SPECIFICATION 339001:
RECLAIMED WATER MAINS AND APPURTENANCES

PART 1.0 GENERAL

1.1 DESCRIPTION

1.1.1 The following specification covers the design, installation, inspection, testing, and acceptance of reclaimed water systems. Construction consists of furnishing all labor, equipment, tools, appliances and materials for performing all operations necessary for the construction and installation of reclaimed water mains and service lines, including all piping, valves, valve boxes, casings, service lines, appurtenances, complete and ready for operation, as indicated on the construction drawings and described herein.

1.1.2 The Developer/Contractor shall furnish to the County a two year warranty on the materials, fabrication, and workmanship of any and all pipe and fittings furnished. Warranty period shall commence upon written acceptance of the particular component or appurtenance by the County for ownership and operation.

1.1.3 All Construction plans, project submittals and record drawings shall comply with the requirements of Section 1 and Section 2 of the Hillsborough County Public Utilities Department (PUD) Technical Manual.

1.2 REFERENCE DOCUMENTS

- American Association of State Highway & Transportation Officials (AASHTO)
- American National Standards Institute (ANSI)
- American Society of Mechanical Engineers (ASME)
- American Society of Sanitary Engineers (ASSE)
- American Society for Testing Materials (ASTM)
- American Water Works Association (AWWA)
- Florida Administrative Code, Chapter 62-555 & 62-610
- Florida Department of Transportation (FDOT)
- Florida Statutes, Water Resources Act, Chapter 373
- The Hillsborough County Cross Connection Control Program, approved August 6, 1993, in accordance with Rule 62-610.469, F.A.C., with legal authority established in the Hillsborough County Code of Ordinances, Chapter 121 Cross Connection Control and Backflow Prevention.
- Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

1.3 SHOP DRAWINGS AND SUBMITTALS

1.3.1 For County run projects, shop drawings and related manufacturer's product certification shall be made in accordance with the General and Special Conditions of the Contract Documents for approval prior to purchase or fabrication of the material by the manufacturer. The following items that require shop drawings are brought to the Contractor's attention. The list may not include all items for which shop drawing submittals are required to meet the requirements of the project:

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 shall be provided for pipe, fittings, valves, service 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 Service 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 shall include the names of the fusion technicians and certification(s), a description of the equipment to be used, and logged information for each joint shall 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 reclaimed water system piping supplied.

1.3.2 Certification and test reports for the materials, manufacturing, and testing of the types of pipe supplied shall be performed and furnished by the pipe manufacturer/supplier in accordance with the latest standards of the industry as described in Part 1.2 herein.

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 Specifications of Division 03
- All Specifications of Division 33
- Hillsborough County PUD Technical Manual
- Hillsborough County Utility Accommodation Guide
- Hillsborough County Transportation Technical Manual

PART 2.0 DESIGN

2.1 LINE SIZING CRITERIA

2.1.1 Criteria for sizing the distribution system piping is included in Part 5 herein; however, the design engineer shall be responsible for obtaining any additional or updated design criteria from the Hillsborough County PUD Reclaimed Water Planning Team.

2.1.2 Pipes shall be sized to maintain a minimum distribution main pressure of 45 psi during peak conditions. County staff will provide the pressure reading at the point(s) of connection.

2.1.3 The minimum size of distribution system mains shall be four inches.
2.2 **LINE ROUTING**

2.2.1 The primary feed for the reclaimed water distribution system for a residential or commercial subdivision shall be routed within County road right-of-way. A secondary feed may be routed within a utility easement that is dedicated to the County (design exception), only if there is no road right-of-way available.

2.2.2 All designs require the Engineer of Record to have Level “A” SUE work (locate) performed for all points of connection. Level “A” SUE shall comply with the definition by ASCE 38-02 and adopted by FDOT.

2.2.3 When the point of connection is an asbestos line, the PUD Utility Coordination Team must be contacted to work out the details at the connection point.

2.2.4 The County requires a project’s off-site infrastructure to be extended beyond the point(s) of connection in the right-of-way to the extent of the development's property. This facilitates future system interconnections. As a minimum, at the entrance to the project, the off-site main extension shall be extended within the right-of-way with a valve and one length of pipe with a restrained cap.

2.2.5 Lines crossing arterial roads, collector roads, and any single access entry to a subdivision, traditional neighborhood development, or commercial driveway shall be cased. The casing shall extend two feet beyond the back of curb/edge of pavement.

2.2.6 All crossings of arterial and collector roads shall be jack and bore unless an alternate installation method is approved by right-of-way permitting, or the Jurisdictional Authority for the road.

2.2.7 For projects where the proposed improvement is over existing lines, all pipe material not meeting the currently approved specifications will require replacement and relocation of the existing lines.

2.2.8 Minimum reclaimed water line clearance from the property line is five feet. If the line is within an easement, it shall be installed in the center of the easement. See PUD Technical Manual Section 2.2.4 for additional design requirements for easement installations.

2.3 **DEPTH OF COVER**

2.3.1 Cover as measured from finished grade to top of the pipeline shall be a minimum 36 inches for pipe diameters up to and including 12 inches. Depth of cover for pipes 16 inches or greater in diameter shall be a minimum of 48 inches. For pipe in FDOT right-of-way, or on County arterial roads the minimum depth of cover shall be 48 inches.

2.3.2 When automatic air release valves are required for pipe diameters up to and including 12 inches, the depth of cover of the entire line must be increased to a minimum of 48 inches (enough to maintain the valve vault flush with the existing or proposed grade). See Specification 339002, Exhibit R-6A through R-6D for ARV details and required depths of bury.

2.3.3 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 reclaimed water lines, the depth of cover shall 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 line shall be replaced or relocated as determined by the County.
2.4 SEPARATION OF RECLAIMED WATER, POTABLE WATER, AND SEWER LINES

2.4.1 General
   2.4.1.1 Reclaimed water mains shall not be installed in the same trench with potable water mains.
   2.4.1.2 Reclaimed water mains should be installed on the opposite side of the street from potable water mains and should be installed in the grassed area between the sidewalk and the pavement.
   2.4.1.3 When the following required horizontal and vertical separations cannot be maintained, a design exception must be obtained from the Utility Design Section Manager prior to construction.

2.4.2 Horizontal Separation: A minimum horizontal separation of three feet (face to face) shall be maintained between reclaimed water mains and potable water mains, sanitary sewers, or sanitary force mains. In addition, for single family residences this separation shall be maintained between all potable water and reclaimed water service lines and meter boxes.

2.4.3 Vertical Separation: Reclaimed water mains shall cross below water mains and above storm water lines, sanitary sewers or sanitary force mains. Where a reclaimed water main crosses another pipeline, a minimum of 18 inches vertical clearance shall be maintained. The crossing shall be arranged so that the reclaimed water joints will be equidistant and as far as possible from the other pipeline joints.

2.5 CROSS-CONNECTION CONTROL

2.5.1 General
   2.5.1.1 Backflow prevention is required in accordance with PL93-523, the Federal Safe Drinking Water Act, and subsequent amendments; and Florida Administrative Code (FAC) 62-555.360 for the protection of the potable water system.
   2.5.1.2 Cross Connections between the reclaimed water and the portable water systems, other pressurized systems, sources, mechanical apparatus, or equipment within the private property footprint is prohibited.

2.5.2 At all locations where reclaimed water service is provided, the public potable water supply shall be protected by installation of an approved backflow prevention device.

2.5.3 All rules, regulations and procedures necessary to administer and enforce the provisions of cross-connection control are established in the Hillsborough County Code of Ordinances, Part B, Public Utilities, Chapter 121 Cross Connection Control and Backflow Prevention, which is incorporated herein and made a part hereof.

2.5.4 Residential Cross-Connection Control: Prior to receiving reclaimed water service, a dual check valve backflow prevention device, as a minimum, will be installed downstream of each residential customer's potable water meter in order to protect the potable water system. Refer to Part 2.5.3 above for final determination of required backflow protection.

2.5.5 Multi-family and Commercial Property Cross-Connection Control
   2.5.5.1 Multi-family complexes and commercial properties with master-metered potable water service and master-metered reclaimed water service shall be required to install a Reduced Pressure Principal type backflow prevention device downstream of the master potable
2.6 GOLF COURSES AND OTHER MAJOR USERS

2.6.1 Golf courses and other major water users (over 100,000 gallons per day annual average) are required to install a meter and equipment to monitor and control the flow entering the property. Prior to connection to the reclaimed water system, the golf course owner must enter into a service agreement with HCPUD. A copy of the standard golf course service agreement will be provided upon request from the Reclaimed Water Planning Team.

2.6.2 The following is a general description of each of the required components.

2.6.2.1 Meters shall comply with the design requirements listed in Part 2.7.

2.6.2.2 Receiving Pond Level Sensor: The golf course owner is responsible for installing and maintaining, in good operating condition, one or more pond level sensors. The type of sensor shall be approved by HCPUD. See Specification 339002, Exhibit R-1E.

2.6.2.3 Control Valve Operator, and Electronic Controller: A control valve shall be installed at the metering station and shall be configured to sustain upstream pressure and shall shut off when commanded from a remote location. In conjunction with an electronic controller, the valve shall maintain a flow rate set point.

2.6.2.4 Pressure Gauges and Pressure Transmitters: Pressure gauges shall be installed on the supply side and distribution side of the metered connection as shown in Specification 339002, Exhibits R-1C and R-1D.

2.6.2.5 Real-time Monitoring and Control Panel with PLC: The real-time monitoring and control field panel shall be installed at the metering station as shown in Specification 339002, Exhibit R-1D. The field panel shall contain all components necessary for both local and remote monitoring and control of the metering stations, including a programmable logic controller (PLC), radio, operator interface unit (OIU), electronic interface controller, open/close/remote hand switch, power supplies to control circuitry, and surge suppression. Provide all programming necessary for operating system.

2.6.2.6 Spare Parts: Provide spare parts in accordance with the detailed specifications, prepared on a case-by-case basis for each metering station.

2.6.2.7 Radio Survey: Conduct a radio survey for each site in which the County elects to communicate via a radio link. The objective of the radio survey is to demonstrate that radio signal strength is sufficient to support reliable communications. The radio survey shall consist of two parts -- a radio propagation computer model and a field survey, where actual radios are used. The radio propagation computer model must include a path profile that clearly shows terrain and obstructions between both the remote and central sites.

2.6.2.8 Power Requirements: Provide all conduit and conductors as necessary for a complete operating system, including grounding, grounding systems inspection, and electrical testing.

2.7 METERS AND METERING ASSEMBLIES

2.7.1 Meter size shall be dependent upon flow characteristics. The design engineer will size the meter or meters subject to approval by the Reclaimed Water Planning Team of HCPUD.
2.7.1 Test ports: For meters three inches and larger a capped tee with a two-inch threaded plug shall be installed immediately downstream of the meter for use as a test port.

2.7.1.2 Bypass Loops: Although bypass loops are typically not required because reclaimed water delivery is not essential to the public health and safety, the County reserves the right to request a bypass design on a case-by-case basis.

2.7.2 A master meter assembly shall be directly accessible by boom truck off the County right-of-way or by an interior road that is not blocked by a wall or gate. The access road shall be a minimum width of 12 feet. All access roads shall comply with Hillsborough County Transportation Technical Manual, and FDOT requirements.

2.7.2.1 The elevation of the concrete slab will be higher than the immediate surrounding area.

2.7.2.2 A five-foot “landscape free” buffer shall be maintained around the meter slab. Do not mulch around the slab. Do not plant any landscape that will hinder access in the future to the meter assembly.

2.7.3 Meter assemblies located above ground within vehicle traffic area (parking lot, driveway, or within 15 feet of the edge of pavement or back of curb) shall be protected by a minimum of four bollards.

2.7.3.1 Bollards shall be six-inch diameter steel pipe filled with Type I Portland cement, 28 day, 3000 psi concrete. Refer to Specification 339002, Exhibit R-1C for details.

2.7.3.2 Bollards shall be painted with one coat of rust prohibitive primer and one coat of Safety Yellow (Fed-Std-595C #13591) or Ultra White (Fed -Std-595C #27925) high grade enamel.

2.7.4 The meter assembly shall be painted above ground with an approved paint for above grade piping, fittings, and valves found in Appendix B (for NACE Classified C5-I Environment) per the paint manufacturer’s recommendations to ensure a service life of five years. The assembly shall be color-coded purple as specified in Part 2.11.1.

2.7.5 Metering for Single-Family Residences

2.7.5.1 Where service is available, a meter shall be installed on a reclaimed water service connection for each single family residence that applies to HCPUD for residential hook-up.

2.7.5.2 Prior to final connection, the homeowner is required to have an approved backflow prevention device installed on their potable water service per the requirements of Part 2.5.

2.7.6 Meters for Commercial Class and Master-Metered Multi-Family Properties

2.7.6.1 All commercial customers and multi-family properties with a common area irrigation system will be metered.

2.7.6.2 All meters shall be appropriately sized and approved per 2.7.1. Meters sized two inches or smaller will be installed by the County; meters larger than two inches shall be installed by the customer, although all connections to the reclaimed water main will be made in accordance to Part 4.19.

2.7.6.3 All reclaimed water meters sized three inches and larger for commercial customers, including multi-family common area connections, shall be installed above ground. The entire meter assembly, including valves and pipes, shall be color-coded purple as specified in Part 2.11.1.

2.7.7 Meters for Golf Courses and Other Major Users: The meter shall be selected from the pre-approved meters listed in Appendix B and meet the requirements of Part 3.7. See Specification 339002 Exhibit R-1D.
2.8 SERVICE CONNECTIONS

2.8.1 Reclaimed water service connections, two inch and smaller, shall be included as part of the distribution system and consist of: the service line, the corporation stop or a tapping valve, the curb stop, and (for dual near-side connections) a dual service wye. A typical service layout is shown in Specification 339002, Exhibit R-2A.

2.8.2 All near-side residential services shall be one-inch polyethylene (HDPE) tubing for both single and dual services. See Specification 339002, Exhibits R-2B and R-2C.

2.8.3 Reclaimed water service connection taps/service saddles shall be at least 18 inches apart. Service connections 2-inch in size are considered commercial size and require a 2-inch isolation/tapping valve at the point of connection.

2.8.4 All far-side residential services shall be single one-inch HDPE tubing with individual service connections. Dual far-side services shall be two individual one-inch HDPE lines. See Specification 339002, Exhibits R-2A & R-2F.

2.8.5 Far-side service lines (one-inch HDPE tubing) crossing under pavement shall be installed in a two-inch PVC or HDPE purple sleeve at a minimum depth of three feet below pavement. A single three-inch purple sleeve may be used to encase two one-inch service lines. The sleeve shall extend a minimum of 24 inches beyond edge of curb and gutter, where present.

2.8.6 Service lines that serve a common area irrigation system shall utilize a 2-inch tap and tapping gate valve. The EOR can downsize the service line to 1-inch as determined by their flow calculations. For irrigation service lines, the purple sleeve crossing under the pavement shall be PVC, 4-inch in diameter. Irrigation lines larger than 2-inch are considered and shall be treated as commercial connections.

2.8.7 A four-inch PVC purple sleeve shall be used for a two-inch service line, or where a dual far-side service is required across a cul-de-sac (extra-long exceeding 50 feet in length).

2.8.8 Service connections shall utilize a tapping or service saddle. Direct taps onto lines is not allowed.

2.8.9 Services two-inch and smaller shall use polyethylene (HDPE) tubing one inch or two inches in diameter.

2.8.10 No trees or shrubs shall be planted within five feet of a service meter.

2.9 VALVES AND VALVE LOCATION

2.9.1 Isolation Valves

2.9.1.1 Valves and roadway boxes shall 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 distribution system. All valves shall be installed at the tee, cross, or point of connection.

2.9.1.2 Valves shall be placed so that the maximum allowable length of reclaimed water main required to be shut down for repair work shall be no more than 1,000 feet in commercial, industrial, multi-family, or residential districts. Valves shall be placed so that the maximum allowable length of reclaimed water main required to be shut down for repair work shall be no more than 2,000 feet on off-site transmission mains.
2.9.1.3 The design should consider and incorporate maintenance considerations when placing isolation valves. Isolation valves shall be gate valves per Part 3.6 herein. The County reserves the right to require additional isolation valves where necessary for efficient operation and maintenance.

2.9.1.4 Valves shall be readily accessible, and located in an area not subject to flooding. Valves shall not be located below the top of bank, within a storm water ditch, or within a swale.

2.9.1.5 Valve boxes shall not be located in ADA (American with Disabilities Act) ramps, or in curbs.

2.9.1.6 All valves shall be permanently tagged with stainless steel tags that differentiate reclaimed water valves from potable water valves.

2.9.2 Air Release Valves (ARV)

2.9.2.1 Air release valves shall be specified at high points where air can accumulate in new or altered water mains.

2.9.2.2 Manual ARVs are preferred, over automatic ARV’s.

2.9.2.3 Automatic air release valves shall not be used in situations where flooding of the ARV manhole may occur.

2.9.2.4 Air release valves shall not be placed in, or adjacent to driveways.

2.9.2.5 Construction plans and record drawings shall include air release valve stationing on both the plan and profile view.

2.9.2.6 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 the ARV assembly fits within the valve vault, and the vault is installed flush with grade. See Specification 339002, Exhibits R-6A and R-6B.

2.9.3 Pressure Reducing Valves: Pressure Reducing Valves shall be certified by a Professional Engineer licensed in the State of Florida and will be reviewed by the County on a case-by-case basis.

2.9.4 Pressure Sustaining Valves: Pressure Sustaining Valves shall be certified by a Professional Engineer licensed in the State of Florida and will be reviewed and approved by the County on a case-by-case basis.

2.10 PIPE, FITTINGS, AND APPURTEYNANCES

2.10.1 Distribution mains outside of residential subdivisions (within the right-of-way or within an easement), or along a collector or arterial road shall be constructed of ductile iron pipe (DIP).

2.10.2 All transmission mains (defined as pipe sizes 16-inch and greater) shall be constructed of ductile iron pipe.

2.10.3 Distribution systems, within a subdivision, pipe sized 12 inches and less, shall be either polyvinyl chloride (PVC) or DIP.

2.10.4 No 10 inch or 14 inch pipe shall be used.

2.10.5 All fittings shall be ductile iron and comply with the requirements of Part 3 herein.

2.10.6 All buried ductile iron pipe (including pipe inside of casing), valves, and fittings shall be polywrapped.
2.10.7 The reclaimed water system is a closed system. The end of pipes shall be capped, or plugged.

2.10.8 Aerial crossing pipe shall be ductile iron. Above grade piping shall be Class 53 (minimum).

2.10.9 Restrained Joints
2.10.9.1 Restrained Joints shall be installed wherever reclaimed water main pipe alignment changes direction.
2.10.9.2 The length of pipe to be restrained and actually restrained shall be noted on the design and record drawings, respectively. Restrained joints shall 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.
2.10.9.3 Shop drawings from the manufacturer shall be submitted to and approved by the Engineer of Record prior to actual construction. Refer to Part 1.3.
2.10.9.4 Thrust blocks are not allowed in the Hillsborough County reclaimed water system.
2.10.9.5 When Exhibit R-5A is used the Design Engineer of Record must fill out the entire restraint table as applicable for their project

2.10.10 At all new points of connections, a tee or cross with the appropriate isolation valves shall be installed.

### 2.11 SYSTEM IDENTIFICATION AND SIGNAGE

2.11.1 General
All reclaimed water piping and appurtenances shall be clearly identified as reclaimed water facilities. The standard color is Pantone Purple 522C (Fed-STD-595C #27160 for paint) for all reclaimed water system piping and aboveground appurtenances including valves, meter assemblies, and backflow prevention devices. All identification and signage shall be in accordance with F.A.C. 62-610.469(7) (f).

2.11.2 Piping and Appurtenances
2.11.2.1 Valves installed below ground shall be identified with a stainless steel tag and purple curb markers to differentiate reclaimed water valves from potable water valves.
2.11.2.2 Covers for all valve boxes, meter and service boxes, and other below-ground devices on the reclaimed water system shall comply in color with item 2.11.1. above, and shall be permanently embossed “RECLAIMED WATER” and bear the words in English and Spanish “DO NOT DRINK, NO BEBER,” together with the equivalent standard international symbol.
2.11.2.3 Above ground piping shall be painted with one coat of rust prohibitive primer and one coat of Reclaimed Purple (Fed–Std-595C #27160) high grade brushing enamel complying with 2.11.1.

2.11.3 Signage
2.11.3.1 The public shall be notified of the use of reclaimed water by posting advisory signs designating the nature of the reuse project area where reuse is practiced. Advisory signs are available from PUD.
2.11.3.2 Signage shall be placed, as appropriate, at entrances to residential neighborhoods where reclaimed water is used for landscape irrigation and at prominent locations at all commercial sites, including: multi-family developments, office parks, schools, churches, condominiums, residential common areas, recreational developments, and golf courses. A notification method for golf courses, for example, would be to post advisory signs at
2.11.3.3 Advisory signs shall be color-coded Pantone Purple 522C and include the following text in English and Spanish "RECLAIMED WATER" and "DO NOT DRINK, NO BEBER," together with the equivalent standard international symbol. A schematic of a typical advisory sign is shown in Specification 339002, Exhibit R-3.

2.11.3.4 Advisory signs shall be posted adjacent to lakes or ponds used to store reclaimed water and at decorative water features that use reclaimed water.

2.11.3.5 Advisory signs at storage ponds or decorative water features shall include the following text in English and Spanish "DO NOT DRINK, NO BEBER" and "DO NOT SWIM, NO NADAR," together with the equivalent standard international symbols, in addition to "RECLAIMED WATER".

2.11.3.6 Tags or labels for all reclaimed water valves and outlets shall be provided, bearing the words in English and Spanish: “Do not drink” together with the equivalent standard international symbol. Curb markers (das type) shall be used when appropriate.

2.12 HOSE BIBB ASSEMBLY

Hose Bibb connections are allowed for hand watering of lawns and other limited outdoor activities. These connections may be used independently or in conjunction with an in-ground irrigation system. The Hose bibb shall be located in a locked box below ground level.

2.13 BLOW-OFF ASSEMBLY

2.13.1 A blow-off assembly shall be installed on dead-end mains and at the end of cul-de-sac distribution mains. See Specification 339002, Exhibits R-4A and 4B for details.

2.13.2 Temporary Blow-off Assembly: Reclaimed water main extensions at a project phase line shall include a valve and no more than one additional standard length of pipe with a cap and a temporary blow-off assembly. The temporary blow-off may use a full sized inline valve. Mark plans appropriately for locations.

2.13.3 Construction plan and record drawings shall include blow-off assembly stationing on both the plan and profile views.

2.13.4 Blow-offs shall not terminate in driveways, sidewalks, or any paved surface.

PART 3.0 PRODUCTS

3.1 PIPE MATERIAL

3.1.1 The following table lists the allowable pipe materials for various sizes of reclaimed water main pipe:
3.1.2 All pipe, fittings and appurtenances shall be supplied in accordance with the approved material list in Appendix B.

3.1.3 Alternative materials may be submitted to Hillsborough County for review by and approval from the Public Utilities Department Product Review Committee (with proper testing documentation, performed by recognized industry authorities) prior to commencement of design. Refer to Section 1 of the PUD 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 Public Utilities Department prior to commencement of design of any alternative material.

### 3.2 DUCTILE IRON PIPE AND FITTINGS

3.2.1 Ductile iron (DI) pipe shall conform to the requirements:

3.2.1.1 Pipe shall conform to ANSI/AWWA C151/A21.51, *Ductile-Iron Pipe, Centrifugally Cast, For Water*, Class 50 (minimum).

3.2.1.2 Joints for ductile iron pipe shall be mechanical or push-on joints, unless otherwise specified herein.

3.2.1.3 Pipe interior shall have a cement mortar lining with an asphaltic seal-coat conforming to ANSI/AWWA C104/A21.4, *Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water*. Buried pipe shall have an exterior asphaltic coating in accordance with ANSI/AWWA C151/A21.51.

3.2.2 The weight and class designation shall be legibly marked on the exterior surface of all pipe and fittings. Manufacturer's code or serial numbers shall be provided on the bell of each pipe joint.

3.2.3 DIP shall be marked with purple stripe/tape in accordance with FAC 62-610.469(7) (f). Adhesive tape shall be two-inch wide vinyl at least 4.5 mil thick.

3.2.4 Fittings

3.2.4.1 All ductile iron fittings shall be mechanical joint, and restrained, with a minimum pressure rating of 250 psi. Fittings shall conform to the requirements of ANSI/AWWA C153/A21.53, *Ductile-Iron Compact Fittings for Water Service*.

3.2.4.2 All fittings shall be coated and lined as specified in Part 3.2.1 for ductile iron pipe.

3.2.5 Mechanical Joints

3.2.5.1 Mechanical joints (MJ) consisting of bell, socket, gland, gasket, bolts and nuts shall

3.2.5.2 Bolts shall be high strength low alloy steel, T-head type having hexagonal nuts.

3.2.5.3 Bolts and nuts shall be machined true and nuts shall be tapped at right angles to a smooth bearing surface.

3.2.6 Push-On Joints: Single seal gasket push-on type joints shall conform to the requirements of ANSI/AWWA C111/A21.11 and shall be as approved in Appendix B for ductile iron pipe.

3.2.7 Restrained Joints

3.2.7.1 Restrained joints (RJ) shall 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.

3.2.7.2 The restraining joints for mechanical joint (MJ) fittings and valves shall conform to the requirements of ANSI/AWWA C111/A21.11 and Appendix B. See Specification 339002 Exhibit R-5A and R-5B.

3.2.7.3 Restrained joints (both manufacturer supplied and field lock gaskets) shall have the bell of the pipe marked in red. Wrap the bell with vinyl adhesive red marking tape.

3.2.8 Aerial Crossing Pipe, hangers, and Accessories

3.2.8.1 Pipe designated for use in aerial crossings and/or attachment to bridge or drainage structures shall comply with the requirements of ANSI/AWWA C151/A21.51, Class 53 (minimum).

3.2.8.2 Pipe length shall correspond to "Long Span Pipe", DIP restrained joint.

3.2.8.3 Pipe joints shall consist of a mechanical joint-flange (MJ-FLG), or flange-plain end (FLG-PE), and flange-restrained joint (FLG-RJ). The flange joint end shall be equipped with O-ring gasket.

3.2.8.4 Flanged joints to be lined as per ANSI/AWWA C115/A21.15, *Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges*. Exterior coating shall be field applied, color coded purple (Fed-Std-595C #27160), and comply with the pre-approved products specified in Appendix B. All exposed threads are to be coated with paint.

3.2.8.5 Hangers and Accessories

a) Anchor bolts shall be Grade 316 stainless steel, installed in accordance with the construction drawings, utilizing non-shrink grout.

b) Roller Stands: Roller stands and roller axles shall be Grade 316 stainless steel.

c) Insulated Pipe Rollers: Pipe support rollers shall be constructed of dielectric synthetic resin.

d) Link seal and sleeve seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall 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 shall be made in accordance with MSS SP-58 and ANSI/ASME pressure piping code B31.1.

3.2.9 Polywrap/Polyethylene Encasement: All buried ductile iron pipe and fittings shall be encased in polyethylene in accordance with ANSI/AWWA C105/A21.5, *Polyethylene Encasement for Ductile-Iron Pipe Systems*. Polyethylene shall be eight mils thick.
3.3 POLYVINYL CHLORIDE PIPE AND FITTINGS

3.3.1 PVC Pipe color shall be an integral part of the pipe material and shall comply with Part 2.11.1, herein.

3.3.2 PVC pressure pipe (four inches through 12 inches in diameter) shall conform to the requirements of ANSI/AWWA C900, except that the pipe does not have to be NSF approved.

3.3.2.1 It shall have the same O.D. as ductile iron pipe and be compatible for use with ductile iron fittings.

3.3.2.2 The pipe shall have a dimension ratio (DR) of 18, shall have a minimum working pressure of 200 psi, and a nominal laying length of 20 feet.

3.3.3 All PVC shall be formulated for sunlight exposure and shall pass the impact strength test as described by ASTM D2444, latest revision, using TUP A with impact level of 94 ft.-lbs.

3.3.4 Fittings: Fittings for PVC pipe shall be ductile iron with mechanical joints, and comply with the requirements of Part 3.2.

3.3.5 Joints

3.3.5.1 All PVC pipe shall have provisions for expansion and contraction provided in the joints.

3.3.5.2 All non-fused joints shall be designed for push-on makeup connection. A push-on joint shall be an elastomeric gasket bell end coupling manufactured as an integral part of the pipe barrel consisting of an integral wall-thickened section with an expanded bell with a ring groove to retain an elastomeric sealing ring of uniform cross-section as pre-approved in Appendix B for PVC pipe.

3.3.5.3 Restrained Joints: See Exhibits R-5A & R-5B in Specification 339002 for restrained joint details. See Appendix B for pre-approved products. The length of pipe to be restrained shall be noted on the Construction Drawings.

3.3.6 Fusible PVC

3.3.6.1 Pipe shall be provided with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.

3.3.6.2 Fusible PVC shall be manufactured in a standard 20 foot, 30 foot or 40 foot nominal lengths.

3.3.6.3 Fusible PVC pipe lengths shall be assembled in the field with butt-fused joints. The Contractor shall follow the pipe supplier’s written guidelines for this procedure, using only demonstrated qualified fusion technicians

3.4 GASKETS

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

3.5 POLYETHYLENE (HDPE) SERVICE PIPE AND TUBING

3.5.1 Extrusion compound shall comply with the applicable requirements for PE 3608 or 4710, very high molecular weight polyethylene plastic material, as specified in ANSI/AWWA C901, and a cell classification of 345464C (or E) or 445474C (or E) as specified in ASTM D3350, Refer to...
Appendix B for a listing of pre-approved products.

3.5.2 Tubing shall be 200 psi, Type CTS (copper tubing size).

3.5.3 Standard Dimension Ratio (SDR):
3.5.3.1 The standard dimension ratio for polyethylene tubing provided in Copper Tubing Sizes shall be nine (9). The average outside diameter, minimum wall thickness and respective tolerances for any cross section shall be specified in ASTM D2737.

3.5.3.2 The standard dimension ratio for three-inch diameter pipe (used as casing pipe) shall be seventeen (17) for IPS pipe sizes. The average inside diameter, minimum wall thickness, and respective tolerances for any cross-section shall be as specified in ANSI/AWWA C901.

3.5.4 Environmental stress cracking resistance testing shall be performed in accordance with ASTM D1693, Condition C, and shall have no failures during a 5000 hour test period.

3.5.5 Pipe identification: All HDPE reclaimed water service pipe or tubing shall be purple (Pantone Purple 522C) or identified with a purple stripe with the words Reclaimed Water at eight-inch intervals. A list of pre-approved materials are given in Appendix B.

3.6 VALVES AND APPURTENANCES

3.6.1 General
3.6.1.1 All valves shall be the manufacturer’s standard design for the service intended, shall be cast on the body with the manufacturer’s distinctive marking or name, the year the valve casting was made, the pressure rating, and if applicable the valve type, size, and flow direction arrow.

3.6.1.2 Valves shall open by turning the operating unit (operating nut or hand wheel) to the left, or counterclockwise, when viewed from the top. The operating nut, or hand wheel, shall have an arrow cast in the metal indicating the direction of opening.

3.6.1.3 Only valve types listed are acceptable for use in Hillsborough County. See Appendix B for pre-approved valves.

3.6.2 Check Valves
3.6.2.1 Check valves shall conform to ANSI/AWWA C508, and shall be iron body, swing non-slam type, and equipped with removable inspection covers for normal horizontal installation in reclaimed water service.

3.6.2.2 The check valve shall be rated for 175 psig for valves with diameters of two inches through 12 inches, and 150 psig minimum working pressure for valves 14 inches through 24 inches in diameter.

3.6.2.3 Check valves shall permit full flow area equal to that of the connecting pipe.

3.6.2.4 Valve ends shall be flanged for above ground installation.

3.6.2.5 Check valves four-inch and larger in diameter shall be equipped with an external backflow actuator & mechanical indicator, or equipped with an outside lever and adjustable weight operator (OLW).

3.6.2.6 Check valves smaller than four inches in diameter shall be bronze body, bronze mounted, horizontal swing, y-pattern, threaded ends, 125 psig WOG.

3.6.2.7 OLW valve designs 12 inches and less shall be metal to metal seat (bronze to bronze). OLW valves 14 inches and greater shall incorporate a rubber-faced bronze clapper disc seated by a bronze clapper arm against a bronze seat ring (resilient to metal). The clapper
arm shall be secured to a stainless steel hinge pin which turns in bronze bushings. The bushings shall be provided with "O"-ring seals.

3.6.3 Gate Valves

3.6.3.1 Gate valves shall be of the resilient seat type meeting the requirements of ANSI/AWWA C509 or C515, and coated per ANSI/AWWA C550, Protective Interior Coatings for Valves and Hydrants. Two-inch valves shall comply with the “intent” of ANSI/AWWA C509/C515 and C550.

3.6.3.2 All gate valves shall be iron body, bronze trimmed, solid wedge, resilient-seated, and shall be equipped with O-Ring type stuffing boxes.
   a) All gate valve stem nuts shall be bronze.
   b) All gate valve “gates” shall be fully encapsulated with and fully bonded to the resilient seat material.
   c) All gate valve resilient wedge, O-Rings, and gaskets in contact with the reclaimed water shall be E.P.D.M. (Ethylene Propylene Diene Monomer) material.

3.6.3.3 All gate valve bolting materials, excluding joint accessories, shall at a minimum be Grade 304 stainless steel, shall be readily accessible for valve maintenance, shall have square or hexagonal heads and shall be in conformance with the requirements of Section 4.4 of ANSI/AWWA C509/C515.

3.6.3.4 All gate valves shall be coated with a fusion bonded epoxy coating applied to both the exterior and the interior surfaces prior to assembly of the valves.

3.6.3.5 All gate valves, when fully opened, shall have an unobstructed waterway diameter equal to or larger than the full nominal diameter of the valve.

3.6.3.6 Underground gate valves
   a) These valves shall have non-rising stems and shall be furnished with two-inch square AWWA operating nuts.
   b) Valves shall have MJ-RJ ends and shall be furnished complete with joint accessories.

3.6.3.7 All gate valves intended to be located above ground and/or inside structures shall be outside screw and yoke (OS&Y) or non-rising stem, hand-wheel operated types with flanged joint ends. The face-to-face dimensions and drilling shall conform to ANSI B16.10 for Class 125, flanged joint-end gate valves.

3.6.3.8 The minimum design working water pressure shall be:
   a) 200 psig for three-inch through 12-inch sizes,
   b) 150 psig for 16-inch through 36-inch sizes.

3.6.3.9 All gate valves, prior to shipment from the manufacturing facility, shall be tested by subjecting it to a minimum hydraulic pressure equal to twice the specified working pressure.

3.6.3.10 All gate valves shall be warranted by the manufacturer for a minimum of 10 years.

3.6.4 Tapping Valves, Tapping Sleeves, & Services Saddles

3.6.4.1 Tapping sleeves, tapping crosses, and tapping valves used to make “wet” taps into existing mains shall be provided and installed at locations shown on the Construction drawings.

3.6.4.2 No size on size taps, or direct taps to pipe, are allowed.

3.6.4.3 Tapping Valves
   a) Tapping valves shall be mechanical joint outlet, non-rising stem, resilient seat gate valves with O-ring seals meeting the applicable requirements of ANSI/AWWA C509/C515 and C550.
   b) Tapping valves shall be specifically designed for pressure tapping with sufficient seat opening to allow full diameter taps to be made.
c) Tapping valves shall be manufactured with an integral tapping flange having a raised lip design in accordance with MSS SP60.

d) All tapping valves shall be coated with a fusion bonded epoxy coating applied to both the exterior and the interior surfaces prior to assembly of the valves.

e) Tapping valves shall be furnished with a combination flange and mechanical joint for connecting the branch to the main.

3.6.4.4 Tapping Sleeves and Crosses

a) Tapping sleeves shall be SS with wraparound gasket style, MJ split iron units, or fabricated carbon steel units with a fusion-bonded epoxy coating and outlet seal gaskets, and shall be pressure rated as listed in 3.6.3.8.

1) SS with wraparound gaskets shall be for use on all pipes up to 12 inches in diameter.

2) MJ split iron units shall be limited for use on PVC pipe up to 12 inches in diameter and shall not be used on AC pipe.

3) Fabricated carbon steel units with fusion bonded epoxy coating and outlet seal gaskets shall not be used on AC pipe.

b) The Contractor shall verify the outside diameter of the existing main before ordering the sleeve.

c) Tapping sleeves shall have an outlet flange per ANSI B16.1, Class 125 standard.

3.6.4.5 Service Saddles

a) Service saddles shall have a ductile iron body, be equipped with double tie straps, and be suitable for either wet or dry installation. Service saddles shall be as pre-approved in Appendix B.

b) The sealing gasket shall be the O-ring type suitable for the applicable service. The outlet connection shall be FIP threads, 2 inch or less.

c) Tie straps and bolts shall be a corrosion resistant alloy steel.

d) Above grade service saddles shall be color-coded purple (Pantone 522C).

3.6.5 Service Connections

3.6.5.1 Corporation Stops

a) Corporation stops from one inch to two inches in diameter shall be manufactured from cast bronze with machined fitting surfaces in accordance with ANSI/AWWA C800, Underground Service Line Valves and Fittings.

b) The inlet connection shall be male Iron Pipe Thread (MIP).

c) The outlet connection shall be a pack joint or compression joint outlet for copper or plastic tubing (CTS). See Appendix B for a list of pre-approved materials and products.

3.6.5.2 Curb Stops and Meter Valves

a) The curb stops shall comply with the requirements of ANSI/AWWA C800. The curb stops shall be ball valve, round way, with check, with lock wing cast on stop body and operating tee cap to provide for locking the stop in closed position. All seats and seals must be made of an elastomeric material that has verifiable experience in water systems that use chloramines for disinfection.

b) The meter valves shall comply with the requirements of ANSI/AWWA C800. They shall be ball or key valves, with check, with lock wing cast on stop body and operating tee cap to provide for locking the stop in closed position. All seats/seals must be made of an elastomeric material that has verifiable experience in water systems using chloramines for disinfection.

c) Meter valves for use with copper or plastic one-inch service lines shall have an inlet
connection with a compression joint and an outlet connection with a meter swivel nut, aka spud connection. See Appendix B for a list of pre-approved products.

d) Curb stops for a two-inch service line shall have an inlet compression joint connection and an outlet female iron pipe thread, and shall be as pre-approved in Appendix B.

3.6.5.3 Dual Services Branches: Dual service branches (near side services only) shall be solid brass, minimum one-inch by one-inch, and have CTS compression type connections with internal and external locking device. Pre-approved dual services branches for a one-inch service are listed in Appendix B.

3.6.6 Air Release Valves

3.6.6.1 Air release valves (ARVs) shall be installed at high points as indicated in Construction drawings. The locations may be considered approximate. Actual locations of ARV on high points shall be determined in the field during construction and reflected on record drawings.

3.6.6.2 Automatic air release valves shall 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 (with vacuum check) shall not exceed 15 inches.

3.6.6.3 The air release valve assembly shall consist of an ARV with a minimum two-inch inlet; a service or tapping saddle; corporation stop (full port ball valve, with iron pipe (IP) outlet) or a 4 inch tapping valve; brass or stainless steel pipe and fittings; and a locking curb stop (IP in/out).

3.6.6.4 The automatic air release valves shall 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.

   a) Manual ARVs shall be installed in a traffic bearing box. Pre-approved traffic bearing boxes are listed in Appendix B.

   b) See Specification 339002, Exhibit R-6A through R-6D for ARV details.

3.6.6.5 Valves, fittings, and piping shall be rated for a minimum working pressure of 150 psi, and meet the requirements of ANSI/AWWA C512, *Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service*

3.6.7 Valve Boxes

3.6.7.1 Cast iron valve boxes with lids shall be provided for all valves installed underground. The valve boxes shall be screw-type adjustable to fit the depth of earth cover over the valve; and shall be designed to prevent the transmission of surface loads directly to the valve or piping. See Specification 339002, Exhibit R-13A.

3.6.7.2 Valve boxes shall have an interior diameter of not less than five inches.

3.6.7.3 Valve box extension shall be installed to reserve a minimum of 50% of the adjustment for a future extension. Extension sections shall be screw type cast iron and compatible with the valve box.

3.6.7.4 The words *Reclaimed Water* shall be cast into the valve box lid. The lids shall be painted purple, and shall be so constructed as to prevent tipping or rattling.

3.6.7.5 All valve locations shall be identified with a concrete valve pad containing a bronze disc embedded in concrete. See Specification 339002, Exhibits R-7 and R-8.

3.6.7.6 For valve boxes in pavement, the protective concrete collar ring shall be constructed of Type I (3000 psi) concrete. See Specification 339002, Exhibit R-8.
3.7 METER AND METER BOXES

3.7.1 General

3.7.1.1 The design shall incorporate all the requirements of Specification 339002, Exhibits R-1A through R-1E (commercial), and Exhibits R-2A through R-2F (residential), Part 2.7 and 2.11, and shall be in compliance with of this specification. Refer to APPENDIX B for pre-approved products.

3.7.1.2 All meter testing and their associated lay lengths shall meet the applicable ANSI/AWWA C700 series standards.

3.7.1.3 Meter Accuracy

a) For meters two-inch and smaller: The meter assembly shall be designed to measure flow to within an accuracy range of plus (+) or minus (-) 1.5% of normal operating flow (1-20 gpm), and with flow indication down to 0.25 gpm (Zero being 100% accurate register reading).

b) For meters three inch and larger: The meter assembly shall meet Class II criteria designed to measure flow to within an accuracy range of plus (+) or minus (-) 1.5% of actual flow (with zero being 100% accurate register reading) for the designed application.

3.7.1.4 Meter Assembly Supports: Pipe supports shall be adjustable.

3.7.1.5 Meter Calibration: Each meter shall be provided with proof of calibration prior to installation. Manufacturer must provide confirmation that independent testing and calibration were performed in accordance with AWWA standards.

3.7.1.6 Registers shall be permanently and hermetically sealed at the factory.

a) Registers shall be direct read or straight read with a center sweep and shall read in U.S. gallons.

b) Digital registers for meters three inches and larger that may be used in high use, industrial, or commercial applications shall be configured to display the flow totalization only with a 100 gallon multiplier (#x100). Flow measurement is in 100 gallon increments

3.7.1.7 One-inch and smaller meters shall be compact and have threaded ends. Meters sized 1-½ inches and larger shall have IP or flanged ends.

3.7.1.8 Polymer clamping devices are not acceptable.

3.7.1.9 All external bolts, nuts, screws and washers shall be 304 or 316 stainless steel.

3.7.1.10 Shear pin bolts shall not be used.

3.7.1.11 All meters shall have automated meter reading (AMR) compatible registers. The meters must be readily modifiable to allow installation of an AMR register. AMR registers must be compatible with PRC pre-approved meters.

3.7.1.12 Strainer where necessary, shall be stainless steel.

3.7.1.13 All meters shall be weather resistant, submersible, and able to withstand extended UV exposure without degradation to the performance of the physical integrity of the meter. Meters shall also be able to withstand extended exposure to Hydrogen sulfide gas and periodic exposure to salt water.

3.7.2 Meter Types

3.7.2.1 Meters sized 12 inches and larger (without telemetry) shall be propeller type as specified in ANSI/AWWA C704.

3.7.2.2 Meters (with telemetry) for golf courses and other major users shall be as specified in Part 2.7 and in Specification 339002, Exhibit R-1D.
3.7.3 Meter Boxes
3.7.3.1 Meter boxes shall be purple in color and of one-piece construction. Boxes shall not exceed 25 pounds in weight.
3.7.3.2 Boxes and lids must pass an AASHTO H-20 (16,000 pound wheel load) test, and the boxes shall be able to withstand a 200 pound side load.
3.7.3.3 Boxes shall have pre-cut pipe entry areas and shall be designed to be securely stackable.
3.7.3.4 Boxes for Residential Service shall be able to take a standard lid size:
   a) Single Service: 11-1/8 inches by 18 inches (+ 1/8 inch).
3.7.3.5 Box depth shall be 12 inches, from the face of the lid to the bottom of the box. Residential boxes and lids shall also comply with Specification 339002, Exhibit R-9.
3.7.3.6 Dimensional deviations must be approved by the Product Review Committee.
3.7.3.7 See Appendix B for a listing of pre-approved products.

3.8 HOSE BIBB ASSEMBLY

3.8.1 The assembly shall include a lock box assembly and key, a hose unit, and Hose Bibb components which include a 3/4-inch curb stop, 3/4-inch 90° elbow or galvanized tee, 3/4-inch galvanized plug (with tee option), 3/4-inch by two-inch galvanized nipple, 3/4-inch full port valve T580, 3/4-inch NY-Glass cam/groove coupling Part B, and pipe nipples.

3.8.2 Lock Box Assembly: Hose Bibb connections shall be located in a locked below-grade vault clearly labeled "RECLAIMED WATER" and bearing the words in English and Spanish "DO NOT DRINK, NO BEBER" together with the equivalent standard international symbol.

3.8.3 Rubber Hose Unit: This shall consist of a 3/4-inch rubber hose with a NY-Glass cam/groove 3/4-inch coupling Part E and 1-1/4-inch stainless steel center punch clamps, designed specifically for this Hose Bibb connection. On the other end of the hose shall be a 3/4-inch brass male nipple to accommodate a standard spray nozzle or sprinkler attachment. See Specification 339002, Exhibit R-10.

PART 4.0 CONSTRUCTION

4.1 WORK AT HIGHWAY OR RAILROAD CROSSINGS
Construction work for any County/FDOT highway or railroad crossing to be performed shall not commence until all Right-of-Way permits for the pipeline occupancy have been obtained.

4.2 PRECONSTRUCTION PIPE INSPECTION/ CERTIFICATION

4.2.1 The Contractor shall 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 shall submit these certificates to the Project Manager prior to installation of the pipe materials.
4.2.1.2 For developer projects, the Contractor shall submit these certificates to the PUD Inspection Group 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 shall 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 shall 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 shall be rejected.

4.3 INSTALLATION

4.3.1 The provisions set forth herein shall be applicable to all underground reclaimed water piping installations.

4.3.2 All pipe shall be installed at a minimum depth of three feet (36 inches to the top of pipe) below final grade.

4.3.3 All mechanical joints, or connections to pipe, fittings, valves, meters or apparatus shall be installed so as 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 shall be color coded PURPLE.
   4.3.4.1 Ductile iron shall marked as specified in Part 3.2.C.
   4.3.4.2 Polywrap shall be color coded purple or clear.
   4.3.4.3 PVC shall be colored purple throughout the thickness.

4.3.5 It shall 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 shall 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 shall be repaired and/or replaced immediately at the Contractor’s and/or developer’s expense, in conformance with current standard industry practices, according to the direction of the owner of such facility, and approved by the County.

4.3.7 See Specification 339002, Exhibit R-11 for Jack and Bore details and Exhibit R-12 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, shall be used. All Directional Drill, and Jack and Bore, locations shall be indicated on the Construction drawings, and approval from PUD is required prior to starting construction.

4.3.9 No pipe shall be laid when the trench conditions or the weather is unsuitable for such work.

4.3.10 The reclaimed water system is a closed system. The ends of pipe shall be capped, or plugged.

4.3.11 Polyvinyl chloride pipe may be damaged by prolonged exposure to direct sunlight. The Contractor shall take necessary precautions during storage and installation to avoid this damage. Pipe shall be
stored under cover and sufficient backfill shall be placed to shield it from the sun as the pipe is
installed.

4.3.12 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 shall
be cased and installed by jack and bore.

4.3.13 All Non-metallic pipe shall be installed with two insulated 10-gauge solid copper or copper clad
steel core locating wires with color coded coating (purple) and attached at 10:00 and 2:00. Wire
for direction drill applications shall be copper clad “hard drawn” steel core with a minimum
breaking strength of 1000 pounds.

4.3.13.1 PVC pipe shall be attached using minimum two-inch wide duct tape. Tape shall be at
every joint and at four to five-foot spaced intervals.

4.3.13.2 Locating wires shall terminate four or more inches above the concrete valve pad and shall
be folded back inside a three-inch PVC access pipe, (See Exhibit R-13A in Specification
339002) A continuity test shall be performed by the Contractor in the presence of the
County inspector.

4.3.13.3 In the case where a valve’s location falls within paved road, wires shall be continuous to
the next valve outside of pavement.

4.3.14 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 shall be current as of the actual
date of fusion performance on the project.

4.3.15 Excavation, trenching and backfilling shall be in accordance with the requirements of the applicable
portions of these specifications. In addition, all underground facility installations shall comply with
the requirements of Section 5.4 of the Utility Accommodation Guide.

4.4 TRENCH EXCAVATION

4.4.1 All excavations shall be open cut, with banks of trenches kept as nearly vertical as possible and
wide enough to allow approximately eight inches clearance on each side of the pipe.

4.4.2 The trench floor shall provide a uniform bearing for each full length of pipe section. Excavate bell
holes after trench has been graded. See Specification 339002, Exhibit R-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 inch 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. 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 shall not take place within the root zone of trees with a trunk
diameter of six inches or larger. The root zone shall 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 339002 Exhibit R-14). 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 shall 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 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) shall be marked as rejected and removed at once from the work.

4.5.3 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 PUD, may be cut off before the pipe is laid. The cut shall be made in the sound barrel at a point of at least 12 inches from the visible limits of the crack. All cutting shall be done with a machine adapted to the purpose. All cut ends shall be examined for possible cracks caused by cutting.

4.5.4 Cutting Pipe: The Contractor shall cut pipe by means of an approved mechanical cutter. The cut shall be perpendicular to the longitudinal axis of the pipe and rough ends or spurs will be satisfactorily removed prior to installation and seating.

4.6  FUSION PROCESS

4.6.1 Fusible PVC shall 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 shall be fused by qualified fusion technicians, as documented by the pipe supplier.

4.6.3 Each fusion joint shall 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 shall 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 shall 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 Fusion machine and maintenance manual shall 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 shall be constructed of the materials specified and as shown on the drawings.
4.7.2 Cradle: Upon satisfactory excavation of the pipe trench, recesses for the pipe bells and joints (or couplings) shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall 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 shall be thoroughly cleaned of all foreign matter before being gently lowered into the trench and shall 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 shall 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 shall be laid straight, and depth of cover shall be maintained uniform with respect to finished 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 shall 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 the pipe has been laid shall be taken up and re-laid.

4.7.5 Pipe/Joint Deflection: Whenever it is desirable to deflect pipe, the amount of deflection shall not exceed the following:
4.7.5.1 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 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 and fittings defective due to interior or exterior damage shall be immediately removed and replaced with sound pipe or fitting at the Contractor's expense.

4.7.7 PVC: All PVC water mains shall have electronic locator wires in accordance with Part 4.3.12, herein. The wires shall be continuous between valves.

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

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

4.8 INSTALLING JOINTS

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

4.8.2 Mechanical Joints: All types of mechanical joint pipes shall be laid and jointed in full conformance with manufacturer's recommendations. Torque wrenches set as specified in ANSI/AWWA C111/A21.11, shall be used; or spanner type wrenches not longer than specified therein may be used with the permission of the County. Impact wrenches shall not be used.
4.8.3 Push-On Joints: Push-on joints shall be made in strict compliance with the manufacturer’s recommendations.
   4.8.3.1 Lubricant shall be an inert, non-toxic, water soluble compound.
   4.8.3.2 Insert the spigot end into the bell so that it is in uniform contact with the gasket.
   4.8.3.3 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.
   4.8.3.4 For DIP, push the pipe until the reference mark on the spigot end disappears into the bell.

4.8.4 Joint Compounds: Sulfur based joint compounds shall not be used.

4.8.5 Restrained Joints shall be provided at all changes in direction, and size changes, of all mains.
   4.8.5.1 All pipe and fitting joints shall be restrained as shown on the Construction Drawings, or where in the opinion of the Design Engineer, settlement or vibration is likely to occur.
   4.8.5.2 All restrained joints shall be installed in accordance with manufacturer’s recommendations.
   4.8.5.3 All restrained joints (manufacturer supplied or field lock gaskets) shall have the joint bell marked in red.
   4.8.5.4 Restraining gaskets must never be pushed; nor should pipe be homed all the way to the bell shoulder.

4.9 INSTALLING APPURTENANCES

4.9.1 Valves and Valve Boxes
   4.9.1.1 Valves shall be carefully inspected on site, opened wide and then tightly closed and the various nuts and bolts shall be tested for tightness prior to installation.
      a) Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat.
      b) Any valve that does not operate correctly shall be immediately removed and replaced by the Contractor.
   4.9.1.2 Valves installed below ground shall be identified with a bronze disc imbedded in concrete to differentiate reclaimed water valves from potable water valves (see Specification 339002, Exhibits R-7 and R-8).
   4.9.1.3 Concrete Valve Pad: Valve boxes outside of paved areas shall be cast in a 3000-psi concrete slab, two-foot by two-foot square and six-inch (minimum) thick. See Specification 339002, Exhibits R-7 for unpaved installations.
   4.9.1.4 Valve Boxes: Valve boxes shall 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 shall 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 as shown on the Construction Drawings. See Specification 339002 Exhibits R-7 and R-8.
      b) The valve box shall not transmit surface loads to the pipe or valve.
      c) Care shall 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 shall be dug out and reset.
      a) Before final acceptance of the work, all valve boxes shall be adjusted to finished grade and valve box extensions shall be installed to reserve a minimum of 50% of the adjustment for future extension. Extension sections shall be threaded/screwed cast iron.
e) The operating nut should not exceed 36 inches below finished grade. However, if conditions require that the operating nut exceeds 36 inches below grade, then an extension, mechanically attached to the valve, shall be added, and the top of the extension shall not exceed 12 inches below finished grade. See Specification 339002, Exhibit R-13B.

f) The valve boxes shall be provided with covers marked “RECLAIMED WATER” and shall be so constructed as to prevent tipping or rattling. Valves shall be marked with a bronze disc embedded in concrete.

g) Valve boxes shall not be installed in ADA ramps, or curbs.

4.9.2 Air Release Valve Assemblies
4.9.2.1 Construction plans and record drawings shall include air release valve stationing on both the plan and profile views.

4.9.2.2 The locations of ARVs indicated on the Construction plans are approximate. The actual placement of the air release valves shall be determined in the field and shall be located at the high points as established during installation of the reclaimed water main and as approved by the Project Manager.

4.9.2.3 Automatic air release valves shall be in a shallow manhole not subject to flooding, as shown in Specification 339002, Exhibit R-6B through Exhibit R-6D.

4.9.2.4 Manual ARVs shall be installed as shown in Specification 339002, Exhibit R–6A.

4.9.2.5 The Contractor shall 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.

4.9.3 Blow-Off Valve Assemblies
4.9.3.1 The Contractor shall furnish and install blow-off valve assemblies as shown on the Construction Drawings.

4.9.3.2 The locations shown are approximate. The actual placement of the blow-off valve shall be determined in the field and shall be located at the low point or end of the pipeline as established during installation of the reclaimed water main and as approved by the Project Manager.

4.10 GOLF COURSES AND OTHER MAJOR USERS
Golf courses and other major water users (over 100,000 gallons per day annual average) are required to install a meter and equipment to monitor and control the flow entering the property. Installation details shall comply with the general requirements herein, and the requirements of Part 2.6.

4.11 SERVICE CONNECTIONS
4.11.1 The Contractor shall furnish and install reclaimed water service connections as shown on the Construction Drawings. Reclaimed water service connections shall include service lines, corporation stops, and curb stops as defined in Part 2 and Part 3, herein.

4.11.1.1 In residential subdivisions, the developer is not required to install the individual meter box. The County will install the meter box in response to the residential customer’s application for service.

4.11.1.2 For County run projects, the Contractor shall include the installation of the meter boxes as part of the project.
4.11.2 Meters installed in residential areas within a meter box shall be installed plumb and level, and positioned facing the lot served. The meter’s depth shall be six (6) inches, plus or minus one (+1) inch, below final grade. A two by two inch stake shall be placed adjacent to the meters with a final grade line clearly marked on it.

4.11.3 Service connections shall utilize a tapping or service saddle. Direct taps of lines is not allowed.

4.11.4 Service Box Location: The developer is required to clearly identify the location of the curb stop and future service connection (see Specification 339002, Exhibits R-2A – D).

4.11.4.1 Temporary identification: During construction, the location may be temporarily identified with a two-inch by two-inch by 18-inch wood stake with the top painted purple and marked with the lot(s) number to be served, and shall clearly show the final grade line.

4.11.4.2 Permanent identification: When the roadway is complete, the Developer shall mark the roadway curb (das type curb marker) indicating the location of the curb stop and reclaimed water service connection. The marking procedure shall be subject to approval by the County.

4.12 INSTALLING BACK-FLOW PREVENTION DEVICES

4.12.1 Residential: Prior to receiving reclaimed water service, a dual check valve assembly (as a minimum) will be installed on each residential customer's potable water meter in order to protect the potable water system. Refer to Specification 331001 for requirements on the installation and type of acceptable backflow preventers.

4.12.2 Commercial: Multi-family complexes and commercial properties with master-metered potable water service and master-metered reclaimed water service shall be required to install a Reduced Pressure Principal Backflow assembly downstream of the master potable water meter.

4.12.3 The Contractor shall call for inspection immediately after installation to obtain approval of performance and operation of the device.

4.13 HOSE BIBB CONNECTION ASSEMBLY

4.13.1 Hose Bibb assembly used with an existing in-ground irrigation system shall be placed downstream of the curb stop. Use a 3/4-inch tee to connect the Hose Bibb assembly to the existing in-ground irrigation system. A Hose Bibb assembly that is not used in conjunction with an in-ground irrigation system shall use a 3/4-inch elbow. Refer to Part 3.9 for a detailed description of the assembly.

4.13.2 Lock Box Assembly: Hose Bibb connections shall be located in a locked box clearly labeled "RECLAIMED WATER" and bearing the words in English and Spanish "DO NOT DRINK, NO BEBER" together with the equivalent standard international symbol.

4.13.3 Hose Bibb Location: The Lock Box and Hose Bibb Assembly shall be located within the owner's property boundary, visible from the street, and shall not be located in the County's right-of-way.

4.14 POLYETHYLENE TUBE ENCASEMENT/ POLYWRAP

4.14.1 All buried ductile iron pipe, valves, and fittings, including ductile iron pipe inside of a casing, shall be polywrapped. Installation of polyethylene tube encasement shall be in accordance with Method
A of ANSI/AWWA C105/A21.5 and as specified herein.

4.14.2 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.

4.14.3 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.

4.14.4 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.

4.14.5 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.

4.14.6 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.

4.14.7 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 restrained joints.

4.14.8 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.

4.14.9 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.

4.14.10 Fittings such as pipe bends shall also be covered by use of the plastic tubing and plastic adhesive tape in much the same manner as the pipe.

4.14.11 Irregular-shaped appurtenances shall be covered by splitting a suitable length of the polyethylene tubing and using the resulting flat sheet with plastic tape to effect the covering of such items.

4.15 BACKFILL/ COMPACTION

4.15.1 Backfilling and compaction shall 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. All trenches shall be prepared per the requirements of Part 4.4. Also refer to Specification 339002 Exhibit R-15.

4.15.2 Backfill and bedding material shall be common fill material free from organic matter, muck or marl, and rock exceeding 2-1/2 inches in diameter, and shall 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.
4.15.3 Method of Compaction: The Contractor shall 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 shall be considered the minimum allowable. See Specification 339002, Exhibit R-15.

4.15.4 Backfilling Procedures: The backfilling procedures outlined in the following shall be for reclaimed water mains and related structures. The backfilling shall be done in three stages as follows:

4.15.4.1 In the first stage, the Contractor shall 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 shall be placed in six-inch layers and thoroughly tamped over the entire surface.

4.15.4.2 In the second stage, the Contractor shall 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 shall be the width of the portion of the trench having vertical sides; or, when no portion of the trench has vertical sides, it shall be to a width at least equal to three times the outside diameter of the pipe. Material to be placed in six-inch layers (loose thickness).

4.15.4.3 In the third stage, the remainder of the trench shall be backfilled with suitable material in layers not to exceed 12-inch loose thickness and compacted.

4.15.5 Compaction Density: The trench backfill density for all stages shall be as provided as follows:

4.15.5.1 From right-of-way line to right-of-way line, including all structures and railroad crossings: Compaction shall be 98% of the maximum density as determined by AASHTO T-180 (ASTM D1557 - Modified Proctor) with no tolerance.

4.15.5.2 For outside of the right-of-way (but within maintenance easements): Compaction shall be 95% of the maximum density as determined by AASHTO T-180 (ASTM D1557 - Modified Proctor) with no tolerance.

4.15.6 Compaction Test Requirements

4.15.6.1 Compaction test results shall be submitted for all work.

4.15.6.2 Results of compaction tests must meet minimum requirements prior to proceeding with the next stage of the work.

4.15.6.3 For developer projects, one complete set of all test reports shall be submitted with the as-built package to the Site Plan and Subdivision Review Section upon project completion.

4.15.6.4 For County run projects, one complete set of test reports shall be submitted with the as-built package to the Project Manager upon project completion.

4.15.6.5 The Contractor shall employ an independent testing laboratory, acceptable to the County and pay for all required tests.

4.15.6.6 The laboratory shall submit one copy of the certified test reports, after testing in each phase, to the Construction Services Section in the Development Services Department, or the County Project Manager (as applicable), for approval.

4.15.6.7 In the second and third stage of backfilling, density tests shall be made every one foot vertically, staggered every 200 feet (minimum) horizontally. There shall be a minimum of one test (per vertical foot) between structures, and a minimum of one test per day

4.16 TEMPORARY POTABLE WATER SERVICE FOR CONSTRUCTION

4.16.1 Refer to Specification 331001, Part 4.13 whenever County supplied temporary potable water
service is desired for Construction. If County water is not available the Contractor will be responsible for supplying their own potable water to the job site.

4.16.2 Removal of County supplied Temporary Water Construction Assembly: After the entire development water distribution system has been installed, pressure tested, disinfected, and accepted by the Department of Health, the Contractor shall remove the backflow assembly as directed by the HCPUD.

4.17 **FLUSHING AND CLEANING**

4.17.1 All mains shall be cleaned and flushed to remove all sand and other foreign matter.

4.17.1.1 The Contractor shall be responsible for developing a flushing plan to be submitted to the Engineer of Record for approval with the shop drawings. If temporary potable water service, per Part 4.16, is used the flushing plan must be submitted with the “temporary water plan”.

4.17.1.2 The Contractor shall dispose of all water used for flushing without causing a nuisance or property damage.

4.17.1.3 Any permits required for the disposal of flushing water shall be the responsibility of the Contractor.

4.17.2 Flushing water used by the Contractor shall be taken from an approved metered source. Flushing water shall be at Contractor's expense.

4.17.3 Pipeline shall 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. Contractor shall be responsible to install and remove appropriate connections to accomplish the required pipeline "pigging".

4.17.4 Temporary plugs or caps shall be installed on new mains until the pressure and leakage tests are completed. Upon satisfactory completion of the tests the caps or plugs shall be removed and the connections made to the existing mains.

4.18 **HYDROSTATIC AND LEAKAGE TEST**

4.18.1 Reclaimed water mains shall be tested in sections between valves. The total length of pipe for any single test shall not exceed 2,000 feet. Testing shall be done immediately after installation and backfilling has been completed.

4.18.2 The piping shall be tested in sections, thereby, testing each valve for secure closure.

4.18.3 The mains shall be tested in accordance with, the latest revision of ANSI/AWWA C600 (for Ductile Iron) and C605 (for PVC) under an average hydrostatic pressure of not less than 150 psi, using a 300 psi gauge, for a minimum of two hours. Pressure shall be maintained until all sections under testing have been checked for evidence of leakage.

4.18.4 While the system is being filled with water, air shall be carefully and completely exhausted. If permanent air vents are not located at all high points, the Contractor shall install corporation stops or fittings and valves at such points so the air can be expelled as the pipe system is slowly filled.

4.18.5 The test pressure shall not vary by more than five psi for the duration of the test. The rate of loss shall not exceed that specified in Part 4.18.14 or 4.18.15. Visible leaks shall be corrected regardless
of total leakage shown by test.

4.18.6 All pumps, gauges and measuring devices shall be furnished, installed and operated by the Contractor; and all such equipment, devices and their installation shall be approved by the County Inspector.

4.18.7 All water for testing and flushing shall be potable water, or reclaimed water, as provided by the Contractor, at the Contractor/developer’s expense, from a source approved by the County. Flow velocity during line filling should not exceed two feet per second.

4.18.8 The quantity of water used for testing, which shall be compared to the allowable quantity, shall be measured by pumping from a calibrated container approved by the County Inspector.

4.18.9 All restrained sections of the buried main shall be completely backfilled before such sections are tested.

4.18.10 All pressure lines shall be tested. All pressure and leakage testing shall be done in the presence of the County Inspector and the Engineer of Record or his designated representative. Pressure and leakage testing is considered a “hold” point and requires the sign off of the County Inspector.

4.18.11 When leakage occurs in excess of the specified amount, the defective pipe, pipe joints or other appurtenances shall be located and repaired at the expense of the Contractor. If the defective portions cannot be located, the Contractor, at his own expense, shall remove and reconstruct as much of the original work as necessary to obtain a water main within the allowable leakage limits upon retesting.

4.18.12 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.

4.18.13 Allowable Limits for Leakage in Ductile Iron Pipe

4.18.13.1 The hydrostatic pressure test shall be performed as herein specified and no installation, or section thereof, will be acceptable until the leakage is less than the number of gallons per hour as determined by the formula:

\[
L = \frac{SD (P)^{\frac{1}{2}}}{148,000}
\]

in which:

- \(L\) = Allowable leakage, in gallons per hour
- \(S\) = Length of pipe in feet being tested
- \(D\) = Nominal diameter of pipe, in inches
- \(P\) = Average test pressure during the test, in psi

4.18.13.2 Water shall be supplied to the main during the test period as required to maintain the test pressure as specified.

4.18.13.3 The quantity used, which shall be compared to the previous allowable quantity, shall be measured by pumping from a calibrated container. A 5/8-inch meter installed on the discharge side of the pump may be used to measure the leakage for large mains when approved by the County Inspector. All hydrostatic leakage tests shall be recorded on the
4.18.14 Allow Limits for Leakage in PVC Pipe

The hydrostatic pressure test shall be performed as herein specified and no installation, or section thereof, will be acceptable until the leakage is less than the number of gallons per hour as determined by the formula:

\[
Q = \frac{LD\ (P)^{1/2}}{148,000} \quad \text{OR} \quad Q = \frac{ND\ (P)^{1/2}}{7,400}
\]

in which:

\[
Q = \text{Allowable leakage, in gallons per hour}
\]

\[
N = \text{Number of joints in the tested line (pipe & fittings)}
\]

\[
L = \text{Length of pipe section being tested, in feet}
\]

\[
D = \text{Nominal diameter of pipe in inches.}
\]

\[
P = \text{Average test pressure during the test, in psi}
\]

**NOTE:** Equation (2) is for integral bell pipe in 20 foot lengths.

4.19 CONNECTION TO EXISTING RECLAIMED WATER MAINS

4.19.1 Connections to existing reclaimed water pipelines shall be made as shown on the Construction Drawings. At all new points of connections, a tee or cross with the appropriate isolation valves shall be installed. Coordination between the County and the Contractor shall be required in order to accomplish this task. The Contractor shall supply connection, procedure, and customer notification schedules to the County, for approval, two weeks prior to the proposed connection date.

4.19.2 No reclaimed water connections can be made until the appropriate backflow preventer is installed on the potable water service lines.

4.19.3 All connections to existing reclaimed water mains shall be made under the direct supervision of Hillsborough County Public Utilities Department.

4.19.4 If a tee and isolation valve cannot be cut in then the following procedures shall be followed.

**Tapping Existing Lines**

4.19.4.1 No size on size taps are allowed.

4.19.4.2 The Contractor shall submit a request to the Service Availability Team, Customer Service Section, of the Hillsborough County PUD to schedule a tap and pay the appropriate tapping fee. The request shall be made a minimum of 48 hours prior to proposed tie-in to the reclaimed water main.

4.19.4.3 No size on size taps are allowed.

4.19.4.4 The Contractor shall furnish, install and pressure test the tapping sleeves and valves to existing reclaimed water mains:
a) For all taps up through 12 inches, County PUD personnel will furnish the necessary
tapping machine and tools and will perform the tap.
b) For taps larger than 12 inches, the Contractor shall furnish the tapping machine and
tools and shall perform the tap under PUD supervision. All taps shall be witnessed
by the County Inspector.
c) A hydraulic driven tapping machine is indicated for tapping concrete pipe mains.
Either hydraulic or pneumatic driven tapping machines may be indicated for mains
other than concrete.

4.19.4.5 Taps smaller than six inches (for single connections or distribution systems) to
transmission mains 16 inches or larger are not allowed.
a) In areas where there is no reasonable alternative for providing service, the County
may approve a four-inch minimum size connection and pipeline configured for a
future parallel distribution system for additional services.
b) The connection shall include a tapping saddle, an isolation valve at the point of
connection, a minimum four-inch tee to allow for expansions, and isolation valves
on each extension.

4.19.4.6 Prior to the tap:
a) The Contractor shall assemble all materials, tools, equipment, labor and supervision
necessary to make the connection.
b) The Contractor shall excavate a dry and safe working area pit of sufficient size to
enable the County PUD personnel to perform the necessary work.
c) The Contractor shall pressure test the tapping sleeve and valve installation under the
supervision of County PUD personnel. The test pressure shall be 150 psi, or 10 psig
above the pressure in the reclaimed water main being tapped (whichever is greater).
This shall be held for 10 minutes at zero pressure loss.

4.19.4.7 Reclaimed water mains shall be tapped in such a manner as to avoid disturbance or
disruption to the operation of the main in service and to protect the reclaimed water supply
from contamination.

4.19.4.8 Valves on existing mains shall be operated only by PUD personnel or under their direct
supervision.

4.19.4.9 The Contractor shall be responsible for properly backfilling the work area pit after the
work is completed.

4.19.4.10 When service must be interrupted to existing customers during construction of a tap or
addition of appurtenances:
a) The Contractor shall provide three days’ notice to the Hillsborough County PUD.
b) The Contractor or developer shall be required to notify existing customers as directed
by the PUD.
c) The Contractor shall be ready to proceed with as much material preassembled as
possible at the site to minimize the length of service interruption. Such connections
may be made at night to minimize effects. No customer shall be without service for
more than six hours.
d) The PUD will postpone a service cut-off if the Contractor is not ready to proceed on
schedule.

4.19.5 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.
PART 5.0 PIPE SIZING CRITERIA

5.1 DESIGN STANDARD FOR RECLAIMED WATER DISTRIBUTION SYSTEMS
The following provides the recommended minimum criteria for determining pipe sizes for reclaimed water distribution systems in residential and commercial developments. The recommended irrigation application for turf grass is one and one quarter inches per week for an annual average daily flow based Hillsborough County reuse data.

5.2 RESIDENTIAL SUBDIVISIONS
To determine the annual average daily flow (AADF) in a residential subdivision, use the following equation:

\[
\text{Gallons per Day (GPD)} = A \times I \times 0.111 \times N
\]

To determine the individual lot irrigation requirement at maximum peak demand in gallons per minute (GPM), use the following equation:

\[
\text{Gallons per Minute (GPM) per Lot} = \frac{(A \times I \times 0.523)}{1,440}
\]

where:

- \( A \) = Average Lot Size (in Square Feet)
- \( 0.523 \) = Conversion Factor (converts irrigation of 1.25 inch/week to gallons/day and includes a 4.7 peaking factor to simulate the peak hour in the peak day of the peak month).
- \( 0.111 \) = Conversion Factor (converts irrigation of 1.25 inch/week to gallons/day)
- \( I \) = Percent of Irrigable Area = 70%
- \( N \) = Number of lots in subdivision

Example:
To determine the gallons per minute (GPM) for 8,000 SF lots and 12,000 SF lots in a subdivision, compute as follows:

\[
\text{GPM (8,000 SF lots)} = \frac{(8,000 \times 0.70 \times 0.523)}{1,440} = 2.03 \quad \text{(round up to next tenth)} = \text{2.1 GPM/lot}
\]

\[
\text{GPM (12,000 SF lots)} = \frac{(12,000 \times 0.70 \times 0.523)}{1,440} = 3.05 \quad \text{(round up to next tenth)} = \text{3.1 GPM/lot}
\]

In addition, place a demand of 75 gpm at critical nodes such as terminus points, high elevation points, and cul-de-sacs to represent simultaneous irrigation by five residential units.

*** The system must be able to support an additional 75 gpm demand at any point in the system ***

5.3 COMMERCIAL DEVELOPMENTS
The developer shall provide an irrigation plan showing irrigation zones and anticipated flow per zone to determine maximum peak demand in gallons per minute for each property in the development for sizing of distribution system.
To determine annual average daily flow (AADF), use the following equation (using the previous definitions) to determine the AADF for each property in the development, then total:

**Gallons per Day (GPD) per property = A \times I \times 0.111**

To determine maximum peak demand in gallons per minute (GPM), use the following equation:

**Gallons per Minute (GPM) per property = (A \times I \times 0.523) / 1,440**

Notes:

1. Contact the Reclaimed Water Planning Team of PUD for flow and pressure characteristics of the County transmission system.
2. Minimum distribution main pressure is 45 psi during peak conditions.
3. Hazen Williams Roughness Coefficient (C): 130 for PVC and cement lined DIP; 140 for Polyethylene (HDPE).
4. Minor losses associated with meters, check valves, etc. shall be included in the hydraulic calculations. The C value of 130 for PVC and cement lined DIP will compensate for the minor losses associated with bends, tees, and other pipeline losses.
5. Minimum residential service line size for single service is one-inch in diameter to avoid high velocities and head losses for simultaneous irrigation at 15-20 gpm. Dual far-side residential service shall be two, one-inch diameter HDPE services.
PART 6.0 PRESSURE TESTING FORMS
PRESSURE TEST REPORT

PROJECT: ____________________________________________

ENGINEER OF RECORD: _____________________________________

CONTRACTOR: _____________________________________________

SERVICE REQUEST NO: ___________ DATE: ______ INSPECTOR: ___________

WATER PRESSURE TEST     FORCE MAIN PRESSURE

RECLAIMED MAIN PRESSURE

CALCULATIONS BASED ON AWWA. STD. C600, SECTION 4.18.13.1

\[ L = \frac{S \cdot D \cdot P}{148,000} \]

WHERE: 
\( L \) = ALLOWABLE LEAKAGE IN GALS. PER HOUR
\( S \) = LENGTH OF PIPE TESTED, IN FEET
\( D \) = NOMINAL DIAMETER OF PIPE IN INCHES
\( P \) = AVERAGE TEST PRESSURE (PSIG)

CALCULATIONS:

\[ L = \left[ \frac{\text{[ ]}}{148,000} \right] \left[ \frac{\text{[ ]}}{\text{[ ]}} \right] (\text{[ ]})^{1/2} = \text{GALS. /HR. ALLOWED} \]

\[ L = \left[ \frac{\text{[ ]}}{148,000} \right] \left[ \frac{\text{[ ]}}{\text{[ ]}} \right] (\text{[ ]})^{1/2} = \text{GALS. /HR. ALLOWED} \]

\[ L = \left[ \frac{\text{[ ]}}{148,000} \right] \left[ \frac{\text{[ ]}}{\text{[ ]}} \right] (\text{[ ]})^{1/2} = \text{GALS. /HR. ALLOWED} \]
ALLOWABLE LEAKAGE TEST REPORT
FOR DUCTILE IRON PIPE

PROJECT NAME: _______________________________ PROJ. NO.: _______________________

ENGINEER OF RECORD NAME: _______________________________________________________

COMPANY: _________________________________________________________________________

CONTRACTOR REPRESENTATIVE NAME: ________________________________________________

COMPANY NAME: ___________________________________________________________________

SERVICE REQUEST NO.: ___________________ DATE: _________________________________

INSPECTOR: _______________________________________________________________________

_________________________________ WATER PRESSURE TEST __________________ FORCEMAIN PRESSURE TEST

_________________________________ RECLAIMED MAIN PRESSURE

CALCULATIONS BASED ON AWWA C600

\[
L = \frac{S \times D \times (P)^{1/2}}{148,000}
\]

WHERE: 
\[L = \text{ALLOWABLE LEAKAGE IN GALS. PER HOUR.}\]
\[S = \text{LENGTH OF PIPE TESTED, IN FEET}\]
\[D = \text{NOMINAL DIAMETER OF PIPE IN INCHES}\]
\[P = \text{AVERAGE TEST PRESSURE (PSIG)}\]

CALCULATIONS:

\[
L = \left[ \frac{\text{[ ]}}{148,000} \right] \left[ \frac{\text{[ ]}}{148,000} \right] \left[ \frac{\text{[ ]}}{148,000} \right]^{1/2} = \frac{\text{[ ]}}{148,000} \text{ GALS./HR. ALLOWED}
\]

\[
\text{GALS./HR. X 2 HR. = [ ] GALS. ALLOWED LOST}
\]

FIELD MEASUREMENTS:

START TEST @_____________ PRESSURE = ___________# READING = ___________

FINISH TEST @_____________ PRESSURE = ___________# READING = ___________

LOSS = ___________# GALLONS = ________________

PEOPLE PRESENT: _______________________________ TEST RESULTS AND COMMENTS: _______________________________
ALLOWABLE LEAKAGE TEST REPORT
FOR POLYVINYL CHLORIDE PIPE

PROJECT NAME: ____________________________ PROJ. NO.: ____________________

ENGINEER OF RECORD NAME: ____________________________________________

COMPANY: _______________________________________________________________

CONTRACTOR REPRESENTATIVE NAME: ______________________________________

COMPANY NAME: _________________________________________________________

SERVICE REQUEST NO.: __________________________ DATE: ____________________

INSPECTOR: ______________________________________________________________

_________________ WATER PRESSURE TEST ______________ FORCEMAIN PRESSURE TEST

_________________ RECLAIMED MAIN PRESSURE

CALCULATION (1) BASED ON AWWA C605
CALCULATION (2) BASED ON UNI-BELL EQUATION 99 FOR GASKETED PIPE IN 20 FT LENGTHS.

(1) \[ Q = \frac{L \times D \times (P)^{1/2}}{148,000} \]  
(2) \[ Q = \frac{N \times D \times (P)^{1/2}}{7,400} \]

WHERE:  
Q = ALLOWABLE LEAKAGE IN GALS. PER HOUR.  
L = LENGTH OF PIPE BEING TESTED, IN FEET  
N = NUMBER OF JOINTS IN THE TESTED LINE (PIPE AND FITTINGS)  
D = NOMINAL DIAMETER OF PIPE IN INCHES  
P = AVERAGE TEST PRESSURE (PSIG)

CALCULATIONS:

\[ Q = \frac{148,000 \times \text{GALS. HR.} \times 2 \text{ HR.}}{2} = \text{GALS. ALLOWED LOST} \]

FIELD MEASUREMENTS:

START TEST @ ________ PRESSURE = ________ # READING = ________  
FINISH TEST @ ________ PRESSURE = ________ # READING = ________  
LOSS = ________ # GALLON = ________

PEOPLE PRESENT: __________________________ TEST RESULTS AND COMMENTS: __________________________