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SECTION 02560
RECLAIMED WATER DISTRIBUTION SYSTEM

The Contractor shall comply with all local codes and regulations of local utilities. He shall coordinate work necessary for the completion of utilities with local utility companies and cooperate with the companies as required. The Reclaimed Water Distribution System shall comply with Georgia Environmental Protection Division's "Guidelines for Water Reclamation and Urban Water Reuse", latest revision.

PART 1 - PRODUCTS:

All pipe material, solder and flux shall be lead free (less than 0.2 percent lead in solder and flux and less than 8.0 percent lead in pipes and fittings). All materials shall be certified for conformance with American National Standards Institute / National Sanitation Foundation Standard 61 (ANSI/NSF61).

1.01 Metal Pipe:

- A. Ductile Iron Pipe - Ductile iron pipe shall be manufactured in accordance with ANSI/AWWA C151/A21.51, latest revision. All pipes larger than 12" shall be ductile iron.

Ductile iron pipe shall be of the thickness according to ANSI/AWWA C150/A21.50, latest revision, for Laying Condition Type 2, at a minimum.

Flange Pipe shall be Pressure Class 350.

- B. Fittings - Fittings shall conform to ANSI/AWWA C111 A21.11, latest revision, and shall be push-on-type unless otherwise shown.

Flanged Fittings shall conform to ANSI/AWWA C110/A21.10, latest revision. The AWWA C110 fitting flanges shall have facing and drilling which match AWWA C115 threaded-on flanges which also match ANSI B16.1 Class 125 flanges except where Class 250 are specifically noted.

Mechanical Fittings shall conform to ANSI/AWWA C153/A21.53, latest revision. Bolts shall conform to ANSI B18.2.1, latest revision. Nuts shall conform to ANSI B-18.2.2, latest revision. Bolts and nuts shall conform to ANSI B1.1

- C. Joints - Push-on Joints shall conform to ANSI/AWWA C111/A21.11, latest revision.

Flanged Joints shall conform to ANSI/AWWA C115/ A21.15, latest

revision. Use only full-face type, red rubber gasket, one-sixteenth inch thick, as manufactured by the U.S. Rubber Company, in all flanged joints.

Mechanical Joints shall conform to ANSI/AWWA C111/A21.11, latest revision. All joints of mechanical joint ductile iron and fittings shall be installed in accordance with the requirements of AWWA C600, Section 3.4. Bolts shall conform to ANSI B18.2.1, latest revision. Nuts shall conform to ANSI B-18.2.2, latest revision. Bolts and nuts shall conform to ANSI B1.1

Restrained joints for pipe, valves, and fittings shall be mechanical joints with ductile iron retainer glands equivalent to "Megalug" or push-on type joints equivalent to "Lock-Ring," "TR Flex," or "Super-Lock," and shall have a minimum rated working pressure of 250 psi. The coating shall consist of a minimum of two coats of liquid Xylan® fluoropolymer coating with heat cure to follow each coat. The coating system shall be Mega-Bond™ by EBAA Iron, or approved equal. Restrained joints shall be capable of being deflected after assembly and they shall have a preset deflection of no more than 5 degrees while being able to take up to 3 degrees of deflection after burial.

- D. Lining and Coating - Lining for ductile iron pipe and fittings shall be a cement mortar lining meeting the ANSI/AWWA C104/ A21.4, latest revision, for standard thickness lining. After cement lining, the interior of the pipe shall be given a seal coat of approved bituminous material in accordance with ANSI/AWWA C104/A21.4, latest revision.

Exterior coating shall be an approved bituminous coating one mil thick in accordance with ANSI/AWWA C151/ A21.51, latest revision.

- E. Protective Coating - Pipe and fittings shall be coated in the field by an approved painting subcontractor. The subcontractor's experience qualifications shall be submitted for approval by City of Savannah.

Buried ductile iron pipe and fittings shall be color coded as per general color code requirements listed in the Utility Location and Coordination Council's Uniform Color Code. Reclaimed water main pipe, joints, and fittings shall be marked with Pantone Purple 522C.

The coating shall cover the top 180 degrees of the pipe outside diameter, except for the spigot area. The standard asphaltic pipe coating shall not be deleted if field painting is selected. The paint shall be an all acrylic, water reducible, fast drying, semi-gloss coating and shall be suitable for

painting over asphaltic coatings. Coating data shall be as follows:

- Surface preparation: clean and dry
- Coverage: theoretical 615 square feet per gallon at 1.0 mil dry film thickness
- Dry film thickness: 1.0-2.0 mils per coat
- Wet film thickness: 3.0-8.0 mils per coat

Apply coating in accordance to manufacturer's recommendations.

Paint shall be manufactured by Induron or approved equal.

After installation, the Contractor shall paint all steel sleeves, tapping sleeves, threaded rods, straps, nuts, bolts, washers, couplings, or other connecting/restraining apparatus with either Roster Laboratories, Inc., "Roskote Mastic No. A-939", Koppers Company, Inc., "Bitumastic Superservice Black", or approved equivalent protective coating.

1.02 PVC Pipe:

PVC pipe shall be Underwriters' Laboratories approved and listed and must meet all requirements of ASTM D2241 and bear the seal of conformance to NSF61. PVC pipe used for reclaimed water mains shall be color-coded using sunlight stable pigment Pantone Purple 522C. It shall meet or exceed AWWA C900 with the following supplemental specifications:

- A. Pressure Pipe - Pipe less than 4 inches shall be Polyethylene Pipe, 200 psi, SDR-7CTS. Pipe 4 inches to 12 inches shall be C-900 with Dimension Ratio 18 or lower (thicker). Plastic pipes are not allowed for sizes larger than 12 inches.
- B. Routine Hydrostatic Proof Test Requirements - Each piece of pipe shall be tested at four (4) times rated pressure class by the Manufacturer.
- C. Outside Diameter - Pipe shall have cast iron pipe outside diameter.
- D. Joints - Pipe shall have elastomeric-gasket integral bell end. Bell section shall have a thickened wall. Gasket groove Wall thickness shall meet or exceed the thickness of the pipe barrel.

Mechanical Joints shall conform to ANSI/AWWA C111/A21.11, latest revision. All joints of mechanical joint ductile iron and fittings shall be installed in accordance with the requirements of AWWA C600, Section 3.4. Bolts shall conform to ANSI B18.2.1, latest revision. Nuts shall

conform to ANSI B-18.2.2, latest revision. Bolts and nuts shall conform to ANSI B1.1

Restrained joints for pipe, valves, and fittings shall be mechanical joints with ductile iron retainer glands equivalent to "Megalug" or push-on type joints equivalent to "Lock-Ring," "TR Flex," or "Super-Lock," and shall have a minimum rated working pressure of 250 psi. The coating shall consist of a minimum of two coats of liquid Xylan® fluoropolymer coating with heat cure to follow each coat. The coating system shall be Mega-Bond™ by EBAA Iron, or approved equal. Restrained joints shall be capable of being deflected after assembly and they shall have a preset deflection of no more than 5 degrees while being able to take up to 3 degrees of deflection after burial.

- E. Fittings - Ductile iron shall be mechanical-joint type conforming to ANSI/AWWA C153/A21.53, latest revision, with cement mortar lining and seal coat in accordance with ANSI/AWWA C104/A21.4, latest revision, and one mil thick petroleum exterior coating in accordance with ANSI/AWWA C104/ A21.4, latest revision, unless otherwise shown.
- F. Affidavit of Compliance - The manufacturer shall furnish an affidavit that all materials delivered comply with the requirements of this standard and supplemental specifications.
- G. Couplings and Fittings – Couplings and fittings shall be furnished by the pipe manufacturer and shall accommodate the pipe for which they are to be used. They shall have the same minimum pressure rating as the pipe. Coupling method shall allow for expansion or contraction of each pipe section to be taken up at each end of the pipe. Couplings shall permit five (5) degree deflection (2 2 degrees on each side) of the pipe with any evidence of infiltration, exfiltration or breaking.
- H. Gaskets – PVC pipe joint gaskets shall meet the requirements of ASTM F477.

1.03 Steel Casing and Casing Spacers:

Steel casing and casing spacers shall be manufactured and installed as specified below,

- A. Casing pipe shall be steel conforming to ASTM A139, yield point of 35,000 psi, of the diameter and thickness shown on the contract drawings for each crossing. All pipe within casing shall be restrained

joint ductile iron.

- B. Casing spacers shall be bolt on style with a shell made in two (2) sections of Heavy T-304 Stainless Steel. Connecting flanges shall be ribbed for extra strength. The shell shall be lined with a PVC liner. All nuts and bolts shall be 18-8 Stainless Steel. Runners shall be made of Ultra High Molecular Weight Polymer with inherently high abrasion resistance and a low coefficient of friction. Runners shall be supported by risers made of Heavy T-304 Stainless Steel. The combined height of the supports and runners shall keep the carrier pipe a minimum of 0.75" from the casing pipe at all times. Casing Spacers shall be as manufactured by Cascade Waterworks Manufacturing Company, or approved equal.

1.04 Gate Valves:

Gate valves shall be right hand operational only and shall conform to the following Specifications:

- A. Resilient-Seated Gate Valves (3 Inches to 12 Inches) - Resilient-seated gate valves 3 inches to 12 inches shall conform to AWWA C509 with non-rising stem.

Unless otherwise indicated or specified, gate valves shall be designed for a working pressure of not less than 250 psig.

Valves shall take full pressure on either face. Valves shall be from one manufacturer and similar sizes shall be identical and parts interchangeable. They shall be constructed with bolted bonnets provided with two O-ring stem seals, which can be replaced with the valve under pressure in the full-open position.

Valves shall be constructed of materials conforming to AWWA C509. All internal and external surfaces shall be coated with fusion-bonded epoxy to a minimum thickness of 8 mils.

Valve seats shall be coated with a rubber material conforming to AWWA C509 so that there shall be no rubber to metal contact when the valve is in the fully closed position.

Valves shall be hydrostatically tested in accordance with AWWA C509.

Valves shall be American, Waterous or approved equal and shall be furnished with standard hand wheels, chain wheels or nuts as shown on the Drawings and/or as specified.

- B. Ball Valves (2 Inches & Smaller) - Ball valves 2 inches and smaller shall be designed for a working pressure of not less than 300 psi, domestic made brass, and shall conform to AWWA standard C 800-89.
 - a) Standard tee head stops in body permit 90-degree right turn only.
 - b) Padlock wings shall be used on the tee head.

1.05 Butterfly Valves 14 Inches and Larger:

- A. Butterfly Valves 14 Inches and Larger - Butterfly valves 14-inches and larger shall be of the tight closing, right hand operational only, rubber seated type, with rubber seat positively locking in place against flow from either direction. No metal-to-metal seating surfaces will be permitted. Valves shall be bubble-tight at rated pressures with flow in either direction. Butterfly valves shall conform to ANSI/AWWA C504, Class 150B.

Valve body shall be high-strength cast iron ASTM A126 Class B with 18-8 Type 304 stainless steel body seat. Valves shall have Mechanical Joints per AWWA C111. All MJ accessories (bolts, glands, gaskets) shall be supplied by the valve manufacturer. Valves for below ground service shall be installed using restrained joints.

Valve shafts shall be 304 stainless steel and shall consist of a one-piece, extending full size through the entire valve or 18-8 stainless steel stub shaft design keyed to the vane with stainless steel torque plugs.

Valve discs shall be solid ductile iron with an epoxy coating making it corrosion resistant. The thickness of the discs shall not exceed 2-1/4 times the shaft diameter.

Valve seats shall be natural or synthetic rubber providing 360 degrees uninterrupted seating. The resilient seat shall be adjustable or replaceable in the field without burning or grinding. The seat shall be molded over a stainless steel ring for support and secured to the disc by corrosion resistant, self-locking stainless steel screws.

All internal ferrous metal surfaces in the waterway shall be factory coated with a non-toxic, two-component, holiday-free, thermosetting epoxy to a nominal thickness of 4 mils. All external surfaces shall be coated with an epoxy coating conforming to AWWA C-550, with a minimum thickness of 10 mils.

All butterfly valves shall be manually operated. Operators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in

any intermediate position without creeping or fluttering. Operators shall be furnished with externally adjustable mechanical stop limiting devices. Valves shall have a 2-inch square-operating nut and shall be installed with extension stems to extend the operating nut in accordance with the project details. The operator shall be integrally mounted on the valve-mounting flange and shall have all gearing totally enclosed for buried service. Maximum force for operating nut shall be 40 pounds.

All valves shall be M&H model 4500, or approved equal.

- B. Tapping Sleeves and Valves - Tapping sleeves and valves shall be used for making branch connections to an existing water main. Tapping sleeves shall be provided at the locations indicated on the Drawings and shall be mechanical joint type, Mueller No. H-615, Clow F-5205 or approved equal. Tapping valves shall be mechanical joint type gate valves, Mueller No. 667, Clow F-5093 or approved equal, and shall conform to the requirements of this Section.
- C. Tapping Saddles (Service Saddle) - Tapping saddles shall be used for making service connections on 4" and larger PVC and/or Ductile Iron Pipe. Drawings shall show a Smith Blair Series 317 service saddle or approved equal. At each point where a 1 2" or 2" connection is required.
- D. Air Release Valves - Air Release Valve shall be 2-inch screwed inlet. The air release valve shall be designed to permit automatic escape of large quantities of air from the pipeline when the line is being filled and must also allow accumulating air to escape while the line is in operation and under pressure. The body and cover shall be able to operate at pressures up to 300 psi. The open end of and air relief pipe from automatic valves or from a manually operated valve shall be extended to the top of the pit and provided with a screened downward facing elbow.

Air release valve manufacturer shall be Crispin Model No. PL-10 or VENT O MAT Series RBX, or approved equal.

- E. Water Service Pipe Material - Pipe shall conform to AWWA Specifications C901-96, Polyethylene Pressure Pipe and Tubing, and shall be marked with AWWA requirements and the following:

<u>Polyethylene</u>	<u>To Be Marked</u>
<u>Nominal Size</u>	<u>On Pipe</u>
ASTM D2837	X
SDR 9	X
PE 3408	X
Working Pressure - 160 psi	X

Water Service Tubing	X
National Sanitation Foundation (NSF 14)	X
Pipe Color	Pantone Purple 522

Unmarked pipe, without information noted above, will not be accepted. Polyethylene pipe shall comply with ASTM D1248 PE3408 Class III, A, 5, P34. Brass (Domestic Made) or bronze compression type fittings shall be used. Flared connections will not be permitted. Continuous metallic tape over the pipe and tracing wire will be required. No gooseneck will be allowed nor will solvent weld joints be allowed. Corporation and curb stops will be required on all laterals. Minimum nominal size shall be 1 inch.

- F. Corporation Stops - At each tapped point a connection to the pipe shall be made by installing a corporation stop. Corporation stops shall be Ford F 1000-4-G AWWA/CC Ground Key Corporation Stop, or approved equal, as required for the type of pipe being tapped.
- G. Curb Stops - Curb stop shall be 1 inch size or as shown on the Drawings and shall be Ford C14-44G1 FIP x GJCTS with a Brass, domestic made, square head cored plug, or approved equal.
- H. Service Saddles - Service saddles shall epoxy coated, ductile iron, double strap - stainless steel manufactured by Smith-Blair, Model 317 Service Saddle, or approved equal.
- I. Valve Box - Each buried valve shall be accompanied by a valve box of the adjustable type of heavy pattern, constructed of cast iron, and provided with cast iron cover.

The upper section of each box shall have a flange at the bottom, having sufficient bearing area to prevent settling. The bottom of the lower section shall enclose the operating nut of the valve. Boxes shall be of lengths consistent with pipe depths as shown on the Drawings. Boxes shall be adjustable, with a lap of at least 6-inches when in the most extended position. Covers shall have the words "RECLAIMED WATER" cast in the top. Each valve box shall have a concrete round collar installed around the top along with a concrete valve marker at each valve.

1.06 Valve Manhole

- A. General - Manholes shall be constructed at such points as designated on the Drawings. Riser and top sections shall be installed level and plumb, such that all manhole steps are in alignment. The top of manholes outside of roads, streets and highways shall be built to grades 2 inches above ground surface, unless

otherwise shown. Manholes in roads, streets and highways shall be built to grades shown on the Drawings.

- B. Precast Concrete Manholes - Precast Concrete manholes shall be constructed of reinforced Class "A" Concrete. Walls shall be not thinner than 5 inches, or 1/12 of the inside diameter, whichever is greater. Precast manholes shall meet all requirements of ASTM C478, "Specification for Precast Reinforced Concrete Manhole Sections."

Rings shall be custom made with openings to meet the necessary pipe alignment conditions and invert elevations. All inlets and outlets shall be cast in or core drilled. Joints and gaskets shall conform to the applicable provisions of ASTM C443, "Joints for Circular Concrete Sewer and Culvert Pipe using Rubber Gasket" or Ram-Nek Pre-molded Plastic Joint Sealer. The sealing compound shall not leak at the joints (while being tested, if required, at 10 psi) for a period of 24 hours. Bell and spigot surfaces shall be smooth, accurately formed, and provide a loose, sliding fit, with a clearance between the bell and spigot of not more than 1/6 inch. Precast manholes shall be bedded on not less than 6 inches of compacted crushed stone at the Contractor's expense. The crushed stone shall extend not less than 6 inches outside the walls of the manhole and under the entire length of pipe within the excavation for the manhole.

- C. Manhole Castings - Provide covers with the inscription "RECLAIMED WATER" cast into the cover in lettering at least 2 inches high. Covers shall be 25-3/4 inches in diameter and shall be 2-inches thick at the bearing surface. Frame shall provide a 24-inch clear opening. Manhole covers and frames shall be USF 227, or equal.
- D. Meter Box - 3/4" and 1" - Meter boxes shall be of cast iron and shall be 3/4" stretch box Ford LYL141-243T or stretch box Ford LY 111-444-YBL-T, or approved equal. The lid shall have the word "RECLAIMED WATER" cast in it.
- E. Tracing Wire - Tracing wire shall be single strand #12 AWG, Vinyon - A THWN or THHN or gasoline and oil resistant II VW 600V or AWM. Tracing wire shall be continuous with all reclaimed water mains. Tracing wire for reclaimed water laterals shall be a single strand from the main to the end of the service lateral terminating in the meter box. Tracing wire shall be a single strand installed from the main to all Utility Marking Post line markers with sufficient length at the marker to be wrapped around the marker several times.
- F. Concrete Valve Marker - Concrete valve marker shall be 4"x4" square by 4'-6" in length with 4-#3 re-bar cast in 4,000 psi concrete. All corners shall have a 3/4" chamfer. A 2" brass marker plate with anchor shall be embedded in the top. The brass plate shall have a directional arrow pointing to valve with the distance to the nearest foot and shall be labeled "Reclaimed Water Valve". The concrete

valve marker shall be set 24" in the finish grade and shall be painted Pantone Purple 522.

- G. Utility Marking Post - Utility parking post shall be placed every 500 feet or as shown on the Drawings above the utility and at fittings and labeled accordingly. The marking post shall be rigid enough to be easily installed in most soil conditions and durable to withstand repeated impacts. The marking post shall be a four (4) inches in width and remain flexible from -40°F to +140°F with UV stabilizers. The marker shall highly visible standard fade resistant colors, White Background and Pantone Purple 522 Lettering with the following imprinted thereon: international ANo Dig@ symbol, federal law warning, "RECLAIMED PIPELINE " with letter size and stroke to comply with the Federal Office of Pipeline Safety Specifications, City of Savannah's name, Water Distribution phone number and State one-call number. Markers shall be Rhino 3-Rail with poly tech coating, or approved equal.
- H. Caution Tape – Caution tape shall consist of a minimum 4.0 mil thickness inert polyethylene plastic that is resistant to alkalis, acids and other destructive elements found in the soil. The tape shall have a minimum 3" width and a minimum tensile strength of 2,800 psi. A continuous warning message repeated every 16" to 36" shall be imprinted on the tape surface. The tape shall contain Pantone Purple 522 color designating the color code appropriate to the line being buried "Caution – Buried Reclaimed Water Line Below" imprinted in black. Caution tape shall be installed 24" above the pipe on all water mains.

PART 2 - EXECUTION:

Excavation, trenching, and backfill for the reclaimed water distribution system shall be as specified below. A minimum cover over the top of the pipe shall be as specified in Subpart 2.01 A.4, from the sub-grade, shoulder or finish grade. A minimum 5' face to face minimum horizontal separation between reclaimed water main and sanitary sewer and drainage lines shall be provided.

2.01 Installation:

Ductile iron pipe shall be laid in accordance with ANSI/AWWA C600; Plastic pipe shall be laid in accordance with AWWA C605, AWWA M23, ASTM D2774, UNI-Bell UNI-B-3 and the pipe manufacturer's recommendations.

Pipe, fittings, valves, other accessories shall, unless otherwise directed, be unloaded at the point of delivery, hauled to and distributed at the site of the project by the Contractor. They shall at all times be handled with care to avoid damage. In loading and unloading, they shall be lifted by hoists or slid or rolled on skidways in such a manner as to avoid shock. Under no circumstances shall they be dropped. Pipe

handled on skidways must not be skidded or rolled against pipe already on the ground. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Coated pipe shall be handled in such a manner that a minimum of damage to the coating will result. Damaged coating shall be repaired. Pipe shall be placed on the site of work parallel with the trench alignment and with bell ends facing the direction in which the work will proceed unless otherwise directed. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Valves shall be drained and stored in a manner that will protect them from damage by freezing before installation. Before installation of any materials, a City of Savannah Inspector shall inspect and approve all material before installation.

Cutting pipe for inserting fittings, or closure pieces, shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise directed, pipe shall be laid with the bell ends facing the direction of laying. For lines on an appreciable slope, bells shall face upgrade. Whenever necessary to deflect the pipe from straight line, whether in the vertical or horizontal plane to avoid obstructions, the degree of deflection shall not exceed 2-1/2 degrees. No pipe shall be laid in water or when the trench condition or the weather is unsuitable for such work. Installation shall be in accordance with manufacturer's instructions.

All pipe and fittings shall be carefully lowered into the trench piece by piece by means of derrick, ropes or other suitable tools or equipment in such a manner as to prevent damage to the pipe. Under no circumstances shall pipe or accessories be dropped into the trench. Before lowering and while suspended, ductile iron pipe shall be inspected for defects and rung with a light hammer to detect cracks. Any defective, damaged or unsound pipe shall be rejected. All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered into its position in the trench and it shall be kept clean by approved means during and after laying. Care shall be taken to prevent dirt from entering the joint space. At all times when pipe laying is not in progress, the open ends of the pipe shall be closed by approved means and no trench water shall be permitted to enter the pipe.

- A. Alignment and Grade – The reclaimed water mains shall be laid and maintained to lines and grades established by the plans and specifications, with fittings and valves at the required locations unless otherwise accepted by the owner. Valve-operating stems shall be oriented in a manner to allow proper operation.
 - 1. Prior Investigation - Prior to excavation, investigation shall be made to the extent necessary to determine the location of existing underground structures and conflicts. Care shall be exercised by the contractor during excavation to avoid damage to existing structures. The pipe manufacturer's recommendations shall be used when the reclaimed water main being installed is adjacent to a facility that is cathodically protected.

2. Unforeseen obstructions - When obstructions that are not shown on the plans are encountered during the progress of work and interfere so that an alteration of the plans is required, the owner will alter the plans, or order a deviation in line and grade, or arrange for removal, relocation, or reconstruction of the obstructions.
 3. Clearance - When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the acceptance of the owner, to provide clearance as required by federal, state, and local regulations or as deemed necessary by the owner to prevent future damage or contamination of either structure.
 4. Depth of Pipe - The Contractor shall perform excavation of whatever substances are encountered to a depth that will provide a minimum cover over the top of the pipe of 36-inches from the existing or proposed finished grade, for pipe 12-inches and smaller. Pipe larger than 12-inches in diameter shall have 48-inches of cover from the finished grade. A maximum cover of 60" (inches) from finished grade shall be used unless approved by the City to avoid a conflict. If the cover will be less than 36", duct iron pipe shall be used.
 5. Fluorinated Hydrocarbon Gaskets - Fluorinated hydrocarbon gaskets are intended for use in soils where a possibility of petroleum contamination is present. Fluorinated hydrocarbon gaskets shall only be used where specifically called for on the drawings.
- B. Trench Construction - The trench shall be excavated to the alignment, depth, and width specified or shown on the plans and shall be in conformance with all federal, state, and local regulations for the protection of the workers.
1. Trench Preparation - Trench preparation shall proceed in advance of pipe installation only as far as stated in the specifications or as directed by the owner. Discharge from any trench-dewatering pumps shall be conducted to natural drainage channels, storm sewers, or as directed by applicable regulatory agencies. Excavated material shall be placed in a manner that will not obstruct the work nor endanger the workers or the public, or obstruct sidewalks, driveways, roadways, or other structures. Placement of excavated material shall be done in compliance with federal, state, and local regulations.
 2. Pavement Removal - Removal of pavement and road surfaces shall be a part of the trench excavation. The amount removed shall depend on the width of trench required for installation of the pipe and the dimensions of the area into which valves, hydrants, manholes, or other structures

will be installed. The dimensions of pavement removed shall not exceed the dimensions of the opening required for installation of pipe, valves, hydrants, specials, manholes, and other structures by more than 6 inches in any direction, unless otherwise required or accepted by the owner. Methods such as sawing, drilling, or chipping shall be used to ensure the breakage of pavement along straight lines. Pavement removal shall occur in accordance with the City of Savannah standard details.

3. Width - The width of the trench at the top of the pipe shall be the same as that afforded by the single-pass capabilities of normally available excavating equipment, and shall be ample to permit the pipe to be laid and joined properly and to allow the backfill to be placed as specified. Trenches shall be of such extra width, when required, to permit the placement of timber supports, sheeting, bracing, and appurtenances as required by the safety requirements of the agency having jurisdiction.
4. Bell holes - Holes for the bells shall be provided at each joint, but shall be no larger than necessary to allow joint assembly and to ensure that the pipe barrel will lie flat on the trench bottom. Push-on type joints require only minimum depressions for bell holes. Other than noted previously, the trench bottom shall be true and even to provide support for the full length of the pipe barrel, except that a slight depression may be provided to allow withdrawal of pipe slings or other lifting tackle without damaging coating or polyethylene encasement.
5. Clearances and bedding procedures shall be observed for pieces of concrete or masonry and other debris or subterranean structures, such as masonry walls, piers, or foundations, that may be encountered during excavation. When encountered, all structures shall be removed to provide a clearance below and on each side of all pipe, valves, and fittings of at least 18 inches for pipe sizes 24 inches or smaller and 24 inches for pipe sizes 30 inches or larger. When excavation is completed, a layer of appropriate backfill material shall be placed on the bottom of the trench to the previously mentioned depths, leveled, and tamped.
6. Previous excavations - Should the trench pass over a sewer or other previous excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soil or to conform to other regulatory requirements in a manner that will prevent damage to the existing installation.
7. Protection of Property - Trees, shrubs, fences, and all other property and surface structures shall be protected during construction, unless their removal is shown in the plans and specifications or directed by the owner. Any cutting of tree roots or branches shall be done only as

directed by the City of Savannah Engineering Department. Temporary support, adequate protection, and maintenance of all underground and surface structures, drains, sewers, and other obstructions encountered in the progress of the work shall be provided in accordance with specifications or applicable regulations. All properties that have been disturbed shall be restored as nearly as practical to their original condition.

8. Unsuitable subgrade material - When the subgrade is found to include ashes, cinders, refuse, organic material, or other unsuitable material, such material shall be removed to a minimum of at least 6 inches below the bottom of the pipe or to the depth ordered by the engineer. The removed material shall be replaced, under the direction of the engineer, with clean, stable backfill material. The bedding shall be consolidated and leveled so that the pipe may be installed.
 9. Safety - Appropriate traffic-control devices shall be provided in accordance with federal, state, and local regulations to regulate, warn, and guide traffic at the work site.
- C. Pipe Installation - Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, and valves shall be lowered carefully into the trench by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to reclaimed water main materials and protective coatings and linings. Under no circumstances shall reclaimed water main materials be dropped or dumped into the trench. Where necessary, the trench shall be dewatered prior to installation of the pipe. Chains shall not be allowed to transport of lower pipe into the trench.
1. Examination of material - All pipe, fittings, valves, and other appurtenances shall be examined carefully for damage and other defects immediately before installation.
 2. Pipe ends - All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign materials before the pipe is laid.
 3. Pipe cleanliness - Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing, or other materials shall be placed in the pipe at any time. Excessive flush water required to clean the pipe after installation may be charged to the contractor.

4. Pipe placement - As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with acceptable backfill material.
 5. Direction of bells - It is common practice to lay pipe with the bells facing the direction in which work is progressing; however, it is not mandatory. For example, when the main is being laid on a slope, the pipe is frequently laid with the bells facing uphill for ease of installation. The direction of the bells is not functionally related to the direction of flow within the main.
 6. Pipe plugs - At times when pipe-laying is not in progress, the open ends of pipe shall be closed by a temporary water-tight plug approved by the owner. The plug shall be fitted with a means for venting. When practical, the temporary plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation, should the trench fill with water. Prior to removal of a permanent plug for extending the line or for any other reason, air and/or water pressure in the line shall be released.
 7. Joint deflection - When it is necessary to deflect pipe from a straight line in either the horizontal or vertical plane, the amount of joint deflection shall not exceed that shown in Tables 1 or 2. The deflections listed are maximum deflections and should not be exceeded.
 8. Pipe cutting - Cutting pipe for insertion of valves, fittings, or closure pieces shall be done in conformance with all safety recommendations of the manufacturer of the cutting equipment. Cutting shall be done in a safe, workmanlike manner without creating damage to the pipe or cement-mortar lining.
 9. Cut ends and rough edges shall be ground smooth, and for push-on joint connections the cut end shall be beveled by methods recommended by the manufacturer and accepted by the owner.
- D. Reclaimed Water Service Connection - Service lines shall be connected to 4-inch and larger mains with a corporation stop. Connections to mains smaller than 4-inches shall be made with a rigid connection. Plugged tees or crosses for future connections shall be installed where shown on the Drawings. A house service connection shall be provided to vacant lots and the exact location marked on the curb with a "RW". The mark shall be made on the vertical face of the curb and shall be a minimum of 1/4-inch deep made with a branding iron. Where services are provided at locations without curb, a 2"x4" 30-inch long pressure treated flag stake painted white shall locate the end of the lateral.

Minimum cover of 30-inches shall be provided until a short transition to the service is stubbed out of the ground.

Reclaimed Water service laterals installed under roadways shall be installed a minimum of 30 inches below the road (laterals shall not be installed in the base of the road). Water service laterals shall be installed one foot short of the property line of all lots along street and right -of-ways in which reclaimed water main is constructed.

- E. Brass Nipples and Brass Pipe Fittings (Domestic Made) - Threads shall be cleanly cut with sharp tools and the jointing procedure shall conform to the best practice. Before jointing, all scale shall be removed from pipe by some suitable means. After cutting, all pipe shall be screwed together with an application for graphite and engine oil, Teflon tape, or other sealing compound applied to all threads and once a joint has been screwed on it shall not be backed off unless the threads are re-cleaned and new compound or Teflon tape applied. Unions shall be installed at every connection to the supply line.
- F. Connection to Existing Reclaimed Water System - The Contractor shall furnish necessary materials and perform all excavation, dewatering, shoring, backfilling, etc., necessary to make the connection of a new reclaimed main to the existing reclaimed water main. The Contractor shall notify the Inspector and City of Savannah, a minimum of 72 hours in advance of construction. The Contractor shall be responsible for coordinating his construction with the City of Savannah. No cross-connection between the reclaimed water system and the potable water system will be allowed.
- G. Damage to Reclaimed Water System - Damage to any part of the reclaimed water system by the Contractor, or subcontractors, that is repaired by City of Savannah shall be charged to the Contractor on the basis of time and material, plus 30 percent for overhead and administration.
- H. Joint Restraints - All restraints shall be used in accordance with engineering and manufacturer=s specifications. Thrust block is not allowed. Joint restraints shall be: Ford 1390 Series, Mega-Lug, EBBA Series 1100 for Ductile Iron 4" and larger, EBBA Series 2000 PV for PVC Pipe 4" and larger, Flexlock, T-lock, Uni-Flange, or approved equal.

2.02 Cleaning of new reclaimed mains:

Clean the interior of all pipe by brushing, swabbing or washing out all debris before laying. Stop up all branches and other openings with wooden plugs or heads until either capped or connected. The use of a cross connection device during flushing shall be required. A flushing velocity of not less than 2.5 feet per second shall be maintained in

pipe sizes less than 24-inches in diameter. For larger diameter mains, an alternative to flushing, such as broom sweeping of the main, is acceptable.

Flush the new pipe lines for a full pipe open end flush until the water runs clear at the end of all mains and laterals. This should be done after the pressure test.

The Contractor is responsible for coordinating with the City Inspector and the City Water Distribution Department to arrange a City of Savannah inspection. Lines will not be placed in operation until City of Savannah approval and the City Inspector directs Contractor to do so.

2.03 Identification and tracer wire:

- A. Mylar tape shall be installed 18 inches below the finished grade over the top of the reclaimed water mains. The tape shall be 2 inches wide, of Pantone purple 522 color and have imprinted on the tape "Caution – Reclaimed Water Line Below." The tape shall be laid the entire length of the trench.
- B. No. 12 AWG solid plastic-coated copper wire shall be installed on top of all water mains where non-metallic pipe is used and attached by means of securing the wire on top of the water main with a 12-inch long by 2-inch wide piece of duct tape. Attach the wire to the main every ten (10) feet.

Wire shall be bonded at splices with 3M DBY-6 Direct Bury Splice Kit at every connection

The wire shall be laid the entire length of the trench and shall be continuous. The Contractor shall demonstrate continuity in wire through the entire length of the project. At every valve manhole the wire shall be run through the pipe opening, up to the ring and cover, secured at the ring by means of grouting the ring to the top of the manhole. The wire shall continue in the same loop back to the opposite pipe opening, through it and continuing in one continuous loop along the main.

At every reclaimed water service lateral, the wire shall be run from the main and corporation stop to the curb stop and attached to the polyethylene pipe by a piece of duct tape wrapped around the wire and tubing. The wire shall be connected to the tracer wire at the main with a single strand from the reclaimed water main to the curb stop or into the meter box.

City of Savannah will field verify all tracer wire prior to acceptance.

PART 3 - TESTING:

3.01 Hydrostatic testing:

All pressure and leakage test shall be performed in accordance with the latest edition of AWWA C600. Leakage test shall be conducted simultaneously with the pressure test. The duration of the test shall be 2 hours and during the test the main or section of main under test shall be subjected to a pressure of 150 psi based on the lowest point in the line or section under test, and connected at that elevation to the test gauge. Test pressure shall not vary more than 5 psi for the duration of the test. Testing allowance shall be defined as the quantity of makeup water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi of the test pressure after the pipe has been filled with water and the air has been expelled. Testing allowance shall not be measured by a drop in pressure in a test section over a period of time. Testing allowance is defined as the quantity of water to be supplied into the newly laid pipe or any valved section thereof, necessary to maintain the specified leakage test pressure after the air has been expelled and the pipe has been filled with water at the test pressure. No pipe installation will be accepted until the testing allowance is less than the number of gallons per hour as determined by the formula.

$$L = \frac{S \times D \times P}{133,200}$$

L = testing allowance (makeup water) in gallons per hour

S = the length of pipe tested in linear feet.

D = the nominal diameter of the pipe in inches

P = the average test pressure during the hydrostatic test in pounds per square inch (gauge).

Should any test of pipe laid disclose leakage greater than the above specified, the Contractor shall at his own expense locate and repair the defective joints until leakage is within the specified testing allowance. All visible leaks shall be repaired regardless of the allowance used for testing. Line shall be retested until Testing Allowance requirement are within the allowable leakage. All additional testing shall be at the Contractors expense.

The Contractor shall provide all necessary equipment and shall perform all work required in connection with the tests. Each section shall be tested by hydrostatic pressure of 150 pounds per square inch. Each section shall be slowly filled with water, care being taken to expel all air from the pipes. If necessary, the pipe shall be tapped at high points to vent the air. The required pressure as measured at the point of lowest elevation shall be applied for not less than 2 hours and all pipe, fittings, valves, and joints shall be carefully examined for defects. Each valve shall be opened and closed several times during the test. Failure of valve(s) to perform will result in its removal from the job site and replacement by the Contractor at his expense. All defective joints shall be repaired or replaced.

END OF SECTION 02560

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