



# **SPECIFICATION 333002: WASTEWATER FORCE MAINS AND APPURTENANCES**

## **PART 1.0 GENERAL**

### **1.1 DESCRIPTION**

The following specification covers the design, installation, inspection, testing, and acceptance of wastewater force main systems. Construction consists of furnishing all labor, equipment, tools, appliances and materials for performing all operations necessary for the construction and installation of wastewater force mains, including all wastewater, sewage sludge, raw sewage and effluent piping, valves, valve boxes, casings, and appurtenances, complete and ready for operation, as indicated on the construction drawings and described herein. All requirements of the Florida Department of Environmental Protection must be complied with in addition to the criteria contained within.

- 1.1.1 The Developer/Contractor must furnish to the County a two-year warranty on the materials, fabrication, and workmanship of any and all pipe and fittings furnished and installed. The Developer/Contractor must guarantee all work and rectify any defects due to faulty materials or workmanship during the warranty period. The Developer/Contractor must also pay for damage to other work resulting from faulty materials or workmanship which occurs within said period. Warranty periods typically commence upon written acceptance of the component or appurtenance by the County for ownership and operation. Section 1.6.4 of the Hillsborough County Public Utilities Water Resources Department (WRD) Technical Manual describes the requirements and duration of a Warranty Bond for all contributed assets.
- 1.1.2 All Construction plans, project submittals and record drawings must comply with the requirements of Section 1 and Section 2 of the Hillsborough County Public Utilities Water Resources Department (WRD) Technical Manual.

### **1.2 REFERENCE DOCUMENTS**

- American Association of State Highway & Transportation Officials (AASHTO).
- American National Standard Institute (ANSI)
- American Petroleum Institute (API)
- American Society of Mechanical Engineers (ASME)
- American Society for Testing and Materials (ASTM)
- American Water Works Association (AWWA)
- Florida Department of Transportation (FDOT)
- Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)
- NSF International (NSF)

### **1.3 SHOP DRAWINGS AND SUBMITTALS**

- 1.3.1 For County run projects, shop drawings and related manufacturer's product certification must be made in accordance with the General and Special Conditions of the Contract for approval prior to purchase or fabrication of the material by the manufacturer. Additional shop drawings may be required by the Contract, but the following items that will require shop drawings are brought to the



Contractor's attention:

- 1.3.1.1 Detail drawings of all classes of pipe, joints, and fittings.
  - 1.3.1.2 Detail Drawings of restrained and flexible joints, including test reports to confirm thrust restraint capacities and restraining mechanism application.
  - 1.3.1.3 Pipeline laying schedule, for pipelines greater than 12-inch in diameter, tabulated and referenced to construction line and grade controls shown on plans, with station, offset, and elevations. References must be provided for pipe fittings, valves, connections and other important features of the pipeline.
  - 1.3.1.4 Detail drawings showing location/plan views of all Jack and Bore Pits (Specification 330524) and all Horizontal Directional Drill Pits (Specification 330523).
  - 1.3.1.5 Line Connections.
  - 1.3.1.6 Valves and Valve Boxes.
  - 1.3.1.7 All Appurtenant Items.
  - 1.3.1.8 Contractor's plan to record and electronically monitor every fusion joint for all fusible PVC installed. The plan must include the names of the fusion technicians and certification(s), a description of the equipment to be used, and logged information for each joint must include the proposed heat plate temperatures, and fusion heating/cooling times and pressures, etc.
  - 1.3.1.9 Contractor's flushing and testing plans for all force main pressure piping supplied.
- 1.3.2 Certification and test reports for the materials, manufacturing, and testing of the types of pipe must be performed and furnished by the pipe manufacturer/supplier in accordance with the latest standards of the industry as described in Part 1.2.
- 1.3.3 **Shop drawing submittals for items listed in Appendix B, the Approved Products List, do not require material certification.**
- 1.3.4 Submit a copy of any design exception prior to installation. Design exceptions are issued by the Utility Design Section Manager. Any deviation from the specifications requires a design exception.

## 1.4 RELATED WORK

- All Sections of Division 03
- All Sections of Division 33
- Hillsborough County Public Utilities Technical Manual
- Hillsborough County Utility Accommodation Guide and Rights of Way Use Procedures Manual (UAG)
- Hillsborough County Transportation Technical Manual (TTM)

## PART 2.0 DESIGN

### 2.1 FLOW CRITERIA

- 2.1.1 Flow estimates for design must be calculated based on full or projected ultimate development. The average daily flow (ADF) for single family or master-metered residences must be the per unit demand factors contained in the most current Hillsborough County Utility Rate Resolution. Industrial and commercial design flows for sanitary wastewater must be no less than the values given in Table 1 of the County's Utility Rate Resolution.



- 2.1.2 Wastewater gravity collection systems, pumping stations, and force mains must be designed for average daily flow times the appropriate peaking factor. Refer to Section 4 of the Public Utilities Technical Manual for flow criteria and peaking factors.
- 2.1.3 Force mains must be designed to maintain a minimum velocity of two feet per second (fps). For design friction losses in force mains calculated using the “Hazen-Williams” formula, the value for “C” must not exceed “C=100” for unlined iron or steel pipe, and “C=120” for smooth pipe materials such as PVC and lined ductile iron.

## **2.2 MINIMUM SIZE**

- 2.2.1 The minimum size force main constructed within the County road right-of-way or dedicated easements must not be less than four inches in diameter.
- 2.2.2 Force mains must be sized to carry the full development peak flow (ref. Part 2.1) from all connected pumping stations within the designated stations service area. Each force main system should be capable of transporting the peak flow from each pump station operating simultaneously without producing excessive pressure, i.e., not to exceed 100 feet Total Dynamic Head (TDH) anywhere in the system.

## **2.3 LINE ROUTING**

- 2.3.1 Force mains for a residential or commercial subdivision must be routed within County Road Right-of-Way.
- 2.3.2 Points of connection to existing transmission mains (line sizes greater than 16 inches in diameter) require special review and consideration. Refer to Part 4.14 listing requirements for all connections to existing force mains.
- 2.3.3 All designs require the EOR to have Level “A” SUE work (locate) performed for all points of connection. Level “A” SUE must comply with the definition by ASCE 38-02 and adopted by FDOT.
- 2.3.4 When the point of connection is an asbestos line, the Water Resources Department (WRD) Utility Coordination Team must be contacted to work out the details at the connection point.
- 2.3.5 Lines crossing arterial roads, collector roads, and any single access entry to a subdivision, traditional neighborhood, or commercial driveway must be cased. The casing must extend two feet beyond the back of curb, or eight feet from the edge of pavement including paved shoulders. Refer to Hillsborough County Utility Accommodation Guide and Right of Way Use Procedures (UAG).
- 2.3.6 All crossings of arterial and collector roads must be by jack and bore, unless an alternate installation method is approved by Right-of-Way Permitting, or the Jurisdictional Authority for the road.
- 2.3.7 For projects where the proposed improvement is over existing wastewater lines, all pipe material not meeting the currently approved specifications will require replacement and relocation.
- 2.3.8 Minimum force main line clearance from the property line is five feet.



2.3.9 Where inverted crown roads are installed the utility infrastructure will be private.

## **2.4 DEPTH OF COVER**

2.4.1 The depth of cover, as measured from finished grade to the top of the pipe must be not less than 48 inches.

2.4.2 When automatic air release valves are required, the depth of cover of the entire line must be increased to a minimum of 52 inches (enough to maintain the valve vault flush with the existing or proposed grade). See Specification 333006, Exhibit S-12A through S-12C for ARV details and required depths of bury.

2.4.3 For road improvement projects (road widening, turn lane additions, and storm water improvements, etc.) where the road is currently built, or will be built, over existing force mains, the depth of cover must be 48 inches (minimum) from top of pipe to the finished road surface. If depth cannot be maintained, or if the existing pipe material does not meet the currently approved specifications, the force main must be replaced or relocated as determined by the County.

## **2.5 HORIZONTAL SEPARATION**

2.5.1 Wastewater force mains must be laid at least 10 feet horizontally from any existing or proposed potable water main.

2.5.2 A three-foot horizontal separation must be maintained between a wastewater force main and all other underground utilities, except as listed in 2.5.1 above (UAG Section 5.4). The distance must be measured face to face.

2.5.3 When the required horizontal separations cannot be maintained, a design exception must be obtained from the Utility Design Section Manager prior to construction commencement.

## **2.6 VERTICAL CROSSINGS**

2.6.1 Vertical separation between wastewater force mains crossing other pipelines/utilities must be a minimum vertical distance of 18 inches between the outside of the other pipelines/utilities and the outside of the wastewater force main. This must be the case where the other pipeline is either above or below the wastewater main.

2.6.2 Potable water main crossings below wastewater line(s) should be avoided whenever possible. Crossing(s) must be arranged so that the wastewater main joints will be equidistant and as far as possible from the water (potable, reclaimed, or storm) main joints.

2.6.3 When the required vertical separations cannot be maintained, a design exception must be obtained from the Utility Design Section Manager prior to construction commencement.

## **2.7 SYSTEM VALVES AND VALVE LOCATION**

2.7.1 Valves and roadway boxes must be provided for all branch connections (three valves on a tee, four valves on a cross) or other locations, as required to facilitate operation of the system. All valves must be installed at the tee, cross, or point of connection.



- 2.7.2 The maximum allowable distance between in-line (isolation) valves, required to be shut down for repair work, must not exceed 1,000 feet.
- 2.7.3 Valves must be readily accessible and located in an area not subject to flooding. Valves must not be located below the top of bank within a storm water “ditch” or within a swale.
- 2.7.4 Valves must not be located in ADA (American with Disabilities Act) ramps, or in curbs.
- 2.7.5 If a valve falls in a driveway or pavement the valve box cover must be a “long skirt” design to prevent the valve cover from flipping should anyone, or any vehicle, land on it. The valve box must be set so it is not a tripping hazard and must be flush with the concrete/pavement. The valve box must be set to ensure that the operating nut is accessible and will operate.

## **2.8 PIPE, FITTINGS, AND APPURTENANCES**

- 2.8.1 All distribution force main piping (sizes 12-inch and less) must be Polyvinyl Chloride (PVC) or ductile iron (DI) except as specified in Part 2.8.3 and 2.8.5.
  - 2.8.1.1 Above ground discharge piping at pump stations must be ductile iron and comply with the requirements in Hillsborough County Technical Specification 333003.
  - 2.8.1.2 No 10- inch or 14-inch diameter pipe must be used.
- 2.8.2 All transmission force mains (defined as pipe sizes greater than 16-inches) must be constructed of ductile iron.
- 2.8.3 All fittings must be ductile iron and comply with the requirements of Part 3 herein.
- 2.8.4 The minimum design working pressure must be 200 psi, with a laying length of 20 feet
- 2.8.5 Aerial Crossing pipe and pipe attached to a bridge or drainage structure must be ductile iron. Above grade piping must be Class 53 (minimum).
- 2.8.6 All buried ductile iron pipe (including pipe inside of casing), valves, and fittings must be polywrapped.
- 2.8.7 The force main system is a closed system. The end of pipes must be capped or plugged.
- 2.8.8 Restrained Joints
  - 2.8.8.1 Restrained joints must be installed wherever force main pipe alignment changes direction.
  - 2.8.8.2 The length of pipe to be restrained, and the actual length that is restrained during construction, must be noted on the design and record drawings, respectively. Restrained joints must be designed with a trench type (per ANSI/AWWA C600 or C605) no higher than Type 3, a safety factor no less than 1.5, and a design pressure no less than 150 psi. When designing for length of restraint, valves must be considered as a “dead end plug”.
  - 2.8.8.3 Shop drawings from the manufacturer must be submitted to and approved by the Engineer prior to actual construction. Refer to Part 1.3.
  - 2.8.8.4 Thrust blocks are not allowed in the Hillsborough County wastewater system
  - 2.8.8.5 When Exhibit S-8A is used the Design Engineer of Record must fill out the entire restraint table as applicable for their project.

**2.8.9 Air Release Valves**

- 2.8.9.1 Air release valves must be specified at high points where air can accumulate in new or altered force mains.
- 2.8.9.2 Air release valves must not be installed in, or adjacent to driveways.
- 2.8.9.3 Construction plans and record drawings must include air release valve stationing and a detailed plan and profile view.
- 2.8.9.4 Where automatic ARVs are required, the depth of bury for the line must be increased. It is incumbent upon the Engineer of Record to ensure that the ARV assembly fits within the valve vault, and the vault is installed flush with grade. See Specification 333006, Exhibits S-12A through S-12C for ARV configurations.
- 2.8.9.5 Automatic air release valves must not be used in situations where flooding of the ARV manhole may occur.

**2.9 CONNECTIONS TO COUNTY SYSTEMS**

All connections to existing County systems must be approved by the County. All connections to existing force mains must be made under the direct supervision of Hillsborough County WRD. At all new points of connections, a tee or cross with the appropriate isolation valves must be installed.

**PART 3.0 PRODUCTS**

**3.1 MATERIAL**

3.1.1 The following table lists the allowable pipe materials for various sizes of wastewater force main pipe:

Diameter	Material	General Specifications
4" to 12"	PVC	AWWA C900 DR 18
4" and Greater	DIP	ANSI/AWWA C151/A21.51, CL 50 (minimum) with internal coating

3.1.2 All pipe, fittings and appurtenances must be supplied in accordance with the pre-approved material list in Appendix B.

3.1.3 Alternative materials may be submitted to Hillsborough County for review by and approval from the WRD Product Review Committee (with proper testing documentation, performed by recognized industry authorities) prior to commencement of design. Refer to Section 1 of the Hillsborough County Public Utilities Technical Manual for submittal procedures. Tests on alternative materials should be at least as rigorous as testing conducted by ASTM, AWWA and ANSI. A letter of variance must be issued by WRD prior to commencement of design incorporating any alternative material.

**3.2 POLYVINYL CHLORIDE PIPE AND FITTINGS**

3.2.1 All PVC pipe must be GREEN.

3.2.2 PVC pressure pipe must have the same O.D. as ductile iron pipe and be compatible for use with



- ductile iron fittings.
- 3.2.2.1 The pipe must conform to ANSI/AWWA C900 or C909, except that the pipe does not have to be NSF approved.
  - 3.2.2.2 It must have a pipe dimension ratio (DR) of 18 (minimum working pressure of 200 psi) and a nominal laying length of 20 feet.
- 3.2.3 All PVC must be formulated for sunlight exposure and must pass the impact strength test as described by ASTM D2444, latest revision, using Tup A with impact level of 94 ft.-lbs.
- 3.2.4 Fittings: Fittings for PVC pipe must be ductile iron mechanical joint and comply with the requirements of Part 3.3.4.
- 3.2.5 Joints
- 3.2.5.1 PVC pipe must have provisions for expansion and contraction provided in the joints.
  - 3.2.5.2 All non-fused joints must be designed for push-on makeup connection. A push-on joint must be an elastomeric gasket bell end coupling manufactured as an integral part of the pipe barrel consisting of an integral wall-thickened expanded bell end section with a ring groove to retain an elastomeric sealing ring of uniform cross-section as approved in Appendix B for PVC pipe.
  - 3.2.5.3 Restrained Joints: See Specification 333006, Exhibits S-8A & S-8B for restrained joint details. See Appendix B for pre-approved products. The length of pipe to be restrained must be noted on the Construction Drawings.
- 3.2.6 Fusible PVC
- 3.2.6.1 Pipe must be provided with plain ends. The ends must be square to the pipe and free of any bevel or chamfer. There must be no bell or gasket of any kind incorporated into the pipe.
  - 3.2.6.2 Fusible PVC must be manufactured in a standard 20-foot, 30-foot or 40-foot nominal length.
  - 3.2.6.3 Fusible PVC pipe lengths must be assembled in the field with butt-fused joints. The Contractor must follow the pipe supplier's written guidelines for this procedure, using only demonstrated qualified fusion technicians.

### 3.3 DUCTILE IRON PIPE AND FITTINGS

- 3.3.1 For Ductile Iron (DI) pipe the following must apply:
- 3.3.1.1 Pipe must conform to the requirements of ANSI/AWWA C151/A21.51, "*Ductile-Iron Pipe, Centrifugally Cast, For Water*", Class 50 (minimum).
  - 3.3.1.2 Pipe coatings must comply with ANSI/AWWA C151/A21.51, section 4.4.3 (protective interior ceramic epoxy coating), and 4.4.1 (external asphaltic coating) for buried pipe. The internal coating must comply with Appendix B. Internal coatings do not require NSF approval.
  - 3.3.1.3 Joints must be mechanical or push-on joints, unless otherwise specified herein.
  - 3.3.1.4 Refer to Specification 333003 for pump station discharge piping.
- 3.3.2 The weight, class designation, size, material, manufacturer's code, and identifying number (serial number or batch number) shall be included on the mill certification sticker affixed to the exterior surface of every pipe and fitting by the manufacturer at its place of production or cast into the pipe or fitting during production. Absence or alteration of the mill certification sticker or cast



- information may be cause for rejection upon delivery.
- 3.3.3 Ductile iron pipe must be marked with a two-inch wide, green stripe. Striping must be 4.5-mil thick (minimum) adhesive backed tape inscribed with the word “wastewater” wrapped around the pipe in a continuous spiral with bands 12 inches to 18 inches apart for the length of each pipe section. The tape must be secured to each end by wrapping it back upon itself.
- 3.3.4 Fittings
- 3.3.4.1 Ductile iron fittings must be mechanical joint and restrained with a minimum pressure rating of 250 psi and must conform to the requirements of ANSI/AWWA C153/A21.53, “*Ductile-Iron Compact Fittings for Water Service*”.
- 3.3.4.2 Coatings must comply with 4.4.6 (protective interior ceramic epoxy coating) and 4.4.2 (external coating) of ANSI/AWWA C153/A21.53. Ductile iron fittings and coatings must be as approved in Appendix B.
- 3.3.5 Mechanical Joints
- 3.3.5.1 Mechanical joints (MJ) consisting of bell, socket, gland, gasket, bolt and nuts must conform to ANSI/AWWA C111/A21.11, “*Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings*”.
- 3.3.5.2 Bolts must be high strength low alloy steel. T-head type having hexagonal nuts.
- 3.3.5.3 Bolts and nuts must be machined true and nuts must be tapped at right angles to a smooth bearing surface.
- 3.3.6 Push-on Joints: Single seal gasket push-on type joints must conform to the requirements of ANSI/AWWA C111/A21.11 and Appendix B.
- 3.3.7 Restrained Joints
- 3.3.7.1 Restrained joints (RJ) must be of the types fabricated by the various pipe manufacturers and not the type that requires field welding or grooves cut into the pipe barrel for restraint.
- 3.3.7.2 The restraining joints for mechanical joint (MJ) fittings and valves must conform to the requirements of ANSI/AWWA C111/A21.11 and Appendix B. See Specification 333006, Exhibit S-8A.
- 3.3.7.3 Restrained joints (both manufacturer-supplied and field lock gaskets) must have the bell of the pipe marked in red. Wrap the bell with vinyl, adhesive red marking tape.
- 3.3.8 Aerial Crossing Pipe, Hangers, and Accessories
- 3.3.8.1 Pipe designated for use in aerial crossings and/or attachment to bridge or drainage structures must be ANSI/AWWA C151/A21.51, Class 53 (minimum) ductile iron pipe.
- 3.3.8.2 For aerial crossings, pipe length must correspond to "Long Span Pipe", DIP restrained joint.
- 3.3.8.3 Pipe joints must consist of a mechanical joint-flange (MJ-FLG) or flange-plain end (FLG-PE), and flange restrained (FLG-RJ). The flange joint end must be equipped with an O-ring gasket.
- 3.3.8.4 The DIP must be ordered to fit the job. No field cuts will be allowed.
- 3.3.8.5 All ductile iron pipe must have an interior ceramic epoxy coating as specified in Appendix B. Exterior coating must be field applied, color coded green, and comply with the pre-approved products specified in Appendix B.
- 3.3.8.6 Hangers and Accessories





- a) Anchor Bolts: Anchor bolts must be 316 stainless steel, installed in accordance with the Construction Drawings, and utilizing non-shrink grout.
  - b) Roller Stands: Roller stands and roller axles must be 316 stainless steel.
  - c) Insulated Pipe Rollers: Pipe support rollers must be constructed of dielectric synthetic resin.
  - d) Link Seal and Sleeve-Seals must be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links must be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut.
  - e) Hangers must be made in accordance with standard practice MSS SP-58, and in full compliance with Federal Specification WW-H-171E and the ANSI/ASME Code for pressure piping B 31.1.
- 3.3.8.7 Polywrap/Polyethylene Encasement: All buried ductile iron pipe and fittings must be encased in polyethylene in accordance with ANSI/AWWA C105/A21.5, *"Polyethylene Encasement for Ductile-Iron Pipe Systems"*. Polyethylene must be eight mils thick.

### 3.4 GASKETS

Pipe and fitting gaskets, conforming to ANSI/AWWA C111/A21.11, must be made of viton (fluorocarbon elastomer), EPDM (ethylene propylene diene monomer) or SBR (styrene-butadiene rubber). Material selection must be dependent upon service and soil conditions.

### 3.5 VALVES AND APPURTENANCES

#### 3.5.1 General

- 3.5.1.1 All valves must be the manufacturer's standard design for the service intended and must be cast with the manufacturer's name and pressure rating on the body, and if applicable, the valve type, size, and flow direction arrow.
- 3.5.1.2 Valves must open left (counterclockwise), when viewed from the top. The operating nut, or hand wheel, must have an arrow cast in the metal indicating the direction of opening.
- 3.5.1.3 Only valve types listed are acceptable for use in Hillsborough County. See Appendix B for pre-approved valves. Valve ends must be flanged for all above ground installations and must follow the general requirements as specified in Specification 333003 "Wastewater Pumping Stations."

#### 3.5.2 Plug Valves

- 3.5.2.1 Plug valves must be fully bidirectional and meet the requirements of AWWA C517 and C550. Valve ports must have a minimum 80 percent full pipe area up to 12 inches, and 100 percent full pipe area for 14 inches and greater.
- 3.5.2.2 Valves must have MJ-RJ ends and must be furnished complete with joint accessories.
- 3.5.2.3 Valves must be coated with a fusion bonded epoxy coating (10 mils minimum) applied to both the exterior and the interior surfaces prior to assembly of the valves.
- 3.5.2.4 Valve and gearing must be rated for a minimum of 150 psi pressure rating. The valves must provide drip-tight shut off at rated pressure in both directions.
- 3.5.2.5 All external hardware must be 304 stainless steel.
- 3.5.2.6 The seat end of plug valves must be installed facing into the direction of flow.

#### 3.5.3 Tapping Valves, Tapping Sleeves & Service Saddles



- 3.5.3.1 Tapping sleeves, tapping crosses, and tapping valves used to make "wet" taps into existing mains must be provided and installed at locations as shown on the Construction Drawings.
- 3.5.3.2 No size on size taps, or direct taps to pipe, are allowed.
- 3.5.3.3 Tapping Valves
  - a) Tapping valves must be gate valves with a mechanical joint outlet, non-rising stem, resilient seat, and with O-ring seals meeting the applicable requirements of ANSI/AWWA C509 or C515, and C550.
  - b) All tapping valves must be coated with a fusion bonded epoxy coating applied to both the exterior and the interior surfaces prior to assembly of the valves.
  - c) Tapping valves must be furnished with a combination flange and mechanical joint for connecting the branch to the main.
  - d) Tapping valves must be specifically designed for pressure tapping with sufficient seat opening to allow full diameter taps to be made.
  - e) Tapping valves must be manufactured with an integral tapping flange having a raised face or lip designed to engage the corresponding recess in the tapping sleeve flange in accordance with MSS SP60.
  - f) Tapping valves without the raised face on the tapping flange are not permitted since they do not assure the proper alignment required to prevent damage by a misaligned shell cutter.
  - g) The tapping valve must be considered sacrificial. Once the tap has been made, a plug valve must be installed for operation/isolation, and the tapping valve must be locked in the fully open position.
- 3.5.3.4 Tapping Sleeves and Crosses
  - a) Tapping sleeves must be stainless steel (SS) with wraparound gasket style, or fabricated carbon steel units with a fusion-bonded epoxy coating and outlet seal gaskets and must be pressure rated listed in 3.5.2.4.
    - 1) SS with wraparound gaskets must be limited for use on all pipes up to 12 inches in diameter.
    - 2) Fabricated carbon steel units with fusion bonded epoxy coating and outlet seal gaskets must not be used on AC pipe.
  - b) The Contractor must verify the outside diameter of the existing main before ordering the sleeve.
  - c) Tapping sleeves must be of the mechanical joint type with outlet flange conforming to ANSI B16.1, class 125.
- 3.5.3.5 Service Saddles
  - a) Service saddles as a minimum must be supplied with double tie straps and must be fabricated of 316 stainless steel and be suitable for either wet or dry installation.
  - b) The sealing gasket must be the "O-Ring" type suitable for the applicable service.
  - c) The outlet connection must be 2-inch female iron pipe size (FIP).
  - d) The body, tie straps and bolts must be corrosion resistant 316 stainless steel.
- 3.5.4 Air Release Valve Assemblies
  - 3.5.4.1 Air release valves (ARVs) must be located at high elevation points as indicated on the Construction drawings. The locations may be considered approximate. The actual location of the ARV at the pipeline high points must be determined in the field during construction and reflected on the record drawings.
  - 3.5.4.2 Automatic ARVs must operate automatically and be of the type that will release air from



- the line when pressurized and keep air from entering the line when not pressurized. Overall height of the ARV (w/vacuum check) must not exceed 19-1/6 inches.
- 3.5.4.3 The ARV body must be 316 stainless steel or plastic. The remainder of the assembly (valves, pipe and fittings) must be 316 stainless steel. The ARV must have a two-inch inlet, service saddle or tee, 2-inch ball valve, pipe and fittings. When an offset ARV is required, an additional 4-inch tapping valve and 4 inch isolation plug valve may be required.
- 3.5.4.4 The ball valve must meet the following criteria:
- a) It must be two-piece, threaded, stainless steel type 316 meeting ASTM-CF8M A351. The inlet and outlet must be FIP (NPT). The pipe thread must be in accordance with ANSI B1.20.1.
  - b) The valve must be full port design, with a blowout proof stem, 1000 psi (WOG) minimum, and reinforced Teflon seats.
  - c) The ball valves must conform to API 598, have a stainless handle, nuts, and washers, vinyl handle grip, lockable handle and be vacuum rated to 29" Hg (inches mercury).
- 3.5.4.5 All fittings and piping must be rated for a minimum working pressure of 150 psi.
- 3.5.4.6 The automatic air release valves must be installed in traffic bearing pre-cast concrete vaults with concrete bottoms. Automatic ARV's are not to be installed in manholes subject to flooding. See Specification 333006, Exhibits S-12A through S-12C.
- 3.5.5 Valve Boxes
- 3.5.5.1 Cast iron valve boxes with lids must be provided for all valves installed underground. The valve boxes must be screw-type adjustable to fit the depth of earth cover over the valve; and designed to prevent the transmission of surface loads directly to the valve or piping. See Specification 333006, Exhibit 9A.
- 3.5.5.2 Valve boxes must have an interior diameter of not less than five inches.
- 3.5.5.3 Valve box extensions must be installed to reserve a minimum of 50% of the adjustment for the future extension. Extension sections must only be screw type cast iron and compatible with the valve box.
- 3.5.5.4 The valve boxes must be provided with covers marked "SEWER". The lids must be painted green and must be constructed so as to prevent tipping or rattling.
- 3.5.5.5 All valve locations must be identified with a concrete valve pad containing a bronze disc embedded in concrete. See Specification 333006, Exhibits S-10 and S-11.
- 3.5.5.6 For valves boxes in pavement, the protective concrete collar ring must be constructed of Type I (3000 psi) concrete. See Specification 333006, Exhibit S-11.

## PART 4.0 CONSTRUCTION

### 4.1 WORK AT HIGHWAY OR RAILROAD CROSSINGS

The construction must not commence for any work along or within County roads, FDOT highways, or railroad crossing until all permits for the pipeline occupancy have been obtained.

### 4.2 PRECONSTRUCTION PIPE INSPECTION/CERTIFICATION

- 4.2.1 The Contractor must obtain from the pipe manufacturer a certificate of inspection to the effect that the pipe and fittings supplied for the project have been inspected at the plant and that they meet the requirements of these specifications.
- 4.2.1.1 For County contracted projects, the Contractor must submit these certificates to the



- Project Manager prior to installation of the pipe materials.
- 4.2.1.2 For developer projects, the Contractor must submit these certificates to the WRD Inspector prior to the installation of the pipe materials.
- 4.2.2 Joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor.
- 4.2.3 The entire product of any plant may be rejected when, in the opinion of the County, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.
- 4.2.4 For County Contracted projects all pipe and fittings must be subjected to visual inspection at time of delivery and before they are lowered into the trench to be laid.
- 4.2.5 PVC pipe must not be off-loaded with chains, wire rope or other pipe handling implements that may scratch, nick, cut or gouge the pipe. Any scratch or gouge that is greater than 10% of the wall thickness is considered significant and must be rejected.

### **4.3 INSTALLATION**

- 4.3.1 The provisions set forth herein must be applicable to all underground wastewater piping installations.
- 4.3.2 All pipe must be installed at a minimum depth of four feet (48 inches to the top of pipe) below final grade.
- 4.3.3 All mechanical joints, or connections to pipe, fittings, valves, or apparatus must be made plumb, so to ensure no negative pressure is placed or potential placed against the joint, or connection, thereby causing a malfunction or failure of the mechanical joint, or connection.
- 4.3.4 All pipe must be color coded GREEN.
- 4.3.4.1 Ductile iron pipe must be marked with a two-inch wide, green, 4.5-mil thick (minimum) adhesive backed tape inscribed with the words "wastewater line," wrapped around the pipe in a continuous spiral with bands 12 to 18 inches apart for the length of each pipe section. The tape must be secured to each end by wrapping it back upon itself.
- 4.3.4.2 Polywrap must be color coded green or clear.
- 4.3.4.3 PVC pipe must be green throughout the thickness
- 4.3.5 It must be the Contractor's and Developer's responsibility to verify all existing conditions and to locate all structures and utilities along the proposed utility alignment in order to avoid conflicts. Where conflicts exist, SUE work must be coordinated with the facility owner and performed so as to cause minimum interference with the service rendered by the facility disturbed.
- 4.3.6 Facilities or structures damaged must be repaired or replaced immediately at the Contractor's or developer's expense. The repair or replacement must be in conformance with current standard industry practices, and according to the direction of the owner of such facility and approved by the County.
- 4.3.7 See Specification 333006, Exhibit S-5 for Jack and Bore details and Exhibit S-6 for Ditch Crossing



details.

- 4.3.8 Directional Drill/Jack and Bore: Where open cut is not practical, directional drilling per Specification 330523, or jack and bore per Specification 330524, must be used. All directional drill, and jack and bore, locations must be indicated on the Construction drawings, and approval from WRD is required prior to starting construction. The minimum size of pipe to be directional drilled is 6 inches.
- 4.3.9 No pipe must be laid when the trench conditions or the weather is unsuitable for such work.
- 4.3.10 The wastewater force main system is a closed system. The ends of pipes must be capped or plugged.
- 4.3.11 Lined DI pipe and fittings must be installed within one year of lining. The date of lining is the first set of numbers in white on the interior of the pipe or fitting.
- 4.3.12 Polyvinyl chloride pipe may be damaged by prolonged exposure to direct sunlight. The Contractor must take necessary precautions during storage and installation to avoid this damage. Pipe must be stored under cover and sufficient backfill must be placed to shield it from the sun as the pipe is installed.
- 4.3.13 All pipe crossing driveways and landscape areas is to be installed by directional drill unless otherwise noted on the construction drawings. All pipe crossing arterial and collector roads must be installed by jack and bore.
- 4.3.14 All pipe must be installed with an insulated 10-gauge or 12-gauge, solid copper or copper clad steel core locating wire with HDPE color coded coating (green) and attached at 10:00 or 2:00. Wire for direction drill applications must be copper clad “hard drawn” steel core with a minimum breaking strength of 1000 pounds.
  - 4.3.14.1 Tracer/locate wire must be attached to the carrier pipe using minimum two-inch wide duct tape. Tape must be at every joint and at four to five-foot spaced intervals. When the tracer wire is installed within a PVC pipe, the PVC pipe must be attached to the carrier pipe.
  - 4.3.14.2 Tracer wire must start at the point of connection to existing County infrastructure and terminate at the end of all mains/ stubs.
  - 4.3.14.3 Locating wire must terminate at a ground level magnetized access point. The access point and base rating is dependent upon final location. When required wires must be spliced together with a waterproof, corrosion proof, connector with a dielectric non-hardening silicone sealant. No more than 6 splices may be used between access points.
  - 4.3.14.4 Tees and crosses must have continuous connection utilizing underground splices on the primary run.
  - 4.3.14.5 Access points (two terminals minimum) must be installed at least every 1000 lineal ft. Ground rods must be installed at every access point.
  - 4.3.14.6 In the case where an access point location falls within a paved road, the locate wires must be continuous to the next/nearest access point outside of pavement.
  - 4.3.14.7 The Contractor is required to submit Certification (signed and sealed by the EOR, or their representative) that a passing locate test has been performed on the installed tracer/locate wire. The locates must be done by either the Contractor or a SUE firm.



- 4.3.15 When fusible PVC is used, Fusion Technicians must be fully qualified by the pipe supplier to install fusible PVC of the type(s) and size(s) being used. Qualification must be current as of the actual date of fusion performance on the project.
- 4.3.16 Excavation, trenching and backfilling must be in accordance with the requirements of the applicable portions of these specifications. In addition, all underground facility installations must comply with the requirements of section 5.4 of the Utility Accommodation Guide.

#### **4.4 TRENCH EXCAVATION**

- 4.4.1 All excavations must be open cut, with banks of trenches kept as nearly vertical as possible and wide enough to allow approximately eight inches of clearance on each side of the pipe.
- 4.4.2 The trench floor must provide a uniform bearing for each full length of pipe section. Excavate bell holes after trench has been graded. See Specification 333006, Exhibit 15.
- 4.4.3 Perform all excavations of whatever substance encountered to the depths shown or indicated on plans.
- 4.4.4 In the event unsuitable or unstable soil is encountered, remove it to a depth of six inches (minimum) below the bottom elevation of the pipe (12 inches if rock or boulders are encountered) and replace with material meeting AASHTO Soil Classification A-1, A-2, or A-3, as approved by the Project Manager or Engineer of Record. Reference FDOT Standard Specifications for Road and Bridge Construction Section 125-4.
- 4.4.5 Dewatering: Remove all water from excavations and maintain the excavations free of water while construction therein is in progress. Provide dewatering equipment as necessary to conform to this requirement. Dewatering procedure must meet all regulatory requirements.
- 4.4.6 Protection of Trees: Trenching must not take place within the root zone of trees with a trunk diameter of six-inch or larger. The root zone must be defined as the greater of one) the drip line of the tree or two) a circular zone extending outward from the base of the tree a distance equivalent to 1/2-foot for every inch of trunk diameter as measured 4-1/2 feet above natural grade (see Specification 333006 Exhibit S-7). Exotic nuisance species, such as Brazilian Pepper and Melaleuca, are exempt from this protection.

#### **4.5 HANDLING AND CUTTING PIPE**

- 4.5.1 Every care must be taken in handling and laying pipe and fittings to avoid damaging the pipe, scratching or marring machined surfaces, and abrasion of the pipe coating both inside and out.
- 4.5.2 Lined DIP must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. must be placed inside the pipe and fittings for lifting, positioning, or laying.
- 4.5.3 Care should be taken not to let the pipe strike sharp objects while swinging or being off loaded. The pipe must not be dropped or unloaded by rolling.
- 4.5.4 Lined DIP should never be placed on grade by use of hydraulic pressure from an excavator bucket or by banging with heavy hammers.



- 4.5.5 Any fitting showing a crack, and any fitting or pipe which has received a severe blow that may have caused an incipient fracture (even though no such fracture can be seen) must be marked as rejected and removed at once from the work.
- 4.5.6 In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved by WRD, may be cut off before the pipe is laid. The cut must be made in the sound barrel at a point of at least 12 inches from the visible limits of the crack. All cutting must be done with a machine adapted to the purpose. All cut ends must be examined for possible cracks caused by cutting.
- 4.5.7 Cutting Pipe: The Contractor must cut pipe by means of an approved mechanical cutter. The cut must be perpendicular to the longitudinal axis of the pipe and rough ends or spurs will be satisfactorily removed prior to installation and seating.
- 4.5.8 Manufacturer guidelines for sealing cut ends and repairing field damaged areas of ceramic epoxy lined DI pipe and fittings must be followed.

## **4.6 FUSION PROCESS**

- 4.6.1 Fusible PVC must be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and the pipe supplier's guidelines.
- 4.6.2 Fusible PVC must be fused by qualified fusion technicians, as documented by the pipe supplier.
- 4.6.3 Each fusion joint must be recorded and logged by an electronic monitoring device affixed to the fusion machine.
- 4.6.4 Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier must be used for the fusion process. Fusion machines must incorporate the following properties/elements: heat plate, carriage, and data logging device.
- 4.6.5 Other equipment specifically required for the fusion process must include the following:
- 4.6.5.1 Pipe rollers used to support the pipe on either side of the fusion machine.
  - 4.6.5.2 A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage.
  - 4.6.5.3 The Fusion machine and maintenance manual must be kept with the fusion machine at all times.
  - 4.6.5.4 Facing blades specifically designed for cutting fusible PVC.

## **4.7 PIPE LAYING**

- 4.7.1 Pipe must be constructed of the materials specified and as shown on the drawings.
- 4.7.2 Cradle: Upon satisfactory excavation of the pipe trench and completion of the pipe bedding, a trough recess for the pipe bells and joints (or couplings) must be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel must receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.
- 4.7.3 Cleanliness: The interior of the pipes must be thoroughly cleaned of all foreign matter before being



gently lowered into the trench and must be kept clean during laying operations by means of plugs or other approved methods. During suspension of work for any reason at any time, a suitable stopper must be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

#### 4.7.4 Gradient

4.7.4.1 Lines must be laid straight, and depth of cover must be maintained uniform with respect to finish grade, whether final grading is completed or proposed at time of pipe installation. When a grade or slope is shown on the Construction Drawings, means must be used by the Contractor to assure conformance to required grade.

4.7.4.2 Any pipe which has its grade or joint disturbed after laying must be taken up and re-laid.

#### 4.7.5 Pipe/Joint Deflection: Whenever it is desirable to deflect pipe, the amount of deflection must not exceed the following:

4.7.5.1 For pipe joints: 75% of the maximum limit as specified in AWWA C600 (for Ductile iron) or AWWA C605 (for PVC), or the manufacturer's recommendation, whichever is less.

4.7.5.2 For PVC pipe: 75% of the maximum limit as specified in AWWA C605, or the manufacturer's recommendations, whichever is less.

4.7.6 Rejects: Any pipe or fittings found defective due to interior or exterior damage must be immediately removed and replaced with sound pipe or fittings at the Contractor's expense.

4.7.7 PVC: All PVC force mains must have electronic locator wires in accordance with Part 4.3.14, herein. The wires must be continuous between valves.

4.7.8 Any section of pipe already laid which is found to be defective or damaged must be replaced with new pipe without additional cost to the County.

4.7.9 Installation of PVC pipe and fittings must be in accordance with the installation requirements established by the manufacturer and AWWA Manual of Practice M23.

## 4.8 INSTALLING JOINTS

4.8.1 The joints of all pipelines must be assembled in straight alignment and made tight. The particular joint used must comply with the requirements of Part 3.2 and 3.3. For County contracted projects, the particular joint used must be reviewed and approved by the Engineer of Record prior to installation.

4.8.2 Ductile iron pipe and fittings can only be pushed when using a restrained joint system that does not allow the spigot to contact the bell shoulder. Pipe may be pulled using restrained joint pipe or restraining gaskets as restraints.

4.8.3 Mechanical Joints: All types of mechanical joint pipes must be laid and jointed in full conformance with manufacturer's recommendations. Torque wrenches set as specified in ANSI/AWWA C111/A21.11, must be used; or spanner type wrenches not longer than specified therein may be used with the permission of the County. Impact wrenches must not be used.

4.8.4 Push-On Joints: Push-on joints must be made in strict compliance with the manufacturer's





- recommendations.
- 4.8.4.1 Lubricant must be an inert, non-toxic, water soluble compound.
  - 4.8.4.2 Insert the spigot end into the bell so that it is in uniform contact with the gasket.
  - 4.8.4.3 For PVC pipe, push the spigot until the reference mark on the spigot end is flush with the end of the bell. If the reference mark is not visible after assembly, the joint is to be cut out and reassembled.
  - 4.8.4.4 For DIP, push the pipe until the reference mark on the spigot end disappears into the bell.
- 4.8.5 Joint Compounds: Sulfur based joint compounds must not be used.
- 4.8.6 Restrained Joints must be provided at all changes in direction, and size changes, of all mains.
- 4.8.6.1 All pipe and fitting joints must be restrained as shown on the Construction Drawings, or where in the opinion of the Design Engineer, settlement or vibration is likely to occur.
  - 4.8.6.2 All restrained joints must be installed in accordance with manufacturer's recommendations.
  - 4.8.6.3 Restraining gaskets must never be pushed; nor should pipe be homed all the way to the bell shoulder.  
**All restrained joints** (manufacturer supplied or field lock gaskets) **must have the joint bell marked in red.** Paint the bell red or wrap the bell with vinyl, adhesive red marking tape.

## 4.9 INSTALLING APPURTENANCES

### 4.9.1 Valves and Valve Boxes

- 4.9.1.1 Valves must be carefully inspected, opened wide and then tightly closed and the various nuts and bolts must be tested for tightness, on site, prior to installation.
  - a) Special care must be taken to prevent any foreign matter from becoming lodged in the valve seat.
  - b) Any valve that does not operate correctly must be immediately removed and replaced by the Contractor.
  - c) The seat end of plug valves must be installed facing into the direction of flow.
- 4.9.1.2 Valves installed below ground must be identified with a bronze disc imbedded in concrete to identify wastewater valves (see Specification 333006, Exhibits S-10 and S-11).
- 4.9.1.3 Concrete Valve Pad: Valve boxes outside of paved areas must be cast in a 3000-psi concrete slab, two-foot by two-foot square and six-inch (minimum) thick. See Specification 333006 Exhibit S-10 for unpaved installations.
- 4.9.1.4 Valve Boxes: Valve boxes must be carefully centered over the operating nuts of the valves so as to permit a valve key to be fitted easily to the operating nut.
  - a) Valve boxes must be set to conform to the level of the finished surface and held in position by a ring of concrete placed under the support flange. See Specification 333006, Exhibits S-10 and S-11.
  - b) The valve box must not transmit surface loads to the pipe or valve.
  - c) Care must be taken to prevent earth and other material from entering the valve box.
  - d) Any valve box which is out of alignment or whose top does not conform to the finished ground surface must be dug out and reset.
  - e) Before final acceptance of the work, all valve boxes must be adjusted to finish grade and valve box extensions must be installed to reserve 50% of their total adjustment



for future extension. Extension sections must be threaded/screwed cast iron.

- f) The operating nut should not exceed 36 inches below finished grade. However, if conditions require the operating nut to exceed 36 inches, then an extension, mechanically attached to the valve, must be added, and the top of the extension must not exceed 12 inches below finished grade. See Specification 333006, Exhibit S-9B.
- g) The valve boxes must be provided with covers marked “SEWER” and must be so constructed as to prevent tipping or rattling. The valves must be identified with a bronze disc embedded in concrete.
- h) Valve boxes must not be installed in ADA ramps or in curbs.

#### 4.9.2 Air Release Valves

- 4.9.2.1 Construction plans and record drawings must include air release valve stationing on both the plan and profile views.
- 4.9.2.2 The location of ARVs indicated on Construction plans are approximate. The actual placement of the air release valves must be determined in the field and must be located at the high points as established during installation of the force main and as approved by Project Manager.
- 4.9.2.3 Automatic air release valves must be installed in a shallow manhole, not subject to flooding, as shown in Specification 333006 Exhibit S-12A through Exhibit S-12C.
- 4.9.2.4 The Contractor must furnish and install at no additional cost to the County all necessary fittings to make adjustments in the field for the installation of air release valves at all high points.

### 4.10 POLYETHYLENE TUBE ENCASEMENT/POLYWRAP

- 4.10.1 All buried ductile iron pipe, valves, and fittings, including ductile pipe inside of a casing, must be polywrapped. Installation of polyethylene tube encasement must be in accordance with Method A of ANSI/AWWA C105/A21.5 and as specified herein.
- 4.10.2 Raise a length of pipe at the side of the trench to a height of about three feet above ground level by means of hoisting equipment and a pipe sling or tongs.
- 4.10.3 Using a precut length of polyethylene tubing, two feet longer than length of pipe to be covered, slide plastic tubing over spigot end of the pipe up to the pipe sling or tongs. Bunch the excess of the plastic tubing near the sling or tongs.
- 4.10.4 Lower the pipe into the trench, joining the lowered length of pipe with that already in place. Shallow bell holes at the pipe joints must be made to facilitate overlapping of the polyethylene at the pipe joints.
- 4.10.5 Raise bell end of the pipe mechanically or by hand, clear of trench bottom. Slide plastic tube along balance of pipe length to the pipe bell. Leave surplus bunched at the bell for subsequent covering of the joint. Approximately one foot of surplus should be provided at each end of pipe.
- 4.10.6 To cover the joined pipe joint pull the plastic tubing from the preceding length of pipe over the bell end of the pipe, fold around the spigot end of new pipe section and wrap with three circumferential turns of 1-1/2 inch wide polyethylene tape to seal and hold the film in place.
- 4.10.7 Pull the bunched polyethylene tubing on the new pipe barrel near spigot end over the first



polyethylene wrap until it covers the joint, neatly folded behind the bell, seal and hold in place by three circumferential turns of 1-1/2-inch wide polyethylene adhesive tape. **Use red tape around all restrained joints.**



- 4.10.8 The polyethylene film covering the pipe will be loose. Excess material should be neatly drawn up around the pipe barrel, folded into an overlap on top of the pipe and held in place by means of pieces of the plastic tape at approximately three to five-foot intervals.
- 4.10.9 Repair any rips, punctures or other damage to the polyethylene with tape or by cutting open a short length of tube, wrapping it around the pipe and securing with tape.
- 4.10.10 Fittings such as pipe bends must also be covered by use of the plastic tubing and plastic adhesive tape in much the same manner as the pipe.
- 4.10.11 Irregular-shaped appurtenances must be covered by splitting a suitable length of the polyethylene tubing and using the resulting flat sheet with plastic tape to cover such items.

#### **4.11 BACKFILL/COMPACTION**

- 4.11.1 Backfilling and compaction must be conducted in a manner as to preclude subsequent settlement and provide adequate support for the surface treatment, pavement, pipelines, or structures to be placed thereon. Structures within the wastewater system include manholes, wetwells, and ARVs. All trenches must be prepared per the requirements of Part 4.4. Also refer to Specification 333006, Exhibit S-15.
- 4.11.2 Backfill and bedding material must be common fill material free from organic matter, muck or marl, and rock exceeding 2-1/2 inches in diameter, and must not contain broken concrete, masonry, rubble or other similar materials. When unstable or unsuitable material is encountered replace with AASHTO soil classification A-1, A-2, or A-3.
- 4.11.3 Method of Compaction: The Contractor must adopt compaction methods which will produce the degree of compaction specified herein without damage to the new or existing facilities. The degree of compaction specified in the following must be considered the minimum allowable.
- 4.11.4 Backfilling Procedures: The backfilling procedures outlined in the following must be for wastewater mains, at all points of connection to the existing system, and at all wastewater related structures. Refer to 4.11.6 for compaction test requirements/locations. The backfilling must be done in three stages:
  - 4.11.4.1 Force Mains
    - a) First stage - the Contractor must provide adequate compacted fill beneath the haunches of the pipe, using mechanical tampers suitable for this purpose. This compaction applies to the material placed beneath the haunches of the pipe and above any bedding material. Fill compacted by mechanical compactors must be placed in 6-inch layers and thoroughly tamped over the entire surface.
    - b) Second stage - the Contractor must obtain a well-compacted bed and fill along the sides of the pipe and to a point of at least one foot above the top of the pipe. The width of backfill and compaction to be done under this second stage must be the width of the portion of the trench having vertical sides; or, when no portion of the trench has vertical sides, it must be to a width at least equal to three times the outside diameter of the pipe. Material to be placed in 6-inch layers (loose thickness).
    - c) Third stage - the remainder of the trench must be backfilled with suitable material in layers not to exceed 12-inch loose thickness and compacted.



- 4.11.4.2 ARV Vaults/Manholes
  - a) The Contractor must provide well-compacted sub-base under the structure.
  - b) From the bedding up to grade the Contractor must backfill around the structure in lifts not to exceed 12-inch layers (loose thickness). The width of the backfill and compaction must be the width of the excavation, or to a width equal to three times the manhole diameter whichever is less.
- 4.11.5 Compaction Density: The excavation backfill density for all stages must be provided as follows:
  - 4.11.5.1 Right-of-way line to right-of-way line, including all structures and railroad crossings: Compaction must be 98 % of the maximum density as determined by AASHTO T-180 (ASTM D1557 - Modified Proctor) with no tolerance.
  - 4.11.5.2 For outside of the right-of-way (but within maintenance easements): Compaction must be 95% of the maximum density as determined by AASHTO T-180 (ASTM D1557 - Modified Proctor) with no tolerance.
- 4.11.6 Compaction Test Requirements
  - 4.11.6.1 Compaction test results must be submitted for all work.
  - 4.11.6.2 Results of compaction tests must meet minimum requirements prior to proceeding with the next stage of the work.
  - 4.11.6.3 In the second and third stage of backfilling, density tests must be made every one foot vertically, staggered every 200 feet (minimum) horizontally. There must be a minimum of one test (per vertical foot) between structures, and a minimum of one test per day.
  - 4.11.6.4 Backfill and compaction requirements at structures must comply with the testing requirements listed in Specification 333001 Part 4.10.6.8.
  - 4.11.6.5 Compaction testing at the **Point of connection** to existing infrastructure is required to be taken at the point of connection within the width of the portion of the trench having vertical sides; or when no portion of the trench has vertical sides, tests must be within a width equal to three times the width of the pipeline or structure
  - 4.11.6.6 For developer projects, one complete set of all test reports must be submitted with the as-built package to the Site Engineering Review Section upon project completion, and a copy must be submitted to the Hillsborough County Inspector.
  - 4.11.6.7 For County run projects, one complete set of all test reports must be submitted with the as-built package to the Project Manager upon project completion.
  - 4.11.6.8 The Contractor must employ an independent testing laboratory, acceptable to the County and pay for all required tests.
  - 4.11.6.9 The laboratory must submit one copy of the certified test reports, after testing in each phase, to the Development Services Department and the WRD Inspector, or the County Project Manager (as applicable), for approval.

## 4.12 FLUSHING AND CLEANING

- 4.12.1 All mains must be cleaned and flushed to remove all sand and other foreign matter.
  - 4.12.1.1 The Contractor must be responsible for developing a flushing plan to be submitted to the Engineer of Record for approval with the shop drawings.
  - 4.12.1.2 The Contractor must dispose of all water used for flushing without causing a nuisance or property damage.
  - 4.12.1.3 Any permits required for the disposal of flushing water must be the responsibility of the Contractor.



- 4.12.2 High pressure cleaning of lined DI pipe and fittings is not to be used.
- 4.12.3 Flushing water used by the Contractor must be taken from an approved metered source. Flushing water must be at Contractor's expense.
  - 4.12.3.1 Force mains must be filled slowly at a rate that allows air to leave the line at the same rate as the water entering the line.
  - 4.12.3.2 When flushing the pipeline, the flow velocity should be a minimum of 3 feet per second (fps).
  - 4.12.3.3 Flushing should continue until the discharge appears clear. However, the minimum duration should be based on a minimum of three (3) changes of pipeline volume
- 4.12.4 Pipeline must be cleaned with a "pig", of an appropriate material for the pipeline to be cleaned, so as not to damage the interior lining of the pipeline. The Contractor must be responsible to install and remove appropriate connections to accomplish the required pipeline "pigging".
- 4.12.5 Temporary plugs or caps must be installed on new mains until the pressure and leakage tests are completed. Upon satisfactory completion of the tests, the caps or plugs must be removed, and the connections made to the existing mains.

### **4.13 HYDROSTATIC TESTING**

- 4.13.1 The force main must be tested in sections between valves. The total length of pipe for any single test must be 2,000 feet. Testing must be done immediately after installation and backfilling has been completed.
- 4.13.2 The piping must be tested in sections, thereby, testing each valve for secure closure.
- 4.13.3 The mains must be tested in accordance with, the latest revision of AWWA C600 (for Ductile Iron) and C605 (for PVC) under an average hydrostatic pressure of not less than 150 psi, using a 300-psig gauge, for a minimum of two hours. Pressure must be maintained until all sections under testing have been checked for evidence of leakage.
- 4.13.4 While the system is being filled with water, air must be carefully and completely exhausted. If permanent air vents are not located at all the high points, the Contractor must install corporation stops or fittings and valves at such points so the air can be expelled as the pipe system is slowly filled.
- 4.13.5 The test pressure must not vary by more than five psi for the duration of the test. Any visible leaks must be corrected.
- 4.13.6 All pumps, gauges and measuring devices must be furnished, installed and operated by the Contractor and all such equipment, devices and their installation must be approved by the County Inspector.
- 4.13.7 Water for testing and flushing must be potable or reclaimed water provided by the Contractor, at no cost to the County, from a source approved by the County. Flow velocity during line filling should not exceed 2 feet per second.



- 4.13.8 All restrained sections of the buried main must be completely backfilled before such sections are tested.
- 4.13.9 All pressure lines must be tested. All pressure testing must be done in the presence of the County Inspector and the Engineer of Record or his designated representative. Pressure testing is considered a “hold” point and requires the sign off of the County Inspector. All hydrostatic leakage tests must be recorded on the form(s) attached in Part 5.
- 4.13.10 When leakage occurs the defective pipe, pipe joints or other appurtenances must be located and repaired at the expense of the Contractor. If the defective portions cannot be located, the Contractor, at his own expense, must remove and reconstruct as much of the original work as necessary to obtain a force main within the allowable pressure upon retesting.
- 4.13.11 If the Contractor elects to perform hydrostatic testing against valves in an existing distribution system, he does so at his own risk and will bear the cost of any damage to the existing valve, piping system, private or public property, or the new pipeline under test.

#### **4.14 CONNECTIONS TO EXISTING SYSTEM**

- 4.14.1 The Contractor must supply a connection and procedure schedule to the County, for approval, two weeks prior to the proposed connection date. Contractor must be responsible for the coordination of any/all the existing private pump stations shutdown. After approval of the schedule, the County will be responsible for shutting down the County owned pump stations or valves as applicable. The Contractor must then make the required connection as quickly as possible. The Contractor is responsible to coordinate and provide any and all pumping, and/or removal of effluent at connection points to existing mains and at affected pump/lift stations (County owned or private) during wastewater connection operations. Contractor is also responsible for any trucking of effluent and the proper disposal of wastewater, and any other work required to maintain existing services until and during transfer to the new service.
- 4.14.2 The Contractor is responsible to provide, operate, and maintain all wastewater flow by-passes required to complete the project. Coordinate and obtain procedure approval from the Engineer and Public Utility representative at least 48 hours prior to implementation.
- 4.14.3 At all new points of connections, a tee or cross with the appropriate isolation valves must be installed. All connections to existing mains must be made under the direct supervision of Hillsborough County WRD after the Contractor has coordinated with and received approval from the County (approval must be obtained through DSD, or the County Project Manager, as applicable). All connections, cut ins, and taps must be done under the supervision of WRD FMS personnel. Final tie-ins may be under the supervision of either WRD Inspection or FMS personnel.
- 4.14.4 Final tie-ins may be under the supervision or either WRD Inspection or FMS personnel. All other connections must be done under the supervision of WRD FMS personnel.
- 4.14.5 Valves on existing mains will be operated by Hillsborough County WRD personnel or under their direct supervision.



- 4.14.6 If a tee and isolation valve cannot be cut in, and approval has been obtained from the Utility Design Section Manager for a Design Exception, then the following procedures must be followed. Tapping a Force Main:
- 4.14.6.1 No size on size taps are allowed.
  - 4.14.6.2 The Contractor must submit a request to the Service Availability Team, Customer Service Section of Hillsborough County WRD to schedule a tap and pay the appropriate tapping fee. The request must be made a minimum of 48 hours prior to the proposed tie-in.
  - 4.14.6.3 The Contractor must furnish, install and pressure test the tapping sleeve and valves to the existing force main.
  - 4.14.6.4 For all taps up through 12 inches, Hillsborough County WRD FMS personnel will furnish the necessary tapping machine and tools and will perform the tap.
  - 4.14.6.5 For taps larger than 12 inches, the Contractor must furnish the tapping machine and tools, and must perform the tap under Hillsborough County WRD FMS Personnel supervision. All taps must be witnessed by the County Inspector.
  - 4.14.6.6 Prior to the tap:
    - a) The Contractor must assemble all materials, tools, equipment, labor and supervision necessary to make the connection.
    - b) The Contractor must excavate and maintain a dry and safe working pit of sufficient size to facilitate the inspection and tapping of the line.
    - c) The Contractor will locate the main and must pressure test the tapping sleeve and valve to 150 psi, or 10 psig above the pressure in the main being tapped, whichever is greater.
    - d) The Contractor will maintain the pressure on the sleeve for 10 minutes at zero (0) pressure loss.
  - 4.14.6.7 When the Contractor is required to make the tap, they must make the tap while the main is in service using standard tapping techniques as approved by the County
    - a) The force main must be tapped in such a manner that the operation of the main in service is not disturbed.
    - b) The Contractor must obtain the approval of Public Utilities Department for methodology and subcontractor personnel prior to initiating any tap.
  - 4.14.6.8 The Contractor must be responsible for properly backfilling the work pit after the work is complete.
  - 4.14.6.9 The tapping valve, isolation plug valve, and sleeve become the property of the County upon successful completion of the tap.
- 4.14.7 Verification is required that each tap has been performed onto the intended pipe. The coupon is to be removed and inspected. The valve is to be cracked open to verify pressure and type of liquid being expelled. At the County's option a pressure test valve may be required to be installed at no cost to the County.
- 4.14.8 Connections of any size will be prohibited in areas that are both outside the Urban Service Area and outside the areas defined in Policy 4.3.1 of the One Water Element of the Comprehensive Plan. Transmission mains outside of these areas must be defined as "Limited Access Transmission Mains".





## PART 5.0 PRESSURE TESTING FORM

### PRESSURE TEST REPORT

PROJECT NAME: \_\_\_\_\_ PROJ. NO.: \_\_\_\_\_

ENGINEER OF RECORD: \_\_\_\_\_

EOR COMPANY NAME: \_\_\_\_\_

CONTRACTOR'S REPRESENTATIVE: \_\_\_\_\_

CONTRACTOR COMPANY NAME: \_\_\_\_\_

SERVICE REQUEST NO: \_\_\_\_\_ DATE: \_\_\_\_\_

INSPECTOR: \_\_\_\_\_

\_\_\_\_\_ WATER PRESSURE TEST \_\_\_\_\_ FORCE MAIN PRESSURE

\_\_\_\_\_ RECLAIMED MAIN PRESSURE

FIELD MEASUREMENTS:

START TEST @ \_\_\_\_\_ PRESSURE = \_\_\_\_\_ psi

FINISH TEST @ \_\_\_\_\_ PRESSURE = \_\_\_\_\_ psi

LOSS = \_\_\_\_\_ psi

LF OF PIPE BEING TESTED \_\_\_\_\_

PEOPLE PRESENT:

TEST RESULTS AND COMMENTS: