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*Standard Reclaimed Water Details* - This section is currently under construction.

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## **PART I: PROCEDURES**

## **1.1 APPLICATION AND SCOPE**

The standards and specifications set forth in this Manual shall apply to all new water, wastewater, and reclaimed water systems, both private and public, and to all alterations, additions, or extensions to any new or existing water, wastewater, or reclaimed water system.

The standards and specifications prescribed by this Manual constitute minimum requirements for the protection of the health and safety of the public.

Nothing in this Manual shall be construed as repealing or superseding provisions of other County ordinances and building codes when such provisions are not inferior to those set forth in this Manual.

The requirements established by this Manual are not intended to be discriminatory against materials, products, or construction techniques of demonstrated capabilities.

When field conditions dictate, or where good engineering practices indicate, appropriate variations of these standards which produce an equal or better end-product may be submitted to the St. Johns County Utility Department (SJCUD) for review on a case by case basis. Any request for such a variation must be accompanied by supporting documentation and calculations.

### **1.1.1 Exceptions**

This Manual shall not apply to:

- A System used solely for the sale, distribution or furnishing of bottled water;
- Manufacturers providing service solely in connection with their on site operations;
- Public lodging establishments providing service solely in connection with service to their guests;
- Landlords providing service solely to their specific compensation for the service;
- A System serving, or having a proposed capacity to serve fewer than 20 connections; i.e. a system wholly owned by a nonprofit corporation, association, or cooperative providing service solely to members who own and control such nonprofit corporation, association or cooperative.
- Restaurants, shopping centers, retail stores, or other commercial establishments providing service solely to their employees and customers on premises owned or leased by such establishments; or
- The utility systems owned and/or operated by the City of St. Augustine, the City of Hastings, and JEA.

### 1.1.2 Purpose

The following purposes are intended to be accomplished by this Manual:

- To promote uniformity in construction of water, wastewater, and reclaimed water systems to facilitate the future option of incorporating such systems into the County Utility System.
- To conserve the limited supply of water. The water supply must be regulated and controlled and subjected only to reasonable and beneficial use to assure an adequate supply of water and adequate wastewater treatment capacity for all members of the public.
- To prevent the construction of water, wastewater, or reclaimed water systems of inferior quality, which would most likely result in abandonment. Abandonment of a system creates an unreasonable economic and administrative burden to customers served by the system and the County.
- To protect customers of each system from increased costs of maintenance and repair of water, wastewater, or reclaimed water systems that are poorly constructed.
- To promote and protect the public health, safety and welfare.

### 1.1.3 Definitions

Except where specific definitions are used within a specific section, the following terms, phrases, words, and their derivation shall have the meaning given herein when consistent with the context. The word "shall" is mandatory, and the word "may" is permissive.

AASHTO - means American Association of State Highway and Transportation Officials. Any reference to AASHTO standards shall be taken to mean the most recently published revision unless otherwise specified.

ADF – means Average Daily Flow, expressed in gallons per day.

ANSI - means American National Standards Institute. Any reference to ANSI standards shall be taken to mean the most recently published revision unless otherwise specified.

ASTM - means American Society for Testing Materials. Any reference to ASTM standards shall be taken to mean the most recently published revision unless otherwise specified.

AWWA - means American Water Works Association. Any reference to AWWA standards shall be taken to mean the most recently published revision unless otherwise specified.

COMPREHENSIVE PLAN - means the St. Johns County Comprehensive Plan adopted by the St. John's County Board of County Commissioners. Any reference to the "Comprehensive Plan" shall mean the most recently adopted version of the Comprehensive Plan, unless otherwise specified.

CONTRACTOR - means the person, firm, or corporation with whom the contract for work has been made by the owner, the developer or the County.

COUNTY - means the St. Johns County Board of County Commissioners, St. Johns County, Florida, and/or its designated representative(s).

COUNTY UTILITY SYSTEM - The water, wastewater, and/or reclaimed water systems owned and/or operated by the County.

DEVELOPER - means the person, firm, or corporation engaged in developing or improving real estate for use or occupancy.

DEVELOPER'S ENGINEER - means an engineer or engineering firm registered with the State of Florida Department of Professional Regulation, retained by the Developer to provide professional engineering services for a project.

DEVELOPMENT - Means the carrying-out of any building activity or mining operation, the making of any material change in the use or appearance of any structure or land, or the dividing of land into three or more parcels.

DIPRA - means Ductile Iron Pipe Research Association.

DIRECTOR - means the Director of the SJCUD of St. Johns County, Florida, acting directly or through an assistant or other representative authorized by him.

DRAWINGS - means engineering drawings prepared by an Engineer to show the proposed construction.

ENGINEER - means a Professional Engineer registered in Florida, or other person exempted pursuant to the provisions of chapter 471, Florida Statutes, who is competent in the field of engineering.

ERC - means Equivalent Residential Connection, consisting of 350 gallons per day of water or 280 gallons per day of sewer capacity.

FAC - means the Florida Administrative Code.

FDEP - means the Florida Department of Environmental Protection.

FDOT - means the Florida Department of Transportation.

FEC - means the Florida East Coast Railway Company.

FORCE MAIN - means a conduit (pipe) that transports Wastewater under pressure.

GEOTECHNICAL ENGINEER - means a Registered Florida Engineer who provides services related to terrain evaluation and site selection, subsurface exploration and sampling, determination of soil and rock properties, foundation engineering, settlement and seepage analysis, design of earth and earth retaining structures, the design of subsurface drainage systems and the improvement of soil properties and foundation conditions, and testing and evaluation of construction materials.

LDC – means the Land Development Code, those regulations adopted by St. Johns County governing the development of land within the unincorporated area of the County.

LIFT STATION – means a facility (with pumps and all associated appurtenances) that collects and pumps wastewater from a collection system to a treatment facility.

MANUAL - means this Manual of Water, Wastewater, and Reuse Design Standards and Specifications, and all amendments thereof.

NEMA - means National Electric Manufacturers Association. Any reference to NEMA Standards shall be taken to mean the most recently published revision unless otherwise specified.

NSF - means National Sanitation Test Laboratory Foundation. Any reference to NSF Standards shall be taken to mean the most recently published revision unless otherwise specified.

OSHA - means the Federal Occupational Safety and Health Administration.

OWNER - means the person, firm, corporation, or governmental unit holding right of possession of the real estate upon which construction is to take place.

PHF – means Peak Hourly Flow, calculated by multiplying the ADF by a determined peaking factor, expressed in gallons per day.

PLANS - means “Drawings” as defined herein above.

PRETREATMENT - means the reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in wastewater to a treatable level, prior to or in lieu of discharging or otherwise introducing such pollutants into a wastewater system.

PUMP STATION – See “Lift Station”.

RECLAIMED WATER – means treated wastewater effluent that could be land applied per



chapter 62-610 of the Florida Administrative Code.

REUSE – see “Reclaimed Water”.

SEWER – see “Wastewater System”.

SJCUD – means the St. Johns County Utility Department.

SPECIFICATIONS – means the specifications contained in this Manual.

STANDARDS - means the minimum design standards contained in this Manual.

STANDARD DRAWINGS - means the detailed drawings in this Manual related to water, wastewater, and reclaimed water main materials and installation.

TRAFFIC CONTROL AND SAFE PRACTICES MANUAL - means the State of Florida Department of Transportation Manual on Traffic Control and Safe Practices for Street and Highway Construction, maintenance and Utility Operation, latest edition.

UTILITY ACCOMMODATION GUIDE - means the State of Florida Department of Transportation Utility Accommodation Guide, latest edition.

UTILITY DEPARTMENT – means the St. Johns County Utility Department (SJCUD).

UTILITY - Any person, business entity, or association owning and/or operating a water, wastewater, and/or reclaimed water system, or proposing construction of a system, who is providing, or proposes to provide, water, including non-potable water, wastewater, and/or reclaimed water services to the public within the unincorporated area of St. Johns county.

UTILITY (PRIVATE) - Any Utility owned or operated by any person, business entity, or association, but excluding any Utility owned and/or operated by St. Johns County, a municipality, or other unit of local government.

UTILITY (PUBLIC) - Any Utility owned or operated by St. Johns County, a municipality, or other unit of local government.

WASTEWATER MAINS - means wastewater gravity sewers, force mains, fittings, valves, service laterals, and miscellaneous related appurtenances.

WASTEWATER SYSTEM - Wastewater system shall mean and shall include any plant, system, facility or property, and additions, extensions and improvements thereto at future times constructed to acquire as part thereof, useful or necessary or having a present capacity for future use in connection with the collection, treatment, purification and disposal of sewage of any nature or originating from any source, and without limiting the generality of the foregoing definition, shall embrace treatment plants, pumping stations, lift stations, valves, force mains,

intercepting sewers, laterals, pressure lines, mains and all necessary appurtenances and equipment, all wastewater mains and laterals for the reception and collection of sewage from premises connected therewith, and shall include all real and personal property and any interest therein, rights, easements and franchises of any nature whatsoever relating to any such system and necessary or convenient for the operation thereof.

WATER MAINS - means water transmission mains, distribution mains, pipes, fittings, valves, hydrants, services, meters and miscellaneous related appurtenances.

WATER SYSTEM - Water system shall mean and include any plant system, facility or property, and additions, extensions and improvements thereto at future times, constructed or acquired as part thereof, useful or necessary or having the present capacity for future use in connection with the development of sources, treatment or purification and distribution of water, and, without limiting the generality of the foregoing, shall include dams, reservoirs, storage tanks, mains, lines, valves, pumping stations, laterals and pipes for the purpose of carrying water to the premises connected with such system, and shall include all real and personal property and any interest therein, rights, easements and franchises of any nature whatsoever relating to any such system and necessary or convenient for the operation thereof.

WORK - means the labor, materials, equipment, supplies, services and other items necessary for the execution, completion and fulfillment of the contract.

## **1.2 PLANNING PROCESS**

### **1.2.1 Letter of Availability**

All developments that require the provision of water, wastewater and/or reclaimed water by a Central Utility Service provider shall be required to request a letter of availability from the respective Utility Provider. The letter will summarize provision of the respective utility service by treatment plant and will indicate if the development is concurrent for water, wastewater and/or reclaimed service per the St. Johns County Land Development Code (LDC).

The letter of availability request form is available on the SJCUD website at:  
[http://www.co.st-johns.fl.us/BCC/Utility\\_Department/Development\\_Group/index.aspx](http://www.co.st-johns.fl.us/BCC/Utility_Department/Development_Group/index.aspx)

### **1.2.2 Commitment of Capacity**

The commitment of water, wastewater, and/or reuse transmission and treatment capacity will be limited to the actual number of Equivalent Residential Connections (ERC's) committed by the County through issuance of a Concurrency Certificate.

### **1.2.3 Utility Line Reimbursements**

All transmission mains installed by a Developer are required to be sized as indicated on the Utility Master Plan or as directed by the SJCUD. Per section 25 E of the SJCUD Ordinance

2006-73 (and as amended), all transmission mains are eligible for reimbursement. Details of the refund agreement are provided in the Ordinance. Transmission mains are defined in Sections 2.2.15 and 2.10.17 of this Manual.

#### **1.2.4 Pre-Design Conference**

It is recommended that each Developer or owner initiates a pre-design conference between himself, his engineer, and the SJCUD. A pre-design conference is mandatory for each development consisting of greater than 500 dwelling units and/or 100,000 square-feet of commercial space.

#### **1.2.5 Modification of Approved Development Plans**

Minor modifications can be accommodated in the as-built drawings. Major modifications that impact utilities or other infrastructure must apply for Development Review Committee (DRC) Modification of Construction Plans.

#### **1.2.6 Connection to Existing System**

Connections to the County Utility System are subject to this Manual, as well as other applicable Codes and Ordinances as they pertain to water, wastewater, and reuse systems and/or facilities.

#### **1.2.7 Conveyance of Extension to County Utility System**

The Developer shall design, construct and convey upon completion to the County, free and clear of all encumbrances and at no cost to the County, any extension approved by the SJCUD for the County's Utility System. Developer shall submit to the SJCUD engineering plans and specifications for the proposed extension prepared by the Developer's Engineer. Following conveyance by the Developer, the extension, and any additions, repair and/or replacements thereto shall at all times remain the sole property of the County and under the exclusive control of the County.

#### **1.2.8 Developer's Right to Connect**

The Developer has the right to connect provided that the Developer's extension is installed with the approval of all public, governmental or other agencies having supervision, regulation, direction or control of such water, wastewater, and/or reclaimed water utility systems, including fees the County shall charge the Developer or its successor-in-title to connect the Developer's extension into the County utility system.

#### **1.2.9 Right to Terminate Service**

The County shall refuse to provide service, and reserves the right to terminate service to any lot or building within the Developer's property. In the event Developer defaults or fails to comply with any of the requirements of this Manual in a timely manner and fails to cure such default or

fails to comply within thirty (30) consecutive calendar days following the receipt by Developer of County's notice of such default or failure to comply, the County has the right to terminate service.

### **1.3 PLAN AND SPECIFICATION REQUIREMENTS**

#### **1.3.1 General**

All submitted plans shall be standard size sheet 24" x 36" with title block. Graphic scale(s) shall be provided on each sheet and all lettering shall be 1/8" or larger to permit photographic reproduction. Submittal of specifications will be required. All plans sheets and the title page of submitted specifications must be signed, sealed and dated by the Developer's Engineer.

All cover sheets shall clearly indicate the Developers' name, address and phone number. The checklist included in Part VI of this Manual shall be provided and signed by the Engineer.

#### **1.3.2 Master Plan**

Whenever possible, the entire water, wastewater, and/or reuse system shall be shown on a single Master Plan. The Master Plan shall indicate the general locations of all water, sewer and reuse mains, manholes, valves, hydrants, lift stations and service laterals with respect to the proposed development improvements and the existing water, wastewater, and/or reuse systems. Main sizes shall be indicated in the Master Plan. Separate master plans shall be submitted for water, sewer and reuse utilities. The Master Plan shall be prepared at a scale not to exceed 1" to 200'. The scale shall be selected such that all items on the plan are clearly legible. Master plans that are not legible shall not be accepted.

#### **1.3.3 Plan and Profile**

All off-site gravity sewers, wastewater force mains, water mains, and reclaimed water mains shall be drawn in plan at 1"=20' and profile at 1"=2' on the same sheet.

SJCUD prefers that on-site water, wastewater, and reclaimed water system plan and profiles be shown on the same sheet at a maximum of 1"=40' and 1"=4', respectively. On-site water mains may be shown in plan view only. Where on-site water or reuse mains cross other utilities, the water or reuse main shall be shown in the profile for 20 feet either side of the crossing. As a minimum, the plan and profile drawings shall include the following information:

- a. General information such as north arrow, names of designer and engineer, revision block with dates, graphic scale(s) and sheet number.
- b. Profile with elevations at 100-foot intervals, or more frequently if required by good design practice.
- c. Development layout with horizontal and vertical controls.

- d. All conflicts with other utility and drainage systems.
- e. All manhole locations and rim elevations for manholes outside of paved areas.
- f. Pipe data including size, lengths, material and slopes.
- g. Size, type, and locations of fittings, valves, hydrants, air release/vacuum relief, and other related appurtenances.
- h. Limits of special exterior coatings.
- i. Limits of special bedding requirements.
- j. Pipe restraint requirements.
- k. Details of connection to existing systems.
- l. Location(s) and general layout of wastewater pumping stations
- m. Construction notes regarding cover, horizontal and vertical control, special construction requirements, and references to standard and special details.
- n. Existing and proposed street names.

#### **1.3.4 Details**

The plans shall include all applicable standard drawings as shown in Part V of this Manual. Special details shall be prepared by the Developer's Engineer for aerial and underwater crossings of rivers, streams, canals and ditches. Other special details shall be prepared by the Developer's Engineer as required.

#### **1.3.5 General Notes**

The plans shall include "General Notes" for the installation of water, sewer and reuse facilities. General notes shall be as provided in Part VI of this Manual. Other notes shall be prepared by the Developer's Engineer as required.

#### **1.3.6 Identification of Plan Components**

All proposed piping, fittings, valves, structures and appurtenances related to water, sewer and reuse facilities shall be tied down by baseline, stationing and offsets in order to establish their exact proposed locations.

All plans shall show a match line for continuity to the next plan sheet. Graphical presentation of

the plan sheet for identification to the overall master plan is preferred but not mandatory.

### **1.3.7 Conformity with Other Standards**

Layout of all utilities shall conform to the standard roadway cross-section provided in the LDC.

At times, when the standard layout conflicts with other requirements of the County, the Engineer will implement good engineering practices and provide a 5' utility easement as shown in the roadway cross-section in Part V of this Manual (and as amended).

Where there is a discrepancy, the most stringent regulation shall apply.

### **1.3.8 Architectural Floor Plans**

To comply with Section 25 of the SJCUD Ordinance 2006-73 (and as amended) architectural floor plans (with dimensions), including a plumbing plan, and E911 address are required to be submitted prior to construction plan approval.

### **1.3.9 SJCUD Review**

All engineering plans and specifications prepared by the Developer's Engineer shall be reviewed by the SJCUD. The Developer's engineering designs, plans and specifications, shall conform to the requirements of this Manual. The SJCUD shall complete the design review within fifteen (15) working days or as identified by the County Development Services Department.

## **1.4 CONSTRUCTION AND CLOSE-OUT PROCEDURES**

### **1.4.1 Pre-Construction Meeting**

Pre-construction meetings shall be held for all SJCUD owned or operated utility facilities prior to the commencement of any construction activities at the offices of the SJCUD. The meetings, at a minimum, must be attended by the Contractor's project superintendent and administered by the SJCUD's project inspector or project engineer. It is preferred that the Developer's Engineer and a representative attend the meeting.

A minimum of five (5) day notice shall be provided to the SJCUD to schedule a pre-construction meeting. A pre-construction meeting can be scheduled only after the approval of shop drawings.

### **1.4.2 Phasing**

Construction of all water, sewer and reuse facilities shall be completed per phasing schedule set on the approved construction plans. Partial clearances not coinciding with the construction plans shall not be commonly accepted and will be approved only on a case by case basis.

### **1.4.3 Construction Water**

The SJCUD shall not provide water for construction on an unmetered basis. All charges, including all minimum charges for water service, shall be paid by the Developer from the date of meter installation in accordance with SJCUD's approved rate schedule. A construction hydrant meter can be made available upon request at the SJCUD Billing Office. The meter will be installed by the SJCUD personnel at an existing hydrant preferable to the contractor. A refundable deposit will be required for the installation.

### **1.4.4 Alternate Water Source**

Developer shall not construct any well, pond, lake or source of water for the purposes of obtaining construction water, future domestic use, or fire protection without prior approval of the SJCUD. Any well constructed for lawn sprinkling and irrigation shall not be connected or cross-connected to domestic water supply.

### **1.4.5 Notice of Connection to System**

Developer and/or Contractor shall notify the SJCUD Engineering Department that he will be connecting to the SJCUD system no less than five (5) days prior to connection to allow time for inspection. If Developer and/or Contractor fail to provide timely notice, the SJCUD may require Developer/Contractor to uncover and expose the connection for inspection, at the sole cost of Developer/Contractor.

### **1.4.6 Cross Connections**

There shall be no cross connection between the SJCUD water system and any other possible source of contamination such as a non-potable water system or non-permitted water system, sewer, drain, conduit, pool, storage reservoir, plumbing fixture, or sprinkler system.

### **1.4.7 Connection of Buildings**

The Developer shall, at his sole cost and expense, connect the private property water pipes and the private property sewer pipes of each dwelling or other building constructed on Developer's property to the meters and sewer laterals of Developer's extension as reflected in plans and specifications approved by the SJCUD.

### **1.4.8 Approval by Governmental Agencies**

The SJCUD's obligations are contingent upon Developer obtaining all necessary approvals for water, wastewater, and/or reuse systems from all concerned governmental agencies. Developer assumes the risk of loss as a result of the denial or withdrawal of the approval of any concerned governmental agency, or caused by an act of any governmental agency which affects the ability of the SJCUD system to provide water, wastewater, and/or reclaimed water service to the Developer not within the sole control of the SJCUD and which, by exercise of due diligence, it is

unable to overcome.

#### **1.4.9 Installation and Inspection**

The Developer's water, wastewater, and/or reuse systems shall be installed in accordance with the engineering plans and specifications reviewed by the SJCUD. The SJCUD shall have the right, but not the obligation, to make inspections as installation progresses.

#### **1.4.10 Tests of Developer's System**

The County utility system will not be connected to the Developer's water and/or wastewater system until new facilities have passed all pre-determined tests, arranged by the Developer and witnessed by the SJCUD, or its representative, to determine whether the facilities are constructed in accordance with the approved engineering plans and specifications. Developer will pay all costs of locating leaks and their repairs deemed necessary by the SJCUD as a result of tests.

#### **1.4.11 Final Acceptance**

Final acceptance by the SJCUD of the completed County owned and/or operated water, wastewater, and/or reclaimed water system shall occur at such time as Developer has met all of the requirements of this Manual and all required engineering submittals have been completed and approved by the SJCUD.

##### **1.4.11.1 Warranty**

Developer shall warrant his extension and hold County harmless against all costs, expenses and losses, including, without limitation, incidental and consequential damages, resulting from any defects in the Developer's extension, including, without limitation, defects in design material and workmanship, which are discovered or arise within a period of one (1) year following the date of the Final Acceptance.

##### **1.4.11.2 Operation and Maintenance Manuals**

An Operation and Maintenance Manual for all new and existing domestic wastewater treatment and effluent disposal or reuse facilities must be developed by both public and private utilities as part of the procedure to obtain an operation permit from the Florida Department of Environmental Protection (FDEP).

##### **1.4.11.3 Grant of Easement Rights**

Prior to the SJCUD providing service to the development, Developer shall execute a grant or grants of easement, in recordable form to be approved by the County.



#### **1.4.11.4 Conditions Precedent to System Usage (SJCUD Owned/Operated)**

Prior to the SJCUD accepting the water, wastewater and/or reuse system, Developer shall comply with all requirements of this Manual and shall provide the following to the SJCUD:

- Releases of liens by the Developer, or his agent, in connection with the construction of the facilities;
- Certified as-builts as specified in Part III of this Manual;
- Schedule of values, in connection with the construction of the water, sewer and reuse facilities;
- Bill of Sale as applicable, restoration easements, easements, warranty letter, and payment of telemetry fees;
- All permits and governmental approvals obtained by the Developer, its contractors or agents; and
- Certification by Developer's Engineer that the facilities have been constructed substantially in accordance with approved plans and specifications.

#### **1.4.11.5 As-Built Drawings**

As-built drawings should be furnished per Part III of this Manual.

#### **1.4.12 Ownership and Dedication of Utilities**

Per Section 14 of the SJCUD Ordinance 2006-73 (and as amended), all water, wastewater, and reclaimed water lines installed by the Developer and deeded to the County as outlined in this Manual shall be the property of the County. Deeds transferring water, wastewater, and/or reuse lines to the County shall be approved by the Board of County Commissioners, and recorded in the County's official public records at the Developer's expense. All water, wastewater and reuse utilities installed in the County right-of-way shall be deeded to the County.

In circumstances where utilities are installed in residential developments that are not in the County right-of-way and that are privately owned, an easement and restoration agreement will be required. A copy of this agreement is included in Part VI of this Manual.

Utilities installed in all other developments, including but not limited to commercial and industrial that are privately owned, shall not be deeded to the County and will remain the property of that development. An ingress and egress will be provided to the County for maintenance of serviceability of the water meter, boxes and related appurtenances.

All lift stations adjacent to County right-of-way shall be deeded fee simple to the County. Lift

stations shall be identified as separate tracts. The County will not accept partial entities of a system. For example, the sewer system will include the entire collection system, lift station and discharge force main.

Installation of water, sewer and reuse facilities between individual lots are not commonly acceptable and will be approved only on a case by case basis. If accepted, such installation shall be provided in a minimum 20' wide tract. Standard utility easements will not be accepted.

## **1.5 INTERFACE ACTIVITIES**

A summary of typical interface activities between the SJCUD, the Developer, Consulting Engineer and Utility Contractor for developments serviced by the SJCUD owned and/or operated utility systems is shown in Part VI of this Manual.

**-- End of Part I --**

## **PART II: DESIGN STANDARDS**



## **2.1 POTABLE WATER BASIS OF DESIGN**

### **2.1.1 Potable Water Design Flows**

Water mains and extensions shall be sized to accommodate the maximum day demand plus fire flow requirements or peak hour demands, whichever is greatest. An average daily demand of 350 and 300 gallons per day per unit should be used for single-family and multi-family residential developments, respectively. Average daily demand for commercial/industrial development shall be calculated by referencing the flow factors outlined in Schedule A of SJCUD Ordinance 2006-73 (and as amended). Maximum day and peak hour water flow rates shall be calculated by using peaking factors specific to the subject area when available. Maximum day and peak hour demand and method of computation shall be subject to review and approval by the SJCUD.

### **2.1.2 Fire Flow**

Fire flow requirements shall be determined in accordance with applicable St. Johns County LDC and/or the St. Johns County Fire Department Codes. Where fire flow requirements exceed the anticipated available fire flow from the central water system, on-site fire protection system, or other Fire Department approved mitigation measures shall be utilized.

### **2.1.3 Water System Pressure**

A minimum residual pressure of 20 psi shall be maintained throughout the distribution system under all flow conditions. The system shall also meet the minimum level of service listed in the St. Johns County Comprehensive Plan. Higher pressures may be required at commercial, industrial, or high-density residential areas.

### **2.1.4 Water System Design Calculations**

The Engineer must clearly state all design flows and pressure conditions and submit to the County signed, sealed, and dated design calculations that include the following:

- ERC's,
- Maximum Day Flow,
- Average Day Flow,
- Peak Hour Flow,
- Peaking Factors,
- Fire Flow Requirements,
- Pipe Size,
- Velocity, and
- Minimum Residual Pressure.

All hydraulic calculations shall be based on a connection pressure provided by the SJCUD at a set point along the existing system adjacent to the proposed development.

All joints shall be designed to resist thrust through the use of restrained joint fittings. The pressure rating of the pipe shall be used as the design basis for thrust restraint.

Head losses through meters and backflow devices shall also be included in calculations.

For residential and commercial developments that have over 100 ERC's, the engineer will be required to provide a computer generated hydraulic model. All water model calculations shall be presented by a tabular format indicating system pressure, demand nodes and other pertinent information on a plot that is clearly legible. All important nodes shall be annotated to identify water demand. Both Peak Hour and Fire Flow plus Max Day scenarios shall be presented.

## **2.2 WATER SYSTEM DESIGN CRITERIA**

### **2.2.1 Water Main and Extension Location**

Water mains are required to be located in grass areas between the edge of pavement and the right-of-way line and as shown in the roadway cross-section included in Part V this Manual. However, if circumstances are not compatible for such installation, a minimum 5' utility easement shall be provided. In some cases, installation under sidewalks may be approved.

Water mains under pavement shall not be acceptable. Pavement crossing shall be accomplished by provision of a casing as approved in this manual. An HDPE, DR-11 pipe could be substituted in lieu of a casing. The HDPE pipe shall be upsized appropriately to match the PVC pipe internal diameter.

Water mains shall be located in dedicated rights-of-way or utility easements. When installed in rights-of-way, water mains shall maintain a consistent alignment with respect to the centerline of the road. All water mains located outside of dedicated rights-of-way shall require a minimum 20-ft. easement. Narrower easements may be approved by SJCUD if circumstances so warrant. Additional easement widths may be necessary due to pipe size or depth of cover requirements. Water mains shall not be placed on private property unless sufficient easements are provided for operation and maintenance. Water mains shall not be placed under retention ponds, tennis courts, or other structures. Water mains shall not be located in between properties in residential subdivisions unless a 10-ft. (to match 20-ft. requirement) minimum tract is provided on each side of the lot line.

### **2.2.2 Water Main Separation Requirements**

The contractor shall install all mains in accordance with the requirements of Rule 62-555.314, FAC, below. The contractor shall notify SJCUD in any instance where the below requirements cannot be met prior to installation of pipe.

#### ***“62-555.314 Location of Public Water System Mains.***

*For the purpose of this section, the phrase “water mains” shall mean mains, including treatment plant process piping, conveying either raw, partially treated, or finished drinking*

*water; fire hydrant leads; and service lines that are under the control of a public water system and that have an inside diameter of three inches or greater.*

*(1) Horizontal Separation between Underground Water Mains and Sanitary or Storm Sewers, Wastewater or Stormwater Force Mains, Reclaimed Water Pipelines, and On-Site Sewage Treatment and Disposal Systems.*

*(a) New or relocated, underground water mains shall be laid to provide a horizontal distance of at least three feet between the outside of the water main and the outside of any existing or proposed storm sewer, stormwater force main, or pipeline conveying reclaimed water regulated under Part III of Chapter 62-610, F.A.C.*

*(b) New or relocated, underground water mains shall be laid to provide a horizontal distance of at least three feet, and preferably ten feet, between the outside of the water main and the outside of any existing or proposed vacuum- type sanitary sewer.*

*(c) New or relocated, underground water mains shall be laid to provide a horizontal distance of at least six feet, and preferably ten feet, between the outside of the water main and the outside of any existing or proposed gravity- or pressure-type sanitary sewer, wastewater force main, or pipeline conveying reclaimed water not regulated under Part III of Chapter 62-610, F.A.C. The minimum horizontal separation distance between water mains and gravity-type sanitary sewers shall be reduced to three feet where the bottom of the water main is laid at least six inches above the top of the sewer.*

*(d) New or relocated, underground water mains shall be laid to provide a horizontal distance of at least ten feet between the outside of the water main and all parts of any existing or proposed “on-site sewage treatment and disposal system” as defined in Section 381.0065(2), F.S., and Rule 64E-6.002, F.A.C.*

*(2) Vertical Separation between Underground Water Mains and Sanitary or Storm Sewers, Wastewater or Stormwater Force Mains, and Reclaimed Water Pipelines.*

*(a) New or relocated, underground water mains crossing any existing or proposed gravity- or vacuum-type sanitary sewer or storm sewer shall be laid so the outside of the water main is at least six inches, and preferably 12 inches, above or at least 12 inches below the outside of the other pipeline. However, it is preferable to lay the water main above the other pipeline.*

*(b) New or relocated, underground water mains crossing any existing or proposed pressure-type sanitary sewer, wastewater or stormwater force main, or pipeline conveying reclaimed water shall be laid so the outside of the water main is at least 12 inches above or below the outside of the other pipeline. However, it is preferable to lay the water main above the other pipeline.*

*(c) At the utility crossings described in paragraphs (a) and (b) above, one full length of water main pipe shall be centered above or below the other pipeline so the water main joints will be as far as possible from the other pipeline. Alternatively, at such crossings, the pipes shall be arranged so that all water main joints are at least three feet from all joints in vacuum-type sanitary sewers, storm sewers, stormwater force mains, or pipelines conveying reclaimed water regulated under Part III of Chapter 62-610, F.A.C., and at least six feet from all joints in gravity- or pressure-type sanitary sewers, wastewater force mains, or pipelines conveying reclaimed water not regulated under Part III of Chapter 62-610, F.A.C.*

*(3) Separation Between Water Mains and Sanitary or Storm Sewer Manholes.*

*(a) No water main shall pass through, or come into contact with, any part of a sanitary sewer manhole.*

*(b) Effective August 28, 2003, water mains shall not be constructed or altered to pass through, or come into contact with, any part of a storm sewer manhole or inlet structure. Where it is not technically feasible or economically sensible to comply with this requirement (i.e., where there is a conflict in the routing of a water main and a storm sewer and where alternative routing of the water main or the storm sewer is not technically feasible or is not economically sensible), the Department shall allow exceptions to this requirement (i.e., the Department shall allow construction of conflict manholes), but suppliers of water or persons proposing to construct conflict manholes must first obtain a specific permit from the Department in accordance with Part V of this chapter and must provide in the preliminary design report or drawings, specifications, and design data accompanying their permit application the following information:*

- 1. Technical or economic justification for each conflict manhole.*
- 2. A statement identifying the party responsible for maintaining each conflict manhole.*
- 3. Assurance of compliance with the design and construction requirements in sub-subparagraphs a. through d. below.*

*a. Each water main passing through a conflict manhole shall have a flexible, watertight joint on each side of the manhole to accommodate differential settling between the main and the manhole.*

*b. Within each conflict manhole, the water main passing through the manhole shall be installed in a watertight casing pipe having high impact strength (i.e., having an impact strength at least equal to that of 0.25-inch-thick ductile iron pipe).*

*c. Each conflict manhole shall have an access opening, and shall be sized, to allow for easy cleaning of the manhole.*

*d. Gratings shall be installed at all storm sewer inlets upstream of each conflict manhole to prevent large objects from entering the manhole.*



*(4) Separation Between Fire Hydrant Drains and Sanitary or Storm Sewers, Wastewater or Stormwater Force Mains, Reclaimed Water Pipelines, and On-Site Sewage Treatment and Disposal Systems. New or relocated fire hydrants with underground drains shall be located so that the drains are at least three feet from any existing or proposed storm sewer, stormwater force main, or pipeline conveying reclaimed water regulated under Part III of Chapter 62-610, F.A.C.; at least three feet, and preferably ten feet, from any existing or proposed vacuum-type sanitary sewer; at least six feet, and preferably ten feet, from any existing or proposed gravity- or pressure-type sanitary sewer, wastewater force main, or pipeline conveying reclaimed water not regulated under Part III of Chapter 62-610, F.A.C.; and at least ten feet from any existing or proposed “on-site sewage treatment and disposal system” as defined in Section 381.0065(2), F.S., and Rule 64E-6.002, F.A.C.*

*(5) Exceptions. Where it is not technically feasible or economically sensible to comply with the requirements in subsection (1) or (2) above, the Department shall allow exceptions to these requirements if suppliers of water or construction permit applicants provide technical or economic justification for each exception and provide alternative construction features that afford a similar level of reliability and public health protection. Acceptable alternative construction features include the following:*

*(a) Where an underground water main is being laid less than the required minimum horizontal distance from another pipeline and where an underground water main is crossing another pipeline and joints in the water main are being located less than the required minimum distance from joints in the other pipeline:*

- 1. Use of pressure-rated pipe conforming to the American Water Works Association standards incorporated into Rule 62-555.330, F.A.C., for the other pipeline if it is a gravity- or vacuum-type pipeline;*
- 2. Use of welded, fused, or otherwise restrained joints for either the water main or the other pipeline; or*
- 3. Use of watertight casing pipe or concrete encasement at least four inches thick for either the water main or the other pipeline.*

*(b) Where an underground water main is being laid less than three feet horizontally from another pipeline and where an underground water main is crossing another pipeline and is being laid less than the required minimum vertical distance from the other pipeline:*

- 1. Use of pipe, or casing pipe, having high impact strength (i.e., having an impact strength at least equal to that of 0.25-inch-thick ductile iron pipe) or concrete encasement at least four inches thick for the water main; and*
- 2. Use of pipe, or casing pipe, having high impact strength (i.e., having an impact strength at least equal to that of 0.25-inch-thick ductile iron pipe) or concrete encasement at least four inches thick for the other pipeline if it is new and is conveying wastewater or reclaimed water.”*

### **2.2.3 Set Back Limits for Water Mains**

#### **A. Landscaping**

No piping shall be constructed within 7.5 feet horizontal of existing or proposed planted landscaped areas unless specifically approved by SJCUD. No piping shall be constructed within five (5) feet of the root zone of protected trees unless specifically approved by SJCUD. For protected trees with large root zones, it is recommended that piping be installed 1 (one) foot per inch diameter of the tree away from the tree.

#### **B. Easements**

No piping shall be constructed within five (5) feet horizontal of an existing or proposed easement and/or tract line unless specifically approved by SJCUD.

#### **C. Structures**

No piping shall be constructed within five (5) feet horizontal of any existing or proposed above ground structures unless specifically approved by SJCUD.

#### **D. Piping Deeper than Five (5) Feet**

For piping deeper than five (5) feet, the horizontal distance between the utility and the landscaped area shall be based on the depth of the utility pipe invert rounded to the next nearest foot. For example, if the utility pipe invert is 8.5 feet below grade, the minimum horizontal distance to the landscaped area, easement line, or structure shall be nine (9) feet.

### **2.2.4 Water Main Diameters**

Only 2", 4", 6", 8", 10", 12", 16", 20", 24", 30", 36", 42", and 48" diameter water mains shall be permitted. Other pipe sizes may be approved on a case by case basis for private systems. Pipe materials for water mains and extensions shall consist of PVC, HDPE, or DIP depending on the location, use, size and approval by SJCUD. If HDPE pipe is used, the pipe will be upsized to match the internal diameter of the required PVC or DI pipe.

### **2.2.5 Fire Hydrants**

As a minimum, specifications outlined in the latest edition of St. Johns County LDC and applicable St. Johns County Fire Department Codes, whichever is more stringent, shall apply. Hydrants shall be placed at a maximum of 660 foot intervals (or as amended in the Fire Department Codes).

Location of fire hydrants shall be at least one foot from right-of-way/property line and within 15 feet from edge of pavement, face of curb, etc. (except as required by FDOT), more than five feet

from driveways and fences and not within swale/ditch area. Fire hydrants shall not be located at street intersections. Hydrants shall be located so as to minimize vulnerability to traffic.

Fire hydrants shall conform to the latest AWWA specifications C502 and shall be of the traffic-model type. The hydrant branch shall be 6-inch in diameter and have a 6-inch isolation gate valve on the branch as close as possible to the main and restrained to the main.

Hydrants shall be furnished with a breakaway feature that will break cleanly upon impact. In commercial/industrial districts, hydrants shall be installed on a minimum 8-inch main and hydrants in residential districts installed on a minimum 6-inch main.

Each fire hydrant shall be capable of delivering a flow required per the LDC or St. Johns County Fire Department Codes with a residual pressure of not less than 20 psi.

### **2.2.6 Water Main Looping and Dead Ends**

In order to provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins whenever practical, as determined by the SJCUD. Where possible, dead ends should be looped between commercial/industrial developments.

All mains that dead end and that are intended for future expansion shall be equipped with a blow-off device for flushing purposes and an isolation valve. Flushing devices shall be sized to provide a minimum of 2.5 feet per second flushing velocity in the water main. No flushing devices shall be directly connected to any sanitary or storm sewer. Dead end lines for future expansion will require a master development plan to verify and support sizing of the water main.

### **2.2.7 Potable Water Valves**

Sufficient valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves shall be located at not more than 500-foot intervals in commercial, industrial, and high-density residential areas and at not more than 800-foot intervals in all other areas. Appropriate valving shall also be provided at all areas where water mains intersect to ensure effective isolation of water lines for repair, maintenance, or future extension. Valves shall not be installed in pavement unless specifically approved by the SJCUD. Installation of valves close to fire hydrants is preferred.

### **2.2.8 Water Main Cover**

For water mains smaller than 12 inches, the minimum and maximum cover shall be 30 inches and 36 inches, respectively, in unpaved areas and 36 inches and 42 inches, respectively, in paved areas, or as required within FDOT or railroad rights-of-way. For water mains greater than 12 inches, the minimum and maximum cover shall be 42 inches and 54 inches, respectively. Exceptions will be made for conflicts.

### **2.2.9 Surface Water Crossings for Water Mains**

Surface water crossings are commonly not acceptable. SJCUD shall be consulted before final plans are prepared.

A. Above Grade

All above grade water crossing pipelines must be adequately supported on an acceptable foundation/support. Piping shall be ductile iron. Plans must be signed and sealed by an engineer registered in the State of Florida. The installation must be protected from damage and must be accessible for repair or replacement. Valves shall be placed at both ends of the water crossing at the normal main depth, so that section of main can be isolated. A combination air release/vacuum valve and crossing guards shall be provided. All above grade ductile iron piping shall be painted in accordance with Chapter 62-555.340.

B. Below Grade

1. A minimum of three (3) feet, or as established by the regulatory agency, whichever is greater, shall be maintained from the top of the water main to the design bottom elevation of the open canal/ditch for below ground piping.
2. Sub-aqueous pipe crossings shall be horizontal directionally drilled using HDPE (DR11) pipe. In cases where the crossing is greater than 1,000 feet, a steel casing will be provided. For canal/ditches greater than fifteen feet in width, the water main shall be designed with flexible, watertight joints.
3. Valves shall be installed at each end of the sub-aqueous crossing so that the sub-aqueous section of the water main can be isolated. Valves shall be easily accessible and shall be provided in a manhole or valve vault.

C. Other Requirements

1. It shall be the responsibility of the Developer to obtain all applicable regulatory permits. When the aerial crossing is accomplished by attachment to a bridge or drainage structure, the Developer shall meet all requirements of the Agencies who own or have jurisdiction over the structures.
2. For aerial stream crossings, impact of flood waters and debris shall be considered. The bottom of the pipe shall be no lower than one (1) foot above the 100 year flood event.
3. Expansion joints shall be provided between the aerial and buried sections of the pipe. Appropriate guards shall be installed at both ends of the crossing to prevent pipe access to the public.

4. Sub-aqueous crossings shall be clearly marked by permanent warning signs placed on the banks of canals, streams, and rivers clearly identifying the nature and location (including depths below design or natural bottom) of the crossings. Crossings of lakes, bays and other large bodies of water shall be similarly identified at the shore and, with suitably fixed signs, in any area where anchoring may normally be expected. Signs shall have characteristics compatible with surrounding land use, while serving the intended purpose.
5. Specifications shall be as provided in Part III of this Manual.

### **2.2.10 Roadway Crossings for Water Mains**

All water piping crossing County and State roadways shall be bore and jacked in accordance with FDOT Utility Accommodation Guide and FDOT Standard Specifications or horizontal directionally drilled.

### **2.2.11 Potable Water Air Release Valves**

At high points in water mains where air can accumulate and restrict flow, provisions shall be made to remove the air. This shall be accomplished in distribution systems by use of strategically placed automatic air release valves. Automatic air relief valves shall not be used in situations where flooding of the valve or valve box may occur. The open end of an air relief pipe from automatic valves shall be extended to at least 1' above grade and be provided with a screened, downward-facing elbow or as otherwise indicated by SJCUD. See Standard Details in Part V of this Manual.

### **2.2.12 Chamber Drainage**

Chambers, valve boxes, pits, or manholes containing valves, blow-offs, meters, or other such appurtenances to a distribution system shall not be connected directly to any storm drain or sanitary sewer, nor shall blow-offs or air relief valves be connected directly to any sewer.

### **2.2.13 Disinfection Following Repair or Replacement**

Any water system that has direct contact with finished water and has been out of service for repair, alteration, or replacement shall be disinfected as outlined in Chapter 62-555.340, FAC.

### **2.2.14 Existing Water Mains**

All existing mains in County rights-of-way that fall under pavement or are not directly accessible due to proposed roads, sidewalks, structures, additions, or modifications will be required to be relocated and installed as new mains meeting requirements of this manual.

Split casings could be utilized for existing mains that fall under new pavement that are perpendicular to the main.

All main relocations shall be implemented with none or minimal interruption of service. Construction that requires interruption of service shall be planned and scheduled at low peak demand hours or as found acceptable by the SJCUD.

### **2.2.15 Transmission Mains versus Distribution Mains**

Distribution mains distribute water service to one or more developments and are capable of supplying up to 2,000 gallons per minute (gpm) as verified by the SJCUD. Most of the distribution mains have a diameter of 12" or less. Transmission mains are major mains that transmit water to the distribution mains and are capable of supplying over 2,000 gpm as verified by the SJCUD. Most transmission mains have a diameter of 16" or greater.

Service connections 4" or smaller are prohibited on transmission mains. Exceptions will be made on a case by case basis. A parallel distribution main will have to be installed to accommodate service connections. All transmission mains installed by a Developer will be required to be sized as indicated on the Utility water Master Plan or as directed by the SJCUD. Per section 25 E of SJCUD Ordinance 2006-73 (and as amended), all transmission mains are eligible for reimbursement. Details of the refund agreement are provided in the Ordinance.

## **2.3 WATER SERVICES AND CONNECTIONS**

Pipe materials, fittings, joints, inspections and testing shall conform to the applicable provisions of this section and the Standard Drawings. Only 1", 1-1/2", 2", 4", 6", 8", 10", and 12" services will be permitted. Where water services greater than 12-inch are required, dual services shall be provided. All water services and connections made to the SJCUD system, either existing or new, shall be made only after approval by SJCUD after payment of applicable fees and charges. All taps and connections shall be inspected by SJCUD.

Individual service taps shall not be placed closer than 36 inches apart. A minimum of 18 inches must be maintained from all water main joints and appurtenances. Individual service taps shall be constructed with double strap saddles and corporation stops. Services shall not exceed 100 feet in length to the meter with the meter generally placed at the property line at an accessible location. A maximum of five (5) services is allowable on a 2" water main.

Services shall have a minimum 30 inches of cover. Proper sizing of non-residential meters and services is the responsibility of the Developer's Engineer subject to the SJCUD approval. Dual metering of a single building service (i.e. two, 1-inch meters instead of one, 2-inch meter) shall not be permitted.

## **2.4 WATER METERING**

All water service connections shall be metered. The method of metering shall follow the guidelines listed below. However, the Developer's Engineer shall obtain approval from SJCUD before finalizing the design of the metering system.

### **2.4.1 Water Meter Sizing**

The Developer shall determine the size of all meters. The Developer's Engineer shall provide sufficient information on estimated peak flows and minimum flows in order that meter size can be determined. The Developer's Engineer shall include head losses through the metering device when designing the water system. Meter bypasses shall be required for meter sizes 3-inch and greater.

### **2.4.2 Meters for Single Family Duplex and Multi-Family with Private ROW**

Individual meters may be permitted if the private streets are designed to County Standards and easements and restoration agreements are dedicated over the entire private street common areas. In addition, sufficient area shall be available outside of paved areas to locate water mains, services, and meters.

### **2.4.3 Meters for Apartments, Condominiums, Shopping Centers and Developments with Private Streets**

All commercial, industrial, institutional, multi-family, apartments, and condominium developments including shopping centers with private streets shall require installation of a fire line master meter.

Where the water demand is less, the Developer may opt to provide a dual system (separate domestic and fire line). Dual systems shall require installation of a reduced pressure zone (RPZ) backflow prevention device, with a leak detector, on the fire line. Meters shall be located in the public right-of-way at the right-of-way line.

Individual meters may be permitted if the private streets are designed to County Standards and restoration easements are dedicated over the entire private street common area or as directed by the SJCUD to provide proper operation and maintenance.

In some cases where the utility mains cannot be designed to County Standards, and County is not able to own the Utility mains, individual meters will be permitted with only ingress and egress easements over the entire private street common area and a 5' x 5' to 10' x 10' (depending on the meter size) restoration easement around the individual meter. Utility mains within private property in such instances will remain private.

### **2.4.4 Water Meter Installation for County Owned/Operated Utility Systems**

All meters shall be installed underground in an approved meter box. Meters shall be located within the public right-of-way or in an easement located adjacent to the public right-of-way, as approved by SJCUD.

## **2.5 WATER MAIN LOCATION AND IDENTIFICATION**

A means for locating and identifying all water mains and valves shall be provided in accordance with the Standard Specifications and Details in this Manual Parts III and V, respectively.

## **2.6 WATER MAIN CROSS CONNECTION CONTROL**

In order to protect the public water supply system from contamination due to cross connections, the Developer shall install approved backflow prevention devices where there is the potential of a non-potable substance coming into contact with the public water system. Some of the common instances requiring installation of the cross connection control devices are listed in the following subsections and shall be in accordance with AWWA M-14 Manual.

### **2.6.1 Backflow Prevention for Commercial, Industrial, and Multi-Family**

All commercial, industrial, and multi-family residential projects shall require installation of a reduced pressure backflow preventer assembly. All projects with fire sprinkler and standpipe systems, and projects with yard on-site fire protection systems shall be required to install a reduced pressure type backflow preventer with a leak detector assembly.

### **2.6.2 Backflow Prevention for Irrigation Systems**

A double check valve backflow prevention assembly shall be required on all irrigation systems unless those systems have chemical agents or additives. In those cases, a reduced pressure backflow prevention assembly shall be required. A separate irrigation meter is not permitted.

## **2.7 PRESSURE PIPE RESTRAINTS AND CONNECTIONS**

### **2.7.1 Pressure Pipe Restraints**

Pipelines shall be restrained at all valves, bends, tees, crosses and dead ends for a specified distance. The use of concrete thrust blocks and tie rodding is prohibited. Restraint devices must be approved by the SJCUD prior to installation. The Engineer of Record shall design the pipe restraint distance in accordance with the specific conditions or circumstances on each pipeline design project. Determination of distances shall occur during design and be specified on the construction drawings by means of a restrained joint schedule, which is to be located in the details section of the construction plans. Calculations for the required lengths of restrained joint piping may be based on the "Thrust Restraint Design Program" which is available free and copyrighted 1989 by EBAA Iron, Incorporated, Eastland, Texas and Associated Technical References.



**2.7.2 Connections**

- A. All connections and ties to the SJCUD water system and transfer of services shall be performed by the Contractor under supervision of the SJCUD representative.
- B. All connections to existing SJCUD mains shall be made by the Contractor only after the connection procedure and his work scheduling has been reviewed and approved by the SJCUD. The Contractor shall submit a written request to the SJCUD a minimum of five (5) working days prior to scheduling said connections. In his request he shall outline the following:
  - 1. Points of Connection, fittings to be used, and method of flushing and disinfection.
  - 2. Estimated construction time for the connections.
- C. The SJCUD shall review the submittal within three (3) working days after receiving it and inform the Contractor regarding approval or denial of his request. If his request is rejected by the SJCUD, the Contractor shall resubmit his request modifying it in a manner acceptable to the SJCUD.
- D. All connections shall only be made on the agreed upon date and time. If the Contractor does not initiate and complete the connection work in the agreed upon manner, he shall be required to reschedule the connection by following the procedure outlined above.
- E. The Contractor shall not operate any valves in the system.
- F. Pressure connections of 4-inch or larger shall be performed by a tapping sleeve and valve. All large diameter taps (4-inch diameter and larger) onto a pressurized main must have a minimum separation of 5 feet along the main being tapped from either the nearest pipe joint or large diameter tap. No more than two large diameter taps shall be made on any 20 foot length of pipe.
- G. All water service connections (new and taps into existing mains) shall have a brass corporation stop at the main and connected directly into the service saddle. All small diameter taps (2-inch and smaller) on water mains 6-inch and larger must have a minimum separation of 36 inches along the main being tapped from the nearest pipe joint or tap. Small diameter taps on 4-inch diameter mains or smaller must maintain a 5 foot separation from pipe joints or other taps. In no case shall there be more than four taps total along any 20 foot length of water main.

## **2.8 WATER SUPPLY, TREATMENT, AND PUMPING FACILITIES**

### **2.8.1 Potable Water Facilities - General**

The criteria contained herein are intended to assure uniformity and quality of construction of the potable water facilities to be constructed hereunder. The water treatment facilities shall be designed to utilize the most cost effective process to adequately meet or exceed water quality standards. The process utilized shall be reviewed by the SJCUD. The design shall meet all the requirements set forth in Chapters 62-500, 62-524, 62-531, 62-550, 62-555 and 62-560, FAC. Plans and specifications shall be certified by a professional engineer registered in the state of Florida.

The treatment plant equipment and appurtenances shall be fabricated and furnished by reputable, recognized manufacturers engaged in the full-time business of, and with a minimum of five years experience in, the construction of potable water treatment facilities.

### **2.8.2 Water Treatment Plant Design Data**

- A. Water treatment facilities shall be sized, designed, and installed to efficiently process anticipated water demands during peak, average, and fire flow periods. Peak, average, and fire flows shall be estimated for both daily and hourly periods. The engineer shall submit, along with the application for a public water system construction permit, the assumptions and calculations used to determine the anticipated water flows.
- B. Average Daily Flow (ADF) is the total amount of flow supplied by a given plant for a one year divided by the number of days in a year (365). For design purposes, ADF for various establishments will be determined by the equivalent residential connection (ERC) method.
- C. Maximum Daily Flow (MDF) is the flow which must be supplied on the highest water use day of the year. MDF will be assumed to be twice the ADF. ( $MDF = 2 \times ADF$ )
- D. Maximum Hourly Flow (MHF) is the flow supplied during the highest water use hour. MHF will be assumed to be 4.0 times ADF. ( $MHF = 4 \times ADF$ )
- E. Fire Flow (FF) is the flow rate capability of water used in combating a fire. Fire flow requirements shall be determined in accordance with the applicable St. Johns County Fire Department Codes. As a minimum the plant will be required to provide 500 GPM fire flow for low density residential areas and 1500 GPM fire flow for industrial, commercial, institutional areas and high density residential.
- F. Peak Flow (PF) is the ultimate flow that is capable of being delivered into the system instantaneously. For design purposes it will be assumed that the PF is fire flow rate plus max daily flow. ( $PF = MDF + FF$ )

**2.8.3 Water Treatment Plant Site**

- A. The treatment plant structures and equipment shall be protected from physical damage that could be caused by the one hundred (100) year flood event.
- B. The treatment plant should be designed to remain fully operational and accessible during the twenty-five (25) year flood event.
- C. Buffer zone requirements for plants and water supply wells must comply with the St. Johns River Water Management District, the FDEP and the LDC.
- D. The plant and well site shall be totally enclosed by or with a fence.
- E. Asphalt-paved roadways for access to the plant and well sites shall be provided by the Developer.

**2.8.4 Water Treatment Plant Safety**

The design of the plant shall incorporate all necessary facilities to assure safe working conditions including all appropriate requirements of OSHA.

**2.8.5 Potable Water Supply and Process Design Criteria**

- A. Well Design - Wells shall be designed in accordance with Chapters 62-532 and 62-555, FAC. Wells shall be sized to produce maximum daily flow (MDF) with the largest well pump out of service.
- B. Treatment Processes - Any and all processes or equipment used for treatment of raw water shall be sized for MDF.
- C. Storage - storage is needed when well water is treated by aeration and chlorination or to equalize peak flow demands. Storage requirements are determined by one of the following four methods as appropriate.
  - 1. Where treatment by aeration is provided for Hydrogen Sulfide or iron removal, storage for treatment shall be equivalent to 4 hours retention time after aeration at the maximum daily demand.
  - 2. Where disinfection by chlorination is provided, storage for treatment shall be equivalent to 30 minutes contact after injection. The detention time can include travel time in the transmission main prior to the first distribution system connection.

3. Where storage is required for fire protection, storage will equal 2 hours of maximum daily demand (MDF) plus fire flow (FF) minus the supply well (WELLS) rate on auxiliary power. Storage  $S = 2 \times 60 [MDF (gpm) + FF (gpm) - WELLS (gpm)]$ . Fire flow and duration for design shall be confirmed with the St. Johns County Fire Marshall.
4. Where storage is required to equalize peak flow demands, storage will be calculated by multiplying the difference between the supply well (WELLS) input rate and high service pumps (HSP) outflow rate by the duration of the peak flow event. The duration is assumed to be 4 hours. Storage  $S = (HSP - WELLS) \times 4 \times 60$ .

The required storage volume will be the greatest amount determined by the four (4) methods described above.

- D. High Service Pumps – High service pumps are used to pressurize the distribution system, pumping water from the storage tanks to the system directly. The high service pumps must be capable of pumping peak flows demanded by the customers. For purpose of maintenance and system reliability, the high service pumps should deliver peak flow with the largest pump out of service.
- E. Chlorination - Chlorination systems shall be of adequate size to provide the required residuals and comply with the FDEP requirements.
- F. Electrical Controls
  1. All electrical outdoor controls, motor starters, and switches shall be installed in a NEMA-type 4X panel enclosure.
  2. Color code all wiring and provide a wiring diagram.
  3. Automatic restart of electrical motors after interruption of power is required.
- G. Auxiliary Power - Auxiliary power shall be provided to plant operation during power outages. As a minimum, the generator should provide electric power to adequately start and run all systems to meet a rate at least equal to average daily demand. The generator shall include an automatic transfer switch.

### **2.8.6 Other Requirements for Water Facilities**

- A. Flow Measurement
  1. There shall be a recording, indicating and totalizing flow meter.
  2. The flow meter shall include a circular chart suitable for recording over a 30 day period and a seven digit straight reading totalizer.

3. Gradations shall be in millions of gallons per or thousands of gallons per day.
  4. Surge and lightening protection is required.
- B. Lighting - Sufficient lighting to illuminate plant area and equipment is required.
  - C. Operating Equipment - A complete outfit of tools accessories, and spare parts necessary for plant operations is required.
  - D. Color coding of all equipment and piping systems shall be as specified in this Manual.
  - E. Operation and Maintenance Manual - Provide three copies of complete operation and maintenance manuals of the plant, equipment owned or operated by the SJCUD.
  - F. Landscaping - Landscaping requirements for private and SJCUD owned or operated facilities will be reviewed on an individual project basis.

## **2.9 FORCE MAIN BASIS OF DESIGN**

### **2.9.1 Force Main System Design Period**

Force main systems shall be designed for the estimated ultimate contributing population, as applied to the development. For transmission corridors, force mains shall be designed for projected flow in the corridor and should be coordinated with the SJCUD and is as delineated in the approved SJCUD Wastewater Master Plan (latest edition), over a 25-year minimum period.

### **2.9.2 Wastewater Design Flows**

An average daily flow of 280 and 240 gallons per day per unit should be used for single-family and multi-family residential developments, respectively. Average daily flow for commercial/industrial development shall be calculated by referencing the flow factors outlined in Schedule A of SJCUD Ordinance 2006-73 (and as amended). Peak hour flows shall be calculated per Tables 2.18-1 and 2.18-2 included in this Manual. Peak flows shall also be based on the flows discharged by the respective pump stations as indicated from design calculations or as shown on pump station models.

Flows for transmission mains shall be calculated by coordinating with the SJCUD and as delineated in the approved SJCUD Wastewater Master Plan.

### **2.9.3 Force Main System Design Calculations**

Developer shall submit design calculations with the plans for all force main projects. Calculations shall show that force mains shall have sufficient hydraulic capacity to transport all

design flows. Calculations shall meet the requirements of Chapter 62-604 of the FAC or Ten State Standards, whichever is more restrictive.

All joints shall be designed to resist thrust through the use of restrained joint fittings. The pressure rating of the pipe shall be used as the design basis for thrust restraint.

## **2.10 FORCE MAIN SYSTEM DESIGN CRITERIA**

### **2.10.1 Force Main Location**

Force mains are required to be located in grass areas between the edge of pavement and the right-of-way line and as shown in the roadway cross-section included in Part V this Manual. However, if circumstances are not compatible for such installation, a minimum 5' utility easement shall be provided. In some cases, installation under sidewalks may be approved.

Force mains under pavement shall not be acceptable. Pavement crossing shall be accomplished by provision of a casing as approved in this manual. An HDPE, DR-11 pipe could be substituted in lieu of a casing. The HDPE pipe shall be upsized appropriately to match the PVC pipe internal diameter.

Force mains shall be located in dedicated rights-of-way or utility easements. When installed in rights-of-way, force mains shall maintain a consistent alignment with respect to the centerline of the road. All force mains located outside of dedicated rights-of-way shall require a minimum 20-ft. easement. Narrower easements may be approved by SJCUD if circumstances so warrant. Additional easement widths may be necessary due to pipe size or depth of cover requirements. Force mains shall not be placed on private property unless sufficient easements are provided for operation and maintenance. Force mains shall not be placed under retention ponds, tennis courts, or other structures. Force mains shall not be located in between properties in residential subdivisions unless a 10-ft. (to match 20-ft. requirement) minimum tract is provided on each side of the lot line.

### **2.10.2 Force Main Separation Requirements**

Horizontal and vertical separations for new force main construction shall be in accordance with Chapter 62-555 of the FAC, which is included in Section 2.2.2 of this Manual.

### **2.10.3 Force Main Set Back Limits**

#### **A. Landscaping**

No piping shall be constructed within 7.5 feet horizontal of existing or proposed planted landscaped areas unless specifically approved by SJCUD. No piping shall be constructed within five (5) feet of the root zone of protected trees unless specifically approved by SJCUD. For protected trees with large root zones, it is recommended that piping be installed 1 foot per inch diameter of the tree away from the tree.

Otherwise, saw cut the roots with a clean cut to minimize damage to the root system of the tree.

#### B. Easements

No piping shall be constructed within five (5) feet horizontal of an existing or proposed easement and/or tract line unless specifically approved by SJCUD.

#### C. Structures

No piping shall be constructed within five (5) feet horizontal of any existing or proposed above ground structures unless specifically approved by SJCUD.

### **2.10.4 Force Main Materials**

Ductile iron pipe shall only be used with prior approval by the SJCUD.

### **2.10.5 Force Main Velocity and Diameter**

At design pumping rates, a minimum cleansing velocity of 2.0 feet per second (2.5 fps preferred) shall be maintained. Maximum velocity at design pumping rates shall not exceed 8 feet per second. The minimum force main diameter shall be 2 inches. Only 2", 3", 4", 6", 8", 10", 12", 16", 20", 24", 30", 36", 42", 48" and 54" diameter (or the equivalent HDPE diameter) force mains shall be permitted. Only HDPE shall be used for all 2 and 3 inch force mains. All HDPE shall be sized for true ID. Other pipe sizes may be approved on a case by case basis for private systems.

### **2.10.6 Force Main Minimum Cover**

For force mains smaller than 12 inches, the minimum and maximum cover shall be 30 inches and 36 inches, respectively, in unpaved areas and 36 inches and 42 inches, respectively, in paved areas, or as required within FDOT or railroad rights-of-way. For force mains greater than 12 inches, the minimum and maximum cover shall be 42 inches and 54 inches, respectively. Exceptions will be made for conflicts.

### **2.10.7 Force Main Friction Loss Factors**

Friction losses through force mains shall be based on the Hazen and Williams formula. The design value for the Hazen and Williams friction loss constant (C) shall be 120 for ductile iron pipe, 130 for PVC pipe and 140 for HDPE pipe, or as documented by the engineer.

### **2.10.8 Force Main Design Pressure**

The force main and fittings, including all restrained joint fittings, shall be designed to withstand pump working pressures of 100 psi.

### **2.10.9 Force Main Termination**

Discharge of force mains to manholes is prohibited. Force mains shall not connect directly into a gravity sewer line. All force mains will be required to be manifolded. Exceptions to this rule will be allowed on a case by case basis. If approved by the SJCUD, force mains may terminate at a receiving manhole located within a pump station site. Force mains shall enter the gravity sewer system through a receiving manhole at a point not more than one (1) foot above the flow line of the receiving manhole.

### **2.10.10 Force Main Air Release and Vacuum Relief Valves**

Air release valves, or combination air release and vacuum valves, shall be provided, as necessary, to prevent air locking and vacuum formation. All such valves shall be clearly delineated on the force main profile on the drawings.

### **2.10.11 Wastewater Valves**

Sufficient valves shall be provided on force main systems to facilitate effective isolation of the pipe system for repairs, maintenance, or future extension. On straight runs of force mains, valve spacing shall not exceed 1,000 feet. Additional valves shall be provided where force mains intersect to facilitate isolation of pipe segments. Valves shall not be installed in pavement unless specifically approved by the SJCUD.

### **2.10.12 Locating and Identifying Force Main**

A means for locating and identifying all force mains and valves shall be provided in accordance with the Standard Specifications and Details in this Manual Parts III and V, respectively.

### **2.10.13 Additional Requirements for Force Main System Design**

The design of force main systems shall consider potential future pump station connections. This requirement shall be reviewed with the SJCUD prior to finalization of the design.

### **2.10.14 Surface Water & Roadway Crossings for Force Mains**

Sections 2.2.9 and 2.2.10 of this Manual shall apply. Special protection shall be furnished for sewer lines crossing canals or other waterways subject to maintenance dredging or where damage may occur from water craft anchorage so as to minimize the potential for unintentional discharge of wastewater into surface waters. Cathodic protection systems may also be required for protection of piping systems under certain circumstances.



### **2.10.15 Existing Mains**

All existing mains in County rights-of-way that fall under pavement or are not directly accessible due to proposed roads, sidewalks, or structures additions or modifications will be required to be relocated and installed as new mains meeting requirements of this manual.

Split casings could be utilized for existing mains that fall under new pavement and are perpendicular to the main.

All main relocations shall be implemented with none or minimal interruption of service. Construction that requires interruption of service shall be planned and scheduled at low peak demand hours or as found acceptable by the SJCUD.

### **2.10.16 Pipe Restraints & Connections**

Refer to potable water design standards related to pipe restraints and connections. All connections to existing facilities shall be made in accordance with Sections 3.4 and 3.5 of this Manual.

### **2.10.17 Transmission Mains versus Collection Mains**

Collection mains collect wastewater from one or more developments and carry less than 2,000 gallons per minute (gpm) as verified by the SJCUD. Most of the collection mains have a diameter of 12" or less. Transmission mains are major mains that collect wastewater from the collection mains and are capable of carrying more than 2,000 gpm as verified by the SJCUD. Most transmission mains have a diameter of 16" or greater.

All transmission mains installed by a Developer will be required to be sized as indicated on the Utility Wastewater Master Plan or as directed by the SJCUD. Per section 25 E of the SJCUD Ordinance 2006-73 (and as amended), all transmission mains are eligible for reimbursement. Details of the refund agreement are provided in the Ordinance.

## **2.11 GRAVITY SEWER DESIGN BASIS**

Sewage collection systems and system extensions shall be designed as separate systems to accommodate the conveyance of wastewater. The system shall be designed to prevent the introduction of precipitation, runoff and ground water into the system.

### **2.11.1 Wastewater Design Flow**

See Section 2.9.2 of this Manual.

### **2.11.2 Gravity Sewer Design Calculations**

Developer shall submit design calculations with the plans for all gravity sewer main projects. Calculations shall show that gravity sewer mains shall have sufficient hydraulic capacity to transport all design flows. Calculations shall meet the requirements of Chapter 62-604 of the FAC or Ten State Standards, whichever is more restrictive.

## **2.12 GRAVITY SEWER DESIGN CRITERIA**

### **2.12.1 Gravity Sewer Location**

Gravity mains shall be located in dedicated rights-of-way, utility easements, and/or tracts. When installed in rights-of-way, gravity mains shall maintain a consistent alignment with respect to the centerline of the road. All gravity mains located outside of dedicated rights-of-way shall require a minimum 20 foot easement. Additional easement widths shall be provided when the pipe size or depth of cover so dictate. Narrower easements will be considered if circumstances are not compatible with this requirement. Additional easement widths shall be provided if the pipe size or depth of cover so dictates. Gravity mains shall not be placed under retention ponds, tennis courts, or other structures. Gravity mains shall not be located along side or rear lot lines unless located within easement with prior approval of SJCUD.

### **2.12.2 Gravity Sewer Pipe Separation Requirements**

Horizontal and vertical separations for new gravity sewer pipe construction shall be in accordance with Chapter 62-555, FAC, which is included in Section 2.2.2 of this Manual.

### **2.12.3 Gravity Sewer Pipe Size and Material**

All gravity sewer mains shall be at least 8 inches in diameter. Pipe material used shall be either polyvinyl chloride (PVC), or ductile iron (DI); however, DI shall only be allowable in special cases.

### **2.12.4 Gravity Sewer Cover**

Minimum cover over gravity sewers and all laterals shall be three (3) feet below the finished grade. Exceptions to this requirement may be made for a short length of pipe where structural considerations are incorporated into the design and variations are approved by the SJCUD.

Maximum cover shall be 15 feet below finished grade. Exception to this requirement can be accommodated only on a case by case basis. In no case the cover shall be over 20 feet.

### **2.12.5 Minimum Slope and Pipe Velocities**

All sewers shall be designed and constructed to give minimum velocities, when flowing full, of two feet per second, and a maximum of four feet per second. Velocity calculations shall be

based on Manning's formula, using an "n" of 0.012 for PVC and 0.013 for other pipe materials. Minimum slopes shall be as specified in Table 2.14-1:

**Table 2.14-1: Minimum Slope for Gravity Sewer**

Sewer Size [inches]	Minimum Slope [feet per 100 feet of pipe]
8	0.400
10	0.280
12	0.220
15	0.150
18	0.120
21	0.110
24	0.080
27	0.067
30	0.058
36	0.046

Under special circumstances, slopes slightly less than those needed to maintain the minimum velocity may be permitted with SJCUD approval. Reduced slopes are allowed only when the depth of flow will be 0.3 of the diameter or greater for design average flow. Whenever such decreased slopes are selected, the Engineer of Record must furnish the computations of the depths of flow in all pipes where the minimum slope is not met. These calculations will include depth of flow for minimum, average and peak flows. Gravity sewer mains shall be installed with uniform slopes between manholes. A 0.1 feet drop will also be required in a manhole between the incoming and outgoing sewer.

#### **2.12.6 Sewer Extensions**

Sewer extensions for future connections shall terminate at a manhole. The SJCUD may allow such extensions without a terminal manhole on a case by case basis subject to all of the following conditions:

- Total sewer extension length shall be limited to 50 feet.
- Sewer extension location at the initiating manhole shall be plugged.
- Such sewer extensions shall not be a part of the accepted sewer facilities. This shall be clearly delineated on the plans.
- All such sewer extensions shall be inspected and accepted as part of the future constructions phase.

### **2.12.7 Additional Requirements for Gravity Sewer Design**

#### **A. Size and Alignments**

Pipe must remain the same diameter between manholes, and any size conversion should be done at the manhole. All gravity sewers shall be laid with straight alignments between manholes.

#### **B. Prohibited Connections**

Main drain and back wash systems for pools and spas and storm drain systems shall not connect to the gravity sewer system.

### **2.12.8 Sewer Service Connections**

#### **A. General**

Service connections shall be made via service laterals and appurtenances to connect the gravity sewer to the residence or establishment being served. All laterals and appurtenances shall be 6 inches or larger and not exceed 100 feet in length. Laterals shall have a minimum slope of one percent.

#### **B. Connections**

Service laterals shall not discharge into a sanitary manhole, except at terminal manholes. The SJCUD reserves the right to approve/disapprove service, physical and system location and size of connections. Lateral invert in terminal manhole shall match manhole spring line elevation. A maximum of three (3) lateral connections will be allowed into a terminal manhole.

## **2.13 MANHOLES**

### **2.13.1 Manhole Location**

Manholes shall be installed at the end of each gravity sewer; at all changes in grade, size or alignment; at all sewer intersections; and at distances not greater than 400 feet. Private sewer systems must be separated from the SJCUD sewage collection system by a manhole located at the right-of-way line. In most cases, the engineer should attempt to locate manholes on centerline of the roadway.

### **2.13.2 Manhole Type**

Manhole type shall be as specified in Standard Details included as Part V of this Manual.

### **2.13.3 Manhole Diameter**

For sewers 24 inches in diameter and smaller, the minimum inside diameter of manholes shall be 48 inches. For sewers between 24 inches and 36 inches, the minimum inside diameter shall be 60 inches. For sewers larger than 36 inches in diameter, a 72 inch inside diameter manhole shall be provided. A minimum access cover diameter of 30 inches shall be provided. All manholes 14 feet and deeper shall have a minimum inside diameter of 60 inches.

### **2.13.4 Manhole Flow Channel**

The flow channel through manholes shall be made to conform in shape and slope to that of the sewers. The angle between all flow channels shall be 90° or greater. When directional changes exceeding 45 degrees occur, an additional flow line elevation drop of 0.1 foot across manholes shall be provided. Benching shall be provided and which shall have a minimum slope of 2 inches per foot.

### **2.13.5 Manhole Materials**

Manholes shall be precast units, as specified in Part III of this Manual. Brick manholes shall not be permitted. Cast-in-place manholes may be accepted on a case by case basis for conflict resolution.

### **2.13.6 Manhole Castings**

Cast iron frames and covers shall be as specified in Part III of this Manual. Bolt down and/or gasket covers shall be provided where manholes are located in areas subject to water accumulation or flooding.

### **2.13.7 Manhole Access**

A 10 foot wide access road shall be provided for all manholes which are located outside of County roadways. The top 8 inches of the access road shall be stabilized to a Florida Bearing value 50 psi, and compacted to 95% of AASHTO T-180.

## **2.14 GREASE TRAPS AND OIL WATER SEPARATORS**

This section refers to facilities discharging to the St. Johns County Utility Wastewater System. Any facility that prepares food shall be required to install an approved grease trap. Any automobile related facility shall be required to install an approved oil/water separator. All grease traps and oil/water separators shall be constructed, maintained and monitored according to provisions set forth in the St. Johns County Oil and Grease Management Ordinance. Each facility shall be required to obtain a Wastewater Discharge Permit from the St. Johns County Utility Department, Pretreatment Division.

## **2.15 WASTEWATER LIFT STATION - GENERAL**

The goal of these standards is to provide dependable wastewater pumping facilities that protect human health and the environment, and provide reliability and uniformity in construction. These standards are for wastewater pump stations, submersible or above-ground type stations that are connected to the SJCUD wastewater system and have a motor horsepower of 5 and greater. Requirements for stainless steel piping, telemetry, and Flygt or Gorman-Rupp pumps do not apply to private lift stations. For pump stations discharging more than 1,000 gallons per minute, the type of pump station and Basis of Design shall be reviewed and approved by the SJCUD before proceeding with the design. Design shall be in accordance with Chapter 62-604 of the FAC, Ten State Standards, and this Manual.

Head capacity curves shall be prepared and submitted to the SJCUD along with the pump station plans. Head capacity curves shall verify that the pumps are suitable for the design flow application. Pump and motor selection and head capacity curves shall reflect the minimum (one pump station flow) and maximum case (all pump stations on) hydraulic operating conditions in cases where receiving force main systems are manifolded with other pumping stations. The pumps shall be capable of operating at any point on the specified pump curve without overloading the rated horsepower of the motor, without consideration of safety factor.

No re-pump stations will be permitted without approval by SJCUD. If approved, all re-pumps shall be equipped with a stand-by pump system or emergency generator. Provide a Master pump station when flows exceed 1,000 gpm or when the number of pump stations within a development exceeds three (3).

Pump stations within a subdivision may be re-pumped to a master pump station within the subdivision. Only one Master pump station force main shall be connected to the SJCUD force main manifold system unless otherwise approved by the SJCUD.

Provide isolation valves at all points of connections to existing wastewater force main manifold system.

## **2.16 WASTEWATER LIFT STATION DESIGN BASIS**

### **2.16.1 Wastewater Design Flows**

See Section 2.9.2 of this Manual for calculating the average daily flow (ADF).

Design pumping capability for individual pump stations shall be based on the Peak Hourly Flow (PHF) which shall be calculated by multiplying the ADF with the applicable minimum peaking factors as outlined in Table 2.18-1.

**Table 2.18-1: Peak Flow Factors based on Flow (One Pump Station)**

Design ADF (GPD)	Minimum Peaking Factor
Flows to 100,000	4.0
100,000 to 250,000	3.5
250,000 to 1,000,000	3.0
Flows greater than 1,000,000	2.5

The PHF will also be based on the number of pump stations discharging in a manifold. PHF varying by number of pump stations are outlined in Table 2.18-2.

**Table 2.18-2: Peak Flow Factors based on Number of Pump Stations**

Number of Pump Stations	Minimum Peaking Factor
2-3	3.5
4-5	3.0
6-7	2.75
8-9	2.5
10 and greater	2.25

Master pump stations shall be designed to accommodate 1.25 times the flow that it is estimated to receive when all the stations in its basin are pumping.

### 2.16.2 Number of Lift Station Pumps

For pump stations with a PHF of 1,500 gpm or less, a minimum of two pump units shall be provided. Where the PHF exceeds 1,500 gpm, three or more units shall be provided. Each pump station shall be capable of pumping the PHF with the largest pumping unit out of service.

### 2.16.3 Wet Well Design

The design fill time and minimum pump cycle time shall be considered in sizing the wet well. The effective volume of the wet well shall be designed for a maximum of 30 minutes fill time at average daily flow.

The effective volume shall be determined between the primary pump “on” elevation and the pump “off” elevations. Self-priming pump motors shall have a total cycle time of not less than ten (10) minutes for motors 25 hp or smaller, fifteen (15) minutes for motors with horse powers

between 26 to 100, and thirty minutes (30) for motors with horse power greater than 100. The effective volume for submersible pump stations shall have a total cycle time no less than ten (10) minutes. The pump "off" level shall be at the top of the motor. The minimum effective volume depth shall be 2 feet. The minimum size shall be 6 feet diameter.

#### **2.16.4 Lift Station Design Calculations and Procedures**

The following procedures shall be followed during pump station design:

1. Request minimum and maximum force main manifold pressures from SJCUD.
2. Provide to the SJCUD hydraulic modeling calculations of the existing wastewater force main manifold system, analyzing the impact to the existing pumping stations. Calculations shall be performed based on existing pump curve data of each of the existing pump stations.
3. Submit to the SJCUD a Master Development Plan (MDP), in accordance with the St. Johns County LDC. The MDP must show land tract(s) and location(s) of connections to the SJCUD system.
4. Submit to the SJCUD signed, sealed and dated design calculations for all pump stations. Calculations shall include the following:
  - Basis of Flow (Residential/Commercial), ADF, PHF;
  - Size, velocity, and pressure of connecting force main;
  - Wet well design and buoyancy calculations, including assumptions;
  - Static head (pump on/off level versus highest elevation of force main);
  - Min/max Total Dynamic Head (TDH) based on friction head and static head;
  - Pump Selection - including type, manufacturer, model number, size, impeller size, flow in gpm, TDH, efficiency, NPSH, system head curves, HP, RPM; and
  - Total cycle times for ADF and PHF (number of minutes "on" and "off").

#### **2.16.5 Small Diameter Lift Stations**

##### **A. Design Basis**

Design and construction of small diameter pump stations shall follow the latest non-master pump station design and construction standards and details, except as noted below. Where no specific guidance is offered below or in the case of a conflict, the non-master pump station design and construction standards shall be followed.

##### **B. Applicability of these Standards**

These standards apply to any lift station with peak flows less than 80 gallons per minute, which will be owned and maintained by the SJCUD presently or in the future. These standards are acceptable for use in residential, commercial, and industrial applications. Specification for small diameter force main (2" and 3") can be found in Part III of this Manual.



## C. Pump Station Details

### 1. 2" Pump Stations

- a. Use the existing larger pump station standards and details as a guide.
- b. Wet Well diameter: 5 feet minimum
- c. These stations shall be grinder type pumps only.
- d. 3 Phase power is required.
- e. All piping shall be flanged stainless steel Schedule 10.
- f. Guide rails shall be provided.
- g. Check valves shall be flapper type, full port, threaded brass; they shall be installed in the vertical position.
- h. Ball valves shall be flanged SS, full port.
- i. The check valve and ball valve shall be installed above ground on top of the wet well.
- j. Provide a tee with a flanged end and blind flange to install the wafer style 2" pressure isolator ring.
- k. No fittings or threaded pipe joints shall be located in the wet well, except at the interface of the pump base. The pump discharge pipe diameter shall be brought above the top of the wet well before changing to 2" piping.
- l. One pressure gauge port shall be installed after the 90 degree bends.
- m. The connection between the SS pump station piping and HDPE force main shall be accomplished by a SS FPT 90 degree bend, SS MPT pipe, Gate valve, and a brass, pack joint male adapter on the HDPE. The gate valve connection shall not be under the concrete pad.

### 2. 3" Pump Stations

- a. Use the existing larger pump station standards and details as a guide.
- b. Wet Well Diameter: 6 feet minimum
- c. Pumps shall be 3" non-clog submersible type ONLY.
- d. Provide a tee with a flanged end and blind flange to install the wafer style 3" pressure isolator ring.
- e. A pressure gauge port shall be installed for each pump prior to the check valve.
- f. All piping shall be stainless steel flanged end Schedule 10 (if flanges are welded on) or Schedule 40 (if flanges are threaded on). All stainless steel piping shall be the same schedule.
- g. The connection between the SS pump station piping and HDPE force main shall be accomplished by a running SS piping through the concrete slab into a MJxMJ DI 90 degree bend, HDPE pipe to the MJxMJ gate valve and continuing the HDPE FM. The gate valve connection shall not be under the concrete pad.

## 2.17 LIFT STATION DESIGN CRITERIA

### 2.17.1 Lift Station Site Selection

In addition to requirements outlined in the St. Johns County LDC and Ordinances, site selection for the pumping station shall be based on the following criteria:

- Proximity to existing/future gravity line and force main (consider hydraulic capacity);
- Land ownership and easements, existing land tracts;
- Site location and size;
- Vehicular access;
- Site and surrounding conditions such as flood potential and drainage issues;
- Landscaping and setback requirements;
- Existing utilities availability;
- Zoning and permitting;
- Operation and maintenance considerations;
- Geotechnical and environmental considerations;
- Noise and odor control; and
- Security fencing and lighting.

A minimum 40 feet by 40 feet tract of land is required for all pump station sites, except master pump station site which require a 50 feet by 55 feet site. The location of specific structures/facilities within the pump station site shall be per the standard details included as Part V of this Manual. Wet well sizing shall depend on the design capacity (as indicated on the plans), type of station, number and type of pumps. In addition, future expansion issues shall be evaluated prior to determining the site size. Developer-constructed station sites and access roads shall be dedicated by tracts to the SJCUD. Ingress/egress easements shall be required around the pump stations located on private roads.

The pumping station shall be located so that it is readily accessible by maintenance vehicles during all weather conditions. The access road to the pump station shall be paved with either asphalt or concrete suitable for an H-20 truck loading. The site shall be a minimum of one foot higher than the existing roadway and drain away from the site. Per Chapter 62-604 of the FAC, the electrical and mechanical equipment shall be protected from physical damage by the 100-year flood. The pump station shall be designed to remain fully operational and accessible during a 25-year flood. Lesser flood levels may be designed for, dependent on local conditions and the approval of SJCUD, but in no case shall less than a 10-year flood be used. Design considerations (water surface elevations, forces arising from water movement, etc.) shall be based upon available information. Where site-specific information is unavailable, sound engineering practices shall be used in siting and design of pump station facilities.

A 6-ft vinyl coated chain link fence with privacy slats shall fully enclose the pump station. Master pump stations shall have an 8-ft high fence. Access shall be provided through a 12-ft double-leaf gate with locking capability. Exceptions to this requirement may be made for pump stations serving residential areas on a case by case basis and subject to sufficient landscape

screening. Landscape screening may be required in addition to fencing, which shall be at the discretion of SJCUD. Should the fence material be changed, a signed maintenance agreement with SJCUD shall be provided prior to acceptance by SJCUD.

### **2.17.2 Pre-Cast Concrete Wet Well**

The wet well design shall comply with the specifications in Part III of this Manual. At a minimum, the wet well design shall consist of a 6-ft diameter pre-cast concrete structure. The wet well shall have a minimum depth of 5-ft below the lowest invert. Additional wet well diameters and depths shall be provided based on flow and cycle time. The interior surface of the wet well shall be coated with Agru Liner, Spectra-Shield, or Sewpercoat, in accordance with manufacturer's recommendations and approved shop drawings. The wet well floor shall have a minimum slope of 1 to 1 to the pump intake.

Low Level Alarm water levels shall provide adequate submergence to prevent pump inlet vortexing and/or air binding. The Low Level alarm shall be 6 inches below "Pump Off" level and a minimum of 2 ft. above the wet well bottom. High Level Alarm water level shall be 6 inches below the lowest invert elevation of the influent pipe(s).

The wet well shall be equipped with a 4-inch minimum quick disconnect pump out pipe connection (male end with cap) and 316 stainless steel type L, schedule 10, drop pipe. The size of the quick disconnect shall be based on the capacity of the lift station.

The wet well shall be equipped with a 4 to 8-inch PVC tee type vent and insect screen based on the size of the wet well.

Buoyancy conditions shall be considered in the wet well design and provisions made to prevent uplift by groundwater conditions at or near ground surface. The weight of interior filleting, pumps and piping, and exterior surface friction shall not be included in the buoyancy calculations. Groundwater shall be considered at ground level unless wet weather geotechnical borings indicate otherwise. The weight of the concrete and soil shall be utilized in the buoyancy calculations.

### **2.17.3 Lift Station Pumps**

Submersible and/or above-ground wastewater pump stations shall comply with the specifications in Part II of this Manual. Submersible pumps and motors shall be designed specifically for raw sewage and be capable of being totally submerged during operation. Above-ground pumps and motors shall be horizontal self-priming pumps designed for raw sewage. The pumps shall be capable of passing solids of at least 3-inch diameter. The pump suction and discharge openings shall be a minimum of 4-inches in diameter.

#### **2.17.4 Lift Station Water Supply**

All wastewater pump stations shall have two, 1-inch water services. One shall be capable of providing adequate capacity and pressure for pump station wash down. The second shall be used for SCADA monitoring by measuring the static water pressure of the water system. The water services shall be separated from the potable water supply by means of an approved reduced pressure backflow preventer. The static line for the SCADA does not require a reduced pressure backflow preventer.

#### **2.17.5 Lift Station Flow Monitoring**

Each wastewater pumping station, designed to handle peak flows in excess of 1,000 gpm, shall be equipped with flow meters and instrumentation for indication, totalizing and recording of the flow. Flow meters shall comply with the specifications in Part III of this Manual.

#### **2.17.6 Lift Station Electrical Equipment, Power Supply and Controls**

All specifications related to pump station electrical supply, conduit, wiring, lighting, telemetry, controls, and instrumentation shall comply with the provisions provided in Section 2.19 of this Manual.

#### **2.17.7 Lift Station Emergency Power**

All pumping stations shall be provided with uniform emergency power receptacles. Fixed stand-by emergency power generators shall be provided at master pump stations and at all pumping stations which are at critical points in the sewer system, which receive flow from one or more pump stations through a force main, which have a peak design capacity of 500 gpm or more, or which discharge through a force main 12 inches in diameter or larger.

Emergency stand by engine driven pumps can be installed in lieu of emergency generators. Additional details are provided in Sections 2.18 and 2.19 of this Manual.

#### **2.17.8 Lift Station Site Grading**

To minimize the chance of inflow and/or infiltration, the pump station site shall be graded to slope away from adjacent water bodies. In addition, the top of the wet well should be the highest point on the site to avoid drainage into the wet well. The wet well concrete slab should be constructed 4 inches above the site elevation. Refer to the standard details in Part V of this Manual for additional information.

## **2.18 WASTEWATER PUMP STATION DESIGN SPECIFICATIONS**

### **2.18.1 General**

This section includes materials and installation standards and Contractor responsibilities associated with the furnishing of all labor, materials, equipment and incidentals required to install, complete and make ready for operation all wastewater pumping stations as shown on the drawings and as specified herein. This section also includes the modifications to existing pumping stations. Wastewater pump stations shall be either submersible, submersible grinder type or above ground, with consideration given to the operation, maintenance, standardization, durability, and future expansion of the collection system served by the pumping station.

#### **A. Qualifications**

All equipment and materials shall be furnished by a manufacturer who is fully experienced, reputable and qualified in the manufacture of items to be installed/constructed.

#### **B. Workmanship**

All work shall be proved to be in first class condition and constructed in accordance with the drawings and specifications. All defects disclosed by tests and inspections shall be remedied immediately by the Contractor at no additional compensation.

#### **C. Materials**

All material shall be free from defects impairing strength and durability and be of the best commercial quality for the purpose specified.

Unless indicated otherwise on the drawings, all metal components in the wet well, with the exception of pumps and motors shall be anodized aluminum or 316 stainless steel as specified herein or on the plans.

The pumps, motors and guide rail system shall be supplied by the pump supplier to ensure unit compatibility.

### **2.18.2 Project Work Schedule and Sequencing**

The project schedule shall be established on the basis of working a normal work schedule including five days per week, single shift, eight hours per day or four days per week, single shift, ten hours per day. Unless approved otherwise by the SJCUD, normal or general items of work such as setting wet well (base and riser sections), field pump test, density testing, connections to existing piping, and final inspections, shall be scheduled during the normal work schedule.

The SJCUD may require the contractor to perform work outside of the normal work schedule for tasks such as tie-in work (cut-in work or other work) and work that may impact the continued (non-interruptible) service to existing SJCUD customers. The contractor shall plan and anticipate the cost impact of these work schedule limitations. A SJCUD representative shall be present during tie-in work. Contractor shall notify SJCUD at least 48 hours prior to scheduling work.

Unless approved otherwise, a SJCUD representative shall be present to observe the excavated area prior to setting (installing) the wet well. The date and time for setting the pre-cast wet well shall be reviewed and approved by SJCUD, at least 48 hours prior to the actual work.

### **2.18.3 Submittals**

#### **A. Shop Drawings**

A minimum of two (2) sets of shop drawings shall be submitted to SJCUD. All submittals shall be previously reviewed and stamped approved by the Engineer of Record. SJCUD will not accept shop drawings that have not been reviewed and approved by the Engineer of Record.

Shop drawings shall include information on the wet well, discharge piping, pumps, valves, guide rail systems, emergency standby pumps, pressure sensors, access covers, control panel, electrical schematics, emergency generator, and any other equipment and appurtenances necessary to complete the lift station installation.

Data shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement, and operation of component materials and devices, the external connections, anchorage, and supports required, and dimensions needed for installation and correlation with other materials and equipment. All part numbers and catalog data required for ordering spares and replacements shall be provided.

The acceptance of drawings returned marked “APPROVED” or “APPROVED AS NOTED” shall not constitute approval of dimensions, quantities, and details of the materials, equipment, device or items shown and shall not relieve the Contractor of any responsibility for errors or deviations from the requirements.

The submitted drawings and data shall be published by the manufacturer and shall include, but not necessarily be limited to, the following:

1. Wet well and discharge valve information.
2. Mechanical equipment.
3. Electric Motors.
4. Controls and Wiring Diagram.
5. Pump curves at rated RPM. Family curves shall not be acceptable.

### B. Certified Factory Pump Curve

Each pump shall be tested in the manufacturer's shop to demonstrate the proper operation of all components. A certified factory pump curve shall be provided for each pump prior to placement into operation. A representative pump shall be acceptable for the factory testing of any pump under 10 horsepower. A specific factory test of the pump to be installed shall be required for all pumps 10 horsepower and greater.

### C. As-Built Drawings

As-Built drawings shall be required for pump station projects, including projects for SJCUD, and private developments (utilities to be dedicated to St. Johns County). As-built requirements are as specified in Part III of this Manual. As-built drawings shall be reviewed and approved by SJCUD. The cost to provide as-built drawings shall be included as part of the related work requirements or general conditions for the utility work.

## 2.18.4 Above-Ground Wastewater Pump Stations

Above-ground pump station type shall be designed by the Developer's Engineer. However, SJCUD shall ensure the compatibility in design and color in relation to the overall existing or proposed development.

### A. Pump Enclosure

The pump enclosure shall not be constructed over the wet well and shall meet the following requirements:

1. Doors shall be aluminum or fiberglass construction.
2. The enclosure shall include a power exhaust fan and aluminum intake louver sized per the manufacturer's recommendations.
3. The enclosure shall include an electric space heater capable of preventing moisture condensation on the motor coils for 3-phase motors. An electric heater thermostatically controlled and properly sized to prevent freezing inside the pump station building shall be provided.
4. The water supply shall be equipped with a reduced pressure backflow preventer (RPZ).
5. The floor drain for removal of spillage or wash water, shall be equipped with a p-trap.
6. Lighting: Interior - Sufficient for night-time repairs. Exterior - Sufficient for security purposes.
7. Hoisting Equipment - provide as required for each station.
8. The enclosure shall be equipped with an emergency power receptacle unless onsite stand-by power or an engine-driven standby pump shall be provided.

## B. Self Priming Centrifugal Pumps

The pumps shall be the horizontal self-priming centrifugal type equal in construction and performance to the "T" Series pumps manufactured by the Gorman-Rupp Company, specifically designed for handling raw, unscreened sanitary domestic sewage.

The pumps shall have the necessary characteristics and be properly selected to perform under the required operational conditions to include:

1. Gallons Per Minute (GPM) at Total Dynamic Head (TDH).
2. Horsepower (HP) (non-overloading).
3. Reprime Lift.
4. Dynamic suction lift.
5. NPSH.

The pump at its rated speed shall be designed to retain adequate liquid in the pump casing to insure unattended automatic repriming in a complete open system without suction or discharge check valves and with a dry suction leg. Upon completion of repriming cycle, pumps shall deliver full rated capacity at TDH at the designed total dynamic suction lift.

The openings and passages of the pump shall be large enough to pass a three inch diameter sphere and dry trash or stringy material which can pass through the average house collection system.

### 1. Cover Plate

The pump shall be equipped with a removable cover plate, weighing not more than 45 lbs., allowing complete access to pump interior to permit the clearance of stoppages and to provide simple access for service and repairs without disturbing suction or discharge piping.

### 2. Wear Plate

The pump shall also be fitted with a replaceable 316 Stainless Steel wear plate. Replacement of the wear plate, impeller and seal shall be accomplished through the removable cover plate. The entire rotating assembly, which includes bearing, shaft, seal, and impeller, shall be removable as a unit without disturbing pump volute or piping.



### 3. Impeller

The impeller shall be a two (2) vane, semi-open, non-clog, cast or ductile iron, with integral pump out vanes on the back shroud, and shall thread onto a pump shaft of high carbon steel. Means shall be provided for external adjustment of the impeller to the wear plate.

### 4. Pump Shaft

The pump shaft shall be covered and protected with a removable sleeve. The shaft shall be contained within a bearing pedestal of ample size to contain heavy-duty ball thrust bearing and radial bearing of adequate size to withstand all imposed loads. Bearings shall be oil lubricated, with the bearing pedestal cooled by pumped liquid.

### 5. Mechanical Seal

A balanced mechanical seal shall prevent leakage around the pump shaft. Both the stationary sealing member and mated rotating member shall be of Tungsten-Titanium carbide alloy. Each of the mated carbide surfaces shall be ground and polished to produce a flatness tolerance not to exceed one half a light band, or 5.8 millionths of an inch, as measured by an optical flat and monochromatic light. To insure the seal faces are in full contact at all times, the stationary seal seat shall be double floating and self-aligning during periods of shock loads that will cause deflection, vibration and axial or radial movement of the pump shaft.

The mechanical seal shall be installed within a separate oil filled reservoir of the pump pedestal, the oil being both lubricating and cooling media.

The seal shall be removable and replaceable through the cover plate opening. The mechanical seal shall be warranted for a minimum period of four (4) years from date of shipment. Should the seal fail within the first year, the manufacturer shall be obligated, upon notification, to furnish a new seal, at no charge to the owner, f.o.b. factory. The cost of replacement seals thereafter shall be on a pro rata basis.

### 6. Suction Check Valves

The pump shall incorporate molded one piece tapered suction check valves that can be removed or installed through the removable cover plate opening without disturbing the suction piping.

### 7. Volute Casing

The pump volute casing shall contain no openings of a lesser diameter than the sphere size specified. Screens or any internal devices that create a maintenance

nuisance or interfere with priming and performance of the pump shall not be permitted.

#### C. Motors

Motors shall be horizontal, open drip proof, induction type, with normal starting torque and low starting current characteristics, suitable for 3 phase, 60 hertz, 230/460 volts, AC electrical current. The motors shall be non-overloading over the full operating range of the pump. Additional motor requirements are provided in Section 2.19.

#### D. Drive Transmission

Power shall be transmitted from motors to pumps by means of V-belt drive assemblies. The drive assemblies shall be selected to establish proper pump speed to meet the specified operating conditions.

Each drive assembly shall have a minimum of two V-belts. In no case shall a single belt drive be acceptable. Each V-belt drive assembly shall be selected on the basis that adequate power shall be transmitted from drive to pump.

Drive systems with a safety factor of less than 1.5 shall not be considered sufficient for the service intended. Computation of safety factors shall be based on performance data published by the drive manufacturer.

##### 1. Belt Guards

Pump drive transmissions shall be enclosed on all sides in a guard constructed of any one or combinations of materials consisting of expanded, perforated, or solid sheet metal, except that maximum perforated or expanded openings shall not exceed 1/2 inch.

Guards shall be manufactured to permit complete removal from the pump unit without interference with any unit component, and shall be securely fastened to the unit base and rigidly braced to some fixed part.

#### E. Pump Base

The pump base shall be comprised of structural steel members and reinforcements designed to prevent flexing or warping under operating conditions. Base flanges shall be drilled for hardware used to secure unit base to concrete pad. Motor mountings shall be adjustable for increased motor frame sizes. Provisions shall be made for adjusting belt tension and motor alignment with pumps. Adjusting bolts shall be provided to maintain correct alignment.

#### F. Suction and Discharge Spools

Each pump shall be equipped with one piece, cast iron suction and discharge spools flanged on each end. Each spool shall have 1/4-inch N.P.T. tapped hole with pipe plug for mounting gauges. Discharge spools shall have 1-1/4-inch N.P.T. tapped hole for mounting an automatic air release valve provided by the pump manufacturer.

#### G. Spare Parts

For each size and type pump, a complete set of mechanical seals, a gasket set, wear rings, and a spare impeller shall be provided, unless otherwise indicated by SJCUD.

### 2.18.5 Submersible Wastewater Pump Stations

#### A. Submersible Pumps

Pumps shall be of the non-clog, submersible type for sewage service as manufactured by Flygt. Pumps shall be complete with a submersible electric motor, floor-mounted discharge base and elbow, guide-rails, motor electrical cable (minimum 50 feet in length) to connect at the demarcation box (no splicing allowed) and all other appurtenances specified or otherwise required for proper operation.

Operating conditions and unit sizes shall be shown on the drawings. The pump design operating conditions shall be within 20% +/- of the best efficiency point, unless otherwise approved by SJCUD. When possible, the pump selection shall be made in the center of the family of curves.

Pump performance shall be stable and free from cavitation and noise throughout the specified operating head range at minimum suction submergence. Pump shall be designed so that reverse rotation at rated head will not cause damage to any component.

The pumps shall have the necessary characteristics and be properly selected to perform under the required operational conditions to include:

1. Gallons Per Minute (GPM) at Total Dynamic head (TDH).
2. Horsepower (HP) (non overloading).
3. Maximum operating head to be 90% of shut off head.

The openings and passages of the pump shall be large enough to pass solids, fibrous materials, heavy sludge, stringy materials, and other matter which can pass through the average house collection system.

1. Pump Casing

The pump casing shall be of grey cast iron, ATSM A-48, Class 35B, with a slide rail guide shoe attached to the discharge flange as an integral assembly. The casing shall be easily removed from the motor for full inspection of the impeller.

2. Impeller

The impeller casing shall have well-rounded water passages and smooth interior surfaces free from cracks, porosity, blowholes, or other irregularities. The impeller shall be a semi-open or enclosed one-piece casting with not more than two non-clog passages. Screw impellers shall not be acceptable. The interior water passages shall have uniform sections and smooth surfaces and shall be free from cracks and porosity. The impeller shall be dynamically balanced and securely locked to the shaft. Fasteners shall be non-corroding.

3. Pump Shaft

The pump and motor shaft shall be a one-piece ASTM 479 stainless steel or ASTM A 572 carbon steel. The lower bearing shall be a double row or two single rows thrust bearing.

4. Mechanical Seals

Pumps shall have double faced mechanical seals, which shall require neither maintenance nor adjustment and shall be readily accessible for inspection and replacement. The seals shall not rely upon the pumped media for lubrication and shall not be damaged if the pump is run un-submerged for extended periods while pumping under load. Mechanical seal wearing faces shall be solid hard faced (not laminated type), tungsten carbide materials. Elastomers shall be nitrile or viton material. The rotating faces shall be double floating and self-aligning.

5. Wearing Rings

Wearing rings shall be abrasion resistant and shall be installed at the inlet side of the pump to provide protection against wear to the impeller.

6. Discharge Base and Elbow

The pump manufacturer shall furnish a discharge base and elbow for the pump supplied. The base shall be sufficiently rigid to firmly support the guide rails, discharge piping and pump under all operating conditions. The base shall be suitable for bolting to the floor, (bolting to a standard 1-inch thick metal plate, see details on drawings), of the wet well. The face of the discharge elbow inlet flange (ANSI 125 lb.) shall make contact with the face of the pump discharge nozzle flange.

The pump and motor assembly shall be a "quick disconnect" type connected to and supported by the discharge base and guide rails. This shall allow the removal of the pump from the wet well and replacement without the need of unbolting, lowering the liquid level or requiring operating personnel to enter the wet well.

Pump shall be provided with a sealing flange and guide rail sliding bracket. The bracket shall be designed to obtain a leak proof seal between flange faces as final alignment of the pump occurs in the connected position. The bracket shall maintain proper contact and a suitably sealed connection between flange faces under all operating conditions. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal watertight contact. Sealing of the discharge interface with a diaphragm or profile gasket will not be acceptable.

#### 7. Guide Rails

Pump shall be equipped with one or more guide rails (no cable wire assembly). Guide rails shall be a minimum of 2-inch diameter and sized to fit the discharge base and the sliding bracket and shall extend upwards from the discharge base to the access hatch cover at the top of the wet well. Intermediate rail braces shall be supplied and solidly secured to the wet well wall. Braces secured to the discharge piping shall not be accepted. Guide rails and brackets shall be 316 stainless steel.

#### 8. Lifting Cable

The lifting cable shall consist of a stainless steel braided wire cable (3/8-inch minimum) attached to the pump lifting bail. An eyelet shall be provided at the upper end of this cable for attaching to the wet well access frame. Unless approved otherwise by SJCUD, the lifting cable shall be shackled to a heavy-duty 316 stainless steel lifting bail attached to the pump/motor housing for removal and reinstallation. Three feet of excess cable above the top of the wet well shall be provided to expedite removal. A cable/motor electric cable holder shall be provided and appropriately sized to accommodate the lifting cable and motor electrical cables provided without deformation. Lifting cable/electric cable holder shall include extra heavy duty 3/8-inch rod hooks for attaching control floats, lifting chains, and other wet well accessories (four hooks minimum) and be located on the side of the wet well hatch opening opposite to the discharge piping. The cable, shackles, lifting bail, and cable holder shall be 316 stainless steel.

#### B. Motors

The pump shall be driven by a totally submersible electric motor suitable for three phase, 60 hertz, 230/460 volts. Motor shall be of sufficient horsepower as to be non-overloading over the entire length of the pump curve. Additional motor requirements are provided in Section 2.19.

1. Motor Stator

The motor and stator housing shall be of cast iron casing. The stator shall consist of copper windings with copper connectors applied to high-grade electrical steel laminations. The stator shall be held securely in place by a heat shrink fit into the motor housing. Any other means of securing the stator, which would require penetration of the motor housing, shall not be acceptable.

2. Motor Bearings

Motor bearings shall be anti-friction, permanently lubricated type.

3. Rotor

Rotor shall be solid cast and dynamically balanced for vibration free operation. Rotor end bars and short circuit rings shall be of aluminum.

4. Seals

All static seals at water tight mating surfaces shall be of nitrile "O" ring type. Use of auxiliary sealing compounds shall not be required. The power and control cables shall enter the motor through a terminal housing. The entrance shall be sealed with a rubber grommet and clamp set which when compressed longitudinally cases a radial watertight seal. The clamp set shall prevent all slippage and rotation of cable while engaged, yet may be easily removed and replaced during routine maintenance. Any other cable entrance design requiring the use of epoxies, silicones, or similar caulking materials shall not be acceptable.

5. Pump Cable

Pump cable assembly shall bear a permanently embossed code or legend indicating the cable is suitable for submerged use. The pump and electrical cables shall be capable of continuous, submergence without loss of waterproof integrity to a depth of 65 feet. Cable sizing shall conform to NEC requirements. The cable shall enter the pump through a heavy-duty assemble with grommet. The system used shall ensure a watertight submersible seal. Cable shall terminate in a junction chamber that shall be sealed from the motor by a compression seal.

6. Thermal Protection

The motor shall be protected from thermal damage by three separate thermostatic switches embedded into the stator windings. Each switch shall open independently and terminate motor operation if temperature of the protected winding reaches the high temperature set point. The thermal sensing devices shall

be connected to the pump control panel by the Contractor. The thermal switches shall be set to open at 125° C.

#### 7. Spare Parts

Spare parts shall be provided per manufacturer's recommendation.

### 2.18.6 Private Pump Stations

All private lift stations shall be in accordance with Chapter 62-604, FAC.

- A. For private pump stations greater than 5 HP, all SJCUD standards shall apply except requirements for stainless steel piping, telemetry, and Flygt or Gorman-Rupp pumps.
- B. For private pump stations less than 5 HP and peak flows greater than 25 gpm, SJCUD standards may be used as guidance; however, the following requirements shall apply:
  - 1. Wet well top and pump-out box shall each be a minimum of 10 inches above the finish grade and surrounded grading. Exceptions may be made if grading plans demonstrate there is no risk of flooding.
  - 2. Control panel shall be a minimum of 5 feet from the edge of the wet well.
  - 3. Check valve on the owner's side shall be adjacent to right-of-way or easement that connects to the service connection.
  - 4. Emergency generator receptacle in all lift stations with 2 HP or greater motors.
- C. For private pump stations with peak flows less than 25 gpm, the above installation requirements shall apply. Approved pumps are as follows:
  - 1. Environment One Corporation submersible positive displacement grinder pumps;
  - 2. Hydromatic HPD 200 submersible positive displacement grinder pumps;
  - 3. Barnes SGPC submersible positive displacement grinder pumps; and
  - 4. Myers MGH200 (for residential use only) or WGL20H submersible centrifugal grinder pumps.
  - 5. Any other pump must be approved by the SJCUD.

### 2.18.7 Backup Diesel Driven Lift Station Pump

#### A. General Description

Contractor shall furnish and install a backup diesel-driven self-priming centrifugal pump at the lift station. The backup diesel driven pump shall be a complete pre-assembled unit to include a solids handling pump, diesel engine, priming system, base with integral fuel tank, sound attenuated canopy, automatic start & stop system and junction box with terminals to facilitate connection to the SJCUD Lift Station

SCADA system. The unit shall be manufactured by Thompson Pump & Manufacturing Company of Port Orange, Florida.

#### B. Centrifugal Pump

1. The centrifugal pump shall be a horizontal end suction solids handling centrifugal type.
2. The pump casing shall be constructed of class 30 cast iron with back pullout design.
3. The impeller shall be fully enclosed and constructed of class 30 cast iron.
4. Suction wear ring shall be of peripheral type requiring no adjustment and constructed of class 30 cast iron.
5. Mechanical seal shall be a John Crane type 1 tungsten carbide vs. silicon carbide mechanical type with viton elastomers and stainless steel spring and hardware.
6. The seal chamber shall include a dished backplate to remove solids and abrasive material away from the seal area and purge air and gas pockets. An oil reservoir shall be provided for automatically feeding lubricant to the seal faces permitting indefinite dry running.
7. Shaft shall be constructed of stress proof steel, machined and polished to transmit full drive output.
8. Shaft sleeve shall be AISI 416 stainless steel. Sleeve designed to be renewable with O-ring and positively locked to prevent rotation on the shaft.
9. Bearing frame shall be constructed of class 30 cast iron.
10. Bearings shall be of sufficient size to withstand the radial and axial thrust loads incurred during service. Bearings shall have a minimum B-10 bearing life of 20,000 hours. Bearings shall be grease lubricated.
11. Centrifugal pump shall be capable of handling up to 3" diameter non-compressible spherical solids.
12. The pump shall be furnished with a liquid-filled vacuum gauge for system diagnostics.



### C. Engine

1. The engine shall be a water-cooled diesel engine, tier II EPA Certified, sized appropriately for the conditions specified.
2. The engine shall drive the pump via an elastomeric torsion drive coupling.
3. The engine shall contain an industrial type battery with 120-volt battery charger.
4. A 12-volt starter and alternator charging system shall be provided.
5. An industrial type muffler shall be provided.
6. Engine shall have a mechanical type governor.
7. Engine shall have manual variable speed throttle control.
8. Engine shall have safety shutdown switches for low oil pressure and high coolant temperature.
9. Instrument panel shall contain the following instrumentation and controls: throttle control, key switch, tachometer, hour meter, voltmeter, oil pressure gauge and temperature gauge.

### D. Frame/fuel Tank

1. The pump set shall be mounted on a combination frame/fuel tank constructed of steel. Fuel capacity shall provide a minimum run time of approximately 24 hours at rated speed.
2. The frame shall incorporate an integral lifting bail capable of lifting the entire pump set.
3. Fuel tank shall have two clean-out ports located at opposite ends of the tank.
4. Fuel tank shall have a removable basket strainer mounted in the fill port and a lockable cap.

### E. Priming System

1. The priming system shall be fully automatic eliminating the need to pre-fill the pump casing with water to achieve initial prime.

2. The priming system shall contain a device to prevent any bypass of the pumping fluid through the ejector and onto the ground. Units not meeting this requirement shall not be considered.
3. The separation system shall not include any screens that can clog creating a maintenance nuisance and cause the priming system to fail.
4. The compressor shall be a single-cylinder, single stage, reciprocating, 13-cfm output, industrial version driven off the auxiliary drive mounting flange of the engine. No belts or pulleys shall be used to drive the compressor.
5. The compressor shall be cooled by the engine's coolant system and lubricated by the engine's pressurized oil system.
6. The compressor shall contain a pressure relief valve for overpressure protection.
7. The venturi shall be constructed of bronze and be of modular design allowing for replacement of individual wear components.
8. A flapper type discharge checkvalve shall be provided to prevent pulling air through the discharge during priming.
9. The priming system shall incorporate a manual valve to permit the pump to operate under positive suction head conditions.
10. The priming system shall be capable of automatically priming the pump with a 28-foot static suction lift with no water in the pump or suction piping.

#### F. Enclosure

1. The entire unit including the pump and engine shall be completely enclosed in a lockable enclosure. Units not meeting this requirement shall not be considered.
2. The enclosure shall reduce operating noise to a maximum of 70 dBA measured at 7 meters @ full speed. Units not meeting this requirement shall not be considered.
3. The enclosure shall be constructed of corrosion-resistant 14-gauge sheet metal. Fiberglass or plastic enclosures shall not be considered.
4. The enclosure shall be insulated with acoustic sound deadening material containing a facing material that is flame retardant, tear resistant and repels oil and water. Open-cell foams that absorb water and are easily damaged shall not be considered.

5. The acoustic sound deadening material shall be positively secured to the enclosure using mounting pins and retainers. Adhesive-style mounting shall not be considered.
  6. The enclosure shall contain lockable-hinged doors. A sufficient number of doors shall be provided to allow unrestricted access to all compartments for servicing without having to disassemble and remove panels. Enclosures that must be disassembled in order to facilitate routine maintenance shall not be considered.
  7. The enclosure shall contain two rear doors that permit access to the pump unit for routine maintenance without having to disconnect the suction or discharge piping.
  8. The enclosure shall be constructed of modular panels, which can be readily disassembled and removed when major repairs are needed such as replacing the engine or pump.
  9. An oil drain valve and hose shall be provided to facilitate draining the engine oil without having to take apart the enclosure.
- G. Control/System Panel
1. An automatic engine controller shall be provided to start and stop the diesel engine in response to varying liquid levels via float switches.
  2. The automatic start-stop engine controller shall be part of the main instrument panel and shall be mounted inside the lockable enclosure. Units requiring multiple control panels shall not be considered.
  3. The system shall contain a safety back-up feature allowing the unit to be operated manually and retain safety shutdown protection in the event of automatic engine controller failure.
  4. The automatic engine controller shall be fully field programmable and contain pass code protection.
  5. The automatic engine controller shall contain automatic and manual start modes.
  6. The automatic start-stop system shall contain two mechanically activated hermetically sealed liquid level control floats; one to turn the pump on and one to turn pump off. Single float designs that are prone to frequent cycling leading to excessive component wear shall not be considered.
  7. The floats shall be clearly marked, top or bottom, for easy installation into wet well. Floats shall be provided with a minimum of 40-feet of cable.

#### H. Junction Box

The backup diesel driven pump shall be equipped with an integral junction box for single point connection to the lift station pump control panel. The junction box shall contain terminals for the following: standby pump start and stop float switches, standby pump "running" and "fault" SCADA system contacts, and 120v power for the battery charger. The standby pump "fault" contact shall be a combination of the pump auto start control panel alarm contacts and the battery charger alarm contacts. All contacts for connection to the SCADA system shall be dry contacts.

#### I. Painting

A minimum 5-mil thick layer of epoxy-coated primer shall be applied to the entire pump set prior to the finish coat. A minimum 5-mil thick layer of industrial enamel paint shall be applied over the primer coat. The color shall be blue.

#### J. Warranty

The manufacturer of the pumping unit shall warrant for a period of one year from the date of shipment that the entire unit and all equipment therein shall be free from defects in design, material, and workmanship.

#### K. Manuals

One complete set of operation and maintenance manuals shall be furnished with the unit.

#### L. Testing

The complete pump set shall be factory tested by a certified quality technician. A test report shall be submitted to SJCUD prior to acceptance.

### **2.18.8 Pre-Cast Concrete Wet Well**

Wet wells shall conform to the latest ASTM C-478 Specification for pre-cast reinforced concrete manholes, with the exclusion of Section 10 (a), except as modified herein. Cement shall meet the requirements of ASTM C-150 latest, specification for Portland Cement, Type II. Steel reinforcement shall conform to ASTM A-615 and ASTM A-185, Latest Revisions. Rings shall be custom made with openings to meet the indicated pipe alignment conditions and invert elevations. Openings shall be adequately sealed with an approved flexible coupling, such as "Kor-N-Seal" or equivalent and installed-in strict conformance with the manufacturer's recommendations so that there shall be zero leakage around pipes and joints. Approval of SJCUD shall be obtained before placing orders for manholes.

Base of the wet well shall be cast integrally with the bottom section. The base section shall be set in a six inch leveling course of Class C concrete directly on the prepared subgrade as shown on the standard detail drawings. In order to permit adjustment of the pre-cast base section and insure full bearing on the Class C concrete leveling course, the section shall be placed just prior to the initial set.

Joint contact surfaces shall be formed with machined castings and shall be exactly parallel with a 2 degree slope and nominal 1/16 inch clearance with the tongue equipped with a proper recess for the installation of an o-ring rubber gasket or pre-molded plastic joint sealer with joints pre-primed.

The interior surfaces of all wet wells shall be coated with a material specifically designed to resist hydrogen sulfide (H<sub>2</sub>S) corrosion. The coating shall be AgruLiner or Sewpercoat or other protective liner approved by the SJCUD. The coating shall be applied in accordance with the manufacturer's recommendations after wet well installation.

The exterior surface of the wet well shall be coated with a coal tar based water proofing applied at the place of fabrication. Additional coatings or touch up work shall be applied after wet well installation as necessary if so directed by SJCUD at no additional cost to SJCUD. No concrete or wet well seams shall be left unprotected. In action, exterior joints shall have an exterior joint wrap material applied, such as "Rub'R-Nek" or other approved equal.

All influent pipes shall extend to a maximum of 8-inch from bottom of wet well or to extend to 4-inch below the level of pump "Off" float switch. Termination of influent pipe shall always remain submerged.

The wet well shall have a concrete top with a pad lockable diamond plate aluminum hatch cover (1/4-inch thick, minimum), with flush mounted pull up hasp and frame with stainless steel hardware. The hatch shall be capable of withstanding a 150 lb. per square foot static load or 300 lb. per square foot static load in traffic areas. Each cover shall have a locking safety handle to retain the covers in an open position. Cover shall be sized and located to allow for unobstructed vertical removal of all equipment. Manufacturer shall be U.S. Foundary Corporation or approved equal by SJCUD.

A stainless steel float cable holder with four (4) hooks shall be mounted inside the wet well hatch with stainless steel anchors.

### **2.18.9 Pressure Sensor and Transmitter**

The discharge from each set of submersible and above ground self-priming pumps shall be equipped with a pressure sensor and transmitter, as specified below:

Pressure Gauge and Transmitter: ABB Model # 264HSPSBA1L1N2

- 3.5 and 348 psi range Factory set at 0-100 PSI;
- 316SS Diaphragm with Silicone oil fill;

- AISI 316SS bottom works with ½” NPT-F;
- Aluminum alloy housing with ½” NPT Electrical connection;
- Hart digital communication and 4 – 20 mA output; and
- Digital LCD integral display Factory set at 0-100 PSI.

Pressure Sensor: ONYX Series PSW (Wafer Style)

- Carbon Steel Center;
- Module seal snubber;
- Delrin Acetal end plates;
- Transmitter by customer assembled by Onyx, vacuum filled with Silicone oil; and
- Calibrated by Onyx.

### **2.18.10 Air Release Valves**

Each set of submersible pumps shall be provided with one 2-inch air release valve assembly connected from the discharge spool. Assembly shall consist of necessary fittings and 2-inch, lever operated, ball valve to automatically vent air entrapped in pump to wet well. A union shall be placed after the ball valve to aid in service.

### **2.18.11 Suction Piping**

For submersible and self-priming pump stations, the wet well piping shall be Sch. 10, 316 Type L stainless steel flanged pipe. Vertical piping in the wet well shall be supported at the wet well. For submersible pump stations the base 90-degree increasing elbow shall be grouted to the wet well bottom. The elbow shall be sized to keep suction entrance velocities below three feet per second. Suction piping shall not be supported by the pumps.

### **2.18.12 Discharge Piping**

For submersible and self-priming pump stations the above grade discharge piping shall be Sch. 10, 316 Type L stainless steel flanged pipe. Below grade piping shall be either ductile iron or PVC. For submersible pump stations, the through wall passages shall be made with sleeves of at least one size larger than the pipe used. Area between sleeve and pipe shall be sealed with silicone caulking for a leak proof seal. A 4-inch minimum male quick coupler connection for pump out shall be provided at all submersible and above ground pump stations.

### **2.18.13 Painting**

For above grade structures, exterior masonry surfaces shall be coated with color impregnated stucco or painted with quality sealer and finish coat. Soffits and fascia shall be painted with oil base primer and semi-gloss enamel finish coat. The Developer shall select exterior color and texture for submittal to and approval by SJCUD. Interior walls and ceiling shall be primed with appropriate sealers and finished with semi-gloss enamel. Ceilings and walls shall be white.

Pumps, bases and interior piping shall be primed and painted gray with oil based semi-gloss enamel. Finish coat for pump belt guards shall be OSHA Orange. Electric motors shall be provided with factory coatings. Piping outside the pump station shall be forest green in color.

### **2.18.14 Check and Plug Valves**

#### **A. Check Valves**

Check valves for ductile iron pipelines shall be swing type and shall meet the material requirements of AWWA C500. The valves shall be iron body, bronze mounted, single disc, 150 psi working water pressure, nonshock, and hydrostatically tested at 300 psi. Ends shall be 125 pound ANSI B16.1 flanges.

When there is no flow through the line the disc shall hang lightly against its seat in practically a vertical position. When open, the disc shall swing clear of the waterway.

Check valves shall have bronze seat and body rings, extended bronze hinge pins and stainless steel nuts on the bolts of bolted covers.

Valves shall be so constructed that disc and body seat may easily be removed and extended hinge arm with outside lever and weight.

#### **B. Plug Valves**

All plug valves shall be installed so that the direction of flow through the valve is in accordance with the manufacturer's recommendations. Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanged valves shall be faced and drilled to the ANSI 125/150 lb. standard. Mechanical joint ends shall meet AWWA C111, Class B.

Valve bodies shall be of ASTM A126, Class B semi-steel, 31,000 psi tensile strength minimum in compliance with AWWA C507 and C504. All exposed nuts, bolts, springs, washers, etc. shall be zinc or cadmium plated. Resilient plug facings shall be of Hycar or Neoprene.

Port areas for valves 4 inches through 20 inches shall be 80 percent nominal pipe diameter. Valves 24 inches and larger shall have a minimum port area of 70 percent of nominal pipe diameter. All exposed nuts, bolts, springs, washers, etc., shall be zinc or cadmium plated.

Resilient plug facings shall be of Hycar or Neoprene.

Valves shall be furnished with permanently lubricated stainless steel or oil impregnated bronze upper and lower plug stem bushings. These bearings shall comply with AWWA C507 and C504.

Seats in 4 inch and larger valves shall have a welded in overlay of a high nickel content on all surfaces contacting the plug face, which comply with AWWA C507 and C504.

Valve shaft seals shall be adjustable and comply with AWWA C507.

#### **2.18.15 Inspection and Testing**

Upon completion of installation, the Contractor shall perform an operational test of the system, in the presence of SJCUD and a representative of the manufacturer, to insure that all component parts meet the specifications.

After the system is ready for full operation, full operating test shall be performed in the presence of SJCUD and a manufacturer's representative. The Contractor shall furnish all labor, materials and equipment required for such test and shall correct any deficiencies noted, by repairing or replacing the defective component, and re-testing as required until the equipment meets the requirements of the specification. A minimum of one complete 8-hour operational period shall be furnished to satisfy the full load operational testing requirements.

SJCUD shall be trained in operation and maintenance of equipment at start-up. Instruction shall be given in operation, service, adjustments, and routine maintenance. Recommended spare parts and maintenance schedules shall be provided.

#### **2.18.16 Flow Monitoring System**

When required, a flow monitoring system capable of indicating, recording and totalizing wastewater flows shall be provided. The system shall include magnetic flowmeter / transmitter, electronic recording receiver, and miscellaneous related accessories. It shall be the Developer's responsibility to provide and install such equipment resulting in a completely operational flow monitoring system. The manufacturer of flow meters shall be Dan Foss or approved equal.

#### **2.18.17 Accessories**

The pump supplier shall provide a vinyl or aluminum placard or tag which indicates all operating conditions of the pumps, including name plate data, impeller size and part number, design flow, TDH, and other pump related data. The tag shall be placed (with adhesive) inside the front panel of the pump control panel or as directed by SJCUD.



## **2.19 WASTEWATER PUMP STATION ELECTRICAL DESIGN**

### **2.19.1 General**

This section includes materials and installation standards and Contractor responsibilities associated with furnishing of all labor, material, auxiliaries, and services necessary to install complete and properly operating electrical systems, including all fees, charges, and permits necessary.

All material shall be new and shall conform with the standards of the Underwriter's Laboratories, Inc., American National Standards Institute, National Electrical Manufacturers' Association, Insulated Power Cable Engineers Association, and Institute of Electrical and Electronic Engineers in every case where such a standard has been established for the particular type of materials in question.

The installations shall be in accordance with the regulations of the latest editions of the National Electrical Code, National Electrical Safety Code, applicable city, state, and local codes and regulations and other applicable codes, including utility company codes.

All permits required by state or local ordinances shall be obtained and after completion of the work, a certificate of final inspection and approval from the electrical inspector shall be furnished to the Owner. All permits for installation, inspections, connections, etc., shall be taken out and paid for as part of the work under this section.

#### **A. Classified Areas**

Electrical systems and components in raw wastewater wet wells, or in enclosed or partially enclosed spaces where hazardous concentrations of flammable gases or vapors may be present, shall comply with the National Electrical Code requirements for Class I, Group D, Division 1 locations.

The pump station control panel and all electrical equipment located outside of the wet wells and classified areas shall be protected by permanent conduit seals to prevent the atmosphere of the wet wells and classified areas from gaining access to the electrical equipment.

Terminal boxes shall be provided outside the wet well such that all equipment located within the wet well may be electrically disconnected and removed without breaking the permanent conduit seals. Terminal boxes shall be 316 stainless steel, UL rated minimum Class I, Zone 2 explosion protected, with stainless steel or aluminum conduit hubs at each conduit connection. Terminal block size, quantity and numbering within the terminal boxes shall match the field terminals located in the pump station control panel. Terminal blocks shall accommodate minimum #12 AWG conductors.

Conduit connections between the terminal boxes and the wet well shall be PVC coated rigid aluminum conduit. Each wet well conduit shall be sealed at the terminal box with malleable non-conductive duct sealing compound.

#### B. Submittals

The Contractor shall provide electrical equipment and installation shop drawing submittals in accordance with the requirements of Section 3.9.1.2. The electrical equipment and installation shop drawings shall include, but not be limited to, the following:

- Electrical service entrance equipment
- Pump station control panel (wiring diagrams, component bill of materials, dimensions, weight, etc.)
- Wet well level controls
- Basic materials and methods (conduit, wire, support channel, terminal boxes, sealing fittings, lighting, etc.)

#### C. Testing

Upon completion, the Contractor shall provide all necessary instruments and special apparatus to thoroughly test the complete installation and shall conduct all tests that may be required to insure system is free of all improper grounds and short circuits, and that all the feeders are properly balanced. Prior to energization, the electrical system ground resistance shall be tested. All electrical equipment shall be tested to determine proper polarity, phasing, relay settings, and operation. System shall be checked for quality and completeness. Any objectionable noise, heating, voltage drop, or excessive current draw, after being placed in operation, shall be identified and corrected.

Each motor starter overload element, and each motor circuit protector, shall be selected and adjusted to coordinate with the nameplate full-load current and service factor of the actual motors installed. Improper units shall be replaced.

#### D. As-Built Documentation

As-built documentation shall be submitted in accordance with the requirements of Section 3.9.1.4. In addition to the as-built drawings, the electrical as-built documentation shall include a tabulation of the final electrical test data (ground resistance tests, full load current and voltage measurements for each phase of each motor, motor nameplate current rating, overload element rating, and motor circuit protector settings) and a tabulation of all as-left device settings (wet well level controller, solid state soft start motor starters, variable frequency drives, automatic transfer switches, etc.).

### E. Equipment Supplier

To ensure coordination, compatibility, and maximum interchangeability with existing St. Johns County Utility Department pump station facilities, the following electrical equipment shall be furnished by the pump supplier:

- Pump Station Control Panel
- Wet Well Level Controls
- Service Entrance Main Disconnect Switch
- Explosion Protected Terminal Boxes

### 2.19.2 Electrical Service

The Contractor shall provide complete new electrical service for each pumping station, including coordination of electrical service selection and approval by St. Johns County Utility Department and the serving electrical utility company. Each pumping station electrical service shall include complete primary and secondary electrical service equipment, metering and installation in accordance with the electrical utility company requirements and these standards.

Unless specifically unavailable from the serving electrical utility company, the electrical service to each pumping station shall be three phase. The basis of design pumping station electrical service to be requested from the serving electrical utility company shall be as follows:

- 25 HP and below: 240 volt, 3 phase, full voltage motor starting, 15 starts per hour
- 26 HP thru 40 HP: 480 volt, 3 phase, full voltage motor starting, 15 starts per hour
- 41 HP and above: 480 volt, 3 phase, solid state reduced voltage motor starting, 10 starts per hour

### A. Documentation of Coordination with the Electrical Utility Company

The pumping station electrical design engineer shall contact the serving electrical utility company and obtain written documentation of the availability of the service requested. The electrical service documentation to be obtained from the serving electrical utility company shall identify each of the following basis of design issues:

- Electrical service voltage and phase
- Electrical service point of connection
- Type of motor starting required (full voltage or reduced voltage)
- Maximum number of starts per hour permitted
- Maximum available fault current

The electrical service documentation to be obtained from the serving electrical utility company shall identify all applicable electrical utility company rules, regulations and

fees. Additionally, the pumping station electrical design engineer shall obtain a schedule that identifies when the requested electrical service would be available from the electrical utility company.

If it is determined that the requested electrical service is not available from the electrical utility company, the electrical design engineer shall submit an alternate basis of design recommendation for review and approval by the St. Johns County Utility Department before proceeding with the pumping station electrical design.

For locations where the serving electrical utility company can only provide 240/120 volt single phase service, the pump motors shall be limited to a maximum of 5 HP. Three phase pump motors shall be provided. Variable frequency drive motor starters shall be used to operate the three phase motors from the single phase electrical service.

#### B. Service Entrance Main Disconnect Switch

Each pump station electrical service shall be equipped with a UL service entrance rated, heavy duty, fused disconnect switch, 600V, 3 pole with NEMA 4X stainless steel enclosure. Each service entrance main disconnect switch shall be equipped with Class RK5 time delay current limiting fuses with solid state visual open fuse indicators. The service entrance main disconnect switch shall be installed outdoors in a location that meets the National Electric Code and is acceptable to both the local authority having jurisdiction and the St. Johns County Utility Department. The Contractor shall provide one complete set of replacement fuses for each service entrance main disconnect switch.

### 2.19.3 Pump Station Control Panel

Each pump station control panel shall be a UL service entrance rated power distribution and pump motor control panel with NEMA 3R stainless steel door-in-door enclosure with aluminum deadfront inner door. Each pump station control panel shall be complete with the following features:

- Main circuit breaker
- Emergency power circuit breaker
- Generator receptacle(s)
- Main service transient voltage surge suppressor
- Three phase power monitor
- Pump motor protection and controls for each pump
- Control power transformer (480 volt services)
- Control power transient voltage surge suppressor
- Branch circuit breaker to serve the pump controls
- Branch circuit breaker to serve inner door mounted GFI receptacle
- Branch circuit breaker to serve remote SCADA system RTU
- Branch circuit breaker to serve remote site lighting

- Low voltage control power transformer (120-24V)
- Wet well level controls
- Alarm light, alarm horn and alarm silence pushbutton

#### A. Main and Emergency Circuit Breakers

The main circuit breaker and emergency power circuit breaker shall be molded case thermal magnetic circuit breakers, operable from the control panel deadfront inner door, and mechanically interlocked to prevent both breakers from being closed at the same time. The main and emergency power circuit breakers shall be identical, and shall be fully rated for the electrical service maximum available fault current.

#### B. Generator Receptacles

Generator receptacles must match the existing St. Johns County Utility Department portable standby power equipment. Each generator receptacle shall be Crouse Hinds Model AR1042-S22 rated 100 Amp, 4 pole, 600 VAC, with spring door housing and type AJA6 angle adapter. Generator receptacles shall be constructed with plug interiors for reverse service. For pump station control panels with main and emergency circuit breakers rated up to 100 amps, one generator receptacle shall be provided. For pump station control panels with main and emergency circuit breakers rated above 100 amps, two generator receptacles shall be provided. Where the total connected standby power demand exceeds 200 amps, the pump station control panel shall be equipped with electrical interlocks to limit the standby power demand to a maximum of 200 amps.

#### C. Transient Voltage Surge Protection

Each pumping station electrical service shall be equipped with transient voltage surge protection. Main service transient voltage surge suppressors (TVSS) shall be designed, manufactured, tested and installed consistent with NEC 285. The main service TVSS unit shall provide LN, LG, NG and LL suppression modes, with minimum 200kA UL short circuit current rating, minimum 50kA per phase surge capacity rating, and maximum 0.5 nanosecond response time. The main service TVSS unit shall be equipped with individually fused suppression modes, thermal cutout for each mode, and AC sinewave tracking filter with EMI/RFI filtering.

Each pumping station control panel shall be equipped with a 120 VAC control power transient voltage surge suppressor to protect the control panel control components and the SCADA system RTU branch circuit. The 120 VAC control power TVSS unit shall be 3-stage hybrid, solid-state power line protector with noise filtering, common mode and normal mode suppression, minimum 10kA peak surge current, less than 5 nanosecond response time, power line tracking, and compression screw terminations.

#### D. Three Phase Power Monitor

Each pumping station control panel shall be equipped with three phase power monitoring to protect the pump motors from single phasing, voltage imbalance and phase reversal. Three phase power monitors shall be automatic reset solid state encapsulated phase and voltage monitoring relays with DPDT output contacts and LED status indication. One output contact shall be interconnected to disable the pump motors during abnormal electrical service conditions. One output contact shall be used for remote monitoring by the SCADA system RTU.

#### E. Motor Power Distribution, Protection and Control

The pump station control panel shall be equipped with motor power distribution, protection and control equipment for each pump motor including circuit breaker type motor circuit protector (MCP), automatic motor starter with ambient temperature compensated overload unit, panel inner door mounted Hand-Off-Automatic selector switch, motor winding over-temperature protection interlock, and three phase power monitor protection interlock. Additionally the pump motor controls shall include pump run status and pump fail status contacts for remote monitoring by the SCADA system RTU.

Motor circuit breakers shall be instantaneous-trip magnetic-only circuit breakers with adjustable trip settings. Motor starters shall be NEMA rated full voltage motor starters designed for operation at 600 VAC. Motor overload protection shall be ambient temperature compensated bimetallic quick trip overload relays selected to coordinate with the operating characteristics of the protected motor.

Solid-state reduced voltage motor starters where required shall be serve duty rated with 3 phase temperature-compensated solid-state motor overload protection relay, individually adjustable acceleration (0-180 seconds) and deceleration (0-60 seconds) control, pump control option to reduce water hammer, 115% FLA continuous duty and 300% FLA for a minimum of 30 seconds. Each starter shall be equipped with a fault indication pilot light and auxiliary contact for remote indication of fault condition. Each solid-state motor starter shall include fully rated isolation contactor and bypass shorting contactor. Each solid-state motor starter shall automatically resume normal operation following a power outage.

#### F. Wet Well Level Controls

Each pumping station control panel shall be equipped with a self-contained solid-state programmable pump controller to provide adjustable automatic wet well level control, automatic pump alternation, and continuous wet well level monitoring. Each pump controller shall provide visual indication of pump station status including wet well level, high level alarm, pump run status, pump running hours, pump number of starts, and pump motor current. Each pump controller shall be equipped with an

intrinsically safe submersible pressure transducer installed within the wet well to provide a continuous wet well level signal to the pump controller. Each pump controller shall be field programmed by the pump supplier to provide proper control of the complete pumping system including sequential restart time delays to prevent simultaneous starting of more than one pump. To ensure coordination, compatibility, and maximum interchangeability with existing St. Johns County Utility Department pump station facilities, the pump station control panel pump controllers shall be Flygt Model APP 521 duplex pump controller with Flygt Model LS100 transducer.

In addition to the automatic pump controller with continuous wet well level signal, each pumping station wet well shall be equipped with a backup high level float control system including 24 volt control power, wet well high level alarm/pump start float switch, wet well high level reset/pump stop float switch, and wet well low level alarm float switch. In the event of a high level alarm condition, the backup high level float control system shall be connected to the pump station control panel pump controls to bypass the pump controller and automatically start each pump, and to provide a high level alarm contact for remote monitoring by the SCADA system RTU.

#### G. Alarm Monitoring

Each pumping station control panel shall be equipped with all necessary equipment for indication of all associated alarms including Transducer High Level Alarm, Backup Float High Level Alarm, and Backup Float Low Level Alarm. The panel shall be equipped with an external flashing alarm light, sonalert audible alarm horn, Silence pushbutton, and dry contacts for remote monitoring by the SCADA system RTU.

### **2.19.4 Master Pump Station Electrical Equipment**

Each master pump station shall be equipped with an air conditioned electrical building containing the following major electrical equipment:

- Motor Control Center with Variable Frequency Drives for each pump
- Free Standing Pump Station Control Panel
- SCADA system RTU

#### **2.19.4.1 Motor Control Centers**

Unless indicated otherwise motor control centers (MCC) shall be NEMA Class II, Type B, provided in NEMA 1 enclosures with open bottom panels. Units located outdoors shall be NEMA 3R. Each lineup shall consist of vertical sections nominally 90" high, 20" deep, and 20" wide. Each lineup shall be provided with starter units, feeder units, main breakers, transfer switches, transformers, panelboards, control equipment, etc., as indicated on the drawings.

Each vertical section shall be fabricated of code gauge steel, reinforced and bolted together to form a rigid, free-standing, completely enclosed assembly. Each section shall have a gray baked enamel final coat over a rust-inhibiting prime coat. Enclosure finish shall be suitably touched up, following installation, with a manufacturer's supplied spray. Unless approved otherwise, the final coat shall be ANSI 61 Light Gray.

Each vertical section shall be provided with a separate vertical wire trough door, a 12" horizontal wireway at the bottom, and a 6" horizontal wireway at the top. Each section shall have flange-formed covers on the rear and flange-formed doors with concealed hinges and quick release quarter-turn latches in the front. Unless approved otherwise, each vertical section shall be front-mounted only, completely front-accessible, and suitable for mounting against the wall. Each lineup shall be provided with continuous lifting angle and floor sills.

Power shall be distributed throughout the lineup by means of a 3-conductor, bolt-connected, edgewise-mounted, tin-plated copper bus bar system. Cable shall not be used on the load side of the main. Each lineup shall be provided with a continuous ground bus and, if indicated, a continuous neutral bus. Each bus shall be braced and the entire motor control center rated for the maximum available short-circuit fault current, minimum 42,000 amperes RMS symmetrical, unless indicated otherwise. The main horizontal bus shall be enclosed in an isolating compartment at the top of each vertical section. The main bus shall be rated as indicated on the drawings and shall not be rated less than 600 amperes. The vertical bus sections shall be sized for the total connected load and shall not be rated less than 300 amperes. The main horizontal bus, transfer switch bus, cable lugs, etc., and the full height of the vertical bus shall be isolated providing a complete, dead-front installation with glass-reinforced polyester barriers equipped with shutter mechanisms for stab openings. Each ground bus shall be rated for the total capacity of the lineup and shall not be rated less than 300 amperes. When provided, each neutral bus shall have 50% of the full capacity of the main horizontal bus and shall be connected to the ground bus by a removable link.

A separate control power source, independent of any single control circuit, starter unit, etc., shall be provided for all control components (control relays, annunciators, level controllers, etc.), integral to multiple control circuits or system operations, or actuated by remote field devices. Where practical, all control components connected to the separate control power source shall be located in a common compartment. For split bus applications, the separate control power source shall be continuously energized from either bus through an appropriately sized mechanically-held automatic reversing contactor.

Each lineup, or each bus for split bus applications, shall include a separate vertical section fully equipped for the installation of power factor correction equipment, including molded case circuit breaker, switching contactor, capacitor banks, and all required control equipment.

Each unit compartment shall be provided with an individual front door, interlocked mechanically with the unit disconnect device to prevent opening the door with the unit energized, or energizing the unit with the door open. Unit disconnect device handles shall indicate the ON, OFF, TRIPPED, and RESET positions and shall be provided with means for padlocking in the OFF or



ON positions. Each unit compartment, including door, shall be individually removable without disturbing adjacent units. Unless approved otherwise, all units shall be of drawout construction with a positive guidance system to insure positive stabbing into the vertical bus. Unit stabs shall be silver-plated copper. Each unit compartment shall be provided with a door-mounted engraved nameplate attached with removable fasteners.

Each motor starter unit shall be the combination type complete with molded case motor circuit protector; magnetic starter; manual resetting, 3-pole, bi-metallic thermal overload relay; individual 120 volt control power transformer; door-mounted pilot control devices, indicators, and instruments; and required accessory control relays, alternators, etc.

- Each motor starter or contactor coil shall be equipped with a transient suppressor to limit high voltage transients.
- Overload element ratings shall be individually selected and adjusted in the field to coordinate with the equipment connected.
- Motor starters for submersible motors shall be equipped with ambient-compensated, bi-metallic, quick-trip type overloads.
- Control power transformers shall be fused on both primary leads and one secondary lead with the remaining lead grounded and shall be sized for the entire control circuit, including motor space heaters and all additional remote auxiliary devices.
- Motor circuit protectors shall be quick-make, quick-break, molded case air circuit breakers with adjustable instantaneous trip, rated not less than 22,000 amperes RMS symmetrical. Where additional capacity is required, motor circuit protectors shall be provided with current limiter attachments (fully coordinated to prevent single phasing) which increase rating to 100,000 amperes RMS symmetrical. Instantaneous trip settings shall be individually adjusted in the field to coordinate with the equipment connected.
- Each unit shall be provided with 2-piece drawout terminal boards, for load and control terminals. The field terminal board component shall be mounted adjacent to the wiring trough.
- As indicated on the drawings, starters shall be full voltage, across-the-line type, or reduced voltage autotransformer closed transition type, connected on the 65% tap, unless noted otherwise. Starters shall be reversing or non-reversing as indicated.
- Multi-speed starters shall have compelling relays which require starting at lowest speed, and prevent instantaneous transition between speeds.
- Starter unit size and ratings shall be coordinated with the equipment supplied. Units of the same size shall be interchangeable.
- In addition to contacts required, all starter units shall be provided with 2 spare N.O. and N.C. auxiliary contacts.

Solid-state reduced voltage motor starters shall consist of three sets of two inverse-parallel connected SCR's with a complete microprocessor based electronics package to provide soft start and smooth stepless acceleration to full speed. Unless otherwise indicated, or required by the application, each solid-state reduced voltage starter shall provide individually adjustable acceleration and deceleration control (0 - 120 seconds). Each starter shall be equipped with voltage transient protection (thermostat, MOV, and RC protection of each pole), shorted SCR

protection, and single phase protection. Each starter shall be equipped with a 3 phase temperature-compensated solid-state motor overload protection relay. Each starter shall be fan-cooled and shall be rated 115% FLA continuous duty and 300% FLA for a minimum of 30 seconds. Each starter shall be equipped with a fault indication pilot light and auxiliary contact for remote indication of fault condition. Unless indicated otherwise, each solid-state motor starter shall include fully rated isolation contactor and integral bypass shorting contactor. Each solid-state motor starter shall automatically resume normal operation following a power outage.

Feeder units shall be equipped with molded case circuit breakers, unless indicated otherwise. Breakers shall be quick-make, quick-break, with trip-free operation, incorporating an internal trip bar and a single external handle. Breakers shall be thermal magnetic type rated not less than 65,000 amperes RMS symmetrical. Where additional capacity is required, feeder breakers shall be provided with current limiters (fully coordinated to prevent single phasing) which increase rating to 200,000 amperes RMS symmetrical. Breakers rated above 150 amperes shall be provided with interchangeable trips. Breakers shall be provided with control accessories, such as shunt trip, auxiliary contacts, etc., as indicated or required for proper interlocking and operation. Unless specified otherwise, main breakers shall be as specified for feeder breakers; however, main breakers shall be 100% rated, equipped with a short-time delay adjustment for system selectivity and shall be fully rated for the maximum fault current, without the use of current limiters.

#### **2.19.4.2 Variable Frequency Drives**

To ensure coordination, compatibility, and maximum interchangeability with the Owner's existing standardized equipment, all Variable Frequency Drive (VFD) equipment shall be Cutler-Hammer SV9000 Series, without exception.

Each variable frequency drive shall control the speed of a standard squirrel-cage induction motor by controlling the frequency applied to the motor and shall be designed to operate from a local manual speed potentiometer or remote automatic speed reference signal. Each VFD shall be capable of operating any NEMA design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the VFD.

Each drive shall be microprocessor-based, Pulse Width Modulated (PWM) design converting the input voltage and frequency to a variable voltage and frequency output via a two-step operation. Insulated Gate Bipolar Transistors (IGBTs) shall be used in the inverter section.

Each drive shall have an efficiency at full load and speed that exceeds 95% for VFDs below 15 HP, and 97% for VFDs 15 HP and above. The efficiency shall exceed 90% at 50% speed and load. The VFDs shall maintain the line side displacement power factor at no less than 0.96 regardless of speed or load.

Each drive shall have a one (1) minute overload current rating of 150% and a two (2) second overload current rating of 250% for constant torque drives; and a one (1) minute overload current rating of 110% for variable torque drives.

Each drive shall be contained within a gasketed, force-ventilated, free-standing motor control center style enclosure. Enclosures shall be equipped with replaceable filters.

Each drive shall be equipped with input circuit breaker, output contactor, 3 phase temperature-compensated solid-state motor overload protection, and fault protection and indication as follows:

- Overcurrent
- Overvoltage
- Inverter fault
- Undervoltage
- Phase loss
- Output phase loss
- Undertemperature
- Overtemperature
- Motor stalled
- Motor overtemperature
- Motor underload
- Logic voltage failure
- Microprocessor failure
- DC injecting braking
- Ground fault

Each drive shall be equipped with the following system interfaces:

- Auxiliary dry contacts for indication of drive operation
- Auxiliary dry contacts for indication of drive fault
- Isolated process control speed reference signal
- Addressable serial communications link to allow drive programming, monitoring, and control
- Digital operator keypad and diagnostic display for indication of drive diagnostic information.

The operator shall be able to scroll through the keypad menu to choose between the following:

- Monitor
- Operate
- Parameter Setup
- Actual Parameter Values
- Active Faults
- Fault History
- LCD Contrast Adjustment
- Information to indicate the standard software and optional features software loaded

Each drive shall provide independently adjustable acceleration (6-75 seconds), deceleration (6-75 seconds), minimum speed (70%-90%), maximum speed (75%-100%), and current limit (100%-120% FLA). All programmable parameters shall be adjustable from a door-mounted digital operator keypad.

Each drive shall automatically restart and resume normal operation following a power outage.

Instrumentation Signal Controlled Systems: Each variable speed pump control system to be controlled by a remote instrumentation signal shall be equipped with all necessary logic and control apparatus to provide the intended automatic mode of operation:

All VFDs shall be equipped with drive output line conditioning as required to protect the connected motors from reflected wave high voltage impulses.

All VFDs while operating at rated load shall limit harmonic distortion to no more than 5% for general systems during operation from the utility source and 10% for dedicated systems during operation from the standby generator source as defined by IEEE 519-latest. The VFD manufacturer shall provide harmonic filtering equipment required to meet this distortion limit and shall submit calculations to demonstrate compliance for drives operating from both sources.

Before shipment, each VFD shall undergo a minimum 24-hour factory burn-in test. Each VFD shall be burned in at 100% inductive or motor load for 24 hours without an unscheduled shutdown. Copies of factory test reports shall be submitted with final drawings.

#### **2.19.4.3 Panelboards**

Lighting and power distribution panelboards shall be dead-front type equipped with main circuit breaker or main lugs only, as indicated on the drawings. Lighting panelboards shall be suitable for 120/208 volt, 3 phase, 4-wire, or 120/240 volt, 1 phase, 3-wire installation as indicated. Power distribution panelboards shall be suitable for 277/480 volt, 3 phase, 4-wire installation.

Panelboards shall be constructed with reinforced galvanized steel frames, sequence phasing, copper or tin-plated aluminum bus bars, code-gauge galvanized steel boxes with adequate wiring gutters, and code-gauge steel front panels with gray enamel finish over a rust-inhibitor. All connections shall be anti-turn solderless mechanical type and each panelboard shall be provided with a solid neutral bar. Front panels shall be provided with hinged doors equipped with semi-concealed hinges, directory card holder, and flush type combination catch and lock (all locks keyed alike with a minimum of 3 keys for each panel). Panelboard enclosures located outdoors or in corrosive atmospheres shall be 316 stainless steel or fiberglass NEMA 4X.

Main and branch breakers shall be bolt-on, quick-make, quick-break, thermal magnetic, molded case, trip-free type containing thermal inverse time delay and magnetic instantaneous over-current trip elements. Automatic tripping shall be indicated by the breaker handle assuming a clearly distinct mid-position. Branch breakers shall be interchangeable and shall be removable

from the front of the panel without disturbing adjacent units. Multi-pole breakers shall incorporate internal trip bar and a single external handle.

Breakers supplying receptacles located in restrooms, locker rooms, shower rooms, etc., or outdoors, or weatherproof receptacles located indoors, shall be GFCI. Breakers supplying unswitched lighting circuits shall be rated SWD. Breakers supplying heating, air conditioning and refrigeration equipment shall be rated HACR.

Equipment ratings as indicated on the drawings shall be approximate. Panelboard and breaker ratings shall be coordinated with the installed service and the loads supplied. Unless indicated otherwise, breakers shall be rated not less than 10,000 amperes RMS symmetrical for 120/240 volts and 22,000 for 277/480 volts.

#### **2.19.4.4 Dry Type Transformers**

Dry type transformers for general power and lighting shall be 2-winding, self-cooled, power transformers with ratings as indicated on the drawings. Unless indicated otherwise, transformers 3 KVA and above shall be provided with 4 fully rated taps, two 2-1/2% above and two 2-1/2% below rated primary voltage. Each unit shall be provided with a 220 degrees C insulation system incorporating a maximum 150 degrees C temperature rise above 40 degrees C ambient and shall be designed for continuous operation at rated KVA.

Transformer core shall be of high quality, cold-rolled, grain-oriented steel, annealed by the manufacturer for low loss and exciting current. Laminations shall be formed to eliminate burrs and annealed to reduce losses to a minimum. Winding conductors shall be annealed and insulated by the transformer manufacturer. Conductor surfaces shall be free from slivers, burrs, and other irregularities. Core and coil assembly shall be vacuum-impregnated for maximum resistance to moisture.

Enclosures shall be drip-proof and rodent-proof; all units installed outdoors shall be 316 stainless steel weatherproof construction.

All materials used in the transformers shall be flame-retardant and self-extinguishing and design shall incorporate vibration dampening systems.

Overload level, sound level, and BIL ratings shall meet or exceed NEMA and ANSI Standards.

#### **2.19.4.5 Master Pump Station Control Panel**

Each master pump station control panel shall include all standard pump station control panel wet well level controls, surge protection, etc., mounted within a NEMA 12 free standing motor control center style enclosure, with open bottom for installation on top of a concrete curb wireway. Additionally, each master pump station control panel shall be equipped with battery backup, wet well level signal isolators, and all required variable frequency drive interface controls.

### **2.19.5 Basic Materials**

Unless otherwise noted, all exposed conduit, couplings, conduit fittings, etc., shall be schedule 80 PVC rigid non-metallic conduit. Underground service entrance conduit segments shall be direct buried schedule 40 PVC rigid no-metallic conduit. Conduit segments that enter the wet well shall be PVC coated rigid aluminum conduit. Conduit sealing fittings, and conduit segments on the field side of conduit sealing fittings, shall be rigid aluminum. Conduit containing variable frequency drive output power or control conductors shall be PVC coated rigid aluminum conduit.

Low voltage wire and cable shall be 600 volt, single-conductor copper, rated 90 degrees C dry and 75 degrees C wet. Unless indicated otherwise, low voltage building wire shall be Type THWN stranded construction. Twisted shielded pair instrumentation cable shall be 300 volt, individually numbered, twisted, and aluminum-mylar shielded pairs, type THHN stranded-copper conductors, with an overall drain wire, overall aluminum-mylar shield, and FR-PVC jacket.

Electrical conduits and equipment, shall be mounted on a system of minimum 1-5/8-inch x 1-5/8-inch heavy wall aluminum or 316 stainless steel channel. Support system hardware shall be aluminum or stainless steel.

#### **2.19.5.1 Grounding**

Each pumping station grounding system shall consist of a grounding electrode system in accordance with NEC specifications, bonded to a main ground bus interconnecting all power distribution equipment. Ground rods shall be located at each service connection, transformer pad, generator pad, outdoor electrical equipment pad, and as indicated or required, and shall be bonded to the main ground bus. Ground rod sections shall be coupled and driven to establish a maximum resistance to ground of 10 ohms throughout the grounding system. Ground rods shall be minimum 10 feet long, 3/4-inch diameter, copper-clad steel sections. All grounding hardware such as clamps, connectors, couplings, lugs, bolts, nuts, and washers shall be of silicone bronze.

#### **2.19.5.2 Lighting**

Each pumping station shall be equipped with a minimum of one site light pole located to illuminate the pump station control panel and wet well, without conflicting with the access clearances required for overhead lifting and installation of the pumping equipment. Each site light shall consist of a direct buried fiberglass pole, aluminum tenon spoke arm, 12' mounting height, 175 watt mercury vapor NEMA area light with integral ballast, photocell and open bottom acrylic refractor. Each site light pole shall be equipped with a weather-proof pole mounted light switch.

### 2.19.6 Motors

All electric motors shall be built in accordance with current NEMA, IEEE, ANSI, and AFBMA Standards where applicable. Each motor shall be of the type and quality described by these specifications and/or as indicated on the drawings, fully capable of performing in accordance with the manufacturer's nameplate rating and free from defective material and workmanship. Electric motors shall be of sufficient capacity to operate the driven equipment, under all load and operating conditions, without exceeding 85% of the motor's nameplate horsepower rating with service factor, and without exceeding its rated temperature limits.

Electric motors for variable speed applications shall be designed for operation at the rated maximum speed and at reduced speeds throughout the variable range, without overloading. Each variable speed motor shall be compatible with all associated control equipment and operating conditions including increased electromagnetic noise (harmonics). Each motor for variable speed operation shall be equipped with internal temperature detectors, in addition to all accessory equipment recommended by the variable speed equipment manufacturer. Electric motors for variable frequency drive applications shall be inverter duty rated in accordance with NEMA MG1 Part 31, and shall be capable of being continuously pulsed at the motor terminals with a voltage of 1600 VAC.

#### A. Squirrel-Cage Induction Motors

Squirrel-cage induction motors shall be IEEE-tested, NEMA-rated, high-efficiency energy-saving design, incorporating increased active electrical material and optimum electrical and mechanical design, to provide maximum operating efficiency and power factor. All motors shall meet or exceed EPACT efficiency requirements. When operated at nameplate voltage and frequency, squirrel-cage induction motors shall be rated normal or high starting torque, as required, low starting current not to exceed 600% full load current, low slip, 1.15 service factor, high efficiency, and continuous duty at rated horsepower and rpm, with totally-enclosed, fan-cooled construction. Unless otherwise indicated, single speed, three phase squirrel-cage induction motors less than 50 HP shall be 200-230/460 volt, 3 phase, 60 hertz. Multi-speed motors, and motors 50 HP and larger shall be single voltage, as required. Single phase squirrel-cage induction motors shall be split-phase or capacitor-start, rated 115/230-208 volt, 1 phase, 60 hertz.

Each motor shall be suitable for full voltage starting and non-injurious heating when operated on power systems with a variation in voltage of not more than  $\pm 10\%$  nameplate rating and a variation in frequency of not more than  $\pm 5\%$  nameplate rating. Locked rotor torque shall be at least 125% full load torque at 100% rated voltage. Output torque shall exceed the maximum full load torque requirements of the driven equipment by at least 20% throughout the full operating range of the driven equipment, from start to full load. Locked rotor torque, breakdown torque, and locked rotor currents shall be in accordance with NEMA standards for the design employed. Open drip-proof motors shall have a non-hydroscopic Class B insulation

system treated with a minimum of 2 extra dips and bakes using 100% solid epoxy varnish. TEFC motors shall have a non-hydroscopic Class F insulation system and shall operate with a Class B temperature rise.

Motors shall be equipped with vacuum degassed anti-friction bearings made to AFBMA Standards and be of ample capacity for the motor rating. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent lubrication, but facilities shall be provided for adding new lubricant and draining out old lubricant without motor disassembly. The bearing housing shall have long, tight running fits, or rotating seals to protect against the entrance of foreign matter into the bearings or leakage of lubricant out of the bearing cavity. Thrust bearings shall be of ample capacity to carry the maximum thrust load of the driven equipment and the total weight of all revolving parts. All bearings shall have a minimum life rating of 5 years in accordance with AFBMA life and thrust values.

Each motor shall be equipped with all necessary accessories as recommended by the manufacturer for the intended service. Each motor 25 HP and larger shall be equipped with space heaters. Space heaters shall be low voltage, 120 volt, single phase, with the leads brought out to the motor conduit box. Where indicated or required, motors shall be equipped with two normally closed automatic reset thermostats imbedded in the stator winding, between phases, and connected in series. The two leads shall be brought to the motor conduit box.

#### B. Submersible Pump Motors

Where applicable, submersible pump motors shall conform to the requirements for squirrel-cage induction motors. Submersible pump motors shall be NEMA B design, induction type with squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C. The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The stator shall be heat-shrink fitted into the cast iron stator housing. Submersible pump motors shall have minimum 1.15 service factor, shall be designed for continuous duty, and shall be capable of up to 15 evenly spaced starts per hour.

Submersible pump motor bearings shall be permanently grease lubricated. Each submersible motor shall be equipped with normally closed thermal switches embedded in the stator lead coils to monitor the temperature of each phase winding. Submersible pump motor electrical junction chambers shall be sealed off from the stator housing and shall contain a terminal board for connection of all power and pilot sensor conductors using threaded compression type terminals.

Each submersible pump motor shall be equipped with a single motor cable containing all power control and grounding conductors. Where multiple motor power and



control cables are required, conduit raceways shall be sized to properly accommodate the additional cables. The motor cables shall be sized according to NEC and ICEA standards and shall be of sufficient length to reach the remote terminal box without splices. Where special motor monitoring pilot cables are required, the pump supplier shall provide additional length to extend the pilot cables from the terminal boxes to the pump station control panel. The outer jacket of each motor cable shall be oil resistant chloroprene rubber. Submersible pump motors and cables shall be capable of continuous submergence underwater without loss of watertight integrity.

### **2.19.7 Fixed Standby Emergency Power Generator**

For pumping stations that require fixed standby emergency power generators, in accordance with Section 3.8.3.7, generator sets shall be designed, tested, rated, assembled and installed in strict accordance with all applicable standards of ANSI, NEC, ISO, UL, IEEE and NEMA. Unless alternate ratings are indicated on the basis of design drawings, the new auxiliary electric generating set ratings shall be sufficient for the pumping station total connected load.

Each auxiliary electric generating set shall be the product of a supplier regularly engaged in the manufacture of this product and shall meet the requirements of the specifications set forth herein. Each auxiliary electric generating set shall be factory assembled and prototype tested. Major exceptions to specifications will be considered sufficient cause for rejection of the item. To best serve the needs and interests of the Owner, it is the intention of these specifications to secure bids only on a standard auxiliary electric generating set which can be properly maintained and serviced without the necessity of the Owner carrying expensive parts stocks or being subjected to the inconvenience of long periods of interrupted service due to lack of available parts. The engine supplier must have 24-hour parts service and factory-trained personnel available in the project's locality and must also be able to offer a full maintenance contract to the Owner. Availability of parts and service will be a factor in making the award. The complete unit shall be sold and serviced from a single source.

Each auxiliary electric generating set shall be a packaged power unit in which all necessary components are mounted on a common base with the exception of the instruments which, if indicated, shall be mounted separately. The ratings of the electric set shall be based on standby duty operation of the unit, at rated generator RPM, in an ambient temperature of 110°F when equipped with all necessary operating accessories. All materials and parts comprising the units specified herein shall be new and unused, of current manufacture, of the highest grade, and free from all defects or imperfections affecting performance. Only bids on a new and current model will be accepted. Workmanship shall be of the highest grade in accordance with modern practice.

Auxiliary electric generating sets shall be as manufactured by Caterpillar or Cummins-Onan.

### A. Diesel Engine

Each electric set shall be driven by a water-cooled, 4-cycle, full compression ignition, diesel-fueled engine. Engines for electric sets rated above 50 kw shall be turbocharged. Engines shall not exceed rated speed. Fuel injection pumps and valves shall be a type not requiring adjustment in service.

Fuel injection pumps shall be positive action, constant stroke pumps, actuated by a cam driven by gears from the engine crankshaft. The engine shall be equipped with an individual injection pump and valve for each cylinder. The engine shall be equipped with a built-in gear type, engine-driven fuel transfer pump.

Each engine shall be equipped with removable wet type cylinder liners of heat-treated, close-grained alloy iron. Each engine shall be equipped with a gear-type lubricating oil pump. Pistons shall be spray-cooled and a suitable water-cooled, engine-mounted lubricating oil cooler shall be provided.

Each engine shall be capable of rated operation on commercial grade No. 2 diesel fuel. Each engine shall be capable of operation at idle or light loads for extended periods of time and shall provide for precombustion of fuel or a similar means for the prevention of carbonization.

### B. Generator

Each generator shall be continuous duty, 0.8 power factor, brush-less type, with electrical characteristics as indicated. Each generator shall be single bearing construction with Class F insulation. Each generator shall incorporate cross current compensation for parallel operation and shall include a resettable thermal protector for exciter/regulator protection against extended low power factor loads.

Each generator shall be equipped with a unit mounted, volts-per-hertz type regulator provided to match the characteristics of the generator and engine. Voltage regulation shall be  $\pm 1\%$  from no load to full load. Readily accessible voltage droop, voltage level and voltage gain controls shall be provided. Voltage level adjustment shall be a minimum of  $\pm 5\%$ .

Each generator shall be a permanent magnet type (PMG) capable of producing 300% rated output for ten seconds on a short circuit condition. Bolt-on series boost options are not acceptable. Each generator shall be equipped with a 120/240 volt, 1 phase space heater.

### C. Cooling System

Each engine shall be equipped with a cooling system having sufficient capacity for cooling the engine when the electric set is delivering full-rated load in an ambient

temperature of 125°F. All cooling system equipment shall be of the type recommended by the engine manufacturer.

Each engine shall be equipped with a high capacity radiator and blower fan. Each engine shall be equipped with an engine-driven centrifugal type water circulating pump and thermostatic valve to maintain the engine at recommended temperature level.

Intake louvers shall be sized to provide sufficient intake air for engine combustion and to provide required air flow through the radiator. Intake and discharge louver adequacy shall be verified by the electric set manufacturer prior to installation.

#### D. Accessories

Each engine and generator shall be close-coupled and mounted on a common welded steel base. The electric set shall be equipped with spring-type vibration isolators for mounting on a concrete foundation.

Unless indicated otherwise, each engine shall be equipped with an electric-sensing governor capable of isochronous frequency regulation from no load to full load.

Each engine shall be equipped with an electric starting system of sufficient capacity to crank the engine at a speed which will start the engine under rated operating conditions. The starting system shall provide for 4 crank cycles, 10 seconds on and 10 seconds off, each. The starting pinion shall disengage automatically when the engine starts.

Each electric set shall be furnished with a complete automatic battery/charger system including lead acid battery set, current limiting battery charger, and all necessary cables, clamps and mounting racks. Battery set shall be of voltage and capacity required for complete operation of the standby electric generating facilities including electric starting system and generator controls station power. Battery charger shall automatically recharge and maintain the battery set at full capacity and shall include a DC ammeter, DC voltmeter, DC low level alarm contact, and AC low level alarm contact.

Each engine shall be provided with anti-freeze and suitable engine-mounted, thermostatically-controlled, jacket water heaters to maintain engine coolant at manufacturer's recommended temperature level. Jacket water heaters shall be suitable for operation at voltage indicated and shall be installed with isolation valves to facilitate maintenance.

Each engine shall be provided with an exhaust silencer of the residential type; Maxim M41, Donaldson DRU, or equal. A flexible stainless steel exhaust adapter at least 18" long shall be furnished for the exhaust outlet to the muffler. Each silencer shall

be shall be equipped with exhaust elbow and rain cap. Exhaust pipe and silencer shall be sized according to the electric set manufacturer's recommendation, and shall be properly insulated to prevent heat rejection into the generator set operating atmosphere.

Each electric set shall be equipped with the following additional accessories:

- Lubricating oil filters
- Dry type air filters
- Replaceable element fuel filters
- Primary fuel filter/water separators
- Fuel priming pumps

Each electric set shall be equipped with all additional accessories and circuitry modifications required to provide proper operation when supplying power to inverter loads such as variable frequency drive equipment.

#### E. Instruments and Controls

Each electric set shall be provided with a unit-mounted instrument panel including the following:

- Fuel pressure gauge
- Water temperature gauge
- Lubricating oil pressure gauge

Each electric set shall be provided with a generator-mounted control panel including the following components:

- AC voltmeter
- AC ammeter
- Ammeter-voltmeter phase selector switch
- Frequency meter
- Elapsed time meter
- AUTOMATIC-OFF-MANUAL starting controls
- Failure and alarm indicator lights
- Main line circuit breaker

The automatic starting control system shall be completely interlocked to provide automatic operation, at the control panel, from a single pole contact.

Each electric set shall be equipped with a complete engine safety control system which shall provide alarm indication, automatically shut down the engine, and shut trip the main line circuit breaker in the event of any of the following:

- Low oil pressure
- High jacket water temperature
- Overspeed
- Overcrank

Each electric set shall be equipped with additional engine warning system which shall provide alarm indication in the event of any of the following:

- Low coolant level
- Low battery charge
- Low fuel level
- Fuel leak detection

Dry contacts for remote alarms shall be provided at the generator control panel for each of the engine safety control and alarm warning signals. Additionally, a dry contact for remote "generator running" indication shall be provided.

Main line circuit breakers shall be inverse time delay, instantaneous magnetic trip molded case circuit breakers. Each breaker shall be provided with shunt trip and shall be rated as indicated.

#### F. Enclosure

The complete diesel engine generator set, including generator control panel, engine starting batteries and fuel oil tank, shall be enclosed in a factory assembled, weather protective enclosure mounted on the fuel tank base.

The enclosure shall be a highly corrosion resistant galvanized steel housing with stainless steel hinged side panels and control panel door. The enclosure shall be finished with polyester powder coating baked at 392 deg. F (200 deg. C). Enamel type paints are not acceptable.

The base frame shall include an integral double wall 48 hour fuel tank, listed to UL142. It shall be contained in a rupture basin with 110% capacity. The tank shall be pressure tested for leaks prior to shipment and have all necessary venting per UL142 standards. A locking fill cap, a mechanical reading fuel level gauge, low fuel level alarm contact, and fuel tank rupture alarm contact shall be provided.

The number of doors on the enclosure shall be as required so that all normal maintenance operations, such as lube oil change, filter change, belt adjustment and replacements, hose replacements, access to the control panels, etc., may be accomplished without disassembly of any enclosure components. Access doors shall be fabricated of the same material as the enclosure walls and shall be reinforced for rigidity. Handles shall be key lockable, all doors keyed alike, and hinges shall be

stainless steel. Fasteners shall be stainless steel. Doors shall be of a lift off design allowing one person to remove door if necessary.

Air handling shall be sized and designed by the manufacturer for 0.5" static pressure drop through enclosure. Intake openings shall be screened to prevent the entrance of rodents

Lube oil and coolant drains shall be extended to the exterior of the enclosure and terminated with drain valves. Radiator access shall be through a hinged, lockable cover on the enclosure. Cooling fan and charging alternator shall be fully guarded to prevent injury.

The generator set manufacturer shall externally mount the exhaust silencer and maintain the weather resistant integrity and aesthetic appearance of the system.

Lifting points shall be provided on base frame suitable for lifting the combined weight of the base tank, generator set and enclosure. The electric generating set shall be equipped with vibration isolators between the generator set & generator set base which shall provide suitable mounting to any level surface.

#### G. Automatic Transfer Switch

Automatic transfer switches, with electrical ratings as indicated, shall consist of a power transfer module and a control module, interconnected to provide complete automatic operation. Each automatic transfer switch shall be mechanically-held and electrically-operated by a simple, over center mechanism energized from the source to which the load is to be transferred. The switch shall be rated for continuous duty, double throw, with mechanically interlocked center off position for load decay. The switch shall provide an adjustable time delay after opening of the closed contacts and before closing of the open contacts for transferring large motor and transformer loads. The automatic transfer switch shall be suitable for use with emergency or auxiliary source provided.

Unless otherwise indicated, automatic transfer switches shall be 3-pole with solid neutral. All transfer switch main contacts shall be segmented silver tungsten alloy contacts with separate arcing contacts, arc quenching grids, enclosed arc chambers and wide contact air gap. Sensing and control relays shall be continuous duty, industrial grade type, with a minimum contact rating of 10 amperes. Transfer switches shall utilize solid-state sensing on normal and emergency, including close differential voltage sensing on all phases of the normal source.

Transfer switch operation shall be adjusted to coordinate with the emergency source provided. Upon failure of the normal source, a voltage drop below the predetermined (75%-98% adjustable) nominal voltage shall initiate a time delay period (0-5 minutes adjustable) prior to closing the engine start signal contact. When the emergency

source builds up to the predetermined (85%-100% adjustable) nominal voltage and (90%-100% adjustable) nominal frequency, the transfer switch shall momentarily transfer to the center open position (0-5 minutes adjustable) then complete transfer operation to the emergency source. Upon restoration of the normal source, a time delay (0-30 minutes adjustable) shall delay the transfer back to the normal source. Following the re-transfer time delay, the transfer switch shall momentarily transfer to the center off position (0-5 minutes adjustable) then complete re-transfer operation to the normal source. Re-transfer time delay shall be automatically bypassed if emergency source fails. Following the transfer back to the normal source, a timer (0-30 minutes adjustable) shall provide an unloaded engine cool-down period prior to engine shutdown.

Each transfer switch shall be provided with the following features:

- Pilot lights to indicate the position of transfer switch.
- Bypass switch to immediately bypass the time delay in re-transferring to normal.
- AUTOMATIC-OFF-TEST switch to control operation of emergency source and transfer switch.
- Engine start contact closes to start emergency electric set.
- Auxiliary alarm contact closes following delay on normal source failure.
- Auxiliary reversible contacts operate when transfer switch is in emergency position. Contacts shall be provided as indicated.
- Auxiliary time delay relay (0-60 seconds adjustable) with contacts to open each facility motor control circuit prior to operation of the transfer switch in either direction.
- Generator set exercising timer to automatically operate generator set with load (adjustable 7-day cycle, 15-minute incremental repeat cycle timer).

Unless otherwise indicated transfer switch enclosures shall be NEMA 4X stainless steel. Automatic transfer switches shall be ASCO Series 7000, Russelectric or equal.

## **2.19.8 SCADA System**

Each new pumping station shall be equipped with a new telemetry system remote terminal unit (RTU) for remote monitoring and control from the existing SJCUD supervisory control and data acquisition (SCADA) system.

### **2.19.8.1 Telemetry System Equipment and Installation Fee**

The telemetry system equipment, including RTU, antenna and antenna mast, shall be provided and installed by SJCUD upon receipt of payment of the applicable "Telemetry System Equipment and Installation Fee" in the amount of: \$16,250.

The "Telemetry System Equipment and Installation Fee" shall be paid by the Contractor to the SJCUD within 60 days of the pre-construction meeting.

## **2.20 WASTEWATER TREATMENT AND DISPOSAL FACILITIES**

### **2.20.1 Wastewater Facilities - General**

The criteria contained herein are intended to assure uniformity and quality of construction of wastewater facilities. The wastewater facilities shall be designed to utilize the activated sludge process to provide secondary or higher levels of treatment as required. The process method utilized shall be reviewed by the SJCUD. The design shall meet all the requirements set forth in Chapter 62-6, 62-600, 62-610, FAC. Plans and specifications shall be certified by a professional engineer registered in the state of Florida.

The treatment plant shall be fabricated and furnished by a reputable, recognized manufacturer engaged in the full-time business of, and with a minimum of five years experience in, the construction of wastewater treatment facilities.

### **2.20.2 Wastewater Plant Design Data**

Water treatment facilities shall be sized, designed, and installed to efficiently process anticipated wastewater flows during peak average, and low flow periods. Peak, average, and low flows shall be estimated for both daily and seasonal periods. The engineer shall submit, along with the application for a wastewater disposal permit, the assumptions and calculations used to determine the anticipated wastewater flows.

### **2.20.3 Wastewater Treatment Plant Site**

- A. The treatment plant structures and equipment shall be protected from physical damage that could be caused by the one hundred (100) year flood event.
- B. The treatment plant should be designed to remain fully operational and accessible during the twenty-five (25) year flood event.
- C. Buffer Zone requirements must comply with applicable rules of River Water Management District and the FDEP.
- D. The plant and disposal site shall be totally enclosed with a fence.
- E. Asphalt paved roadways for access to the plant site shall be provided by the Developer.

### **2.20.4 Wastewater Facilities Safety**

The design of the plant shall incorporate all necessary facilities to assure safe working conditions including all appropriate requirements of OSHA.



### **2.20.5 Other Requirements for Wastewater Facilities**

- A. On-site Lift Station - The on-site lift station shall meet all requirements of wastewater pumping stations as specified in this Manual for SJCUD owned or operated facilities.
- B. Lighting - Provide sufficient light to illuminate plant area and equipment.
- C. Operating Equipment - Provide a complete outfit of tools, accessories, and spare parts necessary for plant operations.
- D. Painting - All equipment and process units shall be painted as per this Manual for SJCUD owned or operated facilities.
- E. Operation and Maintenance Manual - Provide three copies of complete operation and maintenance manuals of the plant, equipment, and effluent disposal facilities owned or operated by the SJCUD.
- F. Landscaping - Landscaping requirements for private and SJCUD owned or operated facilities will be reviewed on an individual project basis.

### **2.21 RECLAIMED WATER USES**

Reclaimed water uses shall be in accordance with Chapter 62-610 of the FAC and approved by SJCUD. Common services using reclaimed water are listed below. The SJCUD reserves the right to approve or disapprove reclaimed water uses on a case by case basis.

#### **2.21.1 Approved Uses for Reclaimed Water**

Following are approved uses for reclaimed water:

- Irrigation areas accessible to the public such as golf courses, parks, highway medians and residential lawns.
- Some fire suppression systems.
- Aesthetic purposes.
- Construction dust control.
- Toilet flushing in commercial or industrial facilities (per 62-610.476(1), FAC).

#### **2.21.2 Prohibited Uses for Reclaimed Water**

In accordance with 62-610 of the FAC, the reclaimed water cannot be used to:

- Fill swimming pools, hot tubs or wading pools.
- Toilet flushing in residential units.
- Above ground hose bibs.

## **2.22 RECLAIMED WATER SYSTEM DESIGN BASIS**

### **2.22.1 Reclaimed Water Service Connection Feasibility**

Connection to the reclaimed water system shall be considered for approval by SJCUD following individual project case presentation by developers. In a case where the development is required to use reclaimed water, but the reclaimed water is not yet available, the reuse mains shall be connected to the water mains at the entrance of the development.

### **2.22.2 Reclaimed Water System Sizing**

The Engineer of Record shall be responsible for the determination of design flows and sizing of the proposed reclaimed water system. The design flows and method of calculation shall be submitted for review by SJCUD. System design requirements shall meet all requirements of the applicable County Ordinances, Chapter 62-610 of the FAC, and standards and specifications listed herein.

All joints shall be designed to resist thrust through the use of restrained joint fittings. The pressure rating of the pipe shall be used as the design basis for thrust restraint.

## **2.23 RECLAIMED WATER DESIGN CRITERIA**

### **2.23.1 Reclaimed Water Main and Extension Location**

Section 2.2.1 of this Manual shall apply.

### **2.23.2 Reclaimed Water Main Separation Requirements**

Horizontal and vertical separations for new reclaimed water main construction shall be in accordance with Chapter 62-555, FAC, which is included in Section 2.2.2 of this Manual.

### **2.23.3 Reclaimed Water Main Sizes**

Section 2.2.4 of this Manual shall apply.

### **2.23.4 Reclaimed Water Main Dead Ends**

Section 2.2.6 of this Manual shall apply.

### **2.23.5 Reclaimed Water Main Valves**

Section 2.2.7 of this Manual shall apply.

**2.23.6 Reclaimed Water Main Cover**

Section 2.2.8 of this Manual shall apply.

**2.23.7 Reclaimed Water Main Surface Water & Roadway Crossings**

Sections 2.2.9 and 2.2.10 of this Manual shall apply.

**2.23.8 Reclaimed Water Main Air Release Valves**

Section 2.2.11 of this Manual shall apply.

**2.23.9 Pipe Restraints & Connections**

Section 2.7 of this Manual shall apply.

**2.24 RECLAIMED WATER CONNECTIONS AND METERING**

Potable water connections and metering standards in Sections 2.3 and 2.4 of this Manual shall apply. All residential reclaimed water services shall be 1" single services. Industrial and commercial sites using reclaimed water for landscaping will require one meter at each service connection. Where possible, the reclaimed water meter box shall be placed on the opposite side of the property from the potable water meter box.

**2.25 RECLAIMED WATER MAIN LOCATION AND IDENTIFICATION**

All reclaimed water valves and outlets shall be appropriately tagged or labeled (bearing the words in English and Spanish: "Do not drink" together with the equivalent standard international symbol) to warn the public and employees that the water is not intended for drinking.

Specifications for locate wiring and pipe markings included in Part III of this Manual shall apply.

**2.26 RECLAIMED WATER CROSS CONNECTION PREVENTION****2.26.1 Reclaimed Water Cross Connection Prevention - General**

All locations where reclaimed water is being provided shall have approved backflow prevention devices installed in accordance with Chapter 62-555.360, FAC. No cross connection between the reclaimed water and potable water systems is allowed. All back flow prevention devices must be installed prior to the introduction of reclaimed water to the service.

Backflow prevention devices shall be installed in agreement with and supervised by the SJCUD. It shall be the Developer's responsibility to pay for, install, and maintain all back flow prevention devices.

### **2.26.2 Residential Reclaimed Water Systems**

A single check valve shall be installed downstream of the individual potable water meter in residential areas being supplied with reclaimed water.

### **2.26.3 Industrial and Commercial Reclaimed Water Systems**

All industrial and commercial facilities making use of reclaimed water shall have a reduced pressure back flow prevention device installed immediately down stream of the potable water meter. The back flow prevention device shall consist of a minimum of two independently acting approved check valves, together with an automatically operating pressure differential relief valve located between the two check valves. The first check valve reduces the supply pressure a predetermined amount so that during normal flow and at cessation of normal flow the pressure between the checks shall be less than the supply pressure. In case of leakage of either check valve, the differential relief valve, by discharging to the atmosphere, shall operate to maintain the pressure between the checks less than the supply pressure. The unit shall include tightly closing shutoff valves located at each end of the device, and each device shall be fitted with properly located test cocks.

Any facility that adds chemicals or has storm water augmentation to the locations reclaimed water system shall install a back flow prevention immediately downstream of the reclaimed water meter or at the facilities' boundary if no meter is installed. The type of back flow prevention device used must be approved by the SJCUD.

## **2.27 SET BACK LIMITS FOR RECLAIMED WATER**

This section specifies setback distances for systems using reclaimed water in accordance with Part III of Chapter 62-610, FAC. Setback distances for systems using reclaimed water not in accordance with Part III are required to meet the specifications of the applicable Parts of Chapter 62-610 of the FAC and must be approved by SJCUD.

### **2.27.1 Reclaimed Water Land Application**

There shall be a minimum of 75 feet of setback between the edge of the wetted area of a public access land application area and potable water supply wells that are existing or have been approved. The setback requirement does not apply to closed loop heating or air conditioning return wells and non-potable water supply wells.

### **2.27.2 Indoor Aesthetic Features Using Reclaimed Water**

Indoor aesthetic features using reclaimed water shall be located no closer than 100 feet to indoor public eating and drinking facilities when the aesthetic feature and eating and drinking facilities are in the same room or building space.

**2.27.3 Reclaimed Water Storage Ponds**

Unlined reclaimed water storage ponds shall have a setback distance of 200 feet from potable water supply wells or as required by the St. Johns County LDC. Lower setback distances are allowed only when approved by SJCUD, with a setback distance greater than 75 feet and in accordance with F.A.C. Part III Chapter 62-610.471(9).

**2.27.4 Reclaimed Water for Landscaping**

No piping shall be constructed within 7.5 feet of the root zone of protected trees unless specifically approved by SJCUD. For protected trees with large root zones, it is recommended that piping be installed 1 foot per inch diameter of the tree away from the tree. Otherwise, saw cut the roots with a clean cut to minimize damage to the root system of the tree.

**2.27.5 Reclaimed Water Setback from Easements**

No piping shall be constructed within 5 feet horizontal of an existing or proposed easement line unless specifically approved by SJCUD.

**2.27.6 Reclaimed Water Setback from Structures**

No piping shall be constructed within 5 feet horizontal of any existing or proposed above ground structures unless specifically approved by SJCUD.

**2.27.7 Reclaimed Water Mains Deeper than 5 Feet**

For piping deeper than 5 feet, the horizontal distance between the utility and the landscaped area shall be based on the depth of the utility pipe invert rounded to the next nearest foot. For example, if the utility pipe invert is 8.5 feet below grade, the minimum horizontal distance to the landscaped area, easement line, or structure shall be 9 feet.

**-- End of Part II --**

## **PART III: CONSTRUCTION SPECIFICATIONS**

**3.1 GENERAL CONSTRUCTION REQUIREMENTS**

**3.1.1 Grades, Survey Lines, and Protection of Monuments**

A. Grade

All work shall be constructed in accordance with the lines and grades shown on the drawings. The full responsibility for keeping alignment and grade shall rest upon the Contractor.

Bench marks and base line controlling points shall be established prior to beginning work. Reference marks for lines and grades as the work progresses will be located to cause as little inconvenience to the prosecution of the work as possible. The Contractor shall so place excavation and other materials as to cause no inconvenience in the use of the reference marks provided. Contractor shall remove any obstructions placed contrary to this provision.

B. Surveys

The Contractor shall furnish and maintain, at his own expense, stakes and other such materials and give such assistance, including qualified helpers, for setting reference marks to the satisfaction of the Engineer. The Contractor shall check such reference marks by such means, as he may deem necessary. The Contractor shall, at his own expense, establish all working or construction lines and grades as required from the reference marks and shall be solely responsible for the accuracy thereof.

C. Monument Preservation

Property corners and survey monuments shall be preserved using care not to disturb or destroy them. If a property corner or survey monument is disturbed or, destroyed during construction, whether by accident, careless work, or required to be disturbed or destroyed by the construction work, said property corner or survey monument shall be restored by a land surveyor registered in the state of Florida. All costs for this work shall be paid for by the Contractor.

**3.1.2 Utility Coordination**

A. Location of Utilities

Prior to proceeding with trench excavation, the Contractor shall contact all utility companies in the area to aid in locating their underground services. It shall be the Contractor's responsibility to contact utility companies at least forty-eight (48) hours before starting construction. The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground utilities may be determined.

The Contractor shall take all reasonable precautions against damage to existing utilities. However, in the event of a break in an existing water main, gas main, sewer or underground cable, the Contractor shall immediately notify the responsible official of the organization operating the damaged utility. The Contractor shall lend all possible assistance in restoring services and shall assume all cost, charges, or claims connected with the interruption and repair of such services.

**B. Deviations Occasioned by Structures of Utilities**

The water, sewer, and/or reuse system shall be constructed in accordance with the SJCUD approved construction drawings and specifications. If there is any deviation from the approved construction drawings or specifications, without prior authorization and consent from the SJCUD, the Contractor shall remove the deviation and restore it to the approved construction drawing configuration at no expense to the SJCUD. Any deviations from the approved documents will delay project clearance.

**C. Test Pits**

Test pits for the purpose of locating underground pipeline, utilities, or structures in advance of the construction shall be excavated and backfilled by the Contractor. Test pits shall be backfilled immediately after their purpose has been satisfied and maintained in a manner satisfactory to the Engineer. The costs for such test pits shall be borne by the Contractor.

**3.1.3 Maintenance of Traffic and Closing of Streets**

- A. The Contractor shall carry on the work in a manner, which will cause a minimum of interruption to traffic. Where traffic must cross open trenches, the Contractor shall provide suitable bridges at street intersections and driveways. The Contractor shall post suitable signs indicating that a street is closed and necessary detour signs for the proper maintenance of traffic. Prior to closing of any streets, the Contractor shall notify and obtain the approval of responsible authorities and the County.
- B. Unless permission to close a street is received in writing from the proper authority (County, City, FDOT, etc.), all excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the Contractor's operations cause traffic hazards, he shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the County.
- C. Detours around construction will be subject to the approval of the authority having jurisdiction and the County. Where detours are permitted, the Contractor shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured the Contractor shall expedite construction operations. Periods when traffic is being detoured will be strictly controlled by the County.



- D. It shall be the sole responsibility of the Contractor to take precautions to prevent injury to the public due to open trenches. Night watchmen may be required where special hazards exist, or police protection provided for traffic while work is in progress. The Contractor shall be fully responsible for damage or injuries whether or not police protection has been provided.

### **3.1.4 Protection of Public and Property**

#### **A. Barricades, Guards, and Safety Provisions**

The Contractor shall be solely responsible for adhering to the rules and regulations of OSHA and appropriate authorities regarding safety provisions. To protect persons from injury and to avoid property damage, adequate barricades, construction signs, lights and guards as required shall be placed and maintained by the Contractor at his expense during the progress of the work and until it is safe for traffic to use the roads and streets. All material piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor.

All signage and barricades shall be in accordance with the Manual on Uniform Traffic Control Devices and the Traffic Control and Safe Practices Manual.

#### **B. Protection of Utility Structures**

Temporary support, adequate protection and maintenance of all underground and surface utility structures, including drains, sewers, manholes, hydrants, valves, valve covers, power poles and miscellaneous other utility structures encountered in the progress of the work shall be furnished by the Contractor at his expense. Any such structures, which may have been disturbed, shall be restored upon completion of the work.

#### **C. Open Excavation**

All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges with handrails and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required. The length of open trench will be controlled by the particular surrounding conditions, but shall be limited unless otherwise approved by the Engineer. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Engineer may require special construction procedures, such as limiting the length of open trench, fencing, prohibiting excavated material in the street and requiring that the trench shall not remain open overnight. The Contractor shall take precautions to prevent injury to the

public due to open trenches. All trenches excavated material, equipment or other obstacles, which could be dangerous to the public, shall be well lighted at night.

D. Protection of Trees and Shrubs

All trees and shrubs not shown to be removed on the plans shall be protected by the Contractor at his expense. No excavated materials shall be placed so as to injure such trees or shrubs. Trees or shrubs destroyed by negligence of the Contractor or his employees shall be replaced by him with new stock of similar size and age at the sole expense of the Contractor.

E. Protection of Lawn Areas

Lawn areas shall be left in as good or better condition as before starting of the work. Where sod is to be removed, it shall be carefully restored with new sod of the same type.

F. Restoration of Fences

Any fence, or part thereof, that is damaged or removed during the course of the work shall be replaced or repaired by the Contractor and shall be left in as good a condition as before the starting of the work. The manner in which the fence is repaired or replaced and the materials used shall be subject to the approval of the Engineer.

G. Protection against Siltation and Bank Erosion

The Contractor shall arrange his operations to minimize siltation and bank erosion on construction sites and on existing or proposed water courses and drainage ditches. The Contractor, at his own expense, shall remove any siltation deposits and restore to original grade.

**3.1.5 Access to the Public Services**

Neither the materials excavated nor the materials or equipment used in the construction of the work shall be placed as to prevent free access to public services. All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing streets, sidewalks and driveways. Excavated material suitable for backfilling shall be stockpiled separately on the site. No material shall be placed closer than 2' from the edge of excavation. Fire hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, or other utility controls shall be left unobstructed and accessible until the work is completed. Gutters shall be kept clear or other satisfactory provisions made for street drainage. Natural water courses shall not be obstructed or polluted. Surplus material and excavated material unsuitable for backfilling shall be transported and disposed of off the site in disposal areas obtained by the Contractor.

**3.1.6 Public Nuisance**

The Contractor shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, or excessive noise or dust. The Contractor shall eliminate noise to as great an extent as practicable at all times.

**3.1.7 Construction Hours**

No work shall be done between the hours of 7:00 p.m. and 7:00 a.m., or on Saturdays and Sundays unless the proper and efficient prosecution of the work requires operations during the night or weekend. Written notification for doing the work shall be provided to the SJCUD a minimum 24 hours before starting such items of the work.

**3.1.8 Construction in Easements and Rights-of-Way**

A. Construction in Easements

In easements across private property, the Contractor shall confine all operations within the easement area and shall be responsible and liable for all damage outside of the easement area. Trees, fences, shrubbery or other type of surface improvements located in easements will require protection during construction. Precautions shall be taken by adequate sheeting or other approved method to prevent any cave-in or subsidence beyond the easement limits or damage to improvements within the easement. In general, the easement area is intended to provide reasonable access and working area for efficient operation by the Contractor. Where easement space for efficient operation is not provided, the Contractor shall be responsible for organizing his operations to perform within the restrictions shown on the plans.

B. Construction in FDOT Right-of-Way

The Contractor shall strictly adhere to the requirements of the Florida Department of Transportation where construction work is in a right-of-way under the jurisdiction of the State of Florida and shall take care to avoid any unreasonable traffic conflicts due to the work in road right-of-way.

C. Construction in County Right-of-Way

This work shall be governed by the St. Johns County LDC as amended.

**3.1.9 Shop Drawings and Submittals**

The Contractor shall submit two (2) sets of shop drawings and product data to the SJCUD for review prior to installation of equipment.

- A. The data shown on the shop drawings shall be complete with respect to dimensions, design criteria and materials of construction. It will be the responsibility of the Developer’s Engineer to check and verify that the shop drawings match the approved plans and specifications. The SJCUD will review these on a courtesy basis in an attempt to confirm requirements of this Manual. The SJCUD will not be responsible or liable for items that have been missed as a part of the review.
  
- B. The SJCUD will require a minimum of fifteen (15) working days to review shop drawings. The Contractor should consider this time in planning construction activities.

The Contractor shall, if requested by the Engineer, furnish certificates, affidavits of compliance, test reports, or samples for check analysis for any of the materials specified in this Manual.

The Contractor shall furnish two (2) sets of operation and maintenance manuals to the SJCUD for each piece of equipment furnished prior to acceptance of the project. Manuals shall be particular to the equipment furnished and shall provide complete repair, maintenance and parts guides.

The manufacturer shall provide a written report, through the Contractor and endorsed in writing by the Contractor, certifying to SJCUD that the equipment has been properly installed and checked and is ready for placement into routine permanent service.

**3.1.10 Pre-Construction Meetings**

Pre-Construction meetings shall be held in accordance with Section 1.4.1 of this Manual.

**3.1.11 As-Built Drawings**

- A. As-built drawings shall be based on all engineering design drawings as released for construction, and shall include all detail sheets and depict any deviations. Re-drafting for the purpose of as-built drawings will not be accepted unless specifically approved by the SJCUD.
  
- B. Each sheet must be labeled “AS-BUILT” in one-inch high bold letters in the bottom right hand corner. The following dimensional references must be depicted on As-built drawings:
  - 1. Station Numbers with offsets.
  - 2. Ties.
  - 3. Lot Numbers.
  - 4. Street Names.
  - 5. North Arrow.
  - 6. Scale.
  - 7. Location, elevation and datum of the Benchmark used.
  - 8. Easements as shown on approved paving and drainage drawings.

- C. As-Built drawings must be prepared and certified by either a Florida Registered Land Surveyor or a Florida Professional Engineer, and his/her name, address, and registration number should be included on the drawings. The certification block to be placed on each drawing sheet is found in Part VI of this manual.
- D. Locations, elevations, sizes, types, and materials of the following must be accurately shown and labeled (as applicable) on the As-built drawings:
  - 1. Manholes (include specialty lining material, pipe invert, manhole rim and bottom elevations).
  - 2. Water and Force Main Valves.
  - 3. Water and Sewer services.
  - 4. Fire Hydrants and all associated structures.
  - 5. Fittings.
- E. All water and sewer mains must be identified on the as-built drawings by their size, material, and DR/SDR classification. Horizontal locations and top of pipe elevations must also be labeled every 100 linear feet.
- F. The requirements listed in the “St. Johns County Development Services - As-Built Survey Requirements and Acceptance Procedures” will also apply.
- G. Electronic file requirements are listed on the documents titled “St. Johns County Utility Department Electronic File Standards” and “St. Johns County Utility Department Electronic File Submittal Form,” both of which are included in Part VI of this Manual. The Contractor must complete and comply with the Electronic File Submittal Form, which is to be submitted with the electronic as-built files.
- H. In addition to the electronic files, Contractor shall provide three (3) sets of signed and sealed “Water & Sewer” blackline As-Built drawings and one (1) set of original mylar reproducible.
- I. The As-Built Certification form, included in Part VI of this Manual, must be completed by the project Engineer of Record.
- J. All new fire hydrant locations shall be identified based upon the Florida State Plane Coordinate System. Submit an electronic file containing this data to the St. Johns County Fire-Rescue Department.
- K. As-Built drawings for pump stations shall include the following:
  - 1. Wet well size and location indicated and located to property lines and/or right-of-way lines.
  - 2. Elevations indicated at inverts, wet well top and bottom, and at ground adjacent to wet well.

3. Identified all types and sizes of lines and fittings.
4. All schedules that show pump, motor, and electrical data are corrected to show the as-built condition.
5. The following are located within the pump station boundaries: water spigot and RPZ, wet well, emergency pump-out, control panel, bends, fittings, manholes, generator and fuel tank, fence, and auxiliary electrical enclosures, as applicable.

### **3.1.12 Material Inspection and Testing**

The SJCUD can inspect all pipe and fittings. This inspection may occur at time of delivery and just prior to installation. If this inspection determines that any pipe or fitting does not meet or exceed specifications, pipe or fitting shall be rejected. Rejected material shall be removed by the Contractor at the Contractor's expense. The collection of water samples, all leak and pressure tests, and any connection to existing SJCUD lines shall be witnessed by an authorized SJCUD representative.

SJCUD may perform random testing of all materials furnished for conformance to the standards herein. The entire product of any manufacturer or of any one plant may be rejected when, in the opinion of SJCUD, the methods of manufacture fail to secure uniform results acceptable to the requirements of these specifications.

Each length of pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant and the class or strength classification of the pipe. The markings shall be plainly visible on the pipe barrel. Pipe which is not marked clearly is subject to rejection. All rejected pipe shall be promptly removed from the project site by the Contractor. The Contractor shall be responsible for all costs associated with removal and replacement of rejected pipe.

All pipe and accessories to be installed shall be inspected and tested at the place of manufacture by the manufacturer as required by the standard specifications to which the material is manufactured.

Each length of pipe shall be subject to inspection and approval at the factory, point of delivery, and site of work. If requested by the Engineer of Record or SJCUD, a sample of pipe to be tested shall be selected at random for testing at a laboratory hired by the Engineer of Record. When the specimens tested conform to applicable standards, all pipe represented by such specimens shall be considered acceptable based on the test parameters measured. Copies of test reports shall be available before the pipe is installed in the project.

In the event that any of the test specimens fail to meet the applicable standards, all pipe represented by such tests shall be subject to rejection. The Contractor may furnish two additional test specimens from the same shipment or delivery, for each specimen that failed and if the pipe samples meet the applicable standards the pipe will be considered acceptable. All such retesting shall be at the Contractor's expense. Pipe which has been rejected by the Engineer of Record or SJCUD shall be removed from the site of the work by the Contractor and replaced with pipe which meets these specifications with all expenses paid by the Contractor.

**3.1.13 Developer Warranty**

The Developer, through his Contractor, shall provide SJCUD a one-year unconditional warranty for labor and materials on all work from the date of final acceptance by the SJCUD.

**3.2 SITE PREPARATION, SURFACE REMOVAL AND RESTORATION**

**3.2.1 General**

The Contractor shall clear and grub all of the area within the limits of construction as shown on the plans and approved by the Engineer prior to the beginning of any work. All site work shall conform to the applicable site clearing ordinance, as well as landscaping and tree ordinances of the County.

**3.2.2 Clearing and Grubbing**

A. Clearing

The surface of the ground for the area to be cleared and grubbed shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish and all other objectionable obstructions resting on or protruding through the surface of the ground. However, trees and shrubs shall be preserved as specified in Section 3.1.4 of this Manual. Clearing operations shall be conducted so as to prevent damage to existing structures and installations and to those under construction, and so as to provide for the safety of employees and others.

B. Grubbing

Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18 inches below the subgrade. All depressions excavated below the original ground surface for or by the removal of such objects shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

C. Stripping

In areas designated, topsoil shall be stripped and stockpiled. Topsoil stockpiled shall be protected until it is placed as specified. Any topsoil remaining after all work is in place shall be disposed of by the Contractor.

#### D. Disposal of Cleared and Grubbed Material

The Contractor shall at his expense dispose of all material and debris from the clearing and grubbing operation in accordance with all applicable ordinances.

#### **3.2.3 Dust Control**

Contractor shall control dust resulting from clearing and grubbing operations to prevent nuisance to adjacent property owners and the general public. Contractor shall use dust control methods and materials approved by the Engineer.

#### **3.2.4 Surface Control**

Along the proposed pipe lines as indicated on the plans, the Contractor shall remove the surface materials only to such widths as will permit a trench to be excavated which will afford sufficient room for proper efficiency and proper construction. All applicable County and FDOT regulations shall be followed. Where sidewalks, driveways, pavements and curb and gutter are encountered, care shall be taken to protect against fracture or disturbance beyond reasonable working limits. All fractured, broken or disturbed surfaces shall be restored to their original condition prior to completion of the work.

#### **3.2.5 Restoration**

Restoration of all surfaces including road subbase, soil cement, limerock base, asphaltic concrete surface, portland cement concrete pavement and driveways, sidewalks and concrete curbs shall be in strict-accordance with road construction specifications. All grassing and mulching shall be done as specified in the road construction specifications.

Solid sodding shall be placed on all slopes greater than 4:1, within 10 feet of all proposed structures and where existing sod is removed or disturbed by the work. In addition, Contractor shall restore all storm drains, culverts, inlets and storm manholes to equal or better condition in accordance with the road construction specifications.

#### **3.2.6 Erosion Control**

Contractor is responsible for designing, providing, and maintaining effective erosion and sediment control during construction. The control measures must ensure erosion and sedimentation will either be eliminated or maintained within acceptable limits as established by St. Johns County.

### **3.3 EXCAVATION, BACKFILL, COMPACTION, AND GRADING**

#### **3.3.1 General**

The Contractor shall furnish all labor, materials, equipment and incidentals necessary to perform all excavation, backfill, fill, compaction, grading and slope protection required to complete the



work shown on the drawings and specified herein. The work shall include, but not necessarily be limited to: pump stations, manholes, vaults, conduit, pipe, roadways and paving; all backfilling, fill and required borrow; grading; disposal of surplus and unsuitable materials; and all related work such as sheeting, bracing and water hand-ling.

### **3.3.2 Soil Borings and Subsurface Investigations**

The Contractor shall examine the site and undertake subsurface investigations, including soil borings, before commencing the work. The Engineer will not be responsible for presumed or existing soil conditions in the work area.

### **3.3.3 Existing Utilities**

Contractor shall locate existing utilities in the areas of work. If utilities are to remain in place, the Contractor shall provide adequate means of protection during earthwork operations. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, the Contractor shall consult the owner of such piping or utility immediately for directions. The Contractor shall be responsible for payment related to damage and repair of such piping and/or the additional utility coordination requirements.

All utility relocations shall be qualified per specifications included in this Manual. In cases where the Contractor has to cut or repair an existing main, extra care should be provided to identify if existing Utilities are provided with restraining mechanisms. All existing mains that are not restrained will be restrained per Section 3.4 of this Manual.

The Engineer shall not be responsible for uncharted or incorrectly charted water and wastewater mains or other utilities. It is the Contractor's responsibility to ensure that such facilities exist at the presumed point prior to commencing construction.

### **3.3.4 Materials**

- A. General - Materials for use as bedding and backfill, whether insitu or borrow, shall be as described under this section. The Contractor shall, upon request by the Engineer, make an appropriate sample of this material available for testing.
- B. Structural Fill - Materials for structural fill shall be bedding rock or select common fill as specified herein or other suitable material as approved by the Engineer.
- C. Common Fill
  - 1. Common fill shall consist of mineral soil, substantially free of clay, organic material, loam, wood, trash and other objectionable material which may be compressible or which cannot be compacted properly. Common fill shall not contain stones larger than 3 inch in any dimension, asphalt, broken concrete, masonry, rubble, or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling. Additionally, common

fill shall be no more than 12 percent by weight finer than No. 200 mesh sieve unless finer material is approved for use in a specific location by the Engineer.

2. Material falling within the above specifications, encountered during the excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the SJCUD, is not suitable for refuse, shall be spoiled as specified herein for disposal of unsuitable materials.
- D. Select Common Fill - Select common fill shall be as specified above from common fill, except that the material shall contain no stones larger than 1-1/2 inches in largest dimension, and shall be no more than 5 percent by weight finer than the No. 200 mesh sieve.
- E. Bedding Rock - Bedding rock shall be 3/16 inch to 3/4 inch washed and graded stone (FDOT #67). This stone shall be graded so that 90 to 100 percent will pass a 3/4 inch screen and 95 to 100 percent will be retained on a No.8 screen. No stones larger than 1 inch in any dimension shall be accepted.

### **3.3.5 Sheeting and Bracing in Excavations**

- A. General - If required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction and to protect adjacent structures, existing piping and/or foundation material from disturbance, undermining or other damage, the Contractor shall construct, brace and maintain cofferdams consisting of sheeting and bracing. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.
- B. Miscellaneous Requirements
1. For trench sheeting for pipes, no sheeting is to be withdrawn if driven below mid-diameter of any pipe and no wood sheeting shall be cut off at a level lower than one foot above the top of any pipe. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given by the Engineer for an alternate method of removal. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction of other structures, utilities, existing piping or property. Unless otherwise approved or indicated on the Drawings or in the Specifications, all sheeting and bracing shall be removed after completion of the substructure. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools specially adapted for that purpose, by watering or otherwise as may be directed.
  2. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating any obligation on its part to issue such orders, and its failure to exercise its right to do so shall not relieve the Contractor from liability for

damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

3. The Contractor shall construct the cofferdams and sheeting outside the neat lines of the foundation unless indicated otherwise to the extent he deems it desirable for his method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting, bracing and cofferdams shall be adequate to withstand all pressures to which the structure will be subjected. Pumping, bracing and other work within the cofferdam shall be done in a manner to avoid, disturbing any construction already performed. Any movement or bulging, which may occur, shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.

### **3.3.6 Dewatering, Drainage and Flotation**

#### **A. General**

1. The Contractor shall excavate, construct and place all pipelines, concrete work, fill, and bedding rock, in-the-dry. In addition, the Contractor shall not make the final 24 inches of excavation until the water level is a minimum of one foot below proposed bottom of excavation. For purposes of these specifications, "in-the-dry" is defined to be within 2% of the optimum moisture content of the soil. The Engineer reserves the right to ask the Contractor to demonstrate that the water level is a minimum of one foot below proposed bottom of excavation before allowing the construction to proceed.
2. Discharge water shall be clear, with no visible soil particles. Discharge from dewatering shall be disposed of in such a manner that- it will not interfere with the normal drainage of the area in which the work is being performed, create a public nuisance, or form ponding. The operations shall not cause injury to any portion of the work completed, or in progress, or to the surface of streets, or to private property. The dewatering operation shall comply with the- requirements of appropriate regulatory agencies. Additionally, where private property will be involved, advance permission shall be obtained by the Contractor.

#### **B. Additional Requirements**

1. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.

2. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavations.
3. It is expected that wellpoints will be required for predrainage of the soil prior to final excavation for some of the deeper in-ground structures, or piping and for maintaining the lowered groundwater level until construction has been completed to such an extent that the structure, pipeline or fill will not be floated or otherwise damaged. Wellpoints shall be surrounded by suitable filter sand and negligible fines shall be removed by pumping.
4. The Contractor shall furnish all materials and equipment and perform all work required to install and maintain the drainage systems for handling groundwater and surface water encountered during construction of structures, pipelines and compacted fills.
5. During backfilling and construction, water levels shall be measured in observation wells located as directed by the Engineer. Continuous pumping will be required as long as water levels are required to be below natural levels.

### **3.3.7 Excavation**

#### **A. General**

1. Excavation consists of removal, storage and disposal of material encountered when established required grade elevations and in accordance with the notes shown in the Drawings.
2. Authorized earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, and other materials encountered that are not classified as rock excavation or unauthorized excavation. Unauthorized excavation consists of removal of material beyond the limits needed to establish required grade and subgrade elevations without specific direction of the Engineer. Unauthorized excavation as well as remedial work directed by the Engineer shall be at the Contractor's expense. Such remedial work shall be performed as directed by the Engineer.
3. If requested by the Engineer, when excavation has reached required subgrade elevations, a Geotechnical/Soils Engineer shall make an inspection of conditions. If the subgrade is unsuitable, Contractor shall carry excavation deeper and replace excavated material with select common fill or bedding rock, as directed by the Engineer.

4. If the Contractor excavates below grade through error or for his own convenience or through failure to properly dewater the excavation or disturbs the subgrade before dewatering is sufficiently complete, he may be directed by the Engineer to excavate below grade and refill the excavation using select common fill or bedding rock.
5. Slope sides of excavation shall comply with local codes and ordinances, and with OSHA requirements. Contractor shall shore and brace where sloping is not possible due to space restrictions or stability of the material excavated. Sides and slopes shall be maintained in a safe condition until completion of backfilling.
6. Contractor shall stockpile satisfactory excavated materials at a location approved by the Engineer until required for backfill and fill. When needed in the work, material shall be located and graded at the direction of a Geotechnical/Soils Engineer. Stockpiles shall be placed and graded for proper drainage. All soil materials shall be located away from the edge of excavations. All surplus and/or unsuitable excavated material shall be legally disposed of by the Contractor. Any permits required for the hauling and disposing of this material shall be obtained by the Contractor prior to commencing hauling operations.

#### B. Excavation for Structures

All such excavations shall conform to the elevations and dimensions shown on drawing within a tolerance of plus or minus 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removing formwork, installation of services and other construction, inspection or as shown on the Drawings. In excavating for footings and foundations, care shall be exercised not to disturb the bottom of the excavation. Bottoms shall be trimmed to required lines and grades to leave a solid base to receive concrete.

#### C. Trench Excavation

1. Excavation for all trenches required for the installation of utility pipes shall be made to the depths indicated on the Drawings and in such manner and to such widths as will give suitable room for laying the pipe within the trenches, for bracing and supporting and for pumping and drainage facilities.
2. The bottom of the excavations shall be firm and dry and in all respects acceptable to the Engineer. Excavation shall not exceed normal trench width as specified in the standard drawings. Any excavation, which exceeds the normal trench width, shall require special backfill requirements as determined by the Engineer.
3. Where pipes are to be laid in bedding rock, select common fill or encased in concrete, the trench may be excavated by machinery to or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

4. Where the pipes are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated by machinery. The last of the material being excavated shall be done manually in such a manner that will give a shaped bottom, true to grade, so that pipe can be evenly supported on undisturbed material, as specified in the standard drawings. Bell holes shall be made as required.
5. Contractor is responsible for compliance with the State of Florida (Chapter 90-96) Trench Safety Act.

### **3.3.8 Bedding and Backfill**

#### **A. General**

1. Material placed in fill areas under and around structures and pipelines shall be deposited within the lines and to the grades shown on the drawings or as directed by the Engineer, making due allowance for settlement of the material. Fill shall be placed only on properly prepared surfaces, which have been inspected and approved by the Engineer. If sufficient select common or common fill material is not available from excavation on site, the Contractor shall provide fill as may be required.
2. Fill shall be brought up in substantially level lifts starting in the deepest portion of the fill. The entire surface of the work shall be maintained free from ruts and in such condition that construction equipment can readily travel over any section.
3. Fill shall be placed and spread in layers by a backhoe or other approved method, unless otherwise specified. Prior to the process of placing and spreading, all materials not meeting those specified in Section 3.3.4 of this Manual shall be removed from the fill areas. The Contractor shall assign a sufficient number of men to this work to insure satisfactory compliance with these requirements.
4. If the compacted surface of any layer of material is determined to be smooth to bond properly with the succeeding layer, it shall be loosened by harrowing or by another approved method before the succeeding layer is placed.
5. All fill materials shall be placed and compacted "in-the-dry". The Contractor shall dewater excavated areas as required to perform the work and in such a manner as to preserve the undisturbed state of the natural inorganic soils. Before compaction, material shall be moistened or aerated as necessary to provide the optimum moisture content. Material, which is too wet, shall be spread on the fill area and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits. If added moisture is required, water shall be applied by sprinkler tanks or other sprinkler systems, which will insure uniform distribution of the water over the area to be treated and give complete and

accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued. The Contractor shall supply all hose, piping, valves, sprinklers, pumps, sprinkler tanks, hauling equipment and all other materials and equipment necessary to place water in the fill in the manner specified. Contractor shall compact each layer to require percentage of maximum dry density or relative dry density in accordance with Section 3.3.9 of this Manual. Backfill or fill material shall not be placed on surfaces that are muddy, frozen or contain frost or ice.

#### B. Bedding and Backfilling for Structures

1. Backfilling shall be carried up evenly on all walls of an individual structure. No backfill shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength.
2. In locations where pipes pass through building walls, the Contractor shall take precautions to consolidate the fill up to an elevation of at least one (1) foot above the bottom of the pipes. Structural fill in such areas shall be placed for a distance of not less than three (3) feet either side of the center line of the pipe in level layers not exceeding eight (8) inches in depth.
3. The surface of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the drawings. No soft spots or uncompacted areas will be allowed in the work.
4. Temporary bracing shall be provided as required during construction of all structures to protect partially completed structures against all construction loads, hydraulic pressure and earth pressure. The bracing shall be capable of resisting all loads applied to the walls as a result of backfilling.

#### C. Bedding and Backfilling for Pipes

1. Bedding for pipes shall be as shown on the plans and detailed on the standard drawings. The Contractor shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed.
2. Backfilling over and around pipes shall begin as soon as practicable after the pipe has been laid, jointed and inspected. All backfilling shall be prosecuted expeditiously and as detailed on the standard drawings.
3. Any space remaining between the pipe and sides of the trench shall be carefully backfilled and spread by hand or approved mechanical device and thoroughly compacted with a tamper as fast as placed, up to a level of one (1) foot above the top of the pipe. The filling shall be carried up evenly on both sides. Compaction shall be in accordance with Section 3.3.9 of this Manual.

4. The remainder of the trench above the compacted backfill, as just described above, shall be filled and thoroughly compacted in uniform layers. Compaction shall be in accordance with Section 3.3.9 of this Manual.

### **3.3.9 Compaction**

#### **A. General**

1. The Contractor shall control soil compaction during construction to provide the percentage of maximum density specified. The Contractor shall provide the Engineer copies of all soil testing reports, prepared by a Geotechnical Engineer, demonstrating compliance with these specifications.
2. When existing trench bottom has a density less than that specified, the Contractor shall break up the trench bottom surface, pulverize, moisture-condition to the optimum moisture content and compact to required depth and percentage of maximum density.

#### **B. Percentage of Maximum Density Requirements**

1. Fill or undisturbed soil from the bottom of the pipe trench to 1 foot above the pipe shall be densified to a minimum density 95% of the maximum dry density as determined by AASHTO T-180.
2. Backfill from 1 foot above utility pipes to grade shall be densified to a minimum density of 95% of the maximum dry density as determined by AASHTO T-180.
3. Fill under and around structures, and to the extent of the excavation shall be densified to a minimum density of 95% of the maximum dry density as determined by AASHTO T-180.

#### **C. Compaction Tests**

1. One compaction test location shall be required for each 300 linear feet of pipe and for every 100 square feet of backfill around structures as a minimum. The Engineer may determine that more compaction tests are required to certify the installation depending on field conditions. The locations of compaction tests within the trench shall be in conformance with the following schedule:
  - a. One test at the spring line of the pipe.
  - b. At least one test for each 12" layer of backfill within the pipe bedding zone for pipes 24 inches and larger.
  - c. One test at an elevation of one foot above the top of the pipe.
  - d. One test for each two feet of backfill placed from one foot above the top of the pipe to finished grade elevation.



2. If based on Geotechnical Engineer testing reports and inspection, fill, which has been placed, is below specified density, Contractor shall provide additional compaction and testing prior to commencing further construction.

### **3.3.10 Grading**

- A. All areas within the limits of construction, including transition areas, shall be uniformly graded to produce a smooth uniform surface. Areas adjacent to structures or paved surfaces shall be graded to drain away from structures and pavement ponding shall be prevented. After grading, the area shall be compacted to the specified depth and percentage of maximum density.
- B. No grading shall be done in areas where there are existing pipelines that may be uncovered or damaged until such lines have been relocated.

### **3.3.11 Maintenance**

- A. Contractor shall protect newly graded areas from traffic and erosion and keep them free of trash and debris. Contractor shall repair and reestablish grades in settled, eroded and rutted areas.
- B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, Contractor shall scarify surface, and reshape and compact to requires density prior to further construction.

### **3.3.12 Inspection and Quality Assurance**

Contractor shall examine the areas and conditions under which excavating, filling and grading are to be performed, and not proceed with the work until unsatisfactory conditions have been corrected.

## **3.4 PRESSURE PIPE RESTRAINT**

### **3.4.1 General**

Pipelines shall be restrained at all valves, bends, tees, crosses and dead ends for a specified distance. The use of concrete thrust blocks and tie rodding is prohibited. Restraint devices must be approved by the SJCUD prior to installation.

### **3.4.2 Restrained Joint Construction**

- A. Piping or fittings requiring restrained joints shall be capable of holding against withdrawal for line pressures 50 percent above the normal working pressure or a minimum of 150 psi.

- B. The design engineer may also determine the minimum number of restrained joints required on each side of fittings or changes in direction of pipe to develop adequate friction with the soil for the length of restrained pipe.

### **3.4.3 Mechanical Restraining Devices**

The restrainer shall be manufactured of ductile iron and shall meet or exceed all the requirements of ANSI A21.11 (AWWA C111) and ASTM A536. The restrainer system shall provide anchoring ductile iron pipe and fittings, valves, and PVC pipe to mechanical joint pipe or fittings or bell to spigot PVC pipe joints. The restrainer shall accommodate the full working pressure rating of the pipe plus surge allowance. The restrainers shall be painted black for ductile iron pipe and painted red for PVC pipe applications. The restraining device shall not damage or lower the working pressure of the pipe installed. Restrainers shall be properly stored to minimize sand and debris build-up. Specifically, the twist-off-screws and associated threads shall be clean (free of sand) prior to installation.

### **3.4.4 Retainer Glands**

Retainer glands shall be manufactured of ductile iron grade 64-42-10, ASTM A536, or SJCUD pre-approved equal and shall be designed to fit standard mechanical joint bells conforming to applicable sections of ANSI A21.10 (AWWA C110), ANSI A21.11 (AWWA C111), and ANSI A21.53 (AWWA C153). The restraining device shall be rated for the full working pressure of the pipe type used including surge allowance and a 2:1 safety factor and shall be EBAA Iron, Incorporated, Megalug or equal. Mechanical restraints shall include a restraining mechanism which, when actuated, imparts a wedging action against the pipe, increasing its resistance as the pressure increases. The restraint shall be compatible with the type of joint being installed. The joint deflection shall not exceed 80% of the pipe manufacturer's recommended maximum deflection. Deflection, if necessary, shall be made before tightening the set screws. Bolts and set screws shall be tightened alternately, 180 degrees apart, to the torque recommended by the manufacturer. Retainer glands having set screws that make point contact with the pipe without using a pad to disperse point loading shall not be used on PVC pipe.

### **3.4.5 Restrainers Specifically for Ductile Iron Pipe**

Joints may be restrained by utilizing a joint restraint gasket which includes a stainless steel locking segment vulcanized into the rubber gasket. The gasket shall be rated for operating pressures up to 250 psi based on the performance requirements of ANSI/AWWA C111/A21.11 Standard for Rubber - Gasket Joints of D.I.P & F. Pipe Manufacturer's restraints for joint restraints designed for operating pressures of up to 250 psi minimum will also be acceptable if approved by SJCUD.

### **3.5 PRESSURE CONNECTION**

#### **3.5.1 Notification and Connection to Existing Mains**

- A. All connections and ties to the SJCUD Water System and transfer of services shall be performed by the contractor under supervision of the SJCUD representative.
- B. All connections to existing St. Johns County Utility mains shall be made by the Contractor only after the connection procedure and his work scheduling has been reviewed and approved by the SJCUD. The Contractor shall submit a written request to the SJCUD a minimum of five (5) working days prior to scheduling said connections. In his request he shall outline the following:
  - 1. Points of Connection, fittings to be used, and method of flushing and disinfection.
  - 2. Estimated construction time for the connections.
- C. The SJCUD shall review the submittal within three (3) working days after receiving it and inform the Contractor regarding approval or denial of his request. If his request is rejected by the SJCUD, the Contractor shall resubmit his request modifying it in a manner acceptable to the SJCUD.
- D. All connections shall only be made on the agreed upon date and time. If the Contractor does not initiate and complete the connection work in the agreed upon manner, he shall be required to reschedule the connection by following the procedure outlined above.
- E. The Contractor shall not operate any valves in the system.
- F. Pressure connections of 4-inch or larger shall be performed by a tapping sleeve and valve. All large diameter taps (4-inch diameter and larger) onto a pressurized main must have a minimum separation of 5 feet along the main being tapped from either the nearest pipe joint or large diameter tap. No more than two large diameter taps shall be made on any 20 foot length of pipe.

#### **3.5.2 Tapping Sleeves**

Tapping sleeves shall be utilized only for pressure tap connections or where specifically approved by SJCUD.

- A. **Stainless Steel**

Tapping sleeves shall be stainless steel. The tapping sleeve including the flange, nuts and bolts shall be 304 stainless steel. The pilot flange shall be:

- 1. Recessed for tapping in accordance with MSS SP-60.

2. Rated Class D per AWWA C207 with a 125 pound drilling conforming to ANSI B16.

A fully encapsulated SBR gasket that is full circle for length of the sleeve and cloth reinforced with attached stainless steel bridges for support at the flange lugs shall be supplied and used for the body gasket. The flange shall be supplied with a gasket bonded to it. The tapping sleeve shall have a test port and plug located at the 12:00 position. The port and plug shall be  $\frac{3}{4}$  inch NPT and made of bronze or stainless steel. Tapping sleeves made of stainless steel shall be rated for a 150 psi and 200 psi minimum operating and testing pressure, respectively. All welds shall conform to ASTM A380 and shall be passivated. FORD stainless steel sleeves style FAST, shall be used for PVC and AC pipe with a working pressure of 150 psi.

### 3.5.3 Tapping Valves

#### A. General

Tapping valves shall be iron body, bronze mounted gate valves, non-rising stem, open left, resilient seat, 2 inch square operating nut, for vertical mounting on buried water lines. The valve ends shall be mechanical joint for use with ductile iron pipe on one side and standard flanged (Class 125) on the other.

#### B. Disinfection of Tapping or Drilling Machine

Prior to tapping a potable water main, the drilling machine's pilot drill, shell cutter, and cutter hub shall be disinfected with a minimum of 1% hypochlorite solution. The pilot drill, shell cutter, and cutter hub shall be swabbed until clean or totally immersed in the sterilizing solution and allowed to remain wet at least five minutes before tapping operation commences. The tapping sleeve shall be disinfected in accordance with AWWA C651. Rinsing the sterilizing solution from the tapping components prior to tapping is not required.

#### C. Hydrostatic and Leakage Test

A hydrostatic and leakage test shall be performed after the tapping sleeve and valve is installed, and prior to tapping of a pressurized water main. The test shall be conducted by introducing water into a tap or test hole located at the neck of the outlet half of the sleeve and with the tapping valve in the closed position. Sleeves shall be provided with a test plug. The sleeve and valve shall be capable of maintaining a test pressure of 150 psi for 15 minutes duration with no sign of visible leaks. All leaks shall be repaired and the sleeve and valve shall be re-tested. Repair and re-testing shall be done until the installation passes the specified test. A bronze or stainless steel watertight plug shall then be inserted into the test hole.

### 3.5.4 Service Saddle

A service saddle shall be used for all service line taps. Service saddles shall be wide single band, anchored by a minimum four (4) bolt pattern on a fused epoxy coated ductile iron saddle body. Service saddles shall utilize the wide stainless steel band sized exactly to the pipe outside diameter. Sealing gaskets shall be BUNA-N rubber. All hardware shall be stainless steel.

### 3.5.5 Installation

- A. Excavation, Backfill, Compaction, and Grading - The applicable provisions of Section 3.3 shall apply.
- B. Construction Details
  - 1. Sufficient length of main shall be exposed to allow for installation of the tapping sleeve and valve and the operation of the tapping machinery. The main shall be supported on concrete pedestals or bedding rock at sufficient intervals to properly carry its own weight, plus the weight of the tapping sleeve valve and machinery. Any damage to the main due to improper or insufficient supports shall be repaired at the Contractor's expense.
  - 2. The inside of the tapping sleeve and valve, the outside of the main, and the tapping machine shall be cleaned and swabbed or sprayed with 10% liquid chlorine prior to beginning installation for water system pressure connections.
  - 3. After the tapping sleeve has been mounted on the main, the tapping valve shall be bolted to the outlet flange, making a pressure tight connection. Prior to beginning the tapping operation, the sleeve and valve shall be pressure tested at 150 psi to ensure that no leakage will occur.
  - 4. For pressure connections through 12" diameter or less the minimum diameter cut shall be 1/2" less than the nominal diameter of the pipe to be attached. For 14" through 20" installations the minimum diameter shall be 1 1/2" less; for larger taps the allowable minimum diameter shall be 2" to 3" less than the nominal diameter of the pipe being attached. After the tapping procedure is complete the Contractor shall submit the coupon to the SJCUD.
  - 5. For pressure connections to wastewater force mains, the tapping valve shall be placed horizontally. After the tapping procedure is complete a plug valve shall be attached to the tapping valve. The tapping valve shall be left in the open position prior to backfilling.

### **3.6 TRENCHLESS TECHNOLOGY**

#### **3.6.1 General**

Installation of water, wastewater, and reuse mains under roadways or railroads without the use of open ditches shall be done by boring and jacking a steel pipe casing or by horizontal directional drilling, of the size shown on the drawings under the highway at the elevations and locations shown. The Contractor shall be required to acquire all applicable permits and contracts to perform this work. Bore and jack operations and horizontal directional drilling shall be performed by fully qualified personnel.

#### **3.6.2 Boring & Jacking**

##### **A. General**

The installation of a casing pipe by the method of boring and jacking shall be covered by these specifications. The overall work scope shall include, but not limited to, boring and jacking pits and equipment, sheeting, steel casing pipe, skid, steel straps, coatings, location signs as required, miscellaneous appurtenances to complete the entire Work as shown on the Standard Drawings, and restoration. Boring and jacking operations shall be performed within the right-of-way and/ or easements.

##### **B. Pipe Material**

1. Steel casing shall conform to the requirements of ASTM Designation A139 Grade "B" with minimum yield strength of 35,000 psi. The casing pipes shall have the minimum nominal diameter and wall thickness as shown on the standard detail in Part V of this Manual.
2. Field and shop welds of the casing pipes shall conform with the American Welding Society (AWS) standard specifications. Field welds shall be complete penetration, single-bevel groove type joints. Welds shall be airtight and continuous over the entire circumference of the pipe and shall not increase the outside pipe diameter by more than 3/4-inch.

##### **C. Carrier Pipe Support**

The carrier pipes shall be supported within the casing pipes so that the pipe bells do not rest directly on the casing. Casing spacers shall be bolt on style split shells made of either T-304 stainless steel or fusion-coated steel (a minimum 0.010" thick coating of PVC shall be provided over the entire band). The shell shall be lined with a PVC liner 0.90" thick with 85-90 Durometer. All nuts and bolts shall be high strength, low alloy meeting AWWA C111. Runners shall be made of a high molecular weight polymer with inherent high abrasion resistance and a low coefficient of friction.

#### D. Jacking Pits

Excavation adjacent to the roads shall be performed in a manner to adequately support the roads. Bracing, shoring, sheeting or other supports shall be installed as needed. Contractor shall install suitable reaction blocks for the jacks as required. Jacking operations shall be continuous and precautions shall be taken to avoid interruptions which might cause the casing to "freeze" in place. Upon completion of jacking operations, the reaction blocks, braces, and all other associated construction materials shall be completely removed from the site.

#### E. Excavation Support Systems

Design shaft excavation support systems to withstand lateral earth pressures, ground loads, unrelieved hydrostatic pressures, bottom heave, equipment loads, applicable traffic and construction loads, and other surcharge loads to allow safe construction of shafts without appreciable movement or settlement of ground, and to prevent damage to or movement of adjacent structures, streets, utilities and trees. Design excavation support systems and casing installation equipment to be compatible with geologic conditions

#### F. Grout Filling Voids Outside of Casing Pipe

Grout filling voids outside a casing pipe installed by jack and bore method shall be performed for all casing pipe with an interior diameter of 24 inches or greater.

#### G. Existing Utilities

Contractor shall confirm location of all existing utilities prior to the start of shaft/pit excavation and pipe installation.

#### H. Shaft/Pit Installation

1. Notify SJCUD not less than 15 working days before beginning shaft excavation.
2. Methods of construction for shafts/pits shall be such as to ensure the safety of the work, Contractor's employees, the public, existing utilities, and adjacent property and improvements, whether public or private.
3. Before beginning construction of shaft/pit, adequately protect existing structures, utilities, trees, shrubs, and other existing facilities.
4. Provide complete groundwater control for excavations at all times.
5. Perform shaft/pit excavations using appropriate excavation or large hole drilling methods, as required.

6. Place fencing, gates, lights, and signs, as necessary around shafts and staging areas to provide for public safety.
7. Inspect shaft/pit excavations daily to check safety of excavation and structural integrity of support system.

#### I. Equipment Selection

Select necessary equipment and methods to install casing and carrier pipe as shown on Drawings. Selected equipment shall be capable of accurate alignment and grade control, and shall protect against subsidence or other disturbance of ground, existing utilities, existing structures, road surface and railroad facilities when applicable

#### J. Casing Installation

1. Casing exterior may be lubricated with bentonite slurry.
2. Verify casing pipe minimum wall thickness is adequate for anticipated jacking loads.
3. Hole diameter shall not exceed outside diameter of casing pipe by more than one inch.
4. Where unstable soil conditions are found to exist, conduct boring operations in a manner that will not be detrimental to facility being crossed.
5. Tolerance shall be as follows:
  - a. Line Tolerance: 2 inches, maximum.
  - b. Grade Tolerance 2 inches, maximum.
6. Provide means of checking line and grade at least once a day to confirm allowable tolerance has been achieved.
7. Contractor shall provide means of steering casing to ensure allowable tolerance can be achieved.
8. If necessary to abandon a bored hole, remedial measures shall be taken by Contractor, subject to review by the Engineer of Record, approval of SJCUD and owner of facility being crossed.



### 3.6.3 Horizontal Directional Drilling

#### A. General

The work specified in this section consists of furnishing and installing an underground pipeline (force main, water main, or reuse main) using the horizontal directional drilling (HDD) method of installation, also commonly referred to as directional boring or guided horizontal boring. This work shall include all services, equipment, materials, and labor for the complete and proper installation, testing, disinfection, and environmental protection and restoration.

#### B. Submittals

Drilling Logs & As-builts: Contractor shall maintain a daily project log of drilling operations and a guidance system log. A copy of this log shall be submitted to the SJCUD representative with the final As-built Drawings at completion of the project. As-built drawing submittals shall meet all requirements as detailed in these standards.

#### C. Pipe Material

Only High Density Polyethylene (HDPE) Pipe as specified in these standards shall be used for directional drilled pipeline installations.

#### D. Horizontal Directional Drilling Procedures

1. Safety: Contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner.
2. Pilot Hole: The Contractor shall be responsible for drilling the pilot hole on bore path with no deviations greater than 5% of depth over a length of 100'. In the event that pilot does deviate from bore path more than 5% of depth in 100', Contractor shall notify the SJCUD Representative. The SJCUD Representative may require the Contractor to pull-back and re-drill from the location along bore path before the deviation. The contractor shall be responsible for restoring any damage caused by a drilling fluid fracture.
3. Reaming: Upon successful completion of pilot hole, Contractor will ream borehole to a minimum of 25% greater than outside diameter of the pipe using the appropriate tools. Contractor will not attempt to ream at one time more than the drilling equipment and mud system are designed to safely handle.
4. Pullback: After successfully reaming bore hole to the required diameter, Contractor will pull the pipe through the borehole. Carrier pipe shall be filled with potable water prior to the pullback and the pullback shall proceed with said pipe full of water. In front of the pipe will be a swivel and reamer to compact

borehole walls. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into borehole. During pull-back operations Contractor will not apply more than 90% of the pipe manufacturer's safety pull (or tensile) strength. A breakaway flange shall be used during pull back to ensure that the maximum pull back force is not exceeded.

### **3.6.4 State/County Highway Crossings**

Permits for all work within the State/County right-of-way shall be obtained by the Design Engineer. The Contractor shall verify the existence of the permit before commencing work. All work located in a State Highway right of way shall be in full compliance with the requirements of the Florida Department of Transportation (FDOT) permit and in accordance with the FDOT Utility Accommodation Guide and standard specifications. County/State highway crossings shall be made by boring and jacking a steel pipe casing or by horizontal directional drill, of the size shown on the drawings under the highway at the elevations and locations shown. The water, wastewater, or reuse main shall be placed in the casing with approved casing spacers as specified in Section 3.7 of this Manual. All joints within the carrier pipe shall be mechanically restrained. After inspection the ends of the casing shall be sealed as detailed in the approved design and as permitted by the FDOT and SJCUD. Where allowed by FDOT a single HDPE carrier pipe may be installed by directional drill in lieu of a carrier pipe inside a casing pipe.

### **3.6.5 Railroad Crossings**

Permits for all work within the railroad right-of-way shall be obtained by the Design Engineer. The Contractor shall verify existence of the permit before commencing work. All work related to the railroad crossings shall be in full compliance with the terms of the permit and AREA Specifications for Pipeline Crossings Under Railway Tracks for Non-Flammable Substances. The water, wastewater, or reuse main shall be placed in steel casing pipe under all railroad crossings whether installed by open cut, bore and jack, or horizontal directional drill. The water main shall be placed in the casing with approved casing spacers. All joints within carrier pipe shall be mechanically restrained. After inspection by SJCUD, the ends of the casing shall be sealed as detailed in the approved design and as permitted by the railroad permit and SJCUD. Upon completion and prior to final acceptance, the Contractor shall place crossing markers of a type acceptable to the Railroad Company at each end of the crossing at the railroad right-of-way. A casing leak detector may be required by the railroad company.

## **3.7 PIPING SUPPORTS**

The Contractor is responsible for furnishing and installing all supports necessary to hold the piping and appurtenances at the lines and grades indicated on the drawings or as specified.

### **A. Supports**

1. Piping shall be adequately supported from floors by approved saddle stands, suitable concrete piers or other pre-approved method.

2. Pipe saddles shall be adjustable (via screw adjustment) and shape fitted to the pipe.
  3. Concrete piers shall conform accurately to the bottom one-third to one-half of the pipe.
  4. Supports shall be located as required, and in no case shall they exceed 8 feet on centers for ductile iron pipe and 4 feet on centers for PVC pipe.
- B. Casing Spacers
1. Casing spacers shall be a two piece prefabricated unit by a single manufacturer.
  2. Casing spacers shall have a shell made from either 304 stainless steel, 14 gauge steel with heat fusion coated PVC plastic (0.01 mils thick) or high density polyethylene.
  3. Casing spacer bands:
    - a. Twelve inch wide steel bands required on 18 inch or larger carrier pipe.
    - b. Eight inch wide steel bands on carrier pipe that is 16 inches or smaller.
    - c. Polyethylene bands shall be used on HDPE spacers.
  4. Casing Spacer Risers and Runners:
    - a. All carrier pipe 16 inches or greater shall use six (two top and four bottom), 10 or 14 gauge steel risers with runners on casing spacers.
    - b. All carrier pipe 14 inches and smaller shall use four, 10 or 14 gauge steel risers with runners on casing spacers
    - c. Carrier pipe using HDPE spacers will have one riser for each diameter inch of carrier pipe.
    - d. High density polyethylene, glass reinforced plastic or UHMW polymer shall be used for runners (risers).
    - e. All risers over two inches in height shall be reinforced.
    - f. All nuts, bolts, and washers shall be 304 stainless steel.
- C. Casing End Seals

Casing ends shall be sealed in a manner that provides a water tight and earth load bearing seal. Casing end seals shall be pre-fabricated by an SJCUD approved manufacturer. Casing end seals are typically made of a synthetic rubber to provide a tight seal and can be either a sleeve type, or link-seal type end seal. Masonry plugs shall not be used to seal casings unless specified by the Engineer and pre-approved by the SJCUD.

### **3.8 LOCATE WIRE & PIPE MARKING**

#### **3.8.1 Locate Wire**

##### A. General

1. Utility marking tape shall be 3-inch wide and 4 mil (min.) thick per ASTM D2103 with a 2750 psi tensile strength per ASTM D882.
2. Tape shall have adhesive backing and industrial standard repeatable message.
3. External color of locate wire shall be blue for potable water, green for sewer, and pantone purple 522C for reuse.
4. Locate wire shall be installed on all PVC, ductile iron, and HDPE piping and services 2 inches and larger. No wire shall be installed on above ground installations or water services smaller than 2 inches.
5. Tape shall be buried directly over all pipes no deeper than 18 inches below ground.

##### B. PVC/Ductile Iron Pipe/HDPE (Open Cut)

Locate wire shall be 10 gauge, single strand, UF rated (direct burial), copper wire with 30 mil. (minimum) insulation.

##### C. HDPE Pipe (Horizontal Directional Drilling)

Locate wire shall be 12 AWG copper-clad carbon steel with 30 mil. (minimum) insulation.

#### **3.8.2 Pipe Marking**

Each length of pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant, design pressure, service and the class or strength classification of the pipe. The markings shall be plainly visible on the pipe barrel.

All pipes shall have a homing mark on the spigot provided by the manufacturer. On field cut pipe, the Contractor shall provide homing mark on the spigot in accordance with manufacturer's recommendations.

### **3.9 PRESSURE AND LEAKAGE TESTING OF PRESSURIZED PIPING**

#### **3.9.1 PVC and Ductile Iron Piping**

- A. General - Hydrostatic testing shall consist of a pressure test and leakage test. Hydrostatic tests shall be conducted on all newly laid pressure pipes, joints, hydrants and valves including all service lines to the curb stops. Air testing of pressure pipes shall not be permitted under any circumstance. Tests shall be made on sections not exceeding 3,000 feet. Contractor shall furnish all necessary equipment and material, make all taps, and furnish all closure pieces in the pipe as required. Equipment to be furnished by the Contractor shall include graduated containers, pressure gauges, hydraulic force pumps, and suitable hoses and piping. The SJCUD or their designated representative shall monitor and approve a satisfactory test. The basic provisions of AWWA C-600 shall apply to ductile iron pipe and AWWA C-605 shall apply to PVC pipe.
- B. The Contractor may conduct hydrostatic tests after the trench has been partially backfilled with the joints left exposed for inspection for his informational purposes only. The hydrostatic tests for acceptance shall only be conducted after the trenches have been completely backfilled and compacted as specified.
1. Testing Criteria - All pipe sections to be pressure tested shall be subjected to a hydrostatic pressure equal to the pressure rating printed on the pipe. At a minimum, water mains will be tested at 150 psi, force mains at 100 psi, and reclaimed water mains at 150 psi. If there are multiple pressure rated pipes or pipe material types on the project, it will be the Contractor's responsibility to isolate the different pipes from each other. The duration of each pressure test shall be for a period of two hours. If during the test, the integrity of the tested line is in question, the SJCUD may require other pressure tests at no expense to the SJCUD. All line valves shall be hydrostatically tested for 15 minutes to ensure tight seal when closed.
  2. Procedure for Pressure Test - Each section of pipe to be tested, as determined by the SJCUD, shall be slowly filled with water, and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner. It shall be standard practice to verify that isolation valves for fire hydrants on potable water systems are in the open position prior to hydrostatic testing to verify that the operating valves on newly installed hydrants do not leak. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made and appropriate valves installed to ensure bleeding of all air from the main. If defective pipes, fittings, valves, or hydrants are discovered during the pressure test, all such items shall be removed and replaced by the Contractor with sound material, and the test shall be repeated until satisfactory results are obtained. In no case will a pressure loss greater than 5 psi during any two-hour pressure test be accepted. Prior to scheduling the SJCUD

witnessed pressure test, the Contractor shall preliminarily test the main to ensure it will pass when the SJCUD is present.

3. Procedure for Leakage Test - After completion of the pressure test, a leakage test shall be conducted to determine the quantity of water lost by leakage under the specified test pressure.

Leakage shall be defined as the quantity of water to be supplied in the newly laid pipe or any valve section under test which is necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. Should any test of pipe laid disclose leakage greater than that allowed, Contractor shall locate and replace or repair the defective joints, pipe, or valve until the leakage from subsequent testing is within the specified allowance.

- a. For Ductile Iron ONLY: Applicable provisions of AWWA C-600 shall apply. Allowable leakage in gallons per hour for pipeline shall not be greater than that determined by the formula:

$$Q = \frac{L * D * \sqrt{P}}{133,200}$$

*Note:*

- Q = Allowable leakage in gallons per hour.  
 L = Length of pipe tested, in feet (max of 3000)  
 D = Nominal diameter of the pipe in inches.  
 P = Average test pressure during leakage test in pounds per square inch gauge.

- b. For PVC ONLY: Applicable provisions of AWWA C-605 shall apply. Allowable leakage in gallons per hour for pipeline shall not be greater than that determined by the formula:

$$Q = \frac{L * D * \sqrt{P}}{148,000}$$

*Note:*

- Q = Allowable leakage in gallons per hour.  
 L = Length of pipe tested, in feet (max of 3000)  
 D = Nominal diameter of the pipe in inches.  
 P = Average test pressure during leakage test in pounds per square inch gauge.

4. Failed Tests

If a section fails to pass the tests, the Contractor shall locate, uncover, and replace the defective pipe, valve, fitting, or joint. Visible leaks shall be corrected regardless of total leakage. Lines which fail to meet these tests shall be retested

as necessary. All testing and retesting shall be performed at the Contractor's expense.

### 3.9.2 HDPE Piping

- A. General - Hydrostatic testing shall consist of a pressure test and leakage test. Hydrostatic tests shall be conducted on all newly laid pressure pipes, joints, hydrants and valves including all service lines to the curb stops. Air testing of pressure pipes shall not be permitted under any circumstance. Tests shall be made on sections not exceeding 3,000 feet. Contractor shall furnish all necessary equipment and material, make all taps, and furnish all closure pieces in the pipe as required. Equipment to be furnished by the Contractor shall include graduated containers, pressure gauges, hydraulic force pumps, and suitable hoses and piping. The SJCUD or their designated representative shall monitor and approve a satisfactory test. The basic provisions of ASTM F2164 – “Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure” shall apply.
- B. The Contractor may conduct hydrostatic tests after the trench has been partially backfilled with the joints left exposed for inspection for his informational purposes only. The hydrostatic tests for acceptance shall only be conducted after the trenches have been completely backfilled and compacted as specified.
1. Testing Criteria - All pipe sections to be pressure tested shall be subjected to a hydrostatic pressure equal to the pressure rating printed on the pipe. At a minimum, water mains will be tested at 150 psi, force mains at 100 psi, and reclaimed water mains at 150 psi. If there are multiple pressure rated pipes or pipe material types on the project, it will be the Contractor's responsibility to isolate the different pipes from each other. The duration of each pressure test shall be a maximum of eight (8) hours including time to pressurize, time for initial expansion, time at test pressure, and time to depressurized the test section. If during the test, the integrity of the tested line is in question, the SJCUD may require other pressure tests at no expense to the SJCUD. All line valves shall be hydrostatically tested for 15 minutes to ensure tight seal when closed.
  2. Initial Expansion Phase - Each section of pipe to be tested, as determined by the SJCUD, shall be slowly filled with water, and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made and appropriate valves installed to ensure bleeding of all air from the main. During the initial expansion phase, gradually pressurize the test section to test pressure and maintain the test pressure for three (3) hours; continue to add water to the test section to account for the expansion of the pipe. If defective pipes, fittings, valves, or hydrants are discovered during the pressure test, all such items shall be removed and replaced by the Contractor with sound material, and the test shall be repeated until satisfactory results are

obtained. Prior to scheduling the SJCUD witnessed pressure test, the Contractor shall preliminarily test the main to ensure it will pass when the SJCUD is present.

3. Leakage Test - After completion of the pressure test, a leakage test shall be conducted to determine the quantity of water lost by leakage under the specified test pressure. Following the initial expansion phase, the test pressure shall be reduced by 10 psi and no water shall be added to the test section at any time. After 1 hour, if the test pressure has dropped 5% or more, the test will be considered a failure.

#### B. Failed Tests

If a section fails to pass the tests, the Contractor shall locate, uncover, and replace the defective pipe, valve, fitting, or joint. Visible leaks shall be corrected regardless of total leakage. Lines which fail to meet these tests shall be retested as necessary. All testing shall be performed at the Contractor's expense.

### 3.9.3 Disinfection of Water Mains (PVC and Ductile Iron)

#### A. General

Before being placed in service, all new water mains shall be chlorinated in accordance with the specifications below and the procedures outlined in AWWA C-651 "Standard Procedure for Disinfecting Water Mains," Chapter 62-555 of the FAC, and a Certification of Completion shall be approved by FDEP.

#### B. Flushing

Sections of pipe to be disinfected shall first be flushed (full diameter) to remove any solids or contaminated material that may have become lodged in the pipe. If no hydrant is installed at the end of the main, then a blow-off valve shall be provided large enough to develop a velocity of at least 2.5 feet per second in the main.

A Flushing plan must be approved by the SJCUD prior to any flushing activities. The Contractor shall modify the flushing plan as directed by SJCUD at no additional cost. Flushing operations shall be scheduled, and may be required to be performed at night during low demand periods at no additional cost. A SJCUD representative shall be present during flushing activities.

All taps required for chlorination or flushing purpose or for temporary or permanent release of air shall be provided for by the Contractor as a part of the construction of water mains. After the disinfection, all such taps shall be sealed to the satisfaction of the SJCUD.



### C. Disinfection Criteria

Before being placed into service, all new mains and repaired portions of or extensions to existing mains shall be chlorinated so that the initial chlorine residual shall be not less than 50 mg/l and a chlorine residual of not less than 25 mg/l remains in the water after standing 24 hours in the pipe.

### D. Form of Applied Chlorine

Chlorine may be applied as liquid chlorine (gas-water mixture) or a mixture of water and high-test calcium hypochlorite. Contractor shall assume responsibility for safe handling of chlorine and shall meet requirements of OSHA and other regulatory agencies for safe handling of chlorine.

### E. Point of Application

The preferred point of application of the chlorinating agent shall be at the beginning of the pipeline extension or any valve section of it and through a corporation stop inserted in the pipe. The water injector for delivering the chlorine bearing water into the pipe shall be supplied from a tap made on the pressure side of the gate valve controlling the flow into the pipe line extension. Alternate points of applications may be used when approved or directed by the SJCUD.

### F. Operation of Valves

Valves shall be manipulated by the SJCUD personnel so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water.

### G. Retention Period

Treated water shall be retained in the pipe at least 24 hours. After this period the chlorine residual at pipe extremities and at other representative points shall be at least 25 mg/l.

### H. Chlorinating Valves and Hydrants

In the process of chlorinating newly laid pipe, all valves or other appurtenances shall be operated while the pipe line is filled with the chlorinating agent and under normal operating pressure.

### I. Final Flushing and Testing

Following chlorination, all treated water shall be thoroughly flushed from the newly installed pipe at its extremity until the replacement water indicates a free chlorine residual not in excess of that normally carried in the system.

After flushing, water samples shall be collected on two successive days from the treated piping system as directed by the SJCUD and shall show acceptable bacteriological results. At least one set of samples shall be collected from every 1,200 feet of the new water main, plus one set from the end of the line and at least one set from each branch. All bacteriological testing shall be performed by the Contractor. All such bacteriological analysis shall be performed by a laboratory certified by the State of Florida.

Proper chain of custody procedures shall be followed and samples shall only be collected by certified laboratory personnel. Copies of testing results and all related correspondence with the FDEP shall be submitted to the SJCUD.

J. Repetition of Flushing and Testing

Should the initial treatment result in an unsatisfactory bacterial test, the original chlorination procedure shall be repeated by the Contractor until satisfactory results are obtained at no additional expense to the SJCUD.

### **3.9.4 Certification of Completion**

Prior to placing any new water main into service, a Certificate of Completion form shall be submitted through the SJCUD and approved by the FDEP in accordance with Chapter 62-555, FAC.

### **3.9.5 Locate Wire Installation and Testing**

A. Locate Wire Installation for Open Cut Mains

Contractor shall furnish and install locate wiring on all water mains and on water service mains 3-inch size and greater. Locate wire shall be brought to grade within a valve box or Locating Station box at 475 foot intervals or less. Locate wire shall be installed in box and along pipeline. Locate wire shall be installed in either the 5:00 or 8:00 position relative to the pipe, but shall not be attached to the pipe. Connection or splices underground which are not inside a locate box or valve box shall not be allowed.

B. Locate Wire Installation for Horizontally Directionally Drilled Water mains

The Contractor shall furnish and install locate wiring on all Horizontally Directionally Drilled (HDD) water mains and water services 2 inches and larger. Locate wires must be attached to HDD water mains and services with duct tape at maximum intervals of 10 feet along the pipeline. Locate wire shall be brought to grade within a valve box or locate wire station box. Locate wires shall be brought to grade at locate stations at each end of HDD water main installations. There is no maximum length interval for locating stations for HDD water mains unless specified by the Engineer. The Contractor shall furnish and install a minimum of two locate

wires on HDD water mains to help ensure a successful pull back with functioning locate wire. In a case where the locate wires do not function after the pull back the Contractor shall take any actions necessary as approved by the SJCUD to ensure the main is locatable. Locate wire shall be installed as detailed in the SJCUD standard details. Where possible, locate wires shall be installed on 5:00 and 8:00 positions on the HDPE water main. Underground connections or splices are prohibited and shall be brought to grade in either a valve box or locate station box.

### C. Testing Equipment

Testing technology shall include variable frequency controls, digital depth read-out, and tone continuity approved by SJCUD.

#### 1. Tester

Testing shall be performed by a person or company that has been certified by the manufacturer of the approved testing equipment as proficient in the use of the equipment and has six months experience in the use of the equipment including documented proof of past performance.

#### 2. Locate Wire Testing Requirements

Locate wiring shall be tested by the Contractor using a certified tester and approved testing equipment. The Certified Tester shall be pre-approved by SJCUD. The SJCUD field representative may elect to be present during the testing period. The Contractor shall provide the Certified Tester a copy of the project drawings. The technician shall trace the entire length of the installed wire and mark the location at 100-foot intervals along the route. The depth of pipe shall be tested at 200-foot intervals. The Certified Tester shall report where the pipe has less than the allowable minimum cover or more than the maximum allowable cover. All laterals shall be marked and recorded. A final Locate Wire Report shall be submitted to SJCUD for review and approval. The report shall include a signed statement from the certified tester which certifies that all installed wire was successfully sounded and traced with no open breaks. The report shall also include a copy of the project drawings which indicate all field notes, breaks found/repaired, depths and other applicable field remarks by the Certified Tester. A certified copy of the report and marked-up drawings shall be furnished prior to final acceptance of the project.

## **3.10 POTABLE WATER SYSTEM MATERIALS**

### **3.10.1 Potable Water Systems - General**

- A. This section includes materials and specifications for pipe, fittings, joints, corrosion protection, linings, coatings, pipe wraps, piping supports, locating wire, water meters and boxes, warranties, and testing for potable water systems.

- B. Pipe used in the SJCUD potable water systems shall be either polyvinyl chloride (PVC), ductile iron (DI) or high density polyethylene (HDPE). All HDPE pipes shall be upsized to provide the required internal diameter of PVC or DI pipe.
- C. All material shall be free from defects impairing strength and durability, shall be of the best commercial quality for the purpose specified and shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail. All materials coming in contact with potable water shall be NSF approved.
- D. The Contractor shall be responsible for all materials furnished and storage of same, until the date of substantial completion. He shall replace at his expense all materials found to be defective or damaged in handling or storage. The Contractor shall, if requested by SJCUD, furnish certificates, affidavits of compliance, test reports, or samples.
- E. SJCUD reserves the right to perform testing of any or all materials furnished for conformance to the standards, herein. SJCUD reserves the right to reject any materials which do not conform to these standards, or where in the opinion of SJCUD the methods of manufacture fail to secure uniform results acceptable to the requirements in the following standards.

### **3.10.2 Potable Water Main**

- A. Ductile Iron Pipe
  - 1. Size: 4 inch through 64 inch.
  - 2. Material: Centrifugally cast, grade 60-42-10 iron meeting requirements of AWWA C150, C151, and C111.
  - 3. Pressure Rating:
    - a. 4 inch through 12 inch: Pressure class 350.
    - b. 16 inch through 20 inch: Pressure Class 250.
    - c. 24 inch: Pressure Class 200.
    - d. 30 inch through 64 inch: Pressure Class 150.
  - 4. Lining: Cement mortar with no sealcoat per AWWA C104. Any type of lining shall be NSF61 approved.
  - 5. Exterior Coating - Below Ground
    - a. Standard - Asphaltic, one mil thick per AWWA C151.

- b. Polyethylene Wrap - Shall conform to AWWA C105, high density polyethylene, 4 mils thick (min.) laminated type or 8 mils thick (linear low density) type. Wrap shall include industrial standard repeatable message (Potable Water or Finished Water) blue color. Use in corrosive soil conditions as described in AWWA C105, Appendix A.
  6. Locate Wiring & Pipe Marking: Section 3.8 of this Manual shall apply.
  7. Joints:
    - a. Push-on - Bell and spigot, gasketed per AWWA C111.
    - b. Flanged - Per AWWA C110 and AWWA C115, ANSI B16.1. Class 125. Gaskets shall be rubber ring type, 1/8-inch thick. Bolts and nuts shall conform to Grade B ASTM A 307.
    - c. Restrained - Restrainers shall be ductile iron per AWWA C111 and ASTM A 536 as manufactured by Ebba Iron, Uni-Flange or manufacturer's standard with prior approval. Joints may also be restrained by a joint restraint gasket with stainless steel locking segments vulcanized into the rubber gasket. Gasket shall be rated for 250 psi per AWWA C111. Twist-off nuts shall be provided. Restrainer shall have a working pressure of 250 psi minimum with a safety factor of 2:1. When a pipe joint is restrained adjacent to a fitting, a harness type restraint device shall be used.
- B. Polyvinyl Chloride (PVC) Pipe
1. Size: 4 inch through 20 inch.
  2. Material: Class 12454 A or B material per AWWA C900, AWWA C905, ASTM D 1784, ASTM D 1785, and ASTM D 2241.
  3. Pressure Rating:
    - a. 4 inch through 12 inch: Class 150 (DR 18) per AWWA C900.
    - b. 16 inch through 20 inch: Pressure Rating 165 (DR 25) per AWWA C905.
  4. Locate Wiring & Pipe Marking: Section 3.8 of this Manual shall apply.
  5. Joints:
    - a. Push on: Bell and spigot, gasketed in accordance with ASTM D3139. Gaskets shall conform to ASTM F477.
    - b. Restrained: Restrainers shall be ductile iron per AWWA C111 and ASTM A 536 as manufactured by Ebba-Iron and Uni-Flange. When a pipe joint is restrained adjacent to a fitting, a harness type restraint device shall be used. Twist-off nuts shall be provided. Pressure rating shall be the same as PVC pipe.

### C. High Density Polyethylene (HDPE) Pipe

1. Size: 4 inch through 36 inch per AWWA C906.
2. Material: PE 3408 meeting cell classification 345464C per ASTM D3350.
3. Pressure Rating:
  - a. 4 inch through 12 inch: 160 psi (DR11)
  - b. 16 inch through 20 inch: 160 psi (DR11)
  - c. 24 inch through 36 inch: 160 psi (DR11) (HDD only)
4. Locate Wiring & Pipe Marking: Section 3.8 of this Manual shall apply. Blue permanent identification shall be provided by co-extruding multiple equally spaced color stripes into the pipe outside surface or by solid colored pipe shell.
5. Joints: Thermal butt-fusion (HDPE pipe to HDPE pipe) according to ASTM D3261 or mechanical adapter for valve, fitting, or dissimilar pipe to pipe connections.

### D. Steel Casing Pipe

1. Size: 14 inch through 66 inch.
2. Material: Steel casing shall be ASTM A139 Grade B, minimum yield strength of 35,000 psi. Casing pipe shall have minimum nominal diameter and wall thickness as shown on the table included on the standard detail in Part V of this Manual.
3. Wall Thickness: Meet the latest requirements of FDOT Standard Specification for Road and Bridge Construction and the American Railway Engineering Association Manual of Recommended Practice. See table included on the standard detail in Part V of this Manual.
4. Locate Wiring & Pipe Marking: Section 3.8 of this Manual shall apply. Pipe furnished by manufacturer shall be cast and machined at one foundry location to assure quality control.
5. Lengths: Full pipe length shall be provided with a minimum length of 8 feet.
6. Joints: Electric fusion (arc) welded by certified operators meeting the requirements of the American Welding Society Standard AWS D7.0 procedures and in accordance with AWWA C206. Field weld joints shall be tapered approximately 45 degrees.

7. Joint Coating: Wire brush welded joints and paint with Koppers Inertol Primer 626 or equal.
- E. PVC Casing Pipe: Casings shall be blue AWWA C-905 PVC (DR 25) and sized to accommodate the carrier pipe.
- F. Polyethylene Tubing (Water Services)
1. Size: 3 inch and smaller.
  2. Material: High density polyethylene (HDPE) with UV inhibitors, manufactured of PE 3408 in accordance with AWWA C901, ASTM D2239, ASTM D2737, and ASTM D3350.
  3. Pressure Rating: 200 psi (SDR9)(CTS)
  4. Locate Wiring & Pipe Marking: Section 3.8 of this Manual shall apply. Pipe shall be blue color and shall have the normal size, pressure ratings, NSF seal, manufacturer's name or trade mark, standard dimension ratio and ASTM specification labeled at intervals not to exceed four feet.
  5. Joints: Heat fusion according to ASTM D3261 or coupling per manufacturer's recommendations.
- G. Brass Pipe
1. Size: 4 inch and smaller
  2. Material: Schedule 40, Brass Pipe per ASTM B43-91
  3. Joints: Threaded
  4. Uses: Flushing hydrants, contaminated soils sites, and small diameter above ground applications.

### **3.10.3 Fittings**

- A. Ductile Iron Fittings
1. Ductile iron fittings shall have a minimum working pressure of 250 psi.
  2. Fittings shall conform to ANSI Specification A21.10 (AWWA C110), A21.11 (AWWA C111), A21.15 (AWWA C115) and/or A21.53 (AWWA C153):
    - a. Long body fittings shall normally be installed. Compact fittings shall be used when conditions so warrant.

- b. Fittings shall be UL/FM approved and shall conform to NSF Standard 61 as applicable. Fittings furnished by the approved manufacturer shall be cast and machined at one foundry location to assure quality control. Fittings shall have cast on them the pressure rating, nominal diameter of openings, manufacturer's name, foundry location, plant code, and degrees or fraction of the circle.
- c. All ductile iron fittings shall be externally coated and internally lined per ductile iron pipe specifications.

## B. Polyethylene Fittings

### 1. Polyethylene Mechanical Joint (MJ) Adapters

- a. Fittings shall be PE3408 HDPE, Cell Class 345464C per ASTM D3350
- b. Mechanical connections of HDPE pipe (4 inch through 24 inch diameter) to Ductile Iron or PVC piping, fittings, or valves shall be by a self-restraining, fusible mechanical joint adapter with or without an integral, internal stainless steel insert.
- c. Mechanical joint adapter shall be of the same SDR rating as the pipe.
- d. A stainless steel type insert is required for pipe sizes through 12 inch.
- e. Provide the mechanical joint adapter with longer tee bolts or stainless steel thread rods with nuts at the mechanical joint.

### 2. Electrofusion Couplings

- a. Polyethylene pipe may be joined using electrofusion couplings.
- b. Fittings shall be PE3408 HDPE, Cell Class 345464C per ASTM D3350.
- c. Electrofusion couplings shall conform to ASTM F1055.
- d. Fittings shall have a pressure rating equal to the pipe.
- e. All electrofusion couplings shall be suitable for pressure use per AWWA C906 with nominal burst value of 3.5 times the working pressure of the fitting.

### 3. Manufacturer's Quality Control

- a. Manufacturers used to supply pipe and fittings shall have an established quality control program. This program must verify cell classification properties of the material.
- b. The Contractor shall certify the cell classification properties of the material.
- c. Incoming polyethylene materials shall be inspected for density, melt flow rated, and contamination.

## C. Brass Fittings

1. Fittings for brass piping applications 4 inch diameter and smaller.



2. Minimum working pressure of 200psi.
3. Fittings shall conform to ANSI B16.15, ANSI B2.1
4. Fittings shall be threaded.

#### **3.10.4 Connectors**

##### **A. Flange Adapters**

1. Flange adapters shall be ductile iron manufactured to ASTM A536 standards.
2. Bolt circles and bolt holes shall meet ANSI B16.1.
3. Adapter flanges shall meet or exceed the test requirements of AWWA C900, ASTM D2241, and ASTM D1599.

##### **B. Pipe Couplings**

1. Couplings used to join two pieces of ductile iron pipe or PVC pipe shall be sized to match the outside diameter of the pipeline.
2. Transition couplings shall be used to join pipes of different outside diameters.
3. The coupling sleeve shall be manufactured of ductile iron conforming to ASTM A536 and coated with 14 mils of epoxy. Bolts shall be manufactured of high corrosion resistant metal and shall conform to ANSI A21.11 (AWWA C111). Gaskets shall be wedge-type and manufactured of virgin SBR. Installation of couplings shall be in accordance with manufacturer's recommendations.
4. Couplers and adapters for polyethylene pipe shall be brass conforming to AWWA C800 and shall be female IPT, pack joint, or compression nut.

##### **C. Full Circle Repair Clamps**

1. Full circle repair clamps shall have type 304 stainless steel shells, lugs, bolts, nuts, and washers as per ASTM A193, A194, and A240.
2. Gaskets shall be SBR per ASTM D2000.

### **3.11 POTABLE WATER SYSTEM INSTALLATION**

#### **3.11.1 Pipe Handling**

- A. Lifting or rigging tools shall not be used on the inside of any lined pipe or fitting during handling and installation. The handling and installation of pipe and fittings

- shall be done in such a manner as to prevent any damage occurring to pipe, the lining inside of pipes, machined surfaces, fittings and the exterior pipe coating. Liner manufactures recommendations shall be followed to repair any damaged pipe liners.
- B. If a pipe is visibly cracked it shall be rejected and removed from the site unless it appears that the crack does not continue internally to the pipe wall and SJCUD approves the repair of the pipe. The cracked portion plus at least 12 inches on both sides shall be removed using a power driven cut-off saw. All ends will be inspected for cracks and the Contractor shall form a ¼ inch bevel on all cut ends of the pipe.
  - C. If a fitting is cracked it shall be rejected and immediately removed from the site.
  - D. Any pipe or fitting which is suspected of being fractured due to improper handling or receiving a severe blow, regardless of if there is a visible crack, shall be rejected and removed from the site immediately.
  - E. Joint gaskets shall be stored in a clean, dark, and dry location prior to use.

### **3.11.2 Pipe Installation**

#### **A. General Requirements**

1. Water mains shall be constructed of the materials specified herein and as shown on the drawings.
2. Water mains shall be installed, cleaned, tested, disinfected, and have a satisfactory bacteriological survey performed per AWWA, FDEP, and SJCUD standards.
3. Ductile iron pipe shall be installed in accordance with AWWA C600.
4. All PVC C900/C905 pipe shall be laid in accordance with AWWA C605 and ASTM D2774.
5. Only suitable soils shall be utilized in the backfill operation up to 12 inches above the pipe.
6. The maximum joint deflection shall be limited to 80% of the pipe manufacturer's recommendation. All precautions shall be taken to prevent sand or other foreign material from entering the pipe during installation.
7. When the pipe installation is not in progress, the open ends of pipe shall be closed by a watertight plug or other method approved by SJCUD.
8. Pipe installation is prohibited when trench conditions (standing water, excess mud, etc.) or the weather is unsuitable for such work, except by approval of SJCUD.

9. The contractor shall coordinate utility locates with Sunshine State One-Call of Florida, Inc. prior to installation.
10. Any main that has its grade or joint disturbed after installation shall be removed and re-laid. All such re-installation and re-alignments are subject to re-inspection by both the Engineer and SJCUD prior to acceptance.

### **3.11.3 Water Main Separation Requirements**

Horizontal and vertical separations for new water main construction shall be in accordance with Chapter 62-555 of the FAC, which is included in Section 2.2.2 of this Manual.

### **3.11.4 Water Service Connections**

Water service connections shall comply with Section 3.5. In addition, all water service connections (new and taps into existing mains) shall have a brass corporation stop at the main and connected directly into the service saddle. All small diameter taps (2-inch and smaller) on water mains 6-inch and larger must have a minimum separation of 36 inches along the main being tapped from the nearest pipe joint or tap. Small diameter taps on 4-inch diameter mains or smaller must maintain a 5 foot separation from pipe joints or other taps. In no case shall there be more than three taps total along any 20 foot length of water main. A minimum 6-inch tap is required for transmission mains.

### **3.11.5 Water Services**

- A. The Contractor will furnish and install new water services in accordance with the plans and contract documents. Installation of long side services shall be in a manner approved by the SJCUD. Although boring is a permitted method of installation (when approved by the SJCUD), water jetting is not allowed. The open cut method may only be used when the entire roadway is being reconstructed. The SJCUD reserves the right to approve or disapprove all methods of installation of long side services.
- B. When a concrete curb is present, a 3-inch high “W” shall be etched or cut in the curb to designate the location of each service, otherwise the locations shall be marked in a method approved by the SJCUD. The area around the “W” on the curb shall be painted blue.
- C. New service piping with all necessary appurtenances between the water main and each existing or new meter shall be installed by the Contractor when:
  1. A new water main is installed.
  2. An existing water main is relocated or replaced.
  3. It is necessary due to a direct conflict with proposed construction.

- D. All residential water services from corp stop to curb stop shall be 1-inch HDPE or larger, as shown on the plans. A maximum of two ¾" water lines (after the meter) shall be served off one 1" water service.
- E. Customers that have reclaimed water service to their property shall have a straight single check valve compatible with yokes installed on the down stream side of the meter. Check valves shall be appropriately sized Ford Model HS91. Check valves shall be in-line accessible for ease of maintenance.

### **3.12 POTABLE WATER VALVES AND APPURTANCES**

#### **3.12.1 General**

All valves and appurtenances shall be supplied, installed and tested by the Contractor in accordance with the drawings and as herein specified. Unless otherwise specified any reference to Industry Standards will be to the latest revisions. All valves and appurtenances shall be products of well-established firms who are experienced and qualified in the manufacture of the product to be furnished.

##### **A. Rotation of Opening**

All valves shall open by turning counter clockwise (or to the left), when viewed from the stem.

##### **B. Extension Stems**

Extension stems shall be provided on all buried valves when the operating nut is deeper than 36 inches below the final grade. Sufficient stem extension shall be provided so that the nut will be no more than 36 inches below finished grade.

##### **C. Valve Markers**

In locations with curbs the valve location shall be marked with a "V" either cut or etched in the curb. In rural areas or locations without a curb along major collector/arterial roadway rights-of-way valves located outside of paved areas shall have an above ground marker. Markers shall be triangular flexible plastic posts as manufactured by Rhino Tri View Flex or approved equal. Markers shall be colored coded to match the service of the valve they are marking (Blue = Water, Green = Sewer, Purple = Reclaimed Water), and shall have reflective permanent decal with white font labeling the post as a valve marker. Markers shall extend a minimum of 3 feet above the ground and shall not be taller than 4.5 feet. Markers shall be installed in accordance with the standard detail drawing and per the manufacturer's recommendations.

### 3.12.2 Gate Valves

#### A. General

Gate valves twelve (12) inches and smaller shall be resilient seat gate valves and shall be designed for 250 psi minimum working pressure meeting AWWA C509. Gate valves shall have a clear waterway equal to the nominal diameter of the pipe. The operating nut or wheel shall have an arrow cast in the metal indicating the direction of opening. All valves shall open by turning the operating nut counter-clockwise. Each valve shall have the manufacturer's distinctive marking, pressure rating, and year of manufacture cast on the body. Prior to shipment from the factory, each valve shall be tested to a hydraulic pressure equal to at least 350 psi. Sealing mechanism shall provide zero leakage at the working pressure with the flow in either direction.

#### B. Buried Valves

Buried gate valves shall be ductile iron body bronze mounted meeting ASTM A536 or cast iron ASTM A126, Class B, rubber encapsulated, resilient seat, solid wedge, non-rising stem with operating nuts and adjustable valve boxes and covers. Operating nuts shall be two inches square. Resilient seat gate valves shall conform to applicable sections of AWWA Standards C509. All ferrous surfaces shall be coated inside and outside with a fusion bonded epoxy coating. Two stem seals shall be provided and shall be of the "O-ring" type. Stem nut shall be independent of the gate.

#### C. Above Ground Valves

Gate valves located above ground or inside structures shall be hand wheel operated, non-rising stem type with flanged ends.

#### D. Valve Joints

All gate valves shall have mechanical joint ends, flanged ends, or screw joints to fit the connecting pipe.

### 3.12.3 Butterfly Valves

#### A. General

All water mains 16 inches and larger shall use butterfly valves. Butterfly valves shall meet the requirements of the applicable classes of AWWA C504, Class 150A or B. Resilient seat butterfly valves with a rubber seat attached to the disc or securely attached and recessed into the valve body with a 90 degree open to shut rotation shall be used. Valves are required to be bubble tight in both directions of flow. Valves shall be installed in the horizontal position (with the stem parallel to the ground) with a valve operator.

#### B. Valve Bodies

Valve bodies shall be constructed of ductile iron conforming to ASTM A-536 or cast iron per ASTM A126, Class B. Buried valves shall have mechanical joint ends with corrosion resistant alloy steel or stainless steel nuts and bolts. Paint the exterior of the valve with two (2) coats of bituminous paint. Above ground valves shall be flanged in accordance with ANSI B16.1, Class 125. Flanged joints shall have hot-dip galvanized or stainless steel nuts, bolts and washers, painted to match color of pipe. Body thickness shall be in accordance with AWWA C504.

#### C. Valve Discs

Valve discs shall be constructed of Ni-Resist, Type 1 or ductile iron, ASTM A536, Grade 65-45-12 with stainless steel seating edges or cast iron ASTM A-126.

#### D. Valve Shafts

Valve shafts shall be "Stub Shaft" type or one piece extending full size through the disc bearings and shall be constructed of ASTM A276, type 304 stainless steel or high tensile steel with stainless steel shaft journals. Shaft diameters shall meet the requirements of AWWA C504 for Class 150B.

#### E. Valve Seats

Valve seats shall be of a natural rubber or a synthetic rubber compound. Valves 24 inches and smaller shall have bonded mechanically restrained seats molded in, vulcanized, and bonded into the valve body. Seat bond shall withstand 75 lbs. pull under test procedure ASTM D429, Method B. Valve seats on 30 inch diameter valves and larger shall be field adjustable and replaceable without dismantling operator, disc, or shaft and without removing the valve from the line. Adjustment shall be provided by heavy corrosion resistant retaining segments. Seats attached to the valve disc shall be held in place by a stainless steel, ASTM A296, Grade CF8, retaining ring. Cap screws through the rubber seat and the seat retaining ring shall be provided for adjustment of the rubber seat. The mating body seat shall be constructed of type 304 stainless steel.

#### F. Valve Bearings

Sleeve type-self-lubricating and corrosion resistant bearings shall be used on butterfly valves. The design load of the bearing material or 1/5 of the compressive strength of the bearing or shaft material shall not be exceeded.

#### G. Valve Operators

Manual valve operators shall be fully enclosed worm gear or traveling nut type. Units above ground shall be equipped with hand wheel operators and shall have an

indicator arrow for valve position. All buried butterfly valves shall be furnished with 2 inch AWWA nut operator with valve box and cover. Operator components shall withstand a pull of 200 lb. for hand wheel operators or an input torque of 400 ft. lbs. for operating nuts.

#### **3.12.4 Corporation Stops**

Corporation stops shall be required on all services and shall be manufactured from cast bronze in accordance with AWWA C800 in sizes 3/4 inch through 2 inches. The inlet connection shall be AWWA corporation stop thread or CC thread. The outlet connection shall be a pack joint outlet for polyethylene tubing. Corporation stops shall be installed directly into the service saddle. Use ¼ turn ball valves.

#### **3.12.5 Curb Stop**

Curb stops shall be manufactured from cast bronze in accordance with AWWA C800 in sizes 3/4 inch through 2 inches. Curb stop shall be full-port ¼ turn ball valve with stop, combined cap and tee, with lock wing cast on stop body and operating tee cap to provide for locking the stop in closed position. Curb stops utilizing poly tubing shall have an inlet connection with a pack joint by yoke connection. Curb stops that are 1.5 or 2 inch are to be flanged to connect directly to meter.

#### **3.12.6 Air Release Valves**

Air release valves shall be automatic float operated and shall be designed for air release or a combination air release/vacuum operation. Valve shall be cast iron body, cover and baffle; stainless steel float, orifice and linkage mechanism; and BUNA- N or VITON seat with stainless steel trim, in compliance with AWWA C-512. Install air release valve with double stainless steel band saddle and 2-inch brass ball valve. Fittings shall be threaded and be constructed of brass.

#### **3.12.7 Casing Leak Detectors**

Casing leak detectors shall be furnished and installed on all casings. Leak detector systems shall consist of a ¾ inch schedule 80 PVC piping that is either tapped into the top of the casing pipe with a service type saddle near the end of the casing pipe, or brought through the end of a casing through a custom link seal type casing end seal. The leak detector pipe shall be brought to the surface and terminated in a traffic rated meter box of sufficient size. The piping shall be terminated in the meter box in such a way that the vent pipe opening faces downward. Casing leak detector boxes shall be located at one end of the casing pipe and shall be placed outside of the roadway or any driveways. In the case where a casing pipe is not level, the leak detector system shall be installed at the higher end of the casing pipe. If the casing leak detector is located in an area where curbing exists, "LD" shall be carved in the curb closest/adjacent to the casing leak detector box. This "LD" shall be painted blue.

### 3.12.8 Fire Hydrants

#### A. General

Fire hydrants shall have a 5-1/4 inch valve opening, ductile iron body, fully bronze mounted, for 150 psi working pressure, complying with AWWA Standard C502. The inlet connection shall be mechanical joint type with harnessing lugs for 6-inch pipe. The hydrant foot shall be epoxy coated and have integral cast tie-back lugs. The integral shut-off valve shall be compression type opening against water pressure. Hydrant shall open by turning to the left (counter clockwise). The main valve seat and the threaded portion of the hydrant shall be bronze. The hydrant barrel drain valve and port shall be bronze. The hydrant barrel drain shall be actuated by operation of the main valve stem. The stem operating threads and thrust bearing shall be sealed by "O" rings and shall be provided with means for lubrication. The hose nozzles shall be bronze with National Standard fire hose coupling screw threads consisting of one, 4-1/2 pumper nozzle and two, 2-1/2 inch hose nozzles. The hydrant operating nut and nozzle cap nuts shall be 1-1/2 inch pentagonal. The nozzle caps shall be securely attached to the hydrant barrel by chains. The hydrant shall be "Traffic" type with a traffic flange or lugs and operating stem section at the ground level. Fire hydrants shall be of ample length for 3-1/2 foot bury depth.

#### B. Painting

All metal parts of the hydrant both inside and outside shall be painted, in accordance with AWWA C501. All inside surfaces and the outside surfaces below the ground line shall be coated with two (2) coats of asphalt varnish in compliance with NSF-61. The outside of the hydrant above the finished grade line shall be thoroughly cleaned and painted with one (1) coat of paint of a durable composition, and one (1) additional coat of chromium yellow with reflective white top and caps in accordance with St. Johns County Land Development Code. Paint shall be RUS-KIL enamel. Private fire hydrants shall be painted red with reflective white top and caps.

#### C. Installation

Hydrants shall be plumb and shall have their nozzles parallel with or at right angles to the curb, with the pumper nozzle facing the curb. Hydrants shall be set so that the lowest hose connection is a minimum of 18 inches above the surrounding finished grade. All hydrants shall be inspected in the field upon delivery to the job to insure proper operation before installation. The resetting of existing hydrants and moving and reconnecting of existing hydrants shall be handled in a manner similar to a new installation. Hydrant "gradelok" for offset adjustments may be utilized. Include pavement location markers per the St. Johns County LDC. A concrete pad using 3,000 psi concrete with nominal dimensions of six (6) inches thick and 16 inches square shall be used.



#### D. Location

Fire hydrants shall be located in the general location as shown on the drawings. Location of fire hydrants shall comply with the St. Johns County Fire Department Codes (and as amended).

### 3.12.9 Valve Boxes

#### A. General

1. The Contractor shall furnish, assemble, and install a valve box for each buried valve. Each valve box installed in unimproved condition areas shall be installed with a 24-inch square 6-inch thick concrete collar with #4 reinforcing rebar rings poured around the top of the valve box cover. The concrete shall have a minimum strength of 3000 psi. Concrete pad shall have flow line scribed on pad indicating direction of pipeline.
2. Grout shall be applied in the annular space between the valve box and concrete pad. The grout shall be placed in the entire 4 inch vertical annular area within the pad open hole space. The concrete pad shall be placed on compacted sand. The top of the concrete pad shall be level with the top of the cast iron valve box and level with grade.
3. A locator peg shall be installed under the concrete valve box pad on all SJCUD owned and operated valves. A 3 inch diameter bronze disc anchored in concrete shall be required for all valves. The bronze tag shall indicate service, size, type, number of turns to open and year installed. Where valves are approved to be installed in existing pavement (where concrete collar nut is required) the brass tag shall be affixed to the bottom of the valve box lid by epoxy or other approved method.

#### B. Valve Boxes

1. All buried valves shall have cast iron two-piece screw-type valve boxes. Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above finished grade. The barrel shall be two-piece, adjustable type, having 5-1/4 inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall have "WATER" cast into the top for all water mains.
2. Valve boxes shall be constructed to ensure that valve stems are vertical and the cast iron box has been placed over the stem with base bearing on compacted fill and top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. Contractor shall remove any sand or undesirable fill from valve box prior to final inspection. The top of the valve box lid and the inside of the top section of the valve box shall be painted blue for in-line valves

and yellow for fire hydrant isolation valves. The upper rim of the box for butterfly valves only shall be painted half blue and half white.

### **3.12.10 Water Meter Boxes**

- A. Following are the requirements for all potable water meter boxes:
1. Lids shall be manufactured in the color blue.
  2. No logo or text is required on the meter box lid.
  3. Lids shall have one 1¾" port per meter which will accommodate touch read or automated meter read (AMR) systems. Ports shall be drilled through the lid and have a recessed area for the touch read pad or AMR antennae to sit flush with the top of the lid.
  4. Lids shall not have a locking mechanism or be bolted down in the field.
- B. HDPE meter boxes and lids shall be used for residential services located along curbed residential road rights-of-way and within the right-of-way that are not paved or exposed to incidental traffic.
- C. Polymer concrete meter boxes and lids shall be used for residential and commercial services located in major or minor collector road rights-of-way (as defined in Appendix E of the St. Johns County LDC), state highway rights-of-way, paved areas (sidewalks, driveways), and unpaved areas potentially exposed to incidental traffic.
- D. Metal lids are not acceptable. Manufacturers for meter boxes and lids shall be as specified in Part IV of this Manual.

### **3.12.11 Backflow Prevention Devices**

- A. Reduced Pressure Type

The Reduced Pressure Principle Backflow Prevention Assembly shall be ASSE® Listed 1013 and supplied with full port ball valves on backflow prevention devices smaller than two inches. The main body and access cover shall be epoxy coated ductile iron (ASTM A 536 Grade B); the seat ring and check valve shall be NORYL™, the stem shall be stainless steel (ASTM A276); and the seat disc elastomers shall be EPDM. The checks and the relief valve shall be accessible for maintenance without removing the device from the line. The Reduced Pressure Principle Backflow Prevention Assembly shall be approved by SJCUD. All backflow prevention devices shall be fitted with adequate and well secured freeze protection insulation.

#### B. Reduced Pressure Detector Type

The Reduced Pressure Detector Backflow Prevention Assembly shall be ASSE® Listed 1047 and supplied with full port rising stem gate valves. The main body and access cover shall be epoxy coated ductile iron (ASTM A 536 Grade B), the seat ring and check valve shall be NORYL™; the stem shall be stainless steel (ASTM A 276); and the seat disc elastomers shall be EPDM. The checks and the relief valve shall be accessible for maintenance without removing the device from the line. The Reduced Pressure Detector Backflow Prevention Assembly shall be approved by SJCUD.

#### C. Double Check Type

The Double Check Backflow Prevention Assembly shall be ASSE® Listed 1015 and supplied with full port gate valves. The main body and access cover shall be epoxy coated ductile iron (ASTM A 536 Grade 4); the seat ring and check valve shall be NORYL™; the stem shall be stainless steel (ASTM A 276); and the seat disc elastomers shall be EPDM. The checks shall be accessible for maintenance without removing the device from the line. The Double Check Backflow Prevention Assembly shall be approved by SJCUD.

#### D. Double Check Detector Type

The Double Check Detector Backflow Prevention Assembly shall be ASSE® Listed 1048 and supplied with full port gate valves. The main body and access cover shall be epoxy coated ductile iron (ASTM A 536 Grade 4); the seat ring and check valve shall be NORYL™ (NSF Listed); the stem shall be stainless steel (ASTM A 276); and the seat disc elastomers shall be EPDM. The first and second check valves shall be accessible for maintenance without removing the device from the line. The Double Check Detector Backflow Prevention Assembly shall be approved by SJCUD.

### 3.13 WASTEWATER FORCE MAIN MATERIALS

#### 3.13.1 Wastewater Force Main - General

- A. This section includes materials and specifications for pipe, fittings, joints, corrosion protection, linings, coatings, pipe wraps, piping supports, locating wire, and testing. SJCUD will review and approve plans for wastewater force mains and extensions only when such mains are designed and constructed in accordance with the criteria set forth in this manual.
- B. The specifications cover the pipe, fittings, and accessory items used for wastewater force main systems. Pipe used in the SJCUD wastewater force main systems shall be either polyvinyl chloride (PVC), ductile iron (DI) or high density polyethylene (HDPE). All HDPE pipe shall be upsized to provide the required internal diameter of PVC and DI Pipe.

- C. The Contractor shall be responsible for all materials furnished and storage of same. The Contractor shall replace at his expense all materials found to be defective or damaged in handling or storage. The Contractor shall, if requested by the SJCUD, furnish certificates, affidavits of compliance, test reports, or samples for review or analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.
- D. All material shall be free from defects impairing strength and durability, shall be of the best commercial quality for the purpose specified and shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

### 3.13.2 Force Main

Wastewater force main pipes shall be made of polyvinyl chloride (PVC), ductile iron (DI) or high density polyethylene (HDPE) and shall meet the following specifications. Use of DI for force mains shall be approved by the SJCUD on a case by case basis.

#### A. Polyvinyl Chloride (PVC) Pipe

1. Size: 4 inch through 36 inch.
2. Material: Class 12454 A or B material per AWWA C900, AWWA C905, ASTM D 1784, ASTM D 1785, and ASTM D 2241. Pipe shall be virgin polyvinyl chloride (PVC) pipe for force main.
3. Pressure Rating:
  - a. 4 inch through 12 inch: Class 100 (DR 25) per AWWA C900.
  - b. 16 inch through 24 inch: PR 165 (DR25) per AWWA C905.
  - c. 30 inch through 36 inch: PR 165 (DR25) per AWWA C905.
4. Joints:
  - a. Push on: Bell and spigot, gasketed in accordance with ASTM D3139. Gaskets shall conform to ASTM F477.
  - b. Restrained: Restrainers shall be ductile iron per AWWA C111 and ASTM A 536 as manufactured by Ebba-Iron and Uni-Flange. When a pipe joint is restrained adjacent to a fitting, a harness type restraint device shall be used. Twist-off nuts shall be provided. The pressure rating shall be no less than the PVC pipe restrained.
5. Locate Wiring & Pipe Marking: Section 3.8 of this Manual shall apply.

6. Unless specified on the plans, all PVC pipe shall have a minimum working pressure rating of 100 psi and shall have a dimension ratio (DR) of 25.

#### B. Ductile Iron Pipe

Use of ductile iron pipe for force mains shall be approved by the SJCUD on a case by case basis. Ductile iron pipe and fittings shall conform to the requirements of ANSI/AWWA C151/A21.51. Glands for mechanical joints shall be of ductile iron or cast iron. All ductile iron pipes shall be marked with the pressure rating, thickness or pressure class, nominal pipe diameter, weight of pipe, manufacturer, and length. Ductile Iron Pipe shall conform to the following:

1. Size: 4 inch through 54 inch.
2. Material: Centrifugally cast, grade 60-42-10 iron meeting requirements of AWWA C150, C151, and C111.
3. Pressure Rating:
  - a. 4 inch through 12 inch: Pressure class 350.
  - b. 16 inch through 20 inch: Pressure Class 250.
  - c. 24 inch: Pressure Class 200.
  - d. 30 inch through 64 inch: Pressure Class 150.
4. Exterior Coating - Below Ground:
  - a. Standard - Asphaltic, one mil thick per AWWA C151.
  - b. Polyethylene Wrap – Shall conform to AWWA C105, high density polyethylene, 4 mils thick (min.) laminated type or 8 mils thick (linear low density) type. Wrap shall include industrial standard repeatable message (Sanitary Water) green color. Use in corrosive soil conditions as described in AWWA C105, Appendix A.
5. Interior Lining: All ductile iron pipes and fittings shall have interior lining. Lining material shall be amine cured novalac epoxy coating at least 20% by volume of ceramic quartz pigment, with a minimum dry thickness of 30 mils. Lining material shall be applied by a competent firm with a successful history of applying linings to the interior of ductile iron pipe and fittings.
  - a. Approved coatings: Protecto 401 Ceramic Epoxy, or SJCUD approved-equal.
6. Cathodic Protection: Cathodic protection may be required for pipeline protection on the following:
  - a. Subaqueous crossings.
  - b. Aerial crossings.

- c. Where other existing utilities are known to be cathodically protected and crossed by ductile iron pipe.

7. Joints:

- a. Push-on - Bell and spigot, gasketed per AWWA C111.
- b. Flanged - Per AWWA C110 and AWWA C115, ANSI B16.1. Class 125. Gaskets shall be rubber ring type, 1/8-inch thick. Bolts and nuts shall conform to Grade B ASTM A 307 (exposed conditions only).
- c. Restrained - Restrainers shall be ductile iron per AWWA C111 and ASTM A 536 as manufactured by Ebba Iron, Uni-Flange or manufacturer's standard with prior approval. Joints may also be restrained by a joint restraint gasket with stainless steel locking segments vulcanized into the rubber gasket. Gasket shall be rated for 250 psi per AWWA C111. Twist-off nuts shall be provided. Restrainer shall have a working pressure of 250 psi minimum with a safety factor of 2:1. When a pipe joint is restrained adjacent to a fitting, a harness type restraint device shall be used.

C. High Density Polyethylene (HDPE) Pipe

High density polyethylene pipe shall conform to the following:

1. Size: 4 inch through 36 inch per AWWA C906
3. Size: 3 inch and smaller per AWWA C901.
4. Material:
  - a. Per ASTM D3350 and AWWA C906 for pipe 4 inches through 36 inches use material designated as PE 3408 meeting cell classification 345434C per.
  - b. Per ASTM 2737 for pipe less than 4 inches use material of Type III or IV, Category 4 or 5, Grade P34 and Class C per ASTM D1248.
5. Pressure Rating (CTS)
  - a. 2 inch and smaller: 200 psi (DR9),
6. Pressure Rating (IPS):
  - a. 3 inch: 160psi (DR11).
7. Pressure Rating (DIPS):
  - a. 4 inch through 12 inch: 160 psi (DR11)
  - b. 16 inch through 20 inch: 160 psi (DR11)
  - c. 24 inch through 36 inch: 160 psi (DR11) (HDD only)

8. Locate Wiring & Pipe Marking: Section 3.8 of this Manual shall apply. Green permanent identification shall be provided by co-extruding multiple equally spaced color stripes into the pipe outside surface or by solid colored pipe shell. Name of pipe manufacturer, nominal pipe size, dimension ratio, and the letters PE followed by the polyethylene grade in accordance with ASTM shall be continuously indented printed on the pipe or spaced at intervals not exceeding five (5) feet.
9. Joints: Thermal butt-fusion (HDPE pipe to HDPE pipe) or electrocoupling according to ASTM D3261 or mechanical adapter for valve, fitting, or dissimilar pipe to pipe connections...
10. All HDPE pipe shall be upsized to provide the required internal diameter of PVC and DI Pipe.

#### D. Steel Casing Pipe

Steel casing pipe should meet requirements as specified in 3.10.2.

#### E. Small Diameter Pipe

##### 1. 2" Force Mains

- a. Only HDPE, CTS, SDR 9, colored GREEN will be allowed; no PVC piping. HDPE pipe supplied shall minimize the number of joints by the use of HDPE rolls.
- b. Connections between ends of the force main shall be accomplished using brass pack joint, compression type fittings or approved heat fusion techniques.
- c. Connection between the 2" force main and the main force main (if manifolded) shall be accomplished using a typical 2" Stainless Steel service saddle with 2" RS Threaded Gate Valve.
- d. Valves located between the pump station and end of the main shall be 2" RS Threaded Gate Valve with 2" operating nut. Adapters to connect the valve to the force main shall be either stainless steel or brass and shall be iron pipe thread pack joint type fitting. Typical valve boxes and concrete pads shall be installed as per our normal details.
- e. All pressure tests and flushing procedures remain in effect for this size.
- f. Connections into a manhole shall be made via a cored hole towards the bottom of the manhole, no higher than 12" above the top of sewer mains, opposite the exit invert. Manhole flow channels and benches shall be formed and/or reconstructed to provide smooth flow for the force main discharge. The cored hole shall be made watertight via methods and materials approved by the SJCUD.

## 2. 3" Force Mains

- a. Only HDPE, IPS, SDR 11 colored GREEN will be allowed; no PVC Piping. HDPE pipe supplied shall minimize the number of joints by the use of HDPE rolls.
- b. Fittings shall be DI, restrained joint, Protecto 401 coated.
- c. Valves shall be 3" Mechanical joint RS Gate valve with restrained joints; gate valves shall conform to existing SJCUD standards, including 2" operating nut.
- d. Connections to a force main shall be accomplished using standard DI, restrained joint Protecto 401 coated fittings or stainless steel tapping sleeves.
- e. All pressure tests and flushing procedures remain in effect for this size.
- f. Connections into a manhole shall be made via a cored hole towards the bottom of the manhole, no higher than 12" above the top of sewer mains, opposite the exit invert. Manhole flow channels and benches shall be formed and/or reconstructed to provide smooth flow for the force main discharge. The cored hole shall be made watertight via methods and materials approved by the SJCUD.

### **3.13.3 Fittings**

#### A. Ductile Iron Fittings

1. Fittings shall have cast on them the pressure rating, nominal diameter of openings, manufacturer's name, foundry location, plant code, and degrees or fractions of the circle. Cast letters and figures shall be on the outside body of the fitting.
2. Ductile iron fittings shall have a minimum working pressure of 250 psi.
3. Fittings shall conform to ANSI Specification A21.10 (AWWA C110), A21.11 (AWWA C111), A21.15 (AWWA C115), and/or A21.53 (AWWA C153):
  - a. Long body fittings shall normally be installed. Compact fittings shall be used when conditions so warrant.
  - b. Fittings shall be UL/FM approved and shall conform to NSF Standard 61 as applicable. Fittings furnished by the approved manufacturer shall be cast and machined at one foundry location to assure quality control. Fittings shall have cast on them the pressure rating, nominal diameter of openings, manufacturer's name, foundry location, plant code, and degrees or fraction of the circle.
  - c. All ductile iron fittings shall be externally coated and internally lined per ductile iron pipe specifications.

#### B. Polyethylene Fittings



1. Polyethylene Mechanical Joint (MJ) Adapters
  - a. Fittings shall be PE3408 HDPE, Cell Class 345464C per ASTM D3350
  - b. Mechanical connections of HDPE pipe (4 inch through 24 inch diameter) to Ductile Iron or PVC piping, fittings, or valves shall be by a self-restraining, fusible mechanical joint adapter with or without an integral, internal stainless steel insert.
  - c. Mechanical joint adapter shall be of the same SDR rating as the pipe.
  - d. A stainless steel type insert is required for pipe sizes through 12 inch.
  - e. Provide the mechanical joint adapter with longer tee bolts or stainless steel thread rods with nuts at the mechanical joint.
  
2. Electrofusion Couplings
  - a. Polyethylene pipe may be joined using electrofusion couplings.
  - b. Fittings shall be PE3408 HDPE, Cell Class 345464C per ASTM D3350.
  - c. Electrofusion couplings shall conform to ASTM F1055.
  - d. Fittings shall have a pressure rating equal to the pipe.
  - e. All electrofusion couplings shall be suitable for pressure use per AWWA C906 with nominal burst value of 3.5 times the working pressure of the fitting.
  
3. Manufacturer's Quality Control
  - a. Manufacturers used to supply pipe and fittings shall have an established quality control program. This program must verify cell classification properties of the material.
  - b. The Contractor shall certify the cell classification properties of the material.
  - c. Incoming polyethylene materials shall be inspected for density, melt flow rated, and contamination.

### **3.13.4 Valves**

#### **A. General**

Iron bodied resilient wedge gate valves with non rising stems meeting the specifications of AWWA 509 shall be used. The design working water pressure 200 psig for 2 inches through 12 inches shall be 200 psig and 150 psig for 16 inches through 30 inches.

#### **B. Valve Construction**

1. Valves shall be furnished with end connections as shown on the plans. Flanged valves shall be faced and drilled in accordance with ANSI B16.1, Class 125. Mechanical joint ends shall meet AWWA C111, Class B.

2. Valve bodies shall be of ASTM A126, Class B gray iron compliance with AWWA C509. All exposed nuts, bolts, springs, washers, etc. shall be zinc or cadmium plated.
3. In the full open position the waterway shall have a diameter equal to or greater than the full nominal diameter of the valve.
4. Resilient seats shall be bonded or mechanically attached to the gate. Resilient seats shall seat against a corrosion resistant surface. The surface may be either metallic or nonmetallic, applied in a manner to withstand the action of the line fluids and the operation of the sealing gate during long-term service. A metallic surface shall have a corrosion resistance equivalent to or better than bronze. A nonmetallic surface shall be in compliance with ANSI/AWWA C550. The resilient sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

#### C. Valve Testing

Gate valves shall be tested in accordance with AWWA C509. Each valve shall meet the performance, leakage, and hydrostatic tests described in AWWA C509. The reports covering proof of design testing as described in AWWA C509 shall be submitted.

#### D. Actuators

Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floor stands, etc. as indicated on the plans. All valves 6 inch and larger shall be equipped with gear actuators. All gearing shall be enclosed in a semi steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. All actuator shafts shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. All exposed nuts, bolts, and washers shall be zinc or cadmium plated. Valve packing adjustment shall be accessible without disassembly of the actuator.

#### E. Valve Boxes

All buried valves shall have cast iron two-piece screw-type valve boxes. Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above finished grade. The barrel shall be two-piece, adjustable type, having 5-1/4 inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall have "SEWER" cast into the top for all force mains.

2. Valve boxes shall be constructed to ensure that valve stems are vertical and the cast iron box has been placed over the stem with base bearing on compacted fill and

top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. Contractor shall remove any sand or undesirable fill from valve box prior to final inspection. The top of the valve box lid and the inside of the top section of the valve box shall be painted green.

### **3.14 WASTEWATER FORCE MAIN INSTALLATION**

#### **3.14.1 Pipe Handling**

Care shall be taken in the handling and laying of pipe and fittings to avoid damaging or scratching the pipe or coating. Any lined pipe and fittings shall be handled only from the outside of the pipe and fittings. If damaged, the material shall be repaired in accordance with the liner manufacturer's recommendations. Mechanical hoist or other approved methods shall be used in the handling. No forks, chains, straps, hooks, etc. shall be placed inside the pipe or fittings for lifting, positioning, or laying.

#### **3.14.2 Pipe Installation**

##### **A. General Requirements**

1. Force mains shall be constructed of the materials specified in Section 3.13 of this Manual and as shown on the drawings.
2. All PVC C900/C905 pipe shall be laid in accordance with AWWA C605. The Contractor shall haul the pipe and appurtenances to the site of the work and distribute them neatly along the trench route prior to laying. Pipe shall be inspected and cleaned prior to lowering into the trench. Pipe and appurtenances shall be kept clean and open ends securely plugged. Precautions shall be taken to prevent dirt or other extraneous material from entering the pipe during installation. No pipe shall be installed when trench conditions (standing water, excess mud, etc.) or the weather (rain, etc.) is unsuitable for such work, except by permission of SJCUD.
3. Any section of pipe already laid which is found to be defective or damaged shall be replaced with new pipe. Any pipe that has its grade or joint disturbed after installations shall be removed and re-laid. All such re-installation and or re-alignment are subject to re-inspection by both the Engineer and SJCUD prior to acceptance.

##### **B. Pipe Cover**

The minimum and maximum cover over force mains shall be 30 inches and 36 inches respectively in unpaved areas and 36 inch and 42 inch respectively in paved areas or as required by FDOT or railroad rights-of-way.

The Contractor shall investigate any conflicts which may require readjustments and notify the Engineer and SJCUD if a conflict is discovered.

#### C. Installation of PVC Piping

PVC pipe shall be installed based on manufacturer's requirements. Adapters shall be furnished and installed as necessary when connections are made to other types of pipe. Lubrication used for pipe and fittings joints shall be nontoxic.

#### D. Installation of Ductile Iron Piping

Installation shall be performed in accordance with AWWA C600 and manufacturer's requirements. Where required, polyethylene encasement shall be installed as set forth under AWWA C105

#### E. Installation of HDPE Piping

HDPE pipe shall be installed in accordance to manufacturer's requirements. A qualified joining technician as designated by the pipe manufacturer shall perform all butt heat fusion joints.

HDPE pipe shall be installed either by Open Trench Construction or Directional Drill Method as outlined in Section 3.6 of this Manual. Under no circumstances shall the pipe or accessories be dropped into the trench or forced through a directional bore upon "pull-back." The pipe shall be joined by the method of butt heat fusion, as outlined in ASTM D2657. All joints shall be made in strict compliance with the manufacturer's recommendations.

### 3.14.3 Force Main Separation Requirements

Horizontal and vertical separations for new force main construction shall be in accordance with Chapter 62-555 of the FAC, which is included in Section 2.2.2 of this Manual.

### 3.14.4 Force Main Connections

All connections to existing facilities shall be made in accordance with Section 3.5 of this Manual. The SJCUD does not typically permit connection of force mains to manholes. However, if an exception is made, force mains shall connect to an existing manhole no more than one foot above the flow line of the receiving manhole.

## 3.15 PIPE MATERIAL FOR GRAVITY SEWERS

### 3.15.1 General

- A. This section includes materials and specifications for pipe, fittings, joints, corrosion protection, linings, coatings, pipe wraps, piping supports, locating wire, and testing.

SJCUD will review and approve plans for gravity sewer systems and extensions only when such mains are designed and constructed in accordance with the criteria set forth in this manual. The specifications cover the pipe, fittings, and accessory items used for gravity sewer systems.

- B. The Contractor shall be responsible for all materials furnished and storage of same. The Contractor shall replace at their expense all materials found to be defective or damaged in handling or storage. The Contractor shall, if requested by the SJCUD, furnish certificates, affidavits of compliance, test reports, or samples for check or analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.
- C. All material shall be free from defects impairing strength and durability, shall be of the best commercial quality for the purpose specified and shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.
- D. SJCUD reserves the right to perform testing of any or all materials furnished for conformance to the standards, herein. SJCUD reserves the right to reject any materials which do not conform to these standards, or where in the opinion of SJCUD the methods of manufacture fail to secure uniform results acceptable to the requirements of the following standards.

### 3.15.2 Pipe Materials

#### A. PVC

##### 1. 15 Inch Diameter and Smaller

- a. In accordance with ASTM D3034, SDR 35 or SDR 26.
- b. Joints: Integral bell and spigot, in accordance with ASTM D3212.
- c. Minimum uniform pipe stiffness at five percent deflection shall be 46 psi.
- d. Cell Classification: 12454 B or 12454 C, as defined by ASTM D1784.
- e. Fittings: SDR 35 minimum wall thickness.
- f. Gaskets: Factory fabricated rubber compression type with solid cross section in accordance with ASTM F477. Lubricant for joining pipe as approved by pipe manufacturer.

##### 2. 18 Inch through 27 Inch Diameter

- a. In accordance with ASTM F679, SDR 35.
- b. Joints: Integral bell and spigot, in accordance with ASTM D3212.
- c. Minimum Pipe Stiffness: 46 psi when tested in accordance with ASTM D2412.
- d. Cell Classification: Minimum 12454 C, as defined by ASTM D1784.

- e. Fittings: Wall thickness no less than wall thickness of equivalent size of pipe.
  - f. Gaskets: Factory fabricated rubber compression type with solid cross section conforming to ASTM F477.
3. All PVC pipe shall bear the NSF-DW seal. The minimum standard length of pipe shall be thirteen feet.
  4. All PVC pipe installed at a depth greater than ten (10) feet shall be SDR 26.
- B. Ductile Iron (DI)
1. Conform to ASTM A746.
  2. Determine proper thickness class to use based on laying condition and depth of backfill.
  3. Minimum Pressure Class: 150.
  4. Joints: Push on with rubber gaskets conforming to AWWA C111. Lubricant for joining pipe as approved by pipe manufacturer.
  5. Fittings: Ductile iron conforming to AWWA C110, lined and coated same as pipe.

C. Steel Casing Pipe

Steel casing pipe should meet requirements as specified in Section 3.10.2.

### 3.15.3 Lining for Ductile Iron Pipe

A. Polyethylene

1. 40 mil nominal ultraviolet resistant compound consisting of a blend of high and low density polyethylene powder conforming to ASTM D1248 carbon black and inert filler.
2. Bond to interior of pipe and fittings by heat.
3. Preheat pipe in furnace (to ensure uniformity of heat distribution) to an adequate temperature to provide uniform fusing of polyethylene powders and to provide bonding to pipe and fittings.
4. Lining shall cover interior surface from plain or beveled end to rear of gasket socket.
5. Coat ends and exterior of ends to a point 1 inch outside gasket position with minimum 8 mil dry film thickness coal tar epoxy.

**B. Ceramic Epoxy**

1. 40 mil nominal lining consisting of ceramic particle reinforced novolac epoxy.
2. Line interior of bell and exterior of spigot in joint sealing areas with 6 to 10 mils of specified lining.
3. Surface Preparation: SP10 near white abrasive blast.
4. Pinhole Detection: 2,500 volts minimum over 100 percent of lined surfaces.

**C. Polyethylene Wrap and Tape for Ductile Iron Pipe Exterior Corrosion Resistance**

1. Polyethylene Wrap: 8 mils, minimum thickness, conforming to AWWA C105.
2. Adhesive Tape: Thermoplastic pressure sensitive; minimum thickness of 8 mils; minimum width of 1 inch.

**3.15.4 Connectors****A. Pipe Couplings**

1. Couplings used to join two pieces of ductile iron pipe or PVC pipe shall be sized to match the outside diameter of the pipeline.
2. Transition couplings shall be used to join pipes of different outside diameters.
3. The coupling sleeve shall be manufactured of ductile iron conforming to ASTM A536 and coated with 14 mils of epoxy. Bolts shall be manufactured of high corrosion resistant metal and shall conform to ANSI A21.11 (AWWA C111). Gaskets shall be wedge-type and manufactured of virgin SBR. Installation of couplings shall be in accordance with manufacturer's recommendations.

**B. Full Circle Repair Clamps**

1. Full circle repair clamps shall have type 304 stainless steel shells, lugs, bolts, nuts, and washers as per ASTM A193, A194, and A240.
2. Gaskets shall be SBR per ASTM D2000.

### **3.16 INSTALLATION OF GRAVITY SEWERS**

#### **3.16.1 General**

- A. All gravity sewer pipes shall be installed in a Trench via Open Cut construction methodology. Gravity sewer pipe installation via directional drill technology is not allowed.
- B. Alternate trenchless technology such as jack & bore and micro-tunneling may be allowed only on a case by case basis.

#### **3.16.2 Pipe Preparation and Handling**

- A. Lifting or rigging tools shall not be used on the inside of any lined pipe or fitting during handling and installation. The handling and installation of pipe and fittings shall be done in such a manner as to prevent any damage occurring to pipe, the lining inside of pipes, machined surfaces, fittings and the exterior pipe coating. Liner manufactures recommendations shall be followed to repair any damaged pipe liners.
- B. If a pipe is visibly cracked it shall be rejected and removed from the site unless it appears that the crack does not continue internally to the pipe wall and SJCUD approves the repair of the pipe. The cracked portion plus at least 12 inches on both sides shall be removed using a power driven cut-off saw. All ends will be inspected for cracks and the Contractor shall form a ¼ inch bevel on all cut ends of the pipe.
- C. If a fitting is cracked it shall be rejected and immediately removed from the site.
- D. Any pipe or fitting which is suspected of being fractured due to improper handling or receiving a severe blow, regardless of if there is a visible crack, shall be rejected and removed from the site immediately.
- E. Joint gaskets shall be stored in a clean, dark, and dry location prior to use.

#### **3.16.3 Gravity Sewer Main Separation Requirements**

Horizontal and vertical separations for new gravity sewer pipe construction shall be in accordance with Chapter 62-555, FAC, which is included in Section 2.2.2 of this Manual.

#### **3.16.4 Sewer Abandonment**

Gravity sewer abandonment of SJCUD mains within the boundaries of road, alley, highways and utility easements shall be performed as follows:

- A. Transfer all existing service and lateral connections to new sewer mains prior to classifying any sewer as abandoned



- B. All abandoned sewer mains where called for on drawings as approved by SJCUD shall be either sealed or filled.
  - 1. Seal all pipe ends and each break in the pipe with class C concrete or concrete grout and rubble extending at least one foot into the pipe.
  - 2. Fill pipes with cement-grout by pumping into the low end of the main. Prior to filling pipe cleaning of mains to remove sand and other debris is required.

### **3.16.5 Testing and Inspection of Gravity Sewers**

#### A. General

All gravity sewers shall be tested for alignment, deflection and integrity prior to acceptance. In addition, a leakage test may be required for gravity sewers, solely at the discretion of the SJCUD. The leakage testing shall be performed by the Contractor who shall be responsible for furnishing all necessary labor and equipment to conduct such testing. Alignment, deflection and integrity testing shall be performed by the Contractor with the Engineer and an authorized SJCUD representative as witnesses.

#### B. Gravity Piping

- 1. Perform testing after service connections, manholes, and backfilling have been completed between stations to be tested.
- 2. Determine groundwater level at time of testing by exploratory holes or other method acceptable to SJCUD.
- 3. Pipe 42 inches diameter and larger: Joint testing device may be used to isolate and test individual joints.

#### C. Hydrostatic Test for Gravity Sewers

##### 1. Testing Equipment Accuracy

Equipment used for hydrostatic testing of gravity sewers shall have an accuracy of plus or minus 0.5 gallon water leakage under specified conditions.

##### 2. Maximum Allowable Leakage

The maximum allowable leakage rate during a hydrostatic test of gravity sewers is 0.16 gallons per hour per inch diameter per 100 feet. Include service connection footage in test section, subjected to minimum head specified.

##### 3. Gravity Sanitary Piping

Test with 15 feet of water to include highest horizontal vent in filled piping. Where vertical drain and vent systems exceed 15 feet in height, systems shall be tested in 15 foot vertical sections as piping is installed.

#### D. Defective Piping Sections

All defective pipe sections that do not meet testing requirements shall be repaired or replaced as approved by the SJCUD. All repaired/replaced piping sections shall be retested and be required to meet specifications herein.

#### E. Pneumatic Test for Gravity Sewers

Permeable and non-permeable pipe may require different allowable times for specified pressure drop. Because air is compressible and therefore a safety hazard, the air test shall not be used on pipe larger than 24 inches in diameter or on pipe that is more than 4 feet below the water table. All testing shall be in accordance with ASTM F1417.

##### 1. Equipment

- a. Calibrate gauges with standardized test gauge at the start of each testing day. The EOR and an authorized representative of SJCUD will witness calibration.
- b. Install gauges, air piping manifolds, and valves at ground surface.
- c. Provide pressure release device, such as rupture disc or pressure relief valve, to relieve pressure at 6 psi or less. With an internal pressure of 6 psi and a test pressure 4 psi greater than external hydrostatic pressure the water table must not be greater than 4 feet above the crown of pipe.
- d. Restrain plugs used to close sewer lines to prevent blow off.

##### 2. Procedure

- a. Require that no person enter manhole where pipe is under pressure.
- b. Slowly introduce air into pipe section until internal air pressure reaches 4 psi greater than average back pressure of groundwater submerging pipe.
- c. Allow 2 minutes minimum for air temperature to stabilize.

##### 3. Allowable Leakage

Test section will be considered defective when time required for pressure to decrease from 3.5 to 2.5 psi greater than average back pressure of groundwater submerging pipe is less than that computed utilizing values from following table:

<b>Pneumatic Test - Allowable Leakage*</b>					
<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>
<b>Pipe Diameter (Inches)</b>	<b>Time per Foot up to Length in Col C (Seconds)</b>	<b>Test Length (Feet)</b>	<b>Test Time for any Length Between Col C &amp; E (Min:Sec)</b>	<b>Length at Which Time in Col F Applies (Feet)</b>	<b>Time per Foot for Total Length (Seconds)</b>
4	0.18	636	1:54	1,114	0.10
6	0.40	424	2:50	743	0.23
8	0.71	318	3:47	557	0.41
10	1.11	255	4:43	446	0.63
12	1.60	212	5:40	371	0.91
15	2.50	170	7:05	297	1.42
18	3.62	141	8:30	248	2.06
21	4.92	121	9:55	212	2.81
24	6.42	106	11:20	187	3.67

EXAMPLE: 15-inch diameter pipe:  
 For 150 feet, T = 2.50 sec (Col B) x 150 ft = 375 sec = 6:15  
 For 250 feet, T = 7:05 (Col D)  
 For 500 feet, T = 1.42 sec (Col F) x 500 ft = 710 sec = 11:50

\*Based on 0.003 cfm per square foot with a minimum significant loss of 2 cfm and a maximum loss of 3.5 cfm.

#### F. Defective Piping Sections

All defective pipe sections that do not meet testing requirements shall be repaired or replaced as approved by the SJCUD. All repaired/replaced piping sections shall be retested and be required to meet specifications herein.

#### G. Inspection for Alignment, Deflection and Integrity

All sewer lines shall be television inspected with audio and a nine point go-no-go mandrel in front of the camera. Prior to final acceptance, the County shall be provided with one copy of the TV inspection report and video cassette showing the entire length of gravity sewer being tested. The report shall contain the condition of pipe, type of pipe, depth, location of services, length, type joint, roundness, and distance between manholes. Any pipe found to be cracked, leaking, misaligned, bellied or otherwise defective shall be removed and replaced at the Contractor's cost.

Lamping inspection will be allowed on a case by case basis as approved by SJCUD. The Contractor is to thoroughly flush and clean the gravity sewer system prior to lamping and TV inspection. Lines will be lamped between manholes and other structures for alignment, obstructions, and deflection. Results of the lamping may

require further inspection by TV camera as determined by the SJCUD. All costs for this additional inspection will be the responsibility of the Contractor.

Prior to repair or replacement of failed sewer pipe, the method of repair or replacement shall be submitted to the SJCUD for approval. Pressure grouting of pipe or manholes shall not be considered an acceptable method of repair.

All inspections must be completed prior to placing pavement.

### **3.17 MANHOLES**

#### **3.17.1 General**

- A. Precast concrete manholes shall be Type 2 Cement and conform to specifications for Precast Reinforced Concrete Manhole Sections, ASTM Designation C478, except as otherwise specified herein.
- B. Cast iron manhole frames and covers shall conform to standard specifications for grey iron castings, ASTM A48 Class 30B.
- C. Each section of precast manholes shall be marked with manufacturer's name or trademark, ASTM designation, manufacturing serial number, date of manufacture, manhole total length, and installation assistance marks.
- D. A manhole will be considered a junction manhole when three or more sewer lines connect into the structure or when a force main discharges into the structure. A receiving manhole is defined as the manhole before the wet well of a pump station. All precast concrete junction and receiving manholes shall have an interior coating specifically designed to resist hydrogen sulfide based corrosion. The coating shall be agru sure grip, SpectraShield, SewperCoat, or other concrete protective liners approved by the SJCUD. In addition, all manholes shall have an exterior joint wrap material applied, such as "Rub-R-Nek" or other approved equal.

#### **3.17.2 Precast Concrete Sewer Manholes**

- A. General
  - 1. The minimum wall thickness shall be 5 inches. Precast concrete manholes shall be constructed with a precast monolithic base structure as shown on the standard drawings. The minimum base thickness shall be 8 inches.
  - 2. Precast concrete top slabs shall be used where cover over the top of the pipe is less than 4ft. Lift rings or non-penetrating lift holes shall be provided for handling precast manhole sections. Non-penetrating lift holes shall be filled with non-shrink grout after installation of the manhole sections.

3. Concrete surfaces shall have oil, curing compounds, dust, dirt and other interfering materials removed by brush or sand blasting and shall be fully cured prior to the application of any coatings. Interior surfaces of manholes shall have a protective epoxy coal tar coating with a minimum dry mil thickness of 16 mils. Exterior surfaces shall have a protective epoxy coal tar coating with a minimum dry mil thickness of 9 mils. Coatings shall be applied in two (2) applications by the manhole manufacturer in strict accordance with the paint manufacturer's recommendations.
  4. Junction manholes and wet wells shall be coated with calcium alumina mortar, agru sure grip, SpectraShield or approved equivalent in accordance with 3.12.4.
- B. Material
1. Concrete for manholes shall be Type II, 4000 psi curing for 28 days. Barrel, top and base sections shall have tongue and groove joints.
  2. All jointing material shall be a cold adhesive preformed flexible joint sealant, conforming to ASTM C990, such as Ram-Nek, or equal.
  3. Sections shall be cured by an approved method for at least 28 days prior to painting and shall not be shipped until at least 2 days after having been painted.
- C. Design Specifications
1. Riser Sections:
    - a. Minimum 48 inches in diameter.
    - b. Fabricate in accordance with ASTM C478.
    - c. Minimum Wall Thickness: 5 inches or 1/12 of the inside diameter, whichever is greater.
    - d. Top and bottom shall be parallel.
    - e. Joints shall be tongue-and-groove type.
  2. Cone Sections:
    - a. Provide concentric cones for manholes with a diameter of 60 inches or less. Eccentric cones may be used for manholes with a diameter greater than 60 inches with the approval of or as directed by SJCUD.
    - b. Same wall thickness and reinforcement as riser section.
    - c. Top and bottom shall be parallel.
  3. Base Sections and Base Slab:
    - a. The base section shall have a base slab that is integral with sidewalls.
    - b. Fabricate in accordance with ASTM C478.

4. Manhole Extensions
  - a. Concrete grade rings shall have a maximum height of 6 inches.
  - b. Fabricate in accordance with ASTM C478.
5. Source Quality Control:
  - a. All test specimens shall be mat tested and meet permeability test requirements of ASTM C14.
  - b. Conduct tests at point of manufacture prior to delivery of any section.
  - c. Sections to be tested will be selected at random from stockpiled material to be supplied for the project.

### **3.17.3 Corrosion Resistant Liner**

#### **A. General**

The Work described within details a complete program for precast concrete manhole structure liners. This Section details the methods, procedures, materials and equipment as required to produce “A Total System for Concrete Structures.” The completed system will provide a corrosion-resistant liner to prevent deterioration from hydrogen sulfide and other corrosive gases/acids within the wastewater stream.

#### **B. Special Guarantee**

The manufacturer warrants the repairs and CCI Spectrum, Inc. for SpectraShield and La Farge calcium aluminates for SewperCoat liner against failure for a period of 10 years.

1. “Failure” will be deemed to have occurred if the protective coating fails to prevent the internal damage or corrosion of the structure or protect the substrate and environment from contamination by effluent.
2. If any such failure occurs within 10 years of initial completion of work by the manufacturer on a structure, the manufacturer will repair the damage and restore the coating at no cost to the Owner within 30 days after written notification of the failure.
3. “Failure” does not include damage resulting from mechanical or chemical abuse or by an act of God. Mechanical or chemical abuse means exposing the coated surfaces of the structure to any mechanical force or chemical substance not customarily present or used in connection with structures of the type involved.
4. The manufacturer makes no warranties express or implied other than those specifically stated in this Section.

C. Materials and Equipment (SpectraShield by CCI Spectrum INC.)

1. The materials to be utilized in the lining of concrete structures shall be designed and manufactured to withstand the severe effects of hydrogen sulfide in a wastewater environment. Manufacturer of corrosion protection products shall have lone proven experience in the production of the coating products utilized and shall have satisfactory installation record.
2. Abrasive blasting equipment shall be suited to completely remove deteriorated concrete and hard contaminants from the existing concrete surfaces. A containment unit to capture spent abrasive material shall be provided. Spent abrasive material shall be removed and disposed by the Contractor.
3. Equipment for installation of lining materials shall be high quality grade and be as recommended by the manufacturer.
4. The lining system to be utilized for concrete manhole structures shall be a multi-component stress panel liner system as described below:

a. Liner:

**Installation**

Moisture Displacement Barrier  
 Moisture Barrier  
 Surfacer  
 Final Corrosion Barrier

**Liner**

Primer  
 Modified Polymer  
 Polyurethane/Polymeric Blend Foam  
 Modified Polymer

b. Primer shall be 100 percent solids.

c. Modified polymer shall be sprayable, solvent-free, two-component polymeric, moisture/chemical barrier specifically developed for the corrosive environment of wastewater.

<b>TYPICAL CHEMICAL ANALYSIS</b>	
<b>“A” Component</b>	
Viscosity, 77 degrees F, cps, ASTM D11638	300 - 400
Physical State	Liquid
Color	Clear to Amber
Hygroscopicity	Reacts with water
<b>“B” Component</b>	
Viscosity, 160 degrees F, cps, ASTM D1638	400 - 600
Physical State	Liquid
Color	Flamingo Pink
Non-Volatile	100 Percent

REACTION PROFILE	
(100 grams, 175 degrees F Sample)	1-2
Tack Free Time, seconds	15
Cure Time, seconds	30

PROCESSING	
A System/B System, volume ratio	1.00/1.00

TYPICAL PHYSICAL PROPERTIES	
Tensile Strength, PSI	>1,500
Elongation, Percent	125
Tear Strength, PSI	350
Shore D Hardness	55-65
100 percent Modulus, PSI	>1,500

- d. Polyurethane/Rigid structure foam, low viscosity two-component, containing fire retardants.

TYPICAL CHEMICAL ANALYSIS	
"A" Component	
Viscosity, 77 degrees F, cps, ASTM D11638	200
Physical State	Liquid
Color	Dark Brown
Hygroscopicity	Reacts with water and evolves CO <sub>2</sub> gas
"B" Component	
Viscosity, 77 degrees F, cps, ASTM D1638	600 - 1000
Physical State	Liquid
Color	Tan
Hygroscopicity	Absorbs water rapidly thus changing ratio

REACTION PROFILE	
(100 grams, 77 degrees F Sample)	
Cream Time, seconds	1 to 4
Tack Free Time, seconds	5 to 8
Rise Time, seconds	6 to 10
Processing A system/B system Volume Ratio	1.00/1.00

TYPICAL PHYSICAL PROPERTIES	
Density, nominal, core, lbs/ft <sup>3</sup> ASTM D1622 @ 74 degrees F	4 - 10
Compression Strength, ASTM D1621 @ 74 degrees F parallel to rise; PSI	90 - 150
Closed Cell Content, Percent - ASTM D1940 @ 74 degrees F	Over 90
Shear strength, PSI, ASTM C-273 @ 74 degrees F	225 - 250



- e. Total thickness of multi-component stress panel liner shall be a minimum of 500 mils.

### 3.17.4 Materials and Equipment (SewperCoat by LaFarge)

1. SewperCoat furnished under this Specification shall be a prepackaged mortar mix, including all cement, aggregates, and any required additives. It is the intent of this Specification that the Contractor only be required to add the proper amount of potable water so as to produce concrete suitable for pneumatic application. Typical package weights shall not be less than 50 pounds and shall be identical for all material furnished on this Project.
2. The chemical composition of the cement portion as well as the aggregates of the mortar mix shall be as follows:

Al <sub>2</sub> O <sub>3</sub>	CaO	FeO + Fe <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>
39-44%	35-39%	9-14%	5-7%

3. The Design Properties of the Mortar Mix shall be as Follows:

Compressive Strength (ASTM C495)	> 7,000 psi	24 hours
	> 9,000 psi	28 days
Flexural Strength (ASTM C293)	> 1,200 psi	24 hours
	> 1,400 psi	28 days
Splitting Tensile Strength (ASTM C496)	> 800 psi	24 hours
Bond Strength/Slant Shear (ASTM C882)	> 1,600 psi	28 days
Shrinkage at 28 days (ASTM C596)	< 0.06% cured @ 90% relative humidity	
Freeze/Thaw after 300 Cycles (ASTM C666)	No visible damage after 300 cycles	

4. The mortar mix shall be SewperCoat as manufactured by Lafarge Calcium Aluminates.
5. Mortar mix must have at least 5 years of successful performance in similar applications and be supplied by an ISO 9002 approved manufacturer.
6. In addition, the mortar mix shall be designed to withstand long-term exposure to a bacterially corrosive hydrogen sulfide environment that may be expected to produce a pH of 1 on normal Portland Cement concrete or typical brick and mortar surfaces.
7. Water used in mixing shall be fresh, clean, potable water, free from injurious amounts of oil, acid, alkali, vegetable, sewage and/or organic matter. Water shall be considered as weighing 8.33 pounds per gallon.
8. Mortar mix shall be stored with adequate provisions for the prevention of absorption of moisture. It shall be stored in a manner that will permit easy access for inspection and identification of each shipment.

- E. Surface Preparation: In accordance with manufacturer's recommendations.
- F. Material Installation:
  - 1. Application of multi-component system shall be in strict accordance with manufacturer's recommendations. A permanent identification number and date of work performed shall be affixed to the structure in a readily visible location.
  - 2. Provide final written report to Owner/Engineer detailing the location, date of report, and description of repair.

### **3.17.5 Manhole Accessories**

#### **A. Cast Iron Sewer Manhole Frames and Covers**

##### **1. Castings**

- a. Castings shall be tough, close-grained gray iron, sound, smooth, clean, free from blisters, blowholes, shrinkage, cold shuts, defects and any other pouring faults.
- b. Cast Iron shall meet the specifications of ASTM A48 Class 30B.
- c. Ductile Iron shall meet the specifications of ASTM A536, Grade 60 40 12.
- d. Plane or grind bearing surfaces to ensure flat, true surfaces. Seating surfaces between frames and covers shall be machined to fit true. No plugging or filling will be allowed.
- e. Lifting or pick holes shall be provided, but shall not penetrate the cover.
- f. All manhole frames and covers shall be traffic bearing to meet AASHTO H-20 loadings.
- g. Frames shall be suitable for the future addition of a cast iron ring for upward adjustment of top elevations.

#### **B. Covers**

- 1. Manhole covers shall be true and seat within ring at all points with the word sewer in 2 inch raised letters. All manhole covers shall be traffic bearing to meet AASHTO H-20 loadings.
- 2. In certain locations (ie. flood prone areas) bolt down covers and gasketed covers shall be provided.

#### **C. Inspections**

- 1. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the SJCUD. Such inspection may be made at the place of manufacture and at the site after delivery. Complete manholes and any section thereof shall be subject to rejection on account of failure to conform to any specifications found or referred to herein; even though

sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for rejection and removed from the job immediately. All sections which have been damaged after delivery will be rejected and, if already installed, removed and replaced, entirely at the Contractor's expense.

2. At the time of inspection, the sections will be carefully examined for compliance with the specified ASTM designation and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch-strength" blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.

### **3.17.6 General Installation Specifications**

#### **A. Excavation and Backfill**

Excavation and backfill for the installation of manholes shall be in accordance with general construction requirements and those listed in Section 3.3 of this Manual.

#### **B. Castings**

1. Castings shall be fully bedded in mortar with adjustment brick courses placed between the frame and manhole. Bricks shall be a minimum two and maximum four courses. Mortar shall conform to ASTM C-270, type M, and the bricks shall be clay and conform to ASTM C-216, grade SW, size 3 1/2" (w)x 8: (L)x 2 1/4" (h).
2. Top of manhole castings located in pavement, shouldered areas, and sidewalks shall be set flush with grade. Top of manhole castings located outside these areas shall be placed 2" above grade.

#### **C. Drop Assembly**

1. Extend pipe from the drop to a minimum of 3 feet beyond the manhole excavation into the trench, and connect to sewer pipe with an adapter.
2. Support lower drop elbow with concrete monolithically-placed with manhole base.

#### **D. Flexible Joints**

1. Provide in pipe not more than 1 1/2 feet from manhole walls.
2. Where the last joint of pipe is between 1 1/2 and 6 feet from manhole wall, provide flexible joint in manhole wall.

#### E. Stubouts for Future Connections

1. Provide same type and class of pipe as specified for use in service connection, lateral, main, or trunk sewer construction. Where there are two different classes of pipe at manhole use higher strength pipe.
2. Grout pipe in precast walls or manhole base to provide watertight seal or use flexible joints as specified herein.
3. The maximum allowable length of stubouts is 1-1/2 feet outside of manhole wall.
4. Construct invert channels as shown in drawings, with smooth and carefully shaped bottoms, built up sides and benching constructed, using cement and brick with no voids. Channels shall conform to the dimension of the adjacent pipe and provide changes in size, grade and alignment evenly. Cement shall be Portland Cement Type II only. Unless otherwise approved by SJCUD, match inside top elevation of service connection pipe to inside top elevation of outlet pipe.
5. Test Plugs
  - a. Install rubber-gasketed plugs in end of stubouts with gasket joints similar to sewer pipe being used.
  - b. Plugs shall withstand internal or external pressures without leakage.
  - c. Adequately brace plugs against all hydrostatic or air test pressures.

#### F. Sewer Manhole Abandonment/Removal

1. Prior to abandonment or removal of a sewer manhole ensure all service laterals and sewer mains connected to manhole have been removed from service or redirected to another sewer main and manhole.
2. Permanent Plugs: Clean interior contact surfaces of pipes to be cut off or abandoned as shown, and construct plug as follows:
3. Pipe 18 inches or less in diameter shall have a concrete plug in installed in the end which is at least 8 inches in length.
4. For pipes 21 inches and larger:
  - a. Construct plugs of common brick, concrete block, or concrete.
  - b. Plaster exposed face of block or brick plugs with mortar.
5. Plugs shall be watertight and capable of withstanding internal and external pressures without leakage.

### **3.17.7 Installation of Precast Manholes**

#### A. Concrete Base:

1. Cast-in-Place:
  - a. Cast-in-place bases shall be utilized only when specifically approved by the SJCUD and the Developer's Engineer of Record.

- b. Unless otherwise specified, cast-in-place bases shall be at least eight inches thick and extend at least six inches radially outside of the outside dimension of the manhole section.
- c. Vibrate to densify concrete and screed so first precast manhole section to be placed has a level, uniform bearing for full circumference.
- d. Deposit sufficient mortar on base to assure watertight seal between base and manhole wall, or place first precast section of manhole in concrete base before concrete has set. Properly locate and plumb first section.

2. Precast

- a. Place precast base on prepared bedding so as to be fully and uniformly supported in true alignment and making sure that all entering pipes can be inserted on proper grade. Properly locate, ensure firm bearing throughout, and plumb first section.

B. Manhole Sections

1. Carefully inspect precast manhole sections to be joined.
2. Thoroughly clean ends of sections to be joined.
3. Do not use sections with chips or cracks in the tongue.
4. Locate precast steps in line with each other to provide a continuous vertical ladder.
5. Precast manhole sections shall be handled by lift rings or non-penetrating lift holes. All lift holes shall be filled with non-shrink grout after installation of the manhole is complete.
6. The first precast section shall be placed and carefully adjusted to true grade and alignment. All inlet pipes shall be properly installed so as to form an integral watertight unit. The sections shall be uniformly supported by the base structure, and shall not bear directly on any of the pipes.
7. Precast sections shall be placed and aligned to provide vertical alignment with a ¼-inch maximum tolerance per five feet of depth. The completed manhole shall be rigid, true to dimensions, and watertight.

C. Mortar Joints:

1. Thoroughly wet joint with water prior to placing mortar.
2. Place mortar on groove of lower section prior to section installation.
3. Fill joint completely with mortar of proper consistency.
4. Trowel interior and exterior surfaces smooth on standard tongue-and-groove joints.
5. Prevent mortar from drying out and cure by applying an approved curing compound or comparable approved method.
6. Do not use mortar mixed for longer than 30 minutes.
7. Chip out and replace cracked or defective mortar.
8. The completed manhole shall be rigid, true to dimensions, and watertight.

D. Preformed Plastic Gaskets (In lieu of mortar joints):

1. Use only pipe primer furnished by gasket manufacturer.
2. Install gasket material in accordance with manufacturer's instructions.
3. The completed manhole shall be rigid, true to dimensions, and watertight.

E. Rubber Gasketed Joints

1. Install in accordance with manufacturer's instructions.

F. Extensions

1. Provide on manholes in streets or other locations where a subsequent change in existing grade may be likely.
2. Install to height not exceeding 12 inches.
3. Lay grade rings in mortar with sides plumb and tops level.
4. Seal joints with mortar as specified for sections, and make watertight.

### **3.17.8 Cleaning and Inspection for Acceptance**

All newly constructed manholes shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulations at the time of final inspection. No visible leakage in the manhole or at pipe connections will be permitted. All manholes shall be inspected by SJCUD prior to acceptance. All manholes failing to meet the specifications set forth or referred to in this section shall be reconstructed or replaced by the Contractor to comply with these specifications. Pressure grouting of manholes is not an acceptable method of repair.

## **3.18 SEWER SERVICE LATERALS**

### **3.18.1 General**

A. Definition

Service connections shall be made via service laterals and appurtenances to connect the gravity sewer to the residence or establishment being served. A service lateral is a branch of gravity sewer constructed from the main gravity sewer to the right-of-way line or to a point established by the SJCUD.

B. Connections

Service laterals shall not discharge into a sanitary manhole, except at terminal manholes. The SJCUD reserves the right to approve/disapprove requested service, location and size of connections.

### C. Pipe and Fitting Materials

Pipe Materials for service laterals shall be PVC or ductile iron. One type of service connection pipe material shall be used throughout, no interchanging of pipe and fittings allowed. Long radius bends shall be used for changes in direction, unless approved otherwise by SJCUD. Service laterals shall be at least 6 inches in diameter and no longer than 100 feet in length with a minimum slope of one percent.

### 3.18.2 Installation

Service lateral connections shall conform to these specifications and standard drawings. All necessary approvals for service sewer construction shall be obtained prior to beginning work.

#### A. Service Connection Installation

1. In general, service connections shall extend to street or alley right of way line or easement line, or as directed by SJCUD.
2. A minimum slope of one foot per 100 feet (1%) shall be maintained in service laterals.
3. A minimum trench depth of 4 feet at property line or on private property within permanent sewer easement is required. The Developer's Engineer of Record will determine required depth at end of line in each case.
4. Unless otherwise approved by SJCUD, install service connection not more than 5 days after backfilling of sewer trench in block or equivalent 400 foot section of sewer.
5. Laying and Jointing of Service Connection Pipe and Fittings:
  - a. Maximum deflection permissible with any one fitting shall not exceed 45 degrees and shall be accomplished with long radius curves or bends. Short radius elbows or curves will not be permitted, except by permission of SJCUD.
  - b. Provide end of service connection line and fittings with standard watertight plug, cap, and stopper, suitably braced to prevent blow off during hydrostatic or air testing.
  - c. The first length of pipe out from tee on lateral or main shall not be greater than 3 feet in length.
6. Show locations, sizes, and depths of service connections on as-built drawings.
7. Line and Grade for Service Connection Pipe and Fittings:

- a. Lay pipe uniformly between tee or top of riser section and end of service connection. Where minimum slopes are used, lay pipe by means of good quality builder's level not less than 24 inches long.
8. Service connection markers shall be placed at end of service connection. Paint top portion of marker immediately after its installation with high quality, white, quick drying enamel. After paint has dried, use black, quick drying enamel and neatly indicate distance from natural ground surface to top of service connection pipe in feet and inches.

#### B. Termination of Service Laterals

SJCUD obligation ends at the service lateral clean-out, which shall be located five (5) feet outside the right-of-way line on the property. The exact location of each installed service lateral shall be marked by extending the clean out cap, which is to be painted in green, 18 inches above ground and by etching or cutting an "S" in the concrete curb. Water-tight factory made plugs shall be installed at the end of each service lateral. Upon completion of the service lateral tie-in connection to the facility, the extended clean out piping should be cut off to final finished grade.

#### C. Restoration, Finishing and Clean-Up

The Contractor shall restore all paved surfaces, curbing, sidewalks or other surfaces to their original condition in such manner as to meet the requirements established in this manual and St. Johns County Road Construction Specifications. All surplus material and temporary structures, as well as all excess excavation shall be removed and the entire site shall be left in a neat and clean condition.

### 3.19 RECLAIMED WATER PIPING MATERIALS & INSTALLATION

All reclaimed water main, valves, and appurtenances shall comply with the potable water specifications in Sections 3.11 and 3.12 and the Standard Details included in Part V of this Manual, except as noted below:

#### A. Pipe

All reclaimed water main shall be pantone purple 522C.

#### B. Valve Boxes

The valve tags and top of the valve covers shall read "RECLAIMED". The top side of all reclaimed water valve box lids and the inside of the top section of the valve box shall be painted pantone purple 522C. In addition, the upper rim of the box for butterfly valves only shall be painted half pantone purple and half white.



C. Meter Boxes

Meter box lids shall be painted pantone purple. The reclaimed water meter box shall be placed on the opposite side of the customer's property from the potable water meter box, unless otherwise approved by the SJCUD. The curb stops and corp stops shall be identified as reclaimed water.

D. Disinfection Requirements - Disinfection of materials and bacteriological clearance is not required for the reclaimed water system.

**-- End of Part III --**

## **PART IV: APPROVED MATERIALS**

Manufacturer & Model selected to designate desired features. To be considered equal, other manufacturers and models must include those standard features.

### Manufacturers for Gravity Sewer

Spec. No.	Item	Manufacturer*	Model
	Piping, PVC	All	
	Piping, DI	All	
	Piping, DI Lining		Protecto 401
	Fittings	All	Ductile Iron, Coated
	Manhole	All	
	Manhole Liner	SpectraShield, Agru-Liner, SewperCoat	
	Castings, Rim and Cover	All	
	MH Boots	All	
	Service Laterals and Fittings	All	

\*Note: Where "All" is used, the submitted manufacturer must still meet the specification requirements.

### Manufacturers for Force Main

Spec. No.	Item	Manufacturer*	Model
	Piping, HDPE	All	
	Piping, PVC	All	
	Piping, DI	All	
	Piping, DI Lining		Protecto 401
	Fittings	All	Ductile Iron, Coated
	ARVs	Val-Matic	Model 48A
	Air/Vacuum Valve	Val-Matic	Model 301A
	Gate Valves	Mueller	Model 2360
	Tapping Valves	M&H	Model 4751
	Tapping Sleeves	JCM	432, SS
	Valve Boxes	Clow	F2452
	Joint Restraints, DI	EBAA Iron	1100 Series
	Joint Restraints, PVC	EBAA Iron	2000 Series
	Bell Restraints, DI	EBAA Iron	1700 Series
	Bell Restraints, PVC	EBAA Iron	1500 Series
	Locate Wire	All	10 Gauge, 30 Mil
	Locate Pegs	Communication Tech	145.7 kHz, C9789
	Service Saddles	Ford	FC202

\*Note: Where "All" is used, the submitted manufacturer must still meet the specification requirements.

Manufacturer & Model selected to designate desired features. To be considered equal, other manufacturers and models must include those standard features.

### Manufacturers for Water Main

Spec. No.	Item	Manufacturer	Model
	Piping, HDPE	All	
	Piping, PVC	All	
	Piping, DI	All	
	Piping, DI Lining		Cement Lined
	Fittings	All	DI
	Water Service Line	All	HDPE SDR 9
	Corp Stops	Ford	F1000-3,4, FB1107
	Fittings	All	
	Curb Stops	Ford	B94-223W, B94-324W
	Service Saddles	Ford	FC202
	Meter Box, HDPE	Rhinobox DFW	MB 16, 17, or 18 36C-BLSM, 37C- BLSM, or DFW 38C- 14-BLSM
	Meter Box, Poly Conc	CDR Systems	Series 11x18 or 15x17
	Gate Valve	Mueller	2360
	Butterfly Valve	Mueller	B-3211-20
	Valve Boxes	Clow	F2452
	ARV	Val-Matic	Model 15A, 22
	Air/Vacuum Valve	Val-Matic	Model 100S
	Fire Hydrant	Mueller	Super Centurion A423
	Restrained Joints, DI	EBAA Iron	Series 1100
	Restrained Joints, PVC	EBAA Iron	Series 2000
	Bell Restraints, DI	EBAA Iron	Series 1700
	Bell Restraints, PVC	EBAA Iron	Series 1500
	Tapping Valves	Mueller	T2360
	Tapping Sleeves	JCM	Model 432, SS
	Locate Wire	All	10 Gauge, 30 Mil
	Locate Pegs	Communication Tech	145.7 kHz, C9789

\*Note: Where "All" is used, the submitted manufacturer must still meet the specification requirements.

-- End of Part IV --

## **PART V: STANDARD DETAILS**

**This section has been removed. Please see updated details at**

**<http://www.sjcfll.us/Utilities/DevelopmentGroup.aspx>**

## **PART VI: FORMS AND EXHIBITS**

**This section has been removed. Please see updated details at**

**<http://www.sjcfll.us/Utilities/DevelopmentGroup.aspx>**