahead of the installed liner plates.

4) Grout all voids between the soil and tunnel liner plates. The maximum grouting pressure shall be 30 PSI. Start grouting at the bottom of the tunnel liner plates and proceed upward progressively and simultaneously on both sides of the tunnel. Install liner plates no more than 6 feet ahead of grout section. Prohibit traffic over ungrouted sections of tunnel unless this section is in solid rock. Thoroughly dry-mix grout ingredients before adding water. After adding water, mix the batch for 3 minutes. Batches shall be of size to allow continuous placement of freshly mixed grout. Grout not used within 30 minutes after mixing shall be discarded. Placing shall be quick and continuous. Placement shall be under pressure with a grout pump. The period between installation of the tunnel liner plate and the placing of grout shall not exceed 7 hours, without the approval of the Public Services Director. Upon completion of grouting, fill grout plugs with provided grout hole plugs.

5) Smoothly pave the bottom of the tunnel with concrete: After installation of the tunnel liner plates, the Contractor shall pour concrete pavement on the bottom quadrant (invert) of the tunnel, the surface of the pavement being parallel to the liner plate, with screed rails embedded in it, on line and grade for the installation of pipe in the tunnel.

6) The periphery of the tunnel shall be trimmed smooth to fit the outside of the steel liner plate as nearly as is practical, so that the void outside the plates is a minimum.

7) After installation of the casing pipe or the tunnel liner, pull the carrier pipe in place a joint at a time. Securely block each section in place. Each joint of the carrier pipe shall be supported at two points by steel saddles or by steel spiders, strapped to the carrier pipe with steel straps. The carrier pipe shall be blocked, in place to the prevent flotation.

8) Close tunnel liner ends to protect against entrance or foreign matter. The open ends of the casing pipe or tunnel shall be closed off by an 8-inch grout or masonry block wall prior to backfilling. A steel drain line to a 1 cubic yard French drain shall be provided.

9) If installation is under railway tracks, all permits shall be obtained and Railway Company shall be notified prior to such installation. The same shall apply to contacting the City of Jacksonville if installation is under roadway.

D. See also **PART 2 – PRODUCTS**, *Section 2.1.7, Tunnel Liners and Appurtenances*.

3.1.4 HORIZONTAL DIRECTIONAL DRILLING OF PVC C900 FUSIBLE WATER PIPE

A. PVC C900 pipe shall be installed by Horizontal Directional Drilling (HDD) using a surface mounted rig, first to drill a guided hole along a bore path consisting of a shallow arc and then to pull a string of pipe into the hole. Facilitate pull back by a back-reamer, which enlarges the hole to approximately one and a half times

the pipe diameter. Inject drilling fluids into the borehole to stabilize the hole and lubricate the pipe and drill-string. Use tracking equipment to guide and direct the drilling.

B. **Installation and Testing**

The Manufacturer shall supply an Installation Manual to the Public Services Director, which outlines guidelines for handling, joining, installing, embedding, and testing of the Fusible C900 Pipeline. These guidelines shall be used as reference material by the Public Services Director in his determination of the required procedures.

Joints between plain ends of Fusible C900 pipe shall be made by butt fusion when possible. The pipe manufacturer's fusion procedures shall be followed at all times as well as the recommendations of the fusion machine manufacturer. The wall thicknesses of the adjoining pipes and fittings shall have the same DR at the point of fusion.

When saddle connections are fusion welded, the Manufacturer's recommended saddle fusion procedures shall be used.

If utilizing mechanical fittings for transitions between pipe materials, repairs, joining pipe sections, saddle connections, or at other locations; the recommendation of the Mechanical Fitting manufacturer must be followed.

Pressure testing shall be conducted in accordance with City of Jacksonville specifications.

C. **Shop Drawings**

Contractor shall submit shop drawings and details on the proposed Fusible C900 pipe, fittings, bore methods, etc., for review and approval of the Public Services Director before ordering material or beginning installation of the Fusible C900 pipe. Contractor shall also submit to the Public Services Director proposed Subcontractor's name as well as references on who he/she plans to use on this project. All subcontractors/installers must be approved by the Public Services Director.

3.2 VALVES AND FIRE HYDRANTS

A. **Valve Applications**

1) **Valves – vault/above ground applications**:

a. Plumbing Gate Valves	Brass non-rising stem type (for air release valve manholes)
b. Gate Valves 2-inch and smaller:	Bronze ¼ turn ball type
c. Gate valves 4-inch and larger:	OS & Y
d. Relief Valves:	Air/Vacuum Release Valves

e.	Water-Regulating Valves:	Pressure-regulating valves Flow-regulating valves
f.	Detection of unauthorized water:	Detector Check Valves
g.	Backflow prevention:	Reduced Pressure Zone Backflow Preventers – USC approved Double Check Valve Assemblies – UL/FM rated

2) **Valves – below ground applications**: Non-rising stem.

3.2.1 GATE VALVES

A. **Setting of valves and valve boxes**: Valves shall be installed with stems in a vertical plane through the pipe axis and perpendicular to the pipe axis. The Contractor shall clean the valves before installation and check for satisfactory operation. All valves adjacent to tees or bends shall be tied to the fitting either with the restraint flange joint restraint system or with ASTM A307 threaded cadmium coated tie rods. See **standard detail 512.07** for number and diameter of tie rods). Valve nut extensions shall not be installed unless approved by the Public Services Director.

Nipples for 6-inch through 12-inch valves shall be cut so that the valves are installed no more than four feet from the fitting (centerline to centerline). 2-inch valves shall be installed with a 4-inch long brass nipple.

B. All underground valves without gearing or operators shall be equipped with a 2-piece valve box with lid (see **standard detail 513.01**). Valve boxes shall be centered with the valve nut. Valve box cover must be set flush with the finished ground surface or pavement. The Contractor shall be responsible for keeping valve boxes clean and free of any foreign matter until acceptance of the project.

C. **Valve Box Adjustment**: The Contractor shall adjust valve boxes to final grade at the time designated by the Public Services Director. As shown on the drawings, the Contractor shall construct a concrete pad set flush with grade and top of the box in a 6 inch thick x 2' x 2' concrete stabilizing pad placed around the valve box in unpaved areas. No extra payment will be made for this item. Valve boxes in easements are to be provided with a valve box marker post as manufactured by Pipeline Supply, Sanford, NC, or approved equal.

D. **Valve Box Removal:** When shown on the drawings or directed by the Public Services Director, the Contractor shall remove existing valve box(es), place select fill, stone or other material and repair pavement. Salvaged valve box(es) are to be delivered to the Water Plant.

E. When valve box tops project more than 1 inch above the unfinished road surface, a temporary layer of asphaltic concrete feathering shall be required to provide a smooth transition from 1 inch below the edge of the rim and cover to the unfinished road surface. The exposed sides of the valve box shall be painted bright orange.

F. Valves at intersections shall be either rodded to the tee or restrained with restraint flange system.

3.2.2 TAPPING SLEEVES AND VALVES

Tapping sleeves and valves shall be installed in accordance with the manufacturer's recommendations at locations shown on the plans. The Contractor shall make connection to existing water mains in the manner shown on the plans or otherwise in a manner that is satisfactory to the Public Services Director. With prior approval, when taps are made on asbestos cement pipe, the Contractor shall excavate at the location of the tap and measure the diameter of the pipe prior to selecting a tapping sleeve to ensure the sleeve will fit the pipe (this information shall be provided to the City of Jacksonville on the as-built drawings). See **standard detail 513.02**. Contactor is responsible for traffic control, excavating, dewatering, and safe access in the trench at the time of tap. The Contractor is to provide taping sleeve and valve. Contractor must have approved traffic control plan.

3.2.3 AIR RELEASE VALVES

Air release valves are to be used to bleed air during filling of a water line and to automatically vent air that collects in the water lines. Pressure air release valves shall be located as shown on the drawings. The valve shall be housed in a precast concrete eccentric manhole and shall be installed in accordance with **standard detail 513.05** (Air Release Valve in Precast Manhole). All pipe and fittings are to be brass including the plumbing gate valve. Air release valve locations shall be as shown on the plans and as otherwise directed by the Public Services Director.

3.2.4 FIRE HYDRANTS

A. **Construction**: Fire hydrants shall be installed where shown upon the plans or as directed by the Fire Marshall of the governing municipal jurisdiction. Place 1 CY of loose #57 stone around the hydrant elbow. See **standard details 514.01 and 514.02**.

The Contractor is responsible for determining barrel length and ordering to meet conditions. Hydrants are to be located at a distance from the curb or edge of pavement to provide ready access and minimize the possibility of damage from vehicle and set to the height prescribed by **standard details 514.01 and 514.02** with the pumper nozzle facing or pointing to the street or fire access lane. A resilient seat gate valve shall be located at the tee and shall be installed and properly rodded or restrained to the blocked fitting with the hydrant installed a minimum of 4 feet from the leg valve. Care shall be taken to keep concrete away from bolts and weep holes. Hydrants must be set with the stem vertical/plumb and the flange above grade. Where hydrants are set behind guardrails, the pumper nozzle shall be set with its centerline a minimum of 12 inches and a maximum of 18 inches above the top of the guardrail.

A City of Jacksonville representative must inspect fire hydrants prior to backfilling.

B. Hydrants are to be rodded to the valve, and from the valve to the main, with 3/4" diameter threaded rods. Where hydrant branches exceed 20 feet, rods are to be attached to the hydrant and the rods to a thrust block behind the first full joint of

pipe on the hydrant branch between the hydrant and the leg valve. If test pressures are expected to exceed 200 psi, rod with a minimum of 4 rods – see **standard detail 512.07. For lines with greater than 100-psi static pressure,** use four 3/4" diameter rods

All threaded rods are to be stainless steel or cold-dipped galvanized ASTM 307 steel. Any rods, which have been cut, are to be coated liberally with coal tar epoxy or other acceptable rust inhibitor to protect the steel from corrosion. Restraint flange joint restraint systems are preferred over tie rods.

C. **Hydrant Bagging**: By City of Jacksonville.

D. **Valving of Main**: A leg valve is required on all hydrant legs. Install hydrant valve as close to the main as possible. When valve is placed outside the pavement, provide a concrete stabilizing pad in accordance with **standard detail 514.01**.

E. Fire hydrants are to be pressure tested with the main.

F. **Permanent Raised Pavement Markers**: A permanent raised bidirectional one color (blue and blue) pavement marker shall be placed at the centerline of the road directly in front of the fire hydrant; the reflective faces oriented toward traffic. Prior to placing the pavement reflector, grind off the existing paint to permit bonding of epoxy to pavement.

3.2.5 BACKFLOW PREVENTERS

Refer to the City of Jacksonville *Water System Cross-Connection Control Ordinance,* Article VI of the City Code, latest revision for hazard classification and type backflow device requirements, which is herein made part of this specification by reference.

3.3 MISCELLANEOUS APPURTENANCES

3.3.1 SERVICES

A. **General**: All fees must be paid and work scheduled with the City of Jacksonville Public Services Department before the tap can be made. All materials must be on-site, trenches open, and shoring and traffic control devices in-place before the tap is made. Contractor may be required to provide approved traffic control plan if require by inspector.

1) **Allowable Tapping methods**:
   a. 1-inch taps are to be made by either direct tap or by all bronze wide single strap tapping saddle. See **standard detail 513.03**.
   b. 1 ½ through 2 inch taps are to be made by either direct tap or all bronze wide or double strap tapping saddle. See **standard detail 513.04**.
   c. 6 inch through 12-inch AWWA C900 PVC pipe may be direct tapped for taps 2 inch or less in size at the option of the Contractor (see **standard detail 513.03**). Direct tapping of C900 PVC pipe, including insertion of the corporation stop, shall be done in accordance with Uni-Bell Recommended Practice (UNI-B-8-79). Direct tapping PVC pipe shall be accomplished through the use of a shell type hole cutter with will retain the coupon or plug.

d. Tapping of cast or ductile iron pipe shall be done in accordance with the recommendation of the tapping machine manufacturer.
e. Taps 4-inches and larger are to be made using an all stainless steel tapping sleeve or a fitting. Iron body sleeves are not permitted.
f. **Tap Location**: No closer than 24 inches from end of pipe up to 16" diameter.
g. Service taps shall also be subject to the requirements of AWWA C600, *Installation of Ductile Iron Water Mains and their Appurtenances, latest revision.*

Service Connections on "In-Service" water mains.	
Size Connection	**Responsibility**
1-inch through 2-inch services	Contractor makes tap and runs service line, sets meter box and setter (as applicable), City furnishes and sets meter.
3-inch and larger services	Contractor makes tap, runs service line, sets meter box or vault, and furnishes all material. City furnishes meter.

2) **Tap Location - 1-inch through 2-inch Copper or PE Service Lines**: Taps 2-inches and smaller shall be made no closer than 24 inches apart (see **standard details 513.03 and 513.04**). Water service pipe shall be one continuous run, from main to meter setter, of copper or PE pipe with no joints or couplings in between. Service lines shall run perpendicular to the main in a straight line from the water main to the meter box/property served. No sharp bends of the service lines are permitted.

Copper or PE service lines shall have firm bedding with at least 30 inches of cover from the water line to the top of the front of the concrete gutter or centerline of the drainage ditch.

Backfill shall be free of rocks or large objects that could crimp or damage the line. Service line trenches in traffic areas shall be tamped to achieve 95% Modified Proctor Density. In landscaped areas, the surface shall be left smooth and uniform with the adjacent surface.

B. **1-inch taps**: All 1-inch taps into water mains shall be made either by direct tap (on DIP) or by using an all bronze tapping saddle, both with an all bronze corporation stop. Corporation stop for saddles or direct taps on ductile iron pipe and shall have AWWA Standard CC tapered threads. Taps shall be made at a 45° angle above the horizontal on the upper half of the pipe. A bend or "gooseneck" in the service line shall be provided in the service line as it leaves the corporation stop to provide for expansion/contraction and flexibility. A double strap shall be used on both PVC and AC pipe. Multiple taps in the same section of the pipe shall be staggered (see **standard details 513.03 and 513.04**).

C. **1 ½ and 2-inch taps**: 2-inch taps shall be made using a 2-inch Ford 202B or Mueller BR2B all bronze wide or double strap saddle or they may be made using the direct tapping method. Water service pipe for 1 ½ and 2-inch connections shall be type K soft copper with flared fittings or PE pipe with compression fittings with solid stainless steel inserts. For short distances between the main

and the meter, threaded brass pipe may be used. Taps shall be made at a 45° angle above the horizontal on the upper half of the pipe. A bend or "gooseneck" in the service line shall be provided in the service line as it leaves the corporation stop to provide for expansion/contraction and flexibility. See **standard detail 513.04** and paragraph 2.3.19 B.

D. **Large taps**: Taps 4-inch and larger shall be made using all stainless steel tapping sleeves and tapping valves or a fitting. A City representative must inspect all service connections prior to backfilling. Only one 4-inch or larger tap shall be made per joint of pipe on AC and/or pit cast (gray iron) pipe. The outside diameter of the pipe must be measured at the location of the tap to determine the appropriately sized tapping saddle.

1) **Tapping Sleeve Support – AC Pipe**: Use stone or brick on AC pipe to support the weight of the tapping sleeve and valve.

E. **Meter Boxes and Setters – Installation**:

1) **Small Meter Boxes**: Meter boxes for 3/4-inch, 5/8-inch, and 1-inch meters shall be installed within the utility strip behind the curb or within the right of way at the back of the curb. Meter boxes shall be set on six concrete brick with one brick set vertical at each end to cover the elongated slot. The box and brick shall be set on fined graded sand. All meter boxes shall be set so that there is a minimum of 8 to 10 inches of clearance between the top of the box and the cut-off nut on the meter setter. The meter setter shall be straight, level and centered in the box. Meter boxes shall be set to avoid inflow of surface water into the box. See **standard detail 515.01**.

2) **1 1/2-inch and 2-inch Meter Boxes**: Meter boxes for 1 ½-inch and 2-inch meters shall be placed with 2 concrete brick on each end to cover elongated slot with a minimum of a 4-inch bed of clean sand. Meter boxes shall be set so that there is a minimum 12 inches of clearance between the top of the box and the cut-off nut on the meter setter. The meter setter shall be straight, level and centered in the box. Meter boxes shall be set to avoid inflow of surface water. Concrete bricks shall be placed underneath meter mox for support.

Meter setters for 1 ½-inch and 2-inch meters shall be provided with a section of copper pipe extending 2 feet horizontally out the back of the meter box, or 2 feet beyond the edge of the sidewalk when meter box is set in sidewalk, and either plugged or crimped. The outlet connection on 2-inch meter setters shall be plugged with a pipe plug until pressure testing has been completed on the section of main to which it is connected. Setters are to be perpendicular to meter and vertical. Use an idler bar to maintain proper spacing until a system is ready for a meter to be set.

Contractor will install 2” meters and setter with materials furnished by the City of Jacksonville.

F. **Large Meter Vaults**: Meter vaults for 3-inch and larger meters shall be placed level on a 6-inch bed of #57 stone that has been thoroughly and firmly consolidated. Meters and fittings shall be supported by pipe stands. Vault doors shall be centered over the meter and otherwise located as shown on **standard detail 515.04**. The City reserves the right to require drains in meter vaults.

G. **Grounding to Water Services**: Grounding shall not be allowed to be connected to meter boxes or vaults. As a minimum, place meter boxes/vaults no closer than 10 feet from a building. If unavoidable, place a grounding jumper around meter box/vault.

H. **Abandoning Water Services**: see paragraph 3.1.1 G *Abandoning of Existing Water Services/Mains*.

I. **Water Service Replacement**

All existing water meters along the water main to be reconnected are to be tied to the new water main. Contractor shall install new 1-inch corporation stop, service line between proposed water line and existing service at the water meter box, a new meter setter, and any brick. All direct taps in PVC pipe shall be accomplished through the use of shell type hole cutter which will retain the coupon or plugs. Existing meter setters will be the property of the City and be delivered to the Water Plant. *Water services shall be classified for payment as to their location in relation to the new water main and the centerline of the street.*

Relocation of water meters to the existing right of way, including all necessary materials, labor, and surface restoration shall be considered incidental to the water service replacement and be included in the unit price bid for the item.

J. **Testing**: All taps and services shall be pressure tested with the main.

3.3.2 RESTRAINTS/CONCRETE THRUST BLOCKING

A. **Thrust Blocking**: Thrust Blocking must be installed at all fittings and changes in direction of the pipeline. Thrust blocks shall be constructed from 3000 psi concrete (at 28 days) and poured against an undisturbed earth trench wall. Concrete thrust blocking shall be constructed in accordance with **standard detail 512.01**. Concrete anchors may be unformed but minimum dimensions must be maintained. All fittings and pipe shall be wrapped in plastic prior to installation of concrete to insure that bolts and nuts are free of concrete and debris to allow accessibility for future repairs. When soft, mucky, unsuitable, or unstable soils are encountered, thrust shall be resisted by running tie rods to solid foundations by removing the soft materials and replacing it with ballast of sufficient size and weight to resist thrust.

Vertical upward thrust at fittings or vertically deflected joints shall be resisted with thrust collars of adequate size and weight to resist thrust. See **standard details 512.03 and 512.04**.

Pipe manufacturer's installation manuals shall be followed for the anchoring of valves and fittings in difficult locations unless superseded by the requirements of these specifications.

Concrete thrust blocking is not recommended where the blocking may bear on other utilities or where the area behind the block may be excavated in the future.

A City representative must inspect all blocking and anchoring prior to backfilling.

B. **Rodding:** 4-inch and larger valves and assemblies of fittings shall be secured to a blocked fitting by threaded rods with eyebolts. Refer to **standard detail 512.07** for the minimum size and number of rods needed for various test pressures. No more than one coupling shall be allowed between rods. Rodding length between fittings shall not exceed 20 feet. When the length between fittings exceeds 20 feet, place a thrust collar on the line and rod to the thrust collar.

All eyebolts and plain or galvanized threaded steel rods shall be coated with a minimum of 12 mils of a 2-component coal tar epoxy meeting ASTM D3359. Coal tar epoxy coating shall meet or exceed Benjamin Moore M47/M48, EpoxySystems Product #216, or approved equal. Rods are to be thoroughly clean and dry before coating.

A restraint flange system may be used in lieu of rodding.

C. **Thrust Collars:** Thrust collars shall be constructed as shown in **standard detail 512.02** for pipes up through and including 36 inches in diameter. The thrust collar shall consist of a wedge action restrainer gland (see paragraph 2.1.1 Ductile Iron Fittings, paragraph B. 3) of this specification for manufacturer and model number of approved restrainer gland) placed around a joint of ductile iron pipe encased in a reinforced 3000 psi concrete block. Where the blocking provides thrust resistance for fittings, threaded rods shall be connected to the restraint flange fitting secured to a full joint of ductile iron pipe. On dead end lines, the thrust collars must be placed on a full joint of ductile iron pipe just after the terminal end line valve.

3.3.3 VAULT CONSTRUCTION

During the contract, the Contractor may be required to perform vault related construction. Prior to performing such work, all materials, specifications, and additional costs (items not bid in other sections,), shall be approved before commencing work.

3.3.4 MANHOLE INSTALLATIONS

Manhole bases shall be placed on a level 6-inch bed of #57 stone that has been thoroughly and firmly consolidated. Voids around the pipe, joints, grade rings, and other openings in the manhole shall be thoroughly and neatly grouted inside and outside with a non-shrink gout to prevent infiltration. A maximum of 2 grade rings or one grade ring and one course of concrete bricks will be allowed to bring the rim and cover to finished grade (see **standard detail C06.03**). If additional height is required, a riser must be installed.

Flat tops shall be used for air release manholes.

3.4 TESTING AND DISINFECTION

3.4.1 GENERAL

Pipelines shall be tested, in sections between valves, as soon as the installation is completed. Using this method, errors in workmanship can be identified immediately and leaks can be fixed quickly and with minimum expense. Prerequisite Conditions for Testing and Disinfection shall be as follows:

A. Pipelines and appurtenances have been laid and the trench backfilled.

B. Hydrants shall be properly located, operable and plumb and at correct elevation.

C. Valves shall be properly located, operable and at correct elevation. Valve boxes or manhole shall be centered over operating nuts and the top of the box or manhole shall be at proper elevation.

D. All reaction anchors have had sufficient set of 7 days or high early strength concrete may be used to reduce the curing time to 3 days. For high early concrete mix, use 4,500 psi or greater concrete. Temporary bracing shall not be allowed.

E. Lines shall be properly vented where entrapped air is a consideration. Air pockets shall be eliminated.

F. All visible leaks, broken or cracked pipe, valves, hydrants, etc. shall be repaired.

G. Air release valves shall be installed complete and in place after pressure test.

H. All construction activities on the project, that requires trenching or excavation within the limits of the water location shall be completed. Pressure testing is to be performed before pavement is put down.

I. Approval from the City of Jacksonville's Inspector on section of line to be tested.

3.4.2 ORDER OF OPERATIONS

A. **Fill Line:** After all prerequisites are met, fill the system slowly with water, at a velocity of approximately 1 foot per second, while necessary measures are taken to eliminate all air at the highest points of the system where air may collect in pockets. After filling, shut off system in order to prevent contaminated water from flowing back in the line supplying the water.

B. **Pressure Test**: A pressure test shall be scheduled with a City representative at least 48 hours in advance, with the Contractor performing the test. Testing shall be in accordance with section 3.4.3, *Pressure Tests & Leakage*. ***If an existing gate valve is known to be leaking, chlorination must be performed prior to pressure testing.***

C. **Flushing:** Allow filled system to set undisturbed for a minimum of 24 hours, then begin flushing operations. The section of main to be disinfected shall be flushed through blowoff assemblies. Flushing shall be a velocity of not less than 2.5 feet per second to remove sediment and other foreign matter until the water runs clear. The Contractor shall be responsible for making adequate provisions for drainage of large volume of flushing water, including proper dechlorination/disposal of chlorinated water. Any damages that may occur from this operation shall be the sole responsibility of the Contractor. In conjunction with beginning flushing, a City representative will perform a high range chlorine concentration test. Chlorine concentration of 50 mg/l minimum must be provided. Allow chlorinated water to set in the test section for 24 hours after which the line shall be flushed and samples taken at various points. The

chlorine concentration shall not drop below 20 ppm within a minimum period of 24 hours. See section 3.4.4, *Disinfection and Bacteriological Testing*.

D. **Sampling**: Check chlorine and turbidity. After allowing the system to flush so that at least two volumes of water pass through the main, the bacteria sample shall be collected at regular intervals not exceeding 1,200 feet, and tested for bacteriological quality. The Contractor shall be responsible for making adequate provisions for drainage of large volume of flushing water, including proper dechlorination/disposal of heavily chlorinated water. See section 3.4.4, *Disinfection and Bacteriological Testing*.

1) Pipe subjected to contaminating materials shall be treated as directed by the Public Services Director. Should such treatment fail to cleanse the pipe, replacement shall be required. The City of Jacksonville shall bear no portion of any cost sustained by the Contractor in meeting this specification.

2) Services shall be included in the main line disinfection process. The Contractor shall have the same responsibility for laterals as for the mains in regard to bearing full cost of any corrective measures needed to comply with either the bacteriological test or other such requirements.

3) After As-Builts have been submitted and reviewed, and NC State Certification of the water main has been received, the water main shall be placed in service.

E. **Final**: After final flushing, flow all hydrants to confirm the valves are open.

3.4.3 PRESSURE TESTS & LEAKAGE

The Contractor shall test and disinfect completed sections of water mains, including service lines, fire hydrants, and fittings with water. The City of Jacksonville reserves the right to test all lines. This testing, however, does not relieve the Contractor of his responsibility to repair or replace any cracked or defective pipe within the eighteen-month warranty period. All work necessary to secure a tight line shall be done at the Contractor's expense. Testing shall be performed in the presence of the Public Services Director or his/her designated representative.

All additions or replacements to water system, including fire lines and backflow prevention devices, shall be tested and chlorinated before being placed in service. Such work must take place under the supervision of the Public Services Director or his/her designated representative.

The newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for two hours to a leakage test with a constant test pressure of 150% of design working pressure, but no less than 150 psi. The test pressure shall be allowed to build up slowly using a hand pump or power pump to the test pressure. Only City personnel shall operate water valves on the City of Jacksonville's existing water system (see paragraph 1.11 *Coordination*). Extreme care shall be used to prevent backflow into the potable water supply. The lines should be allowed to stand under pressure for a period of 24 hours prior to the test. Air should be vented from all high points just prior to the test.

Only clean water, free of dirt and other debris, from a clean container shall be used for testing. The Contractor shall notify the Public Services Director at least 24 hours in advance of any expected test. The Contractor shall pretest all mains for a period of 2 hours before notifying the City of Jacksonville for a final pressure test. No final pressure test will begin after 2:00 PM. The maximum allowable leakage shall be no greater than allowances shown in Table 1 below (in accordance with Section 5.2, Table 6A - Hydrostatic Testing of AWWA C 600-93, *AWWA Standard for Installation of Ductile Iron Water Mains and Their Appurtenances*). For PVC pipe, the test procedure and allowable leakage shall be as specified in the latest edition of the Uni-Bell Plastic Pipe Association Handbook of PVC pipe, Chapter X, Construction. No leakage shall be allowed for services.

Tapping sleeve and valve shall be hydrostatically tested in place prior to tapping of the existing line in accordance with the manufacturer's recommendations.

The City's Inspector will verify one pressure test – the final observation of the test section.

A. **Acceptance Tests:**

1) **Pressure Test**: Subject the pipe system to a hydrostatic pressure test. Raise the pressure by pump to 150 psi, 150% of design working pressure, or test pressure as shown on the drawings, whichever is greater. Measure pressure at the low point on the system compensating for gauge elevation. Maintain this pressure (+ or – 5 psi) for 2 hours. If pressure cannot be maintained using reasonable pumping rate, determine cause, repair, and repeat the test until successful. Contactor shall be responsible for all labor, materials, and equipment to perform the testing.

2) **Leakage Test**: Leakage shall be defined as the quantity of water that must be supplied into the pipe to maintain the test pressure, after all air in the pipeline has been expelled and the pipe has been tested for a duration of 2 hours. Leakage shall not exceed the quantity determined by Table 6A (excerpted from AWWA C600-93), attached. For allowable leakage for PVC pipe, refer to Uni-Bell Handbook of PVC Pipe, Table 10.5, *Testing Allowance for PVC Pipe with Elastomeric Joints.*

   If leakage exceeds allowances, the Contractor shall be responsible for locating and repairing leaks, and retesting of line until successful.

   No leakage will be allowed for welded steel pipe. If leaks are revealed by test, repair by rewelding. Peening of leaks will not be allowed. A certified welder must perform all welding.

3.4.4 DISINFECTION AND BACTERIOLOGICAL TESTING

Pipe Disinfection and Bacteriologic Testing: Comply with ANSI/AWWA C-651, *Disinfecting Water Mains*. The Contractor shall disinfect water mains and accessories in accordance with the procedures listed below and meet the requirements of the City of Jacksonville. Bacteriological testing shall comply with Section 5 of AWWA C651. All samples shall be tested for bacteriological (chemical and physical) quality in accordance the *Standard Methods for the*

Examination of Water and Wastewater; and shall show the absence of coliform organisms and the presence of chlorine residual. The lines shall not be placed in service or pressure tested until a negative bacteriological report has been received from the City of Jacksonville.

Purity Testing includes a number of 24-hour tests that must be taken. Samples cannot be collected if any type of precipitation is falling.

All sampling pipe shall be copper, brass or PVC.

The Contractor is responsible for furnishing all material and construction sampling points. Temporary pipes used for sampling shall be composed of sections of vertical pipe terminating into a 90-degree horizontal bend and nipple at least 18 inches above ground level. Copper tubing used for sampling shall terminate horizontally with the ground, at least 18 inches above ground level. It may be difficult to obtain passing samples from outlets other than those listed above. Samples will not be taken from a hose.

The City's Inspector will prepare a Sampling Log, including a sketch of the sampling points, as specified by the City. The City of Jacksonville is responsible for collecting and approving samples after receiving adequate notice form the Contractor. Samples can only be taken Monday through Thursday no later than 1:00 PM. Chlorine injected on Friday yielding a 48-hour contact time will be reviewed and approved on a case by case basis. The normal turnaround time for the City of Jacksonville's laboratory to acquire results is 24 hours.

A. **Forms of chlorine for disinfecting**

1) Calcium hypochlorite – Two forms are available – granular and tablets (both with 65% available chlorine). It will normally require 6.5 lbs. of Calcium Hypochlorite to produce a concentration of 50mg/L of available chlorine in 10,000 gallons of water. (Warning Note: *This chemical must not be used on solvent-welded or on screwed-joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite*!)

B. **Methods of chlorine application**

The Contractor will inject a chlorine solution as specified in AWWA Standard C651, latest revision, into the water main. The chlorination shall be in accordance with the following minimum guidelines for calcium hypochlorite granules:

Pounds of calcium Hypochlorite granules per 1000 feet of pipe to provide 50 ppm	
6-inch diameter pipe	0.93 lbs.
8-inch diameter pipe	1.68 lbs.
12-inch diameter pipe	3.77 lbs.
16-inch diameter pipe	6.71 lbs.
20-inch diameter pipe	10.50 lbs.
24-inch diameter pipe	15.11 lbs.
30-inch diameter pipe	23.61 lbs.

The chlorine solution shall be injected in the section of the main nearest an existing main. The chlorine solution shall result in a chlorination concentration of 50 ppm or greater. Chlorine injected on Friday yielding a 48-hour contact time will be reviewed and approved on a case by case basis. Manually operated pumps shall not be used to inject the solution into the main.

1) **Application for Continuous Feed**

Taps will be made at the control valve at the upstream end of the line and at all extremities of the line including valves. These taps shall be located in such a manner as to allow chlorine solution to be fed into all parts of the line. Taps shall be properly abandoned after the Bac-T test passes.

The chlorine solution shall be circulated in the main opening of the control valve while systematically manipulating hydrants and taps at the line extremities. The Chlorine solution must be pumped in at a constant rate for each discharge rate in order that a uniform concentration will be produced in the lines.

2) **Continuous feed method** – Potable water shall be introduced into the pipe main at a constant flow rate. Chlorine shall be added at a constant rate to this flow so that the chlorine concentration in the water in the pipe is a least 50mg/L. The chlorinated water shall remain in the main at least 24 hours, after which, the chlorine concentration in the water shall be at least 10mg/L. All valves and appurtenances shall be operated while the chlorinated water remains in the main.

C. **Bacteriologic Tests- General**: Before the water main is placed in service, all samples shall be collected at regular intervals not exceeding 1,200 feet and tested for bacteriologic quality and shall show the absence of both background growth (gram positives) and coliform organisms.

Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate. A chain of custody shall accompany the samples delivered to the plant. Results cannot be read until 24 hours after sample has been run by lab. If laboratory results indicate the presence of coliform bacteria, the samples are unsatisfactory. If laboratory results indicate background growth masking the detection of coliform bacteria, the sample will be considered unsatisfactory. If the line fails first sampling, the main shall be re-chlorinated by the Contractor and new tests performed prior to moving to the next section of main. The tablet method cannot be used in repeated disinfecting. Cleaning and disinfecting will be the responsibility of the Contractor. The City of Jacksonville will furnish water and operate all necessary valves for these operations. The Contractor shall be responsible for loading, hauling, discharging of water, and dechlorinating device.

Samples for bacteriological analysis shall be collected for each section of pipe between main line valves after flushing is completed.

Primary sampling points are blow-offs (see the table of *Minimum Blow-off sizes*, paragraph D, below), 2-inch setters and all fire lines. Sampling will be allowed at hydrants if available to flush and sample the entire section of newly laid pipe. Otherwise, the Contractor shall install a flushing and sampling tap consisting of a corportaion cock installed in the pipe with a temporary copper pipe. Such additional work required for this shall be at the Contractor's expense, and is to be properly abandoned after acceptance.

D. **New Water Mains Disinfection and Purity Testing - Procedure**

STEP 1: Disinfection

The Contractor is responsible for furnishing all taps and materials required to satisfactorily disinfect the water system. The City and the Contractor will complete the following steps cooperatively.

1) The City's Inspector will supervise the flushing of the section of main to be disinfected until the water appears clear.

Minimum blow-off sizes:	
2" – 8" lines	2" blow-offs
12" lines	4" blow-offs
16" & larger lines	6" blow-offs

The Contractor is responsible for adequate disposal of the large volumes of water generated from flushing and dechlorinating device.

2) The Contractor will inject a chlorine solution as specified in Section 4 of the AWWA Standard C651, latest revision, into the water main.

   a. Do not use manually operated pumps to inject the solution into the main.
   b. The chlorine solution shall result in a chlorine concentration of 50 ppm or greater.
   c. The chlorine solution should be injected in the section of main nearest an existing water main.

3) The City's Inspector will draw water from the following areas until at least 50 ppm chlorine concentration has been measured at all points of discharge at which time each point will be closed:
   - end of the main
   - hydrants
   - lateral lines
   - other connections

   a. The City's Inspector will close all control valves feeding water into the main.
   b. The chlorine concentration shall not drop below 20 ppm within a minimum period of 24 hours.

c. Sometime after the 24-hour period expires, the City's Inspector will check the chlorine concentration to confirm that it has not dropped below 20 ppm.

STEP 2: Preparing for Purity Testing

The Contractor is responsible for furnishing all material and constructing sample points.

1) The City's Inspector is responsible for preparing a Sampling Log that includes a sketch of sampling points.

2) The Contractor must ensure that each sample point terminates horizontally at least 18" above ground level.

3) **SAMPLES WILL NOT BE TAKEN FROM A HOSE.**

Samples are to be taken on Monday through Thursday, no later than 1:00 PM.

STEP 3: Purity Testing

The City is responsible for collecting and approving samples. Samples cannot be collected if any type of precipitation is falling.

SAMPLING

1) Before chlorinating is performed, the City's Inspector will first flush the new water main. The main must be flushed so that two volumes of water pass through the main.

2) The City's Inspector will check both chlorine concentration and turbidity.
   a. The chlorine concentration must be less than 4ppm for consumption purposes but greater than or equal to 2 ppm for testing purposes.
   If the chlorine concentration and turbidity are not within these limits, the City's Inspector must flush and rechlorinate the water line again and resample at a later date.

3) If the chlorine concentration and turbidity are within limits, the City's Inspector will collect samples from the new main and from an approved/control water main in the distribution system.

   Obtaining a control sample allows the laboratory to compare the water quality in the distribution system with that in the new water main.

4) On the day of collection, the City's Inspector will deliver the collected sample to the City's laboratory. Samples may be delivered only Monday through Thursday no later than 1:00 PM.

5) The City's laboratory personnel will conduct a total coliform test using the membrane filter method. **This test required 24 hours of incubation before the result is obtained.**

6) The test results must be negative for coliform and E. Coli bacteria.
   a. If the samples from the water main are positive, the main must be disinfected again which means Step 1 must be repeated in its entirety. This will prolong testing.
   b. In the rare event that the samples from the control main are positive, the control main must be flushed and resampled at a later date. This will prolong testing.

E. **Dechlorination**: No discharge of heavily chlorinated water into a storm sewer or a stream will be permitted unless the discharge is first treated by a neutralizing chemical applied to the water to be wasted to neutralize thoroughly the residual chlorine. A dechlorinating device is required. Disposal of heavily chlorinated water shall meet the applicable sections of AWWA C651, latest revision.

3.5 FINAL ACCEPTANCE

Upon completion of water main installations and prior to acceptance, the Contractor shall provide adequate and competent personnel to conduct, in conjunction with the City of Jacksonville, an inspection of each valve and hydrant on the newly completed main. The purpose of this inspection shall be to insure the operability and location of each valve and to further insure that all valves are left in the open position. Upon receipt of State Certification, the main valve serving the new section of main(s) shall be turned on and placed into service by the City of Jacksonville.

END OF SECTION 02510

Back to top

bj.NC.Jacksonvile.Specs.COJdv02610Water.doc

AWWA C600 TABLE 6A
ALLOWABLE PRESSURE TEST LEAKAGE
(Allowable Leakage per 1000 ft. of Pipeline * in gph)
(This table is excerpted from AWWA C-600, Section 5.2 Table 6A)

AVG. TEST PRESSURE PSI	NOMINAL PIPE DIAMETER-IN.																
	2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450	0.32	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60
400	0.30	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11
350	0.28	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300	0.26	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02
275	0.25	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72
250	0.24	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41
225	0.23	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03
200	0.21	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73
175	0.20	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36
150	0.19	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97
125	0.17	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100	0.15	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05

* For pipe with 18 ft. nominal lengths. To obtain the recommended allowable leakage for pipe with 20 ft. nominal lengths, multiply the leakage calculated from the table by 0.9. If the pipeline under test contains sections of various diameter, the allowable leakage will be the sum of the computed leakage for each size.