Putnam County
Water and Sewer Standards Manual

For the Design and Construction of Water and Wastewater Systems

April 2007

Table of Contents

Table of Contents (Cont'd)

Table of Contents (Cont'd)

Table of Contents (Cont'd)

Table of Contents (Cont'd)

Table of Contents (Cont'd)

Table of Contents (Cont'd)

Table of Contents (Cont'd)

Table of Contents (Cont'd)

Table of Contents (Cont'd)

SECTION 1.0 - GENERAL CONDITIONS

1.1 GENERAL

The Minimum Standards set forth in this document are intended to provide basis for design that promote uniformity and quality of construction of potable water, wastewater and reuse systems. Users of these standards include contractors, developers, engineers and both public and private utilities. These standards shall be used in the design and construction of such systems that reside within the unincorporated area of Putnam County. Putnam County reserves the right to modify, change or require alternative Standards to these Standards at any time. These Standards shall be applied in cooperation with the Putnam County Land Development Code.

The County shall assume no responsibility for the design of improvements or for any material specified. Approval of the Plans and Specifications or use of the Minimum Standards does not relieve the Engineer of Record and/or Owner/Developer from his/her responsibility for providing a complete working system that does not adversely impact the operation of the existing system.

1.2 MATERIAL AND CONSTRUCTION STANDARD

All referenced standards (AWWA, ANSI, ASTM, NSF, etc.) are the latest revisions thereof. The County assumes no responsibility for standards developed by outside agencies. Note that these standards may not satisfy other agency requirements. Conflicts, technical error, typing errors etc. shall be deferred to the County in writing for resolution and the following precedence will apply: State and local ordinance, FDEP regulations, these standards, drawings and specifications.

1.3 COUNTY OWNERSHIP AND RESPONSIBILITY

The County's responsibility for ownership, operation and maintenance of water mains or water service lines shall end at the meter. Hydrant mains and hydrants shall be owned by the County, unless stated otherwise. Fire sprinkler mains shall be owned by the County to the backflow prevention device. Proper easements and testing are required by all County-owned facilities as described below.

The County will not be responsible for maintaining sewer services within private property. The County will not operate, maintain or acquire ownership of any on-site wastewater facility that is not constructed to the County standards. Responsibility for these mains or lift stations will reside with the owner/developer. Ownership and maintenance of all facilities shall be at the discretion of the County.

1.4 ENGINEER RESPONSIBILITY

It shall be the responsibility of the Engineer of Record to secure proper existing utility information, size facilities and prepare plans all in accordance with these minimum standards. The County may, at its option, apply more stringent standards where site specific conditions warrant. Copies of all design criteria and calculations shall be provided to the County.

1.5 CONSTRUCTION REVIEW

All construction plans shall be reviewed and approved by the County or its designated representative as indicated in Section 2.0 of this Manual. No changes shall be made on approved plans without specific County concurrence. The County will enforce the approved construction plans and specifications to a level equal to that of the minimum standards. The Developer shall be responsible for all costs associated with the review as indicated in Section 2.0 of this Manual.

1.6 COMMENCEMENT OF CONSTRUCTION

No construction shall start prior to a pre-construction conference with the County and its designated representative in attendance. While the County will make every effort to ascertain that the plans are in conformance with these standards, the right is reserved to enforce the minimum standards regardless. The County reserves the right to review shop drawings.

1.7 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.

ADMINISTRATOR – Means County Administrator.

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.

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 Putnam County Board of County Commissioners, Putnam County, Florida, and/or its designated representative(s).

DEPARTMENT – means Department of Public Works, Putnam County, Florida.

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 Public Works of Putnam 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 of 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 Putnam 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 recent 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.

REQUIREMENTS – means the minimum requirements contained in this Manual.

REUSE – see "Reclaimed Water".

SEWER – see "Wastewater System".

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.

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 Putnam County.

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

UTILITY (PUBLIC) – Any Utility owned or operated by Putnam 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 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, 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 a 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, material, equipment, supplies, services and other items necessary for the execution, completion and fulfillment of the contract.

1.8 EASEMENTS

Easements shall be of sufficient width to guarantee that structures are not placed closer than 10 feet to a facility or main. In addition, the easement will allow unhindered access to all such facilities and mains. For easements adjacent and parallel to a road right-of-way, a minimum 10 foot wide easement shall be provided. A minimum 12 foot wide easement shall be provided for single mains in open areas. A 15 foot wide easement will be necessary for a main that is not typically or easily accessible. A 30 foot wide easement will be necessary when multiple utilities (such as water and sewer) are placed parallel to each other. Wider or different easements may be required by the County when design conditions warrant. Easements shall be recorded by the owner/developer in a manner and at such time as directed by the County. Easements for lift stations shall be reviewed by the County or its designated representative. If the depth of the trench exceeds 5 ft, additional easements may be necessary.

1.9 OPERATION AND MAINTENANCE MANUALS

The Engineer of Record shall supply to the County four (4) complete sets of operation and maintenance manuals for all electrical and mechanical components including pumps, motors, control circuits, radios, sensors, meters, wiring diagrams, etc. An O&M manual must be provided for all lift station equipment and installed in the control panel (not part of the 4 sets to be supplied to the County).

1.10 OTHER AGENCIES

The Engineer of Record is hereby notified that approval of plans and specifications by the County for water, wastewater, and reuse systems does not relieve the Developer from obtaining approval by other agencies as may be required.

1.11 EXISTING FACILITIES

All taps, tie-ins, etc., to existing facilities shall only be completed within the presence of a County representative. All connections shall be made in accordance with approved plans and specifications as issued by the County.

1.12 COMMENCEMENT OF WORK

No construction work shall be started without approval by the County Public Works Director and by other interested agencies having jurisdiction. A pre-construction meeting shall be held a minimum of 48 hours prior to commencement of construction.

1.13 USE OF RIGHT-OF-WAY

Permission for use of right-of-way shall be obtained from the County and any other appropriate governing agency having jurisdiction. All required right-of-way use permits shall be obtained prior to construction. Owner is responsible for applying and obtaining all required permits. A copy of the permit must be maintained on the job site.

1.14 SAMPLING AND TESTING

Except as otherwise provided, sampling and testing of materials, and the laboratory methods and testing equipment used, when required, shall be in accordance with the latest published standards (including published tentatives) or methods of ASTM, (including published tentatives) or methods of ASTM, AASHTO, AWWA, or other such organizations recognized as authoritative for the type of test required.

1.15 LEGAL RESTRICTIONS AND PERMITS

The Contractor at all times shall observe and comply with all Federal, State, County, City, and other laws, codes, ordinances, and regulations in any manner affecting the conduct of the work. He shall further procure all permits and licenses, pay all charges and fees, and give all notices necessary and incidental to the due and lawful prosecution of the work. The Engineer will be responsible for City, County, State, Regional, and Federal permits.

1.16 PUBLIC CONVENIENCE AND SAFETY

Materials stored at the site of the work shall be so placed and the work shall at all times be so conducted as to cause no obstruction to vehicular or pedestrian traffic. No roadway shall be closed except by express permission of Putnam County or other authorized public agency having jurisdiction.

Precaution shall be exercised at all times for the protection of persons and property. The Contractor shall be responsible for safety on the job site. The safety provisions of applicable laws, building codes and construction codes shall be observed. Machinery, equipment and other hazards shall be guarded in accordance with the safety provisions of OSHA, the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America, and Maintenance of Traffic (MOT) Work Zone Safety Regulations required by FDOT.

1.17 PROTECTION OF PROPERTY

The Contractor shall not enter upon private property for any purpose without first obtaining permission, and he shall use every precaution necessary to prevent damage or injury to any public or private property, trees, fences, monuments, and underground structures, etc., on and adjacent to the site of the work. If work is to be performed in an easement on private property, then affected property owners will be notified 24 hours in advance of construction to provide ingress/egress to and from their property.

The Contractor shall not do any work that would affect any railway track, pipeline, telephone, power transmission line, or other utilities or structure, or enter upon the right-of-way or other land appurtenant thereto, until authority has been secured from the proper persons. Utility location agencies shall be given sufficient notice prior to construction in accordance with Underground Facility Damage and Protection Regulation FS 556.

The Contractor shall be responsible for all damage or injury to property resulting from any act, omission, neglect or misconduct in his manner or method or executing said work, from his non-execution of said work, or from defective work or materials, and he shall not be released from said responsibility until the work has been completed and accepted and the warranty requirements fulfilled.

1.18 RESTORATION OF PROPERTY

Responsibility: All damage as a result of construction work done to existing structures, wetland areas, roadway pavement, driveways, other paved areas, fences, utilities, traffic control devices, and any other obstruction not specifically named herein, shall be repaired, restored, or replaced by the Contractor unless otherwise specified.

When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, or in consequence of the non-execution thereof on the part of the Contractor, he shall restore such property, at his own expense, to a condition equal to or better than that existing before such damage or injury was done by repairing, rebuilding, or otherwise restoring, as may be directed, or he shall make good such damage or injury in a manner acceptable to the damaged or injured party.

Temporary Repairs: All damage named in above shall be at least temporarily repaired, restored, or replaced immediately following construction efforts at that location. Temporary restoration shall mean putting the affected area back into a safe, usable condition. In no case shall trenches remain open overnight within a street right-of-way unless specific approval is granted by the agency having jurisdiction.

Permanent Repairs: All damage named above shall be permanently repaired, restored, or replaced no later than the 30 calendar days following the completion of construction at that location unless otherwise stipulated. Permanent repairs will be accomplished in a professional workmanship-like manner in accordance with specifications contained herein, or contract documents, if addressed. The Contractor may be relieved of the 30-day time limit only by specific written agreement with the Director.

Putnam County Restitution: In the event that the Contractor fails to make the permanent repairs within the time specified above, Putnam County, at its option, will complete the repair, restoration, or replacement of the affected area to be accomplished. The costs of such work plus 20% will then be deducted either from the next pay request or from any other monies owed the Contractor by Putnam County.

Protection and Restoration of Easements on and/or Road Right-of-Way, and Private Property: During the course of construction, the Contractor shall take special care and provide adequate protection in order to minimize damage to vegetation, surfaced areas, and structures within the construction right-of-way, easement, or site, and take full responsibility for the replacement or repair thereof. The Contractor shall immediately repair any damage to the private property created by encroachment thereon. Should the removal or trimming of

valuable trees, shrubs or grass be required to facilitate the installation within the designated construction area, this work shall be done in cooperation with the appropriate agency having jurisdiction in the area in which the work takes place. Said valuable vegetation, removed or damaged, shall be replanted, if possible, or replaced by items of equal quality, and maintained until growth is reestablished. Topsoil damaged in the course of work shall be replaced with at least a four-inch layer of suitable material.

Following construction completion, the work area along the route of the installation shall be finish graded to elevations compatible with the adjacent surface, with grassing or hand-raking required within developed areas.

Sidewalk and Driveway Restoration: Existing sidewalks and driveways removed, disturbed, or destroyed by construction shall be replaced or repaired. Restoration shall be to the nearest joint, right-of-way line or road apron. The finished work shall, as a minimum, be equal in all respects to the original.

Cleanup: Work site cleanup and property restoration shall follow behind construction operations without delay. In order to facilitate an acceptable construction site, debris and waste materials shall be removed from the site daily and trenching length versus pipe laying shall be coordinated to preclude overnight trench opening. Construction site maintenance, along with on-going cleanup and final property restoration acceptance, shall be as directed and approved by the County or its designated representative or the State if necessary.

1.19 WORK IN STREETS

Traffic Control: The Contractor shall provide bypasses, crossings, and other means for the maintenance of one-way traffic in all streets, and two-way traffic wherever possible, in all streets where work is in progress. Construction operations shall be carried on only between those hours and days as required by the appropriate agency having jurisdiction, except for operations specified for alternate times or in cases of emergency. The Contractor shall plan and schedule his operations to impose the least possible interference with normal traffic flow. The Contractor is required to have a, County, or State approved traffic control plan for each situation which may occur during the course of construction. This applies to State-controlled right-of-way as well as County right-of-way. The traffic control plan must be submitted to the appropriate agency having jurisdiction for review and approval prior to start of any activity.

Guardrails and Barricades: The Contractor shall provide, erect, and maintain effective barricades, danger signals, and signs on all intercepted streets or highways and in other locations where required for the protection of the work and the safety of the public. Barricades or obstructions which encroach on, or, are adjacent to, public rights-of-way shall be provided with lights which shall be kept burning at all times between sunset and sunrise. Conformity with State, County, and local laws and regulations is required in the use of streets and highways. The Contractor shall be responsible for all damages resulting from any neglect or failure to meet these requirements. Watchmen shall be provided as required by local regulations or as necessary to fulfill the requirements stated herein.

Traffic and Services: Adequate means of access to all public and private properties during all stages of construction shall be provided. Unless approval in writing is secured from the appropriate agency having jurisdiction, there shall be no interruption of service to present customers of such utilities requiring repairs, changes, or modifications caused by the construction work.

Applicable Codes: The State of Florida Department of Transportation Roadway and Traffic Design Standards, Uniform Manual for Traffic Control Devices, and Putnam County Ordinances shall be followed as applicable.

1.20 DISRUPTION TO EXISTING SYSTEM OPERATIONS

The Contractor shall perform operations necessary for connecting to the existing system at times of minimum flow rate. Said operations shall be accomplished expeditiously in order to minimize service disruption. All schedules shall be coordinated with and approved by the County. A plan for connection shall be submitted to the County at a minimum of 72 hours prior to connection.

1.21 MINIMIZING SILTATIONS AND BANK EROSION

During all dewatering or other operations involving the use and disposal of water, suitable means shall be provided by the Contractor to minimize soil erosion, siltation, and sedimentation of natural or artificial ditches, drainage channels, streams, lakes, or other waterways. The Engineer must approve such means proposed by the Contractor prior to any dewatering, pumping, or other water-involved operations in above areas. If required, in the opinion of the Engineer, methods such as stilling basins, baffles, siltation basins, matting, spread-disposal, recharge pits, etc., shall be used by the Contractor to minimize siltation and bank erosion, with said methods in full compliance with Florida Department of Environmental Protection (FDEP), Suwannee River Water Management District (SRWMD) and St. Johns River Water Management District (SJRWMD) standards and requirements. Copies of all approved and applicable permits from Federal, State, and local agencies shall be in the possession of the Contractor prior to commencing any work.

1.22 SURVEY AND CONSTRUCTION STAKES

It shall be the responsibility of the Contractor to provide and set in place all construction stakes and marks for lines, grades and measurements necessary or required for the proper execution and control of the work. He shall be responsible for the accuracy and preservation of the stakes and marks. The plans shall also show or describe the reference points or monuments from which the Contractor shall lay out the work, and the Contractor shall scrupulously preserve these reference points. He shall immediately restore any damaged, dislodged, or lost reference points, at his expense.

1.23 BENCHMARKS AND MONUMENTS

The Contractor shall carefully maintain all benchmarks, monuments, and other reference points. Survey monuments or benchmarks which have to be disturbed by this construction work shall be carefully witnessed before removal and replaced upon completion of the work by a Professional Land Surveyor, registered in and by the State of Florida.

1.24 NAMEPLATES

Each piece of equipment shall be provided with a substantial nameplate of non-corrodible metal, securely fastened in place and clearly and permanently inscribed with the manufacturer's name, model or type designation, serial number, principal rated capacities, electrical or other power characteristics, and similar information as appropriate.

1.25 CHARACTER OF EMPLOYEES, SUPERINTENDENTS AND EQUIPMENT

Superintendents and Employees: The Contractor shall employ superintendents, supervisory personnel, and employees who are careful and competent. The County may demand the removal of any person or persons employed by the Contractor who is deemed incompetent, unsafe, or negligent in the proper performance of their duties, or neglect or refuse to comply with the directions given.

1.26 SANITARY PROVISIONS

The Contractor shall provide and maintain in a neat and sanitary condition, accommodations for the use of his employees as may be necessary to comply with the requirements and regulations of OSHA, State, local health department, or other agencies having jurisdiction.

1.27 CONFORMITY WITH PLANS AND ALLOWABLE DEVIATIONS

The entire installation and each part thereof shall be constructed in the position required, the finished surfaces of structures shall conform to the elevations and gradients specified, and all parts of both substructures and superstructures shall be in proper alignment and adjustment. The Contractor shall provide all frames, forms, falsework, shoring, guides, anchors, and temporary structures that may be required to assure these results. Any deviation from the plans and working drawings that may be required must have prior approval of the Engineer, and the Public Works Director.

1.28 SUBSTITUTIONS OR "APPROVED EQUALS"

Whenever a material or article required is specified or shown on the approved plans by using the name of the proprietary product or of a particular manufacturer or vendor, it shall be considered that this was done only for the purpose of establishing a standard of quality for the specified materials. Any material or article which will perform the function imposed by the general design will be considered equal and satisfactory, provided the County or its designated representative is assured the material or article so proposed is of like substance, form and function. Such substitutions shall not be purchased or installed without written approval from the County or its designated representative. Substitution may be restricted due to inventory control.

1.29 INSPECTION BY OTHER AGENCIES

The U.S. Environmental Protection Agency, the U.S. Department of Labor, the Florida Department of Environmental Protection, and other authorized governmental agencies having legal interest in the project shall have free access to the site for inspecting materials and work, and the Contractor shall afford them all necessary facilities and assistance for doing so. Any instructions to the Contractor resulting from these inspections shall be given through the County or its designated representative. These rights of inspection shall not be construed to create any contractual relation between the Contractor and these agencies.

1.30 DEFECTIVE AND UNAUTHORIZED WORK

All work that has been rejected or condemned shall be removed and replaced unless a repair is approved by the County or its designated representative. Materials not conforming to the requirements of the specifications shall be removed immediately from the site of the work and replaced with satisfactory material by the Contractor at his own expense.

Upon reasonable cause, due justification by, and at the request of the County, the Contractor shall, at any time before final acceptance of the work, remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore the said portions of the work to the condition required by the approved plans and specifications. If the work uncovered is rejected, then the Contractor is responsible for restoration, as well as repair.

Failure to reject any defective work or material during construction shall not prevent later rejection upon discovery prior to acceptance or obligate Putnam County to final acceptance.

1.31 WARRANTY

One-Year Warranty Period: If, within one year after the date of release of final payment by Putnam County or such longer period of time as may be prescribed by laws or regulations, or by the terms of any applicable special guarantee required by the contract documents, or by any specific provision of the contract documents, any work is found to be defective, the Contractor shall promptly, without cost to Putnam County and in accordance with written instructions from the County or its designated representative, either correct such defective work, or if it has been rejected, remove it from the site and replace it with nondefective work.

If the Contractor does not promptly comply with the terms of such instructions, Putnam County may have the defective work corrected or the rejected work removed and replaced, and all direct, indirect, and consequential costs of such removal and replacement (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals) will be paid by the Contractor. In special circumstance where a particular item of equipment is placed in continuous service before substantial completion of all the work, the warranty period for that item may start to run from an earlier date if so provided by the specifications or by written amendment.

Emergency Repairs: During the time that a utilities construction project is either under construction or under a warranty period, emergencies which arise must be handled as the situation dictates. In as much as each situation is unique due to time, place, and circumstance, the following guidelines will be used to the extent possible:

An emergency is defined as a situation which develops suddenly and demands immediate action to halt a worsening condition.

Upon notification of an emergency situation, The County Contractor will respond as rapidly as possible to bring the situation under control, i.e., to terminate the emergency.

The Contractor will be notified of the situation, as soon as practical by the County. Repairs which must be affected in the aftermath of an emergency are the responsibility of the Contractor.

Those non-emergency type repairs must be complete or at least in progress within seven (7) calendar days of notification by the County.

Any repairs accomplished under this section the County are subject to be billed to the Contractor. If circumstances warrant, notifications should be given to Emergency Operations Center – 911.

1.32 UTILITY EASEMENTS

For required minimum utility easements see Section 1.8 of these standards.

Sidewalks shall not be constructed within utility easements, unless approved in writing by Putnam County.

1.33 ACTIVATION OF NEW SERVICES

The following items are required by the County before activation of new services.

Letter of Certification from the Engineer, stating all lines or lift stations, etc., have been inspected, tested, and installed according to the Engineer's specifications and record. Show calculations and test results according to AWWA standards.

Verification from FDEP stating that the facilities have been approved and may be put into use.

A complete set of digital record drawings, three hard copy sets on 22" x 34" paper signed and sealed by the Engineer and/or Contractor, copy of all release of liens, and a final take-off and cost of construction quantities shall be submitted to the County prior to activation of new services. The record drawings shall be prepared using AutoCAD version 2005 or the latest edition available, compatible with the County and be in the State Plane Coordinates system.

Owner is required to make application for service, make payment of applicable fees, and execute a Utility Service Agreement, if applicable and provide a maintenance bond.

In addition, the County reserves the right at its own expense to video tape the mains.

Send complete package to: Putnam County, Public Works Department, P.O. Box 310, East Palatka, Florida 32131.

SECTION 2.0 – PLAN REVIEW, APPROVAL, CONSTRUCTION, AND ACCEPTANCE OF DEVELOPMENT AND REDEVELOPMENT PROJECTS

2.1 PRE-DESIGN CONFERENCE

It is recommended that each Developer or owner initiates a pre-design conference between himself, his engineer, and the County and the County's designated representative. A pre-design conference is mandatory for each development consisting of greater than 50 dwelling units and/or 100,000 square feet of commercial space.

2.2 LETTER OF AVAILABILITY

For developments that require the provision of water or wastewater and/or reclaimed water by a Central Utility Service provider a request for a letter of availability from the utility is required. 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 Putnam County requirements.

The commitment of water, wastewater, and/or reuse transmission and treatment capacity will be limited to the actual number of Equivalent Residential Connections (ERCs) committed by the County through issuance of Concurrency in the availability letter.

2.3 PLANS AND SPECIFICATIONS

2.3.1 General

All submitted plans shall be standard size sheet (22" x 34" or 11" x 17") 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 only be required when special facilities outside the scope of this Manual are proposed. All plan sheets and the title page of submitted specifications must be signed, sealed and dated by the Developers Engineer.

2.3.2 Master Plan Drawing

Whenever possible, the entire development or redevelopment of a parcel shall be shown on a single Master Plan Drawing. The Master Plan Drawing shall indicate the general locations of all streets, sidewalks, parks, mains, manholes, valves, hydrants, services and service laterals with respect to the proposed development improvements and the existing streets, sidewalks, parks, and water and wastewater systems.

2.3.3 Plan and Profile

All gravity sewers, wastewater force mains, water mains and reclaim mains shall be drawn in plan and profile.

Whenever possible, street layout and on-site water and wastewater systems shall be shown on the same plan sheet. As a minimum, the plan and profile drawings shall include the following information:

a. Provide general information on all sheets such as north arrow, names of designer and engineer, revision block with dates, graphic scale(s) and sheet number.

b. Plan and Profile drawings provide profile elevations at 100-ft interval, or more frequently if required by good design practice.
c. Profile sheets are required for gravity sewers (show all crossings. Profiles may be required for water and sewer mains.
d. Development layout with horizontal and vertical controls.
e. Provide all manhole locations and rim elevations for manholes outside of paved areas.
f. Provide all pipe data including size, lengths, material, and slopes.
g. Provide type and locations of fittings, valves, hydrants, air release/vacuum relief, and other related appurtenances.
h. Provide limits of pipe deflection.
i. Provide limits of special exterior coatings.
j. Provide limits of special bedding requirements.
k. Provide pipe restraint requirements.
l. Provide location(s) and general layout of wastewater pumping stations.
m. Provide construction notes regarding cover, horizontal and vertical control, special construction requirements, and references to standard and special details.
n. Use County details where applicable. Revise details as required for the specified Project.
o. Provide all applicable detail drawings.
p. Call out interferences with conflicting pipes with indication of "over" or "under" on plan sheet.
q. Place gravity sewer data, including manhole invert, rim elevations, and distances between manholes on Profile sheets.

2.3.4 Details

The plans shall include all applicable standard drawings as shown in Appendices 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.

2.3.5 Scale

The master plan drawings shall be prepared at a scale not to exceed 1" to 200'. Plan sheets shall not exceed a scale of 1"=40'. Vertical profiles shall be a maximum of 1"=4'. Profiles shall show elevations at 100' intervals as good practice.

2.4 REQUIRED DESIGN REVIEW SUBMITTALS

The Developer's Design Engineer/Engineer of Record shall submit the following drawings to the County or the County's designated representative for review. The developer shall be responsible for all costs incurred by the County for the review including outside engineering fees for the County's designated representative to attend the pre-design meeting, review the drawings, attend the pre-construction meeting and perform periodic construction inspections. The total number of these inspections shall be agreed upon prior to construction and shall consist of no less than one (1) visit per week during the length of construction. This is in addition to the Developer's Engineer or his designated representative making daily

inspection. The inspector shall provide the daily reports based on a weekly basis to the County for review.

The Developer shall prepare and submit four (4) sets of grading, staking, drainage and utility plans on 22" x 34" sheets and four (4) copies of the specifications on 8-1/2" x 11" sheets. Specification sheets shall be bound. The plans shall be signed and sealed by a professional engineer licensed by the State of Florida.

The Developer or the Developer's Engineer shall submit four (4) copies of all design calculations and cut sheets for major processes such as lift station buoyancy calculations, pump design calculations, water and wastewater process equipment and basin and tank design criteria. The County reserves the right to request additional information as deemed necessary by the County or its designated representative.

2.5 WATER AND WASTEWATER IMPROVEMENTS

2.5.1 General

This section covers all improvements to be constructed in compliance with the County's Land Development Code and this Manual.

2.5.2 Design and Plan Review

Design of subdivision improvements shall be in compliance with the design standards of this Manual. Plans will be reviewed and approved by the County or its designated representative as part of the subdivision review and approval process. Submittals for the design and plan review are detailed in Section 2.4 of this Manual.

2.5.3 Construction Inspection

Inspection of improvements shall be in accordance with criteria established by the County. The County or its designated representative shall be afforded the opportunity to observe the improvements to assist the Developer to ensure their compliance with requirements of this Manual. The Developer shall be required to notify the County at specific points during construction as identified in this Manual.

2.5.4 Approval and Acceptance

Approval and acceptance of improvements shall be in accordance with the criteria established by the County.

2.5.5 Maintenance, Materials, and Workmanship Warranty Bond

A bond shall be posted by the Developer and executed by a company authorized to do business in the State of Florida that is satisfactory to the County, payable to Putnam County in the amount of 100 percent of the estimated construction cost of all required improvements. Such bond shall guarantee maintenance of all improvements and the materials, workmanship and structural integrity of all systems, and miscellaneous related facilities, excluding mechanical equipment for a two-year period,

commencing after a Certificate of Completion has been issued by the County (see Appendix G) The Contractor's warranty shall be submitted for review by the County's Attorney prior to release of surety bond. As an alternative to the provision of a surety bond, the Developer may provide for the deposit of cash in an escrow account or a letter of credit acceptable to the County.

2.5.6 Certificate of Completion/Approval for Maintenance

After successful completion of all improvements, and after receipt of the required documents outlined in Appendix G, the County will provide a "Certificate of Completion" verifying the satisfactory construction of all improvements. After the two-year Warranty Period and verification by the County of satisfactory performance of all improvements, the County will issue the "Approval for Maintenance", thereby releasing the Developer from further responsibilities. See form on page in Appendix G.

2.6 MISCELLANEOUS IMPROVEMENTS

All improvements constructed shall be designed, reviewed, inspected and accepted in strict compliance with the criteria established in this Manual.

2.7 COMPLIANCE WITH OTHER REGULATORY REQUIREMENTS

It shall be the responsibility of the Developer to obtain and comply with all applicable Federal, State and Local regulatory permits.

2.8 AS-BUILT DRAWINGS

The Developer's Engineer shall submit a certified set of As-Built Drawings to the County prior to issuance of Certificate of Completion for the improvements. The Developer's Engineer shall be responsible for recording information on the approved Plans concurrently with construction progress. As-Built Drawings submitted to the County as part of the project acceptance shall comply with the following requirements:

1. Drawings shall be legibly marked to record actual construction.
2. Drawings shall show actual location of all underground and aboveground water and wastewater piping and related appurtenances. All changes to piping location including horizontal and vertical locations of utilities and appurtenances shall be clearly shown and referenced to permanent surface improvements. Drawings shall also show actual installed pipe material, class, etc.
3. Drawings shall clearly show all field changes of dimension and detail including changes made by field order or by change order.
4. Drawings shall clearly show all details not on original contract drawings but constructed in the field. All equipment and piping relocation shall be clearly shown.

5. Location of all manholes, hydrants, valves, and valve boxes shall be shown. All valves shall be referenced from at least two and preferably three permanent points.
6. Video tape of mains and service lines.
7. Dimensions between all manholes shall be field verified and shown. The inverts and grade elevations of all manholes shall be shown.
8. Drawings shall show actual location of all streets, sidewalks, lights and other improvements. All changes to locations, including horizontal and vertical locations of utilities and appurtenances, shall be clearly shown and referenced to permanent surface improvements.

Each sheet of the PLANS shall be signed, sealed and dated by the Developer's Engineer as being "As-Builts". Construction Plans simply stamped "As-Builts" and lacking in above requirements will not be accepted, and will be returned to the Developer's Engineer. The "Certificate of Completion" will not be issued until correct "As-Built Drawings" have been submitted. An electronic copy of the "As-Built Drawings" shall be provided to the County. The electronic copy shall be provided in the latest version of AutoCAD.

2.9 LIST OF MATERIALS AND APPROVED MANUFACTURERS

A list of Materials and Approved Manufacturers for the various products specified in this Manual is included in Appendix E. It is the intent of the County to review and update Appendix E as appropriate to ensure efficient operation of the services and facilities under the jurisdiction of this Manual. For this purpose, the County shall evaluate technical submittals from interested manufacturers or suppliers at least once every three years.

SECTION 3.0 - GENERAL DESIGN STANDARDS

3.1 GENERAL

These general design standards are established for the design of water distribution, wastewater collection and reuse systems in the unincorporated area of Putnam County. The Design Engineer/Engineer of Record and/or Developer shall apply these guidelines and submittal criteria for making a utility construction plan submission to the County.

All design and construction drawings for water distribution and wastewater collection systems shall comply with these standards, or the standards titled "Recommended Standards for Water Works," and "Recommended Standards for Wastewater Facilities," established by the Great Lakes Upper Mississippi River Board of State Public Health and Environmental Managers, or the standards established by the Florida Department of Environmental Protection (FDEP), which ever is more stringent, unless otherwise approved by Putnam County.

3.2 STANDARD DRAWING SIZE AND REQUIRED SUBMITTALS

The Design Engineer/Engineer of Record and/or Developer should supply the following prior to making a utility construction plan submission to Putnam County.

Prepare and submit four (4) sets of plans on 22" x 34" sheets, one (1) set on 11" x 17" sheets and four (4) copies of the specifications on 8½" x 11" sheets. Specification sheets shall be bound. Use an appropriate scale no smaller than 1 inch = 40 feet, unless smaller scale is warranted and approved by Putnam County in advance of plan submittal. Scales used shall be same as on a standard engineer's scale. Vertical Profile shall be in a scale of the Plan Horizontal Scale divided by 10. The plans shall be signed and sealed by a professional engineer licensed by the State of Florida.

Obtain and submit Fire Department approval of fire protection system.

Submit four (4) sets of paving and drainage plans, preliminary plat showing easements and dedication language, master utility plan for multi-phase project, key sheet, cover sheet with relevant location map, lift station calculations with buoyancy and pump calculations, pump cut sheets, and site plan of pump station(s)

3.3 MINIMUM REQUIRED DRAWING INFORMATION

Whenever possible, the entire development or redevelopment of a parcel shall be shown on a single site plan or Master Plan. The Site Plan/Master Plan shall indicate the general locations of all streets, parks, sidewalks, water and sewer mains, manholes, valves, hydrants, services and service laterals with respect to the proposed development improvements and the existing street, sidewalks, parks and water and wastewater systems. Show appropriate clear phase lines and match lines. The following are required on the drawings:

- Provide general information on all sheets such as north arrow, names of designer and engineer, revision block with dates, graphic scales and sheet number.
- For plan and profile drawings provide profile elevations at 100-ft intervals, or more frequently if required by good design practice.

- Profile sheets are required for gravity sewers (show all crossings). Profiles may be required for water and sewer mains.
- Provide both horizontal and vertical controls.
- Provide all manhole locations and rim elevations for manholes outside of paved areas.
- Provide all pipe data including size, lengths, material and slopes.
- Provide type and location of fittings, valves, hydrants, air release/vacuum relief and other related appurtenances.
- Provide limits of pipe deflection.
- Provide limits of special exterior coatings.
- Provide limits of special bedding requirements.
- Provide pipe restraint requirements.
- Provide location(s) and general layout of wastewater pumping stations.
- Provide construction notes regarding cover, horizontal and vertical control, special construction requirements, and references to standard and special details.
- Use the County details where applicable. Revise details as required for the specified project.
- Provide all applicable detail drawings.
- Call out interferences with conflicting pipes with indication of "over" or "under" on plan sheet.
- Place gravity sewer data, including manhole invert, rim elevations, and distance between manholes on profile sheets.

Avoid placing piping outside of road right-of-way areas. Easements are required for all facilities which fall outside of road right-of-ways.

Avoid placing manholes and sewer mains out of pavement areas.

No manhole inside drops greater than 2 feet are allowed. Drops over 2 feet require an outside drop manhole.

All road crossing and pavement cuts shall be detailed and shall be in accordance with requirements of the particular authority governing the area.

Provide specific details for all connections to existing facilities.

A minimum of four (4) sets of shop drawings for all materials used in construction and four (4) sets of final construction plans must be submitted for review by Putnam County prior to scheduling of the pre-construction meeting.

SECTION 4.0 - WATER SYSTEM BASIS OF DESIGN

4.1 MINIMUM DESIGN CRITERIA

Water mains shall have a minimum size based on a hydraulic analysis to determine the maximum day demand (MDD) plus fire flow requirements or peak hour demands (PHD), whichever is greatest, while maintaining a minimum 20 psi residual pressure throughout the County distribution system. Minimum pipe diameter where fire hydrants are required shall be six-inches within loop systems and eight inch on dead-ends, unless otherwise approved by the County. In commercial and industrial areas, minimum eight-inch looped mains shall be required.

4.2 DEMAND DESIGN CRITERIA

When data is available the maximum 3-month Average Daily Demand (ADD) shall be determined by using at a minimum one years worth of actual data and calculating a rolling 3-month average of the ADDs. The Maximum 3-month ADD is divided by the number of actual connections to determine the gallons per day per connection (gpd/conn). When data is not available, ADD is estimated at 100 gallons per person per day with 3.0 persons per household. This estimate should be modified as necessary based on specific zoning and land use data. Justification for using different "persons per household" value should be provided.

MDD and PHDs are determined as follows:

MDD = ADD x 1.5*

PHD = ADD x 4

*(If data is available the peaking factor can be determined by dividing the Maximum 3-month rolling average of MDD by the Maximum 3-month rolling average of ADD)

4.3 FIRE FLOWS

In residential areas, design fire flow requirements shall be 500 gpm, while maintaining a minimum 20 psi residual pressure in the system. For commercial and industrial areas design fire flow requirement shall be 1,000 gpm, while maintaining a minimum 20 psi residual pressure in the system. The Developers Engineer shall provide a signed and sealed hydraulic evaluation of the County's system to verify that fire flow and residual pressure is available. Fire flow tests and calibrations of the system shall be done by an independent testing agency and paid for by the Developers. These flow rates represent a minimum system design condition. Should local fire ordinance and/or the State Insurance Services Office require different condition, then the more stringent requirement shall prevail. 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. Fire system lines shall be a dedicated line off the main.

4.4 PIPE MATERIAL FOR WATER MAINS

Water main piping shall be either ductile iron (DI), polyvinyl chloride (PVC) or High Density Polyethylene (HDPE) pipe as outlined below. Only 4", 6", 8", 10", 12", 16", 20", 24", 30", 36", 42", 48" and 54" diameter water mains shall be permitted.

DI pipe wall thickness and pressure class shall conform to ANSI Specification A21.50 (AWWA C150) and ANSI A21.51 (AWWA C151) with minimum pressure class of 150. For water mains 14-inch diameter or smaller the DI pressure class shall be 350. For DI water mains larger than 14-inch the pressure class shall be 250.

Interior coats for all DI pipe and fittings shall be an approved cement-lined or epoxy coating meeting NSF 61 requirements. Exterior coatings for DI pipe and fittings shall conform to ANSI A21.51 bituminous coating.

Flanged pipe shall have threaded ductile iron fittings and conform to the requirements of AWWWA C115. All Flanges shall be ductile iron Class 150, ANSI B16.5. Flanges shall be flat faced and all joints shall use 1/8 inch black neoprene full faced gaskets.

PVC pipe shall conform to AWWA Standard C900 DR 18 for sizes 4-inch through 12-inch diameter pipe and AWWA Standard C905 DR 18 for sizes 14-inch through 36-inch diameter pipe. The pipe material shall be Class 12454-A or 12454-B PVC Compound conforming to ASTM resin specification D1784 with wall thickness of T-1. PVC pipe shall not be used in above ground applications.

HDPE Pipe and fittings shall be PE 3408 High Density Polyethylene meeting Cell Classification 345464C per ASTM D3350; and meeting Type III, Class B or Class C, Category 5, Grade 134 per ASTM D1248; and shall be listed in the name of the pipe and fitting Manufacturer in PPI TR-4, Recommended Hydrostatic Strengths and Design Stresses or Thermoplastic Pipe Fittings Compounds, with a standard grade rating of 1600 psi @ 73°F per ASTM D-2837. HDPE piping is for directional drilling only.

4.4.1 DI Fittings

DI fittings shall have a minimum working pressure of 250 psi. Fittings shall conform to ANSI A21.10 (AWWA C110), A21.11 (AWWA C111), A21.15 (AWWA C115) and/or A21.53 (AWWA C153). Compact fittings shall normally be installed. Long body fittings shall be used only when the drawings specifically call for them.

In areas where soils are corrosive in nature, ductile iron pipe, fittings, valves and other appurtenances shall be protected with polyethylene wrap or tubing. Corrosive soil shall be defined as described in AWWA-C105, appendix "A". The contractor shall furnish and install polyethylene tube or wrap for ductile iron pipe at the locations shown on the construction drawing or as directed by Putnam County or its Engineer.

Polyethylene material shall meet or exceed the requirements of ANSI A 21.5/AWWA C105 in all respects. The wrap shall be virgin, high density polyethylene, 4mils thick minimum cross laminated type or 8 mils linear low density type. The polyethylene wrap shall be included industrial standard repeatable message blue color.

The polyethylene material shall be installed to prevent contact between the pipe and the surrounding backfill. Installation shall be done in accordance with one of the methods described in AWWA C105, subject to approval by the Engineer and the manufacturer.

4.4.2 PVC Fittings

Fittings for PVC pipe shall be DI as described above.

4.4.3 DI Joints

Joints for DI pipe shall be Mechanical, Push-on, or Flanged. Mechanical and Push-on joints shall be in accordance with ANSI A21.11 (AWWA C111) and glands shall be made of ductile iron. Flanges joints shall conform to ANSI A21.10 (AWWA C110) and ANSI A21.15 (AWWA C115). Flanges shall be in accordance with ANSI B16.1, Class 125.

4.4.4 PVC Joints

PVC joints shall be Push-on bell type with rubber sealing ring in accordance with ASTM D3139. Elastomeric gaskets shall conform to ASTM F477.

4.4.5 Mechanical Joints

All joint materials for mechanical joints shall be provided by the pipe and/or fitting manufacturer. Material assembly and bolting shall be in accordance with ANSI Specification A21.11 (AWWA C111). All glands shall be made of ductile iron only.

4.4.6 Push-On Joints

Ductile Iron: Push-on joints shall be in accordance with ANSI Specification A21.11 (AWWA C111). All joint material shall be provided by the pipe manufacturer and installation shall be in accordance with the manufacturer's recommended practice.

PVC: PVC pipe joints shall be the manufacturer's standard push-on bell type with rubber sealing ring in accordance with ASTM D3139. Elastometric gaskets shall conform to ASTM F477.

4.4.7 Flanged Joints

Ductile iron flanged joints shall conform to ANSI A21.10 (AWWA C110) and ANSI A21.15 (AWWA C115). Flanges shall be in accordance with ANSI Specification B16.1, Class 125 with any special drilling and tapping as required to insure correct alignment and bolting.

4.4.8 Restrained Joints

Restrainers 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. In the assembly of the restrain device, the contractor shall tighten the bolts to the correct torque range as recommended by the restraint manufacturer. 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 san and debris build-up. Specifically, the twist-off-screws and associated threads shall be clean (free of sand) prior to installation.

Restrainer specifically for DI pipe 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.

4.5 STEEL CASING PIPE

Steel casing pipe shall conform to either ASTM Standard A139, with a minimum yield strength of 35,000 psi or API Specification API-5LX, Grade X42 Welded Steel Pipe. The wall thickness shall meet the requirements of the latest Revision of the American Railway Engineering Association Manual of Recommended Practice or the Florida Department of Transportation Standard Specification for Road and Bridge Construction, as applicable.

4.6 PIPE INSTALLATION FOR WATER MAINS

Installation of water mains and associated appurtenances shall be in accordance with current AWWA specifications and manufacturer's requirements for their particular products.

4.6.1 Storage of Materials

Loading and unloading and storage of pipe, fittings, valves etc., shall be done in such a manner so as to avoid damage. The interior of all pipe, fittings, valves, etc., shall be kept free of dirt and foreign matter at all times.

4.6.2 Minimum Cover

Minimum cover over all piping shall be 36-inches.

4.6.3 Thrust Restraint

Thrust Restraining Devices: All non-flanged fittings and valves shall be restrained using on of the following methods.

Mechanical Restraint: Restraint at fittings and valves and along adjacent joints of pipe to a length specified herein using the approved material in the approved materials list.

Mechanical Restraint with Tie Rods: Restraint using restraining devices and/or tie rods along adjacent joints of pipe to a length as specified herein. All pipes sizes 3-8-inches in diameter shall have a minimum of 2 tie rods per joint, pipes sizes 10 to 12-inches in diameter shall have a minimum of 4 tie rods per joint and pipes 14 to 20-inches in diameter shall have 6 tie rods per joint. To connected tie rods to fitting, offset eyebolts shall be used. Tie rods shall be 316 SST ¾-inch diameter, threaded as required and installed with a washer and nut of the same size and material.

Thrust Blocks: Thrust blocks shall be limited to situations such as point repair where exposing several joints of pipe is not feasible due to existing ground conditions and also must be used with mechanical joint restraining devices when, in the judgment of the Engineer, the nature and criticality of an installation is such as to require positive assurance of stability. Concrete collars with tie rods may be used on dead end lines at the Contractors discretion. Concrete used for this purpose shall be 2,500 psi minimum. When applicable, schedule and details for the required thrust blocks are included on the drawings.

4.6.4 Pipe Trenches

All pipe shall be laid in trenches having a dry and stable bottom. Backfill shall be free of boulders and debris. Pipe shall be fully supported along its entire length. Sharp or rocky material or unsuitable material such as much encountered in the base shall be replaced a minimum of 6-inches below the pipe in order to achieve satisfactory bedding of the pipe.

4.6.5 Locate Wire

Locate wire shall be installed on all PVC and HDPE main piping. No wire shall be installed on above ground installations. Locate wiring shall be 10 gauge, single strand, UF rated (direct burial), copper wire 30 mil. (minimum) insulation. The wire shall be attached to the water line and services with plastic ties at 10-ft intervals and on each side of bell joints or fittings. Locate wire shall be brought to grade within a valve box or locating station box at 450-ft intervals maximum. Locate wire shall be installed either in the 1:00 or 11:00 position on the pipe. Splices or connections not in a location box will be prohibited unless it is unavoidable. If the connection is unavoidable, the wire shall be first tied in a knot (to minimize future separation), then the ends connected utilizing an electric wire nut. Upon doing that the connection shall be made in a water tight condition by using either vinyl mastic tape (4" wide x 0.09" thick by 3M-Scotch 2210) or plastic enclosure (SnapLoc Model LV 9500/951-4 large by TKHP). The outside color of the wire shall be either white or yellow.

4.6.6 Separation Requirements

Horizontal separation from sanitary sewers and force mains shall be no less than ten (10) feet from edge of main to edge of main. In cases where it is not possible to maintain a ten (10) feet separation, the water main must be laid at an elevation so that the bottom of the water main is a minimum of 18-inches above the top of the sanitary sewer or force main. Horizontal separations of 15 feet to buildings, top of banks and other structures shall be maintained.

Vertical separation from a sanitary sewers, force mains or reclaim water mains shall be a minimum of 18-inches between the outside of pipes.

When a sanitary sewer, force main or storm sewer crosses a water main it should be laid below the water main with a minimum of 18-inches of separation. At the crossing, one full-length joint of water main shall be laid in such a way the both joints will be as far away from the sewer as possible.

Where it is not practical to design for these separations specific requirements from the regulatory agencies must be followed.

4.6.7 Cleaning and Flushing

Foreign material shall be kept out of all pipe or cleaned from the pipe prior to installation. Upon completion of installation, the mains shall be flushed and the water disposed of without creating a nuisance. If, in the opinion of the County, there is insufficient water available for proper flushing, the Contractor shall clean the lines by pigging. Flushing must achieve a minimum water velocity of 2.5 feet per second in all portions of the pipe. The duration of the flushing shall be as directed by the County's

representative. The County shall pay for County water used for all testing at current water use rates.

4.6.8 Testing

Pressure and Leakage: Contractor and developer shall provide all equipment, materials and labor necessary for pressure and leakage testing. All mains and services shall be tested for leakage. Water shall be supplied to the main at the expense of the developer and/or Contractor and pumped to the required pressure of 150 psi. The main tested shall either be isolated from active lines or protected from leakage by a double valve arrangement. All water utilized for the pressure and leakage test shall be potable water with adequate chlorine residual.

The maximum length of a line to be tested as one section is 1,500 feet. The maximum allowable leakage shall be as determined in accordance with the current AWWA leakage specifications. The standard test length is two hours. Testing procedures shall meet or exceed AWWA C600. The contractor shall successfully complete a pretest prior to scheduling the pressure and leakage test with the County. The pressure and leakage test must be observed by a County representative and the design Engineer. The Contractor shall replace or adjust components of the pipeline which fail the test. The pipeline shall then be tested as described above until it passes the test criteria. The pressure and leakage test shall be done concurrently.

Disinfection: Procedures for disinfection and clearance of the water mains shall be conducted in accordance with Section 62-555.340 of the Florida Administrative Code and AWWA Standards C651.

Initial flushing shall be done on all sections of pipe to be disinfected. The flushing shall be a full diameter flush 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.

Bacteriological sample points shall be installed every 1,000 feet (maximum) and at dead-ends and stub outs greater than 40 linear feet, at a minimum. All taps required for chlorination or flushing, 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 County.

Chlorine shall be applied as a 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. The solution shall be prepared and injected into the system in accordance with the procedures of Section 5 of the AWWA procedure. This method requires that a concentration not be less than 25 mg/L at the beginning of the required 24 hour holding period and shall not be less than 10 mg/L at the end of the holding period. Procedures shall insure contact with all parts of the system.

Following chlorination, all treated water shall be thoroughly flushed from the pipe until the residual in the replacement water reaches the level of chlorine normally carried in the distribution system – maximum 1.0 mg/L.

Dechlorination of flushing water may be required to be in compliance with the State of Florid Surface water Quality Standards (F.A.C. 62-302.530). Dechlorination is necessary if the flushing of highly chlorinated water is to be discharged directly to a surface water or to a stormwater system. If the water can be sheet flowed over a large area or discharge to a holding pond, dechlorination may be avoided.

After flushing, samples shall be collected and submitted to the Florida Department of Environmental Protection (FDEP) until satisfactory results are obtained on two (2) successive working days. Care must be taken because if the initial sampling fails to produce satisfactory results, disinfection must be repeated and samples resubmitted. Samples shall be collected by and tested by a private laboratory that is certified by the State of Florida.

Copies of the testing results and all related correspondence with the FDEP shall to the County.

4.7 MAIN LINE TAPS

Mains may be tapped as long as the tapping line is smaller than the tapped line unless otherwise approved by the County. Equal size line taps not approved by the County shall require that a tee be cut into the main. Tees are also required at locations dictated by the County. Tapped connections in pipe and fittings shall be made in such a manner as to provide a watertight joint and adequate strength against pull-out.

Tapping Sleeves and Valves shall be ductile iron, mechanical joint. Tapping sleeves and valves are required for all taps 4-inches and greater. Taps that are less than 4-inches shall be provided with a service saddle. Valves shall be provided on all taps. Tapping sleeves shall be a minimum of 6 feet from pipe joints or other fittings.

4.8 VALVES

Valving of all water distribution systems shall be designed to facilitate the isolation of each section of pipeline between intersections and to reduce operation and maintenance inconvenience and sanitary hazards of the network. Valves shall be located at not more than 500-foot intervals in commercial, industrial and high density residential areas and at no more than 1000-foot intervals in all other areas. At intersections, the number of valves shall be one less than the number of pipes forming the intersection. Gate valves, 4-inches to 12-inches, shall be resilient seat type conforming to AWWA C509.

4.9 AIR RELEASE VALVES

At points in the water main profile where entrapped air can accumulate, which may result in flow restriction, provisions shall be made to remove the air. This shall be accomplished in the distribution system by use of strategically placed fire hydrants or blowoffs. In general, air relief assemblies shall only be used at aerial crossings and other similar circumstances. When air relief assemblies are utilized, automatic assemblies are encouraged over manual.

4.10 FIRE HYDRANTS

Fire hydrants shall be provided in all water mains, transmission and distribution systems. Fire hydrants shall be spaced such that the maximum distance for protection will not be more than 500 feet as the fire hose lays. The Fire Marshal has final jurisdiction on all hydrant and fire sprinkler line locations during plan review.

A Fire Marshal approved plan is required with all preliminary plan submissions.

Each hydrant shall be left turn, counterclockwise, opening and capable of delivering a flow of at least 500 gallons per minute with a residual design pressure of not less than 20 psi.

Fire hydrants shall be of the dry barrel NST or fire threads, break-away type conforming to AWWA C502, with two 2½ inch threaded hose nozzles and one 4½ inch threaded pumper nozzle, which must point toward the road. Hydrants shall have a 5¼ inch interior valve opening and be restrained from hydrant to tee at the main. Restraint by use of "all-thread" rods shall not be allowed. At the discretion of the County, additional protection for fire hydrants shall be provided including but not limited to concrete filled ductile iron traffic posts.

Fire hydrants shall be painted per NFPA Standard.

Fire hydrant branches (from main to hydrant) shall be a minimum of 6 inches inside diameter. Each branch shall be provided with a resilient seat gate valve located as close as possible to the main. Hydrants shall be located near road lines. Hydrants shall be laid to minimize their vulnerability to traffic. A clear zone around all fire hydrants shall be adhered to, consisting of a five (5) foot radius around the hydrant and seven (7) feet above the top of the hydrant. Placement of landscaping, fencing, etc. shall be considered in order to meet this clear zone requirement.

4.11 WATER SERVICE AND CONNECTIONS

No direct service taps shall be allowed. Only double strap brass saddles shall be used. Saddles shall be IP thread pattern and material as required by the County.

Water service taps on the main shall be spaced at a minimum distance of 18 inches apart and a minimum of 18-inches from a bell or fitting. Consecutive taps shall be offset 45 degrees. All service line taps shall be supplied with corporation stops. Angle meter valves must be installed for each service. All service lines shall be installed in accordance with the construction details of this manual.

Services shall not exceed 100 feet from the main to the meter.

A line valve shall be provided by the design Engineer on the building side of the meter in an easily-accessible location for use by the building tenant.

4.12 METER INSTALLATION

Each water service connection shall be metered. Construction plans shall include a typical meter installation for each size meter to be installed as outlined in the Standard Details. Meters and water service connections to existing County systems up to 4" will be installed by the County upon payment of applicable fees and charges. Services and connections to new water systems and existing systems 6" and larger shall be made by the Contractor. Each unit within a residential building (i.e., single family, duplex, triplex, etc.) shall have a separate meter. All buildings within Commercial, Industrial and Institutional Projects shall be individually metered. All projects shall require installation of a fire line master meter. The Developer's Engineer shall size the meters and provide the County with sufficient information on estimated peak flows and low flows so that the meter sizes can be verified. The proper size of service lines is the responsibility of the design Engineer. Water service connections shall be in the following sizes and may require dual services be provided: ¾, 1,

1½, 2, 3, 4, 6, 8 and 12-inch. Services greater than 12" may be installed based on County approval. Meter boxes for 2" and smaller meters are standard. Industrial/Office/Commercial type developments will require above-grade type meter installations as outlined in the Standard Details. The County reserves the right to request historical data for meter sizing.

Meters should be placed in the County Right-of-Way within 1-ft of the property line if practical. The customer will be responsible for maintenance of all lines downstream of the meter assembly.

4.13 BACKFLOW PREVENTION DEVICES

Backflow prevention devices shall be provided, as required by the County and as set forth in these Standards. All irrigation systems, water services for industrial/office/commercial, schools, mobile home parks, multi-family residences and any other locations as determined by the County shall require backflow prevention assemblies. Water services to lift stations shall be fitted with reduce pressure backflow preventers.

All fire lines shall have a minimum of double check valve backflow preventer and appurtenances as outlined in the Standard Details.

Backflow prevention device assemblies shall be provided with all necessary parts and accessories for a complete operable installation. Assemblies shall be the latest approved product of a manufacturer regularly engaged in the production of equipment of this type. All assemblies shall be as approved by the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California. All assemblies shall be permanently labeled with the following information:

A. Type of Assembly (Reduced Pressure, Double Check Valve, etc.)

B. Name or Trademark

C. Size

D. Model Number

E. Direction of Flow (shown by arrow)

F. Unit Serial Number

G. Rated Working Water Pressure (RWWP)

H. Rated Working Water Temperature (RWWT)

Type and size of assemblies shall be indicated on the drawings.

4.14 DEAD ENDS

To increase reliability of service and reduce head loss, dead ends shall be minimized by making the appropriate tie-ins whenever practical, as determined by the County. Fire Hydrants are required at all Dead Ends.

4.15 JACK AND BORE/DIRECTIONAL DRILL

Casing pipe used with jack and bores shall be in accordance with the requirements of Florida Department of Transportation (FDOT) or railway specifications. Carrier pipe shall be as described herein.

A. The Contractor shall perform the pipe boring and jacking in accordance with the requirements specified herein.

B. Boring and Jacking materials shall be in accordance with the latest requirements of the State of Florida Department of Transportation and be in accordance with, b but not limited to, the following:

Material:	Welded Steel Pipe, ASTM A139, Grade B.
Size & Thickness:	Varies and 0.500 inches.
Coatings:	Two (2) coats inside and out, Koppers Bitumastic No. 50 or equal, applied in strict accordance with manufacturer's instructions.
Pipe Ends:	Beveled for field welding.
Material Certificate:	Affidavit of Compliance certifying pipe complies with ASTM A139, Grade B.
Blocking:	Stainless steel casing spacers with polymer runners spaced in accordance with the manufacturer's requirements.
Casing Pipe Ends:	Masonry bulkheads as shown on the plans, or other sealing systems on new installations, subject to County's approval.

C. Boring and Jacking installation work shall be installed in accordance with standard practice and the requirements of the Florida Department of Transportation. The work shall be in accordance with and not limited to the following:

Contractor's Equipment:	Shall be compatible with subsoil conditions encountered. The Engineer may order the Contractor to change his boring equipment if he considers it so non-compatible, and if, in his opinion, the change is necessary to safeguard the public and to protect public or private property.
Soil Stabilization:	Unstable soil shall be stabilized ahead and around casing pipe by chemical grout injection and/or other acceptable methods.
Jacking:	Installation of the casing pipe shall be a continuous operation until completed. It shall be done from one end of the crossing to the other without horizontal deflection or settlement of ground, surface facilities or structures.
Boring:	Excavated materials shall be removed as jacking proceeds without causing voids behind casing pipe.

Grade Control:	Casing lead pipe grade shall be checked at least every four feet or whenever directed. A jack shall be used at the head end to control grade as required.
Alignment Control:	Alignment shall be controlled by guide rails set in the jacking pit.
Casing Pipe:	Lengths shall be circumferentially welded in conformance with AWWA C206. After welding, the joint area inside and out shall be cleaned and given 2 coats of Koppers Bitumastic No. 50 or equal.
Carrier Pipe:	The carrier pipe shall be jacked or cable-pulled with no tensile forces exerted on any pipeline joints.

SPECIFICATIONS FOR CARRIER AND CASING PIPES		
	CARRIER PIPE	CASING PIPE
CONTENTS TO BE HANDLED	WATER/WASTEWATER	NONE
OUTSIDE DIAMETER	DETERMINED BY PROJECT	SEE TABLE
PIPE MATERIAL	DIP	STEEL
SPECIFICATION AND GRADE	CLASS 50 OR 52	ASTM A139, GRADE "B"
WALL THICKNESS	DETERMINED BY MFG	0.500"
ACTUAL WORKING PRESSURE	150 PSI	NONE
TYPE OF JOINT	RESTRAINED	WELDED
COATING	BLACK BITUMINOUS	BLACK BITUMINOUS
METHOD OF INSTALLATION	CASING SPACERS	JACK AND BORE
PROTECTION AT ENDS OF CASING	N/A	BRICK AND MORTAR SEAL OR CASING END SEAL

NOTES:

1. CASING PIPE TO BE INSTALLED UNDER ROAD BY BORING AND JACKING.
2. ALL WORK DONE WITHIN FDOT RIGHT-OF-WAY IS SUBJECT TO INSPECTION AND DIRECTION OF THEIR ENGINEER.
3. ALL WORK SHALL BE DONE IN ACCORDANCE WITH CURRENT AWWA STANDARDS FOR PIPE LINES CONVEYING NONFLAMMABLE SUBSTANCES AND FDOT REQUIREMENTS AS PER UTILITY ACCOMMODATION GUIDE, MAY 1990, DOCUMENT NO. 710-020-001-b WHENEVER THERE IS A DIFFERENCE IN REQUIREMENTS OR THE SHOP DRAWINGS THE MORE STRINGENT SHALL APPLY.
4. FIELD AND SHOP WELDS OF THE CASING PIPES SHALL CONFORM WITH AWS STANDARD SPECIFICATIONS. FIELD WELDS SHALL BE COMPLETE PENETRATIONS, SINGLE-VEE GROOVE OR SINGLE-BEVEL GROOVE TYPE JOINTS.
5. STEEL CASING SHALL CONFORM TO THE REQUIREMENTS OF ASTM DESIGNATION A139. THE CASING PIPES SHALL HAVE THE MINIMUM NOMINAL DIAMETER AND MINIMUM WALL THICKNESS AS SHOWN.
6. CONTRACTOR SHALL VERIFY LOCATION AND DEPTH OF ALL EXISTING UTILITIES PRIOR TO STARTING BORING AND JACKING.
7. MINIMUM VERTICAL CLEARANCE BETWEEN EXPOSED CASING PIPE AND OTHER EXISTING UTILITIES SHALL BE 12" MIN.
8. STAINLESS STEEL CASING SPACERS WITH POLYMER RUNNERS, AS MADE BY PSI OR BY CASCADE WATER WORKS MANUFACTURING COMPANY OR APPROVED EQUAL, SUBJECT TO APPROVAL OF ENGINEER.

CARRIER PIPE SIZE	NOMINAL DIA OF STEEL CASING PIPE
6"	14"
8"	16"
10"	20"
12"	24"
14"	24"
16"	30"
18"	34"
20"	36"
24"	42"
30"	42"
36"	48"
42"	54"
48"	72"

STANDARD DETAIL

JACK AND BORE CASING PIPE DETAILS

SECTION 5.0 – GRAVITY SEWER SYSTEM BASIS OF DESIGN

There shall be no physical connection made between sanitary or storm water sewer systems. All gravity sewers shall be designed to deliver peak flows based on the ultimate tributary population.

5.1 DESIGN CALCULATIONS

The Developer's Engineer shall submit signed, sealed and dated design calculations with the Plans for all sewer projects. Calculations shall show that sewers will have sufficient hydraulic capacity to transport all design flows.

5.2 GRAVITY SEWER FLOW DESIGN

Wastewater systems shall be designed on the basis of an average per capita daily flow of not less than 100 gallons of sewage flow for the estimated ultimate tributary population. Based on this, a lateral sewer service shall be designed with capacities when running full of not less than four times the average flow. Collection sewers shall have capacities under the same conditions of not less than 4.0 times the average flow. Special allowances may be made for sewage from industrial plants upon approval by the County.

5.3 PRETREATMENT

All installations where foods are prepared, processed or served shall have a grease trap (minimum) of adequate capacity with a solids retention device installed through which the wastewater from the preparation area shall pass before entering the sanitary sewer system. The owners shall be responsible for having these grease traps cleaned on a regular basis.

Industrial wastes from service stations and manufacturing plants shall not be connected into the sanitary sewage system without pre-treatment specifically approval by Putnam County such as grease, oil and sand interceptors or lint traps and preferably should be disposed of separately. Caustic wastes and all other manufacturing wastes shall not be connected into the sanitary sewage system without pre-treatment approved by Putnam County. A testing program shall be submitted to the County and the owner of the pre-treatment system shall be responsible for testing the wastes, maintaining and operating the pre-treatment system. All pre-treatment facilities costs (capital, operation and maintenance costs) shall be paid by the developer.

5.4 GRAVITY SEWERS MAIN SIZES

The minimum allowable size for any gravity sewer main other than the service laterals house sewer connections shall be 8-inches in diameter. Upsizing of sewer lines to reduce slopes will not be permitted unless justified by calculated flow. When gravity sewers are increased in size, or when a smaller sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient.

5.5 GRAVITY SEWER MAIN SLOPES

All gravity sewer mains shall be designed with hydraulic slopes sufficient to give mean velocities, when flowing full or half full, of not less than 2.0 ft per second, based on Manning's formula using an "n" value of 0.012 for PVC and 0.013 for other pipe materials. Slope shall be steep enough to prevent solid/fluid separation.

The following minimum slopes shall be used for design:

Diameter of Sewer	Minimum Slope in Feet Per 100 Feet
	Other Material
4-inch (Service lateral)	1.0%
6-inch (Service lateral)	1.0%
8-inch	0.40%
10-inch	0.28%
12-inch	0.22%
18-inch	0.12%
21-inch	0.10%
24-inch	0.08%

5.6 GRAVITY SEWER MAIN ALIGNMENT

Gravity sewer mains shall be designed and constructed in straight alignments with uniform slope, not exceeding 400 feet in length between manholes. Straight alignment shall be checked by either using a laser beam, lamping or other approved method. Size conversion between manholes shall not be allowed.

Gravity sewer mains of different diameters shall connect at a sewer manhole. The invert of the larger main shall be lowered sufficiently below the smaller main to maintain the same energy gradient.

5.7 PIPE MATERIAL FOR GRAVITY SEWER MAINS

Gravity mains shall be either PVC or DI pipe as outlined below.

PVC pipe shall conform to ASTM D3034, SDR 35 for sizes 4-inch thru 15-inch diameter pipe and ASTM F679 for 18-inch through 36-inch diameter pipe. The pipe material shall be Class 12454-B PVC Compound conforming to ASTM resin specification D1784 with wall thickness of T-1. PVC pipe shall not be used in above ground applications.

DI pipe wall thickness and pressure class shall conform to ANSI Specification A21.50 (AWWA C150) and ANSI A21.51 (AWWA C151) with pressure class of 150 as a minimum. Interior coats for all DI pipe and fittings shall be an approved epoxy coating. Exterior coatings for DI pipe and fittings shall conform to ANSI A21.51 bituminous coating.

5.7.1 PVC Fittings (4" and 6" Service Laterals Only)

PVC fittings shall meet the requirements of ASTM D3034 and ASTM F1336 for sizes 4-inch through 15-inch diameter and ASTM F679 and ASTM F1336 for 18-inch through 36-inch diameter with minimum wall thickness of SDR 35. Gasket joint type shall meet the requirements of ASTM D3212. Elastomeric gaskets shall conform to ASTM F477 or ASTM F913. PVC material shall have cell classification of 12454-B in accordance with ASTM D1784.

5.7.2. DI Fittings

DI fittings shall have a minimum working pressure of 250 psi. Fittings shall conform to ANSI A21.10 (AWWA C110), A21.11 (AWWA C111), A21.15 (AWWA C115) and/or A21.53 (AWWA C153). Compact fittings shall normally be installed. Long body fittings shall be used only when the drawings specifically call for them.

5.7.3 PVC Joints

PVC joints shall be Push-on with a bell type coupling and thickened wall section integral with the pipe barrel. Joints for PVC SDR 35 shall be in accordance with ASTM D3212. Elastomeric gaskets shall conform to ASTM F477 or ASTM F913 for PVC SDR 35.

5.7.4 DI Joints

Joints for DI pipe shall be Mechanical, Push-on, or Flanged. Mechanical and Push-on joints shall be in accordance with ANSI A21.11 (AWWA C111) and glands shall be made of ductile iron. Flanges joints shall conform to ANSI A21.10 (AWWA C110) and ANSI A21.15 (AWWA C115) and shall be used above ground only. Flanges shall be in accordance with ANSI B16.1, Class 125.

5.8 PRECAST CONCRETE SEWER MANHOLES

Manhole bases, sections and cones shall be set according to the construction plans and shall be precast sewage manholes and shall comply with ASTM C478. Cement for the manholes shall meet the requirements of ASTM C150, "Specification for Portland Cement Type H". Concrete shall have compressive strength of not less than 4,000 psi at 28 days.

Manhole joints shall be tongue and groove configuration and sealed with a continuous 6-inch wide exterior joint sealant membrane.

Manholes shall be coated inside and outside with two (2) coats of coal tar epoxy. The exterior shall include the outside bottom. The film thickness for each layer shall be a dry thickness of 8 mils per coat.

Pipe connections to the manholes shall be cut flush with the inside wall of the manhole. Manhole covers shall be rated for roadway use and shall be provided with rain guards.

5.8.1 Location

Manholes shall be installed at the terminal end of each gravity sewer; at every change in grade/direction, size or alignment change; at all sewer intersection; and at distances not greater than 400 feet apart.

Manholes shall be placed in accessible locations, preferably in pavement, always flush to the surface except as approved by the County. If manholes are placed outside of hardened surfaces, a concrete collar shall be installed around the manhole ring.

5.8.2 Minimum Size

The minimum inside diameter of sanitary sewer manholes shall be four feet and have a minimum top opening of two feet. The minimum depth of manholes shall be four feet from the finished grade to invert of the manhole. If DIP gravity sewer main is

used minimum depth can be three feet with approval of the County. For sewers greater than 24 inches, the minimum inside diameter shall be five feet.

5.8.3 Drop Manholes

Outside drop manholes shall be installed when the invert of the influent pipe is greater than 2 feet above the outgoing invert of the manhole. Where the difference in inverts is equal to or less than 2 feet, the invert across the manhole shall be grouted to prevent deposition of solids.

5.8.4 Flow Channel

The manhole shall have a flow channel across the bottom that conforms in shape and carrying capacity to that of the sewers. The channel walls shall be shaped to the full height of the crown of the outgoing pipe in such a way as to not obstruct maintenance or hydraulic capacity of the pipe. All manholes shall have a flow line elevation drop of 0.2 foot (minimum). Flow direction changes in excess of 90 degrees shall not be included in sewer alignments without special consideration.

5.8.5 Pipe Connections

Pipe connections to manholes shall be made by use of prefabricated, rubber ring, water-stop type boots cast directly into the manhole at the factory or other type system approved by the County.

Service connections shall not be allowed into manholes. Services connections shall be through a lateral. Service laterals that fall under the responsibility of the operating and maintenance entity of the County shall be limited to 50 linear feet of pipe. All service laterals shall require a clean-out connection. Service laterals and fittings shall be a minimum of 6 inches in diameter. Service laterals shall have a minimum slope of 1%.

5.9 PIPE INSTALLATION FOR GRAVITY SEWER MAINS

The Contractor shall be responsible for setting all grade lines, centerline of construction, and locating property lines. The pipe shall be laid on an unyielding foundation with uniform bearing under the full length of the barrel of the pipe.

5.9.1 Storage of Materials

Loading and unloading and storage of pipe, fittings, valves etc., shall be done in such a manner so as to avoid damage. The interior of all pipe, fittings, valves, etc., shall be kept free of dirt and foreign matter at all times.

5.9.2 Minimum Cover

Minimum cover over all piping shall be 36-inches.

5.9.3 Pipe Trenches

All pipe shall be laid in trenches having a dry and stable bottom. Backfill shall be free of boulders and debris. Pipe shall be fully supported along its entire length. Sharp or rocky material or unsuitable material such as muck encountered in the base shall be

replaced a minimum of 2-feet below the pipe in order to achieve satisfactory bedding of the pipe.

5.9.4 Locate Wire

Locate wire shall be installed on all PVC and HDPE main piping. No wire shall be installed on above ground installations. Locate wiring shall be 10 gauge, single strand, UF rated (direct burial), copper wire 30 mil. (minimum) insulation. The wire shall be attached to the water line and services with plastic ties at 10-ft intervals and on each side of bell joints or fittings. Locate wire shall be brought to grade within a valve box or locating station box at 450-ft intervals maximum. Locate wire shall be installed either in the 1:00 or 11:00 position on the pipe. Splices or connections not in a location box will be prohibited unless it is unavoidable. If the connection is unavoidable the wire shall be first tied in a knot (to minimize future separation), then the ends connected utilizing an electric wire nut. Upon doing that the connection shall be made in a water tight condition by using either vinyl mastic tape (4" wide x 0.09" thick by 3M-Scotch 2210) or plastic enclosure (SnapLoc Model LV 9500/951-4 large by TKHP). The out side color of the wire shall be either white or yellow.

5.9.5 Separation Requirements

Horizontal separation from water mains shall be no less than ten (10) feet from edge of main to edge of main. In cases where it is not possible to maintain a ten (10) feet separation, the water main must be laid at an elevation so that the bottom of the water main is a minimum of 18-inches above the top of the sanitary sewer or force main. Horizontal separations of 15 feet to buildings, top of banks and other structures shall be maintained.

Vertical separation from a water main shall be a minimum of 18-inches between the outside of pipes.

When a sanitary sewer, force main or storm sewer crosses a water main it should be laid below the water main with a minimum of 18-inches of separation. At the crossing, one full-length joint of water main shall be laid in such a way the both joints will be as far away from the sewer as possible.

Where it is not practical to design for these separations specific requirements from the regulatory agencies must be followed.

5.9.6 Inspection and Testing

All gravity sewer lines shall be inspected and tested in accordance with these requirements. Equipment for performing tests and personnel required for supervision and assistance with items such as removing manhole covers, moving ladders and equipment, holding lights, cleaning, etc. shall be provided by the Contractor. Sections of lines which fail to pass the tests, listed below, shall have the defects located and repaired or replaced and retested until leakage is within the specified allowance. The County shall be notified a minimum of 48 hours in advance of testing, so that a representative of the County may be present. Testing shall be preformed after the backfill and road base is in place.

5.9.6.1 Cleaning

Prior to other tests, all sewer lines shall be cleaned and inspected for major defects. Precleaning by appropriately sized sewer cleaning ball or by high velocity jet or other methods may be necessary.

5.9.6.2 Visual Inspection

All sewer lines shall be inspected visually to verify accuracy of alignment and freedom from debris and obstructions. The full diameter of the pipe for straight alignments shall be visible when viewed between consecutive manholes. The method of test shall be by visually lamping with mirrors and lights unless an alternate method is specifically required by the County. The contractor shall provide all required equipment and personnel to do the visual test. Low points, dips, joint separation and misaligned joints are not acceptable.

5.9.6.3 Testing

The locations for performing leakage and the method of testing will be selected by the County. Methods of test which are suitable for various conditions are low pressure air exfiltration, water infiltration or water exfiltration. Plugs, caps and branch connections must be secured against blow-off during leakage tests.

Air Testing: The duration permitted for a prescribed low pressure exfiltration pressure drop between two consecutive manholes shall be not less than that shown in the following table. The prescribed drop shall not exceed 0.5 psi from 3.5 to 3.0 psi in excess of the groundwater pressure above the top of the sewer.

Minimum Duration For Air Test Pressure Drop

Pipe Size (Inches)	Time (Minutes)	Max. Length (Feet)
4	1.5	1,000
6	2.5	750
8	3.47	550
10	4.5	450
12	5.4	370
24	11.3	180

Infiltration Testing: Infiltration testing shall be an acceptable method of leakage tests only when the groundwater level is above the top of the pipe throughout the length being tested. Tests shall be conducted for a minimum of four (4) hours. The allowable infiltration for any portion of sewer system shall be measured by a weir placed in the appropriate manhole and shall not exceed 50 gallons per inch of internal pipe diameter per mile of pipe per day. Laterals are not included in the infiltration calculation.

Exfiltration Testing: Exfiltration testing is an acceptable method of test only in dry areas or when the groundwater level at the time of testing is below the top of the pipe. Tests shall be conducted for a minimum of four (4) hours. The allowable water exfiltration for any length of sewer pipe between manholes shall be measured and shall not exceed 50 gallons per inch of pipe diameter per mile of pipe per day. During

exfiltration testing, the maximum internal pipe pressure at the lowest end shall not exceed 25 feet of water or 10.8 psi and the internal water head at the upstream end shall be two feet higher than the top of the pipe. The Contractor shall provide and install service plugs as needed to perform test.

Deflection Testing (PVC Only): The maximum allowable pipe deflection (reduction in vertical inside diameter) shall be 7 ½ percent. Contractor shall pull a seven-skid mandrell through each gravity sewer line. All locations with excessive deflection shall be excavated and repaired by re-bedding or replacement of the pipe.

SECTION 6.0 – WASTEWATER FORCE MAIN AND RECLAIM WATER MAINS BASIS OF DESIGN

All force mains and reclaim water mains shall be designed to deliver peak flows based on the ultimate tributary population.

6.1 DESIGN CALCULATIONS

The Developer's Engineer shall submit signed, sealed and dated design calculations with the Plans for all sewer projects. When more than one pump station is tying into a force main a signed and sealed computer hydraulic analysis is required by the Developer or the Developers Engineer. The Developer shall use the installed certified pump curves from all applicable pump stations in this analysis. Calculations shall show that sewers will have sufficient hydraulic capacity to transport all design flows.

6.2 FORCE MAIN AND RECLAIM WATER MAIN FLOW DESIGN

Force mains systems shall be designed on the basis of an average per capita daily flow of not less than 100 gallons of flow for the estimated ultimate tributary population. Reclaim water systems shall be designed using generally the same demand design criteria for water mains described in Section 4.0. The main shall be sized to adequately handle the build-out peak operational pump flow of the wastewater lift station(s) serving particular area. Minimum scouring velocities are two (2) feet per second and shall apply to the ultimate minimum operational pump flow. Design Pumping rates shall not exceed 8 feet per second for Ductile Iron pipe or 5 feet per second for PVC pipe. Scouring velocities less than two (2) feet per second, that are temporary, will be considered under special circumstances as approved by the County. Based on this, the mains shall be designed with capacities of not less than 4.0 times the average flow.

6.3 FORCE MAIN AND RECLAIM WATER MAIN SIZES

Force mains shall not be less than 4-inches in diameter and have a minimum design velocity of two (2) feet per second.

All reclaim water mains shall be sized as required for the specific application and will require approval from the County. Only 4", 6", 8", 10", 16", 20", 24", 30", 36", 42", 48" and 54" diameter force mains shall be permitted.

6.4 PIPE MATERIAL FOR FORCE MAINS AND RECLAIM WATER MAINS

Pressure mains shall be either PVC or DI pipe as outlined below.

PVC pipe shall conform to AWWA Standard C900 DR 18 for sizes 4-inch through 12-inch diameter pipe and AWWA Standard C905 DR 25 for sizes 14-inch through 36-inch diameter pipe. The pipe material shall be Class 12454-A or 12454-B PVC Compound conforming to ASTM resin specification D1784 with wall thickness of T-1. PVC pipe shall not be used in above ground applications.

DI pipe wall thickness and pressure class shall conform to ANSI Specification A21.50 (AWWA C150) and ANSI A21.51 (AWWA C151) with pressure class of 150 as a minimum. Interior of all DI pipe and fittings shall be lined with an amine cured novalac epoxy coating. Acceptable coatings include protecto 401 ceramic epoxy, SP 2000 ceramic

epoxy, or poly bond plus. Exterior coatings for DI pipe and fittings shall conform to ANSI A21.51 bituminous coating.

Rubber gaskets shall be suitable for the specified pipe sizes. Rubber-gasket joints shall conform to AWWA C111, and gaskets shall be furnished by the pipe manufacturer with the pipe.

6.4.1 PVC Fittings

Fittings for PVC pipe shall be DI as described below.

6.4.2 DI Fittings

DI fittings shall have a minimum working pressure of 250 psi. Fittings shall conform to ANSI A21.10 (AWWA C110), A21.11 (AWWA C111), A21.15 (AWWA C115) and/or A21.53 (AWWA C153). Compact fittings shall normally be installed. Long body fittings shall be used only when the drawings specifically call for them. Interior lining for DI fittings shall be amine cured novalac epoxy coating. Acceptable coatings include protecto 401 ceramic epoxy, SP 2000 ceramic epoxy, or poly bond plus. Exterior coatings for DI fittings shall conform to ANSI A21.51 bituminous coating.

6.4.3 PVC Joints

PVC joints shall be Push-on bell type with rubber sealing ring in accordance with ASTM D3139. Elastomeric gaskets shall conform to ASTM F477.

6.4.4 DI Joints

Joints for DI pipe shall be Mechanical, Push-on, or Flanged. Mechanical and Push-on joints shall be in accordance with ANSI A21.11 (AWWA C111) and glands shall be made of ductile iron. Flanges joints shall conform to ANSI A21.10 (AWWA C110) and ANSI A21.15 (AWWA C115) and only used above grade. Flanges shall be in accordance with ANSI B16.1, Class 125.

6.4.5 Restrained Joints

Restrainers 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. In the assembly of the restrain device, the contractor shall tighten the bolts to the correct torque range as recommended by the restraint manufacturer. 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 san and debris build-up. Specifically, the twist-off-screws and associated threads shall be clean (free of sand) prior to installation.

Restrainer specifically for DI pipe 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.

6.5 STEEL CASING PIPE

Steel casing pipe shall conform to either ASTM Standard A139, with a minimum yield strength of 35,000 psi and a wall thickness of 0.25-inches or API Specification API-5LX, Grade X42 Welded Steel Pipe. The wall thickness shall meet the requirements of the latest Revision of the American Railway Engineering Association Manual of Recommended Practice or the Florida Department of Transportation Standard Specification for Road and Bridge Construction, as applicable.

6.6 FORCE MAIN TAPS

Mains may be tapped as long as the tapping line is smaller than the tapped line unless otherwise approved by the County. Equal size line taps not approved by the County shall require that a tee be cut in. Tees are also required at locations dictated by the County. Tapped connections in pipe and fittings shall be made in such a manner as to provide a watertight joint and adequate strength against pull-out.

Tapping sleeves and valve shall be ductile iron, mechanical joint. Tapping sleeves and valves are required for all taps 4-inches and greater. Taps less than 4 inches shall be provided with a service saddle. Valves shall be provided on all taps. Tapping sleeves shall be a minimum of 6-feet from pipe joints or other fittings.

6.7 RECLAIM WATER SERVICE LINES AND TAPS

No direct service taps shall be allowed. Only double strap brass saddles shall be used. Saddles shall be IP thread pattern and material as required by the County.

Reclaim water services taps on the main shall be spaced at a minimum distance of 18 inches apart and a minimum of 18 inches from a bell or fitting. Consecutive taps shall be offset 45 degrees. All service lines taps shall be supplied with corporation stops. Angle meter valves must be installed for each serviced. All service lines shall be installed in accordance with the details in this manual. Service line tubing shall be polyethylene PE 3408 material conforming with AWWA C901, SDR 9. Tubing shall be installed in a continuous length with no in-line fittings except for U-branch for multi meters between corporation stop and angle stop. Tubing shall be routed through a 2-inch PVC Schedule 40 sleeve. The minimum size for single and double services shall be 1 inch to the U-branch and ¾ inch for each service from the U-branch. Services over 50 feet shall be 1½ inch minimum. Services shall not exceed 100 feet from the main to the meter.

6.8 RECLAIM WATER METER INSTALLATION

Construction plans shall include a typical meter installation for each size meter to be installed. Meters will be installed by the Contractor or developer at the time of installation. Each unit within a residential building shall have a separate meter. The proper sizing of service lines is the responsibility of the developer or developer's engineer. The County assumes no responsibility for undersized meters and problems associated with it. Upon service the meters become the property of the County.

Meters should be placed 18 inches inside the adjacent utility easement or right-of-way. In developments where the property line is not clearly defined the meter should be placed for ready access and approved by the County. Meters shall not be placed in areas that can be fenced such as backyards. Meter boxes shall be kept out of pedestrian walkways and out of

driveway areas. For shopping areas, the developer's Engineer should give special consideration to the placement of meters to satisfy these requirements.

6.9 ISOLATION VALVES

Valving of all force main and reclaimed water systems shall be designed to facilitate the isolation of each section of pipeline between intersections of the network. Generally, the number of valves at an intersection shall be one less than the number of pipes forming the intersection. All force main valves shall be ductile iron, eccentric plug valves with mechanical joints conforming to AWWA C500, latest revision.

Reclaim water main vales, 4 inches to 12 inches, shall be the resilient seat gate valve conforming to AWWA C509. Reclaim water main valves larger than 12 inches shall be gear operated butterfly valves, conforming to AWWA C504. Isolation valves shall generally be installed at intervals of not more than 1,000 LF on mains.

6.10 AIR RELIEF VALVES

Manual air release valves shall be incorporated into the design of force mains and reclaim water mains at all high points of the main to prevent air accumulation within the main. The force main and reclaim water main must be designed with a minimum of grade breaks and as flat as possible to consistently maintain a full pipe flow. Vacuum relief valves may be necessary to relieve negative pressures at extreme high points. Force main configuration and pumping conditions shall be evaluated for the placement and need of relief valves by the County.

6.11 TERMINATIONS

Force mains shall not terminate directly into a gravity sewer line. Force mains shall enter the gravity sewer system at a point not more than 1 foot above the flow line of the receiving manhole.

6.12 PIPE INSTALLATION FOR FORCE MAINS AND RECLAIM WATER MAINS

Installation of force mains and reclaim water mains and associated appurtenances shall be in accordance with current AWWA specifications and manufacturer's requirements for their particular products.

6.12.1 Storage of Materials

Loading and unloading and storage of pipe, fittings, valves etc., shall be done in such a manner so as to avoid damage. The interior of all pipe, fittings, valves, etc., shall be kept free of dirt and foreign matter at all times.

6.12.2 Minimum Cover

Minimum cover over all piping shall be 36-inches.

6.12.3 Thrust Restraint

Thrust Restraining Devices: All non-flanged fittings and valves shall be restrained using on of the following methods.

Mechanical Restraint: Restraint at fittings and valves and along adjacent joints of pipe to a length specified herein using the approved material in the approved materials list.

Mechanical Restraint with Tie Rods: Restraint using restraining devices and/or tie rods along adjacent joints of pipe to a length as specified herein. All pipes sizes 3-8 inches in diameter shall have a minimum of 2 tie rods per joint, pipes sizes 10 to 12 inches in diameter shall have a minimum of 4 tie rods per joint and pipes 14 to 20 inches in diameter shall have 6 tie rods per joint. To connected tie rods to fitting, offset eyebolts shall be used. Tie rods shall be 316 SST ¾-inch diameter, threaded as required and installed with a washer and nut of the same size and material.

Thrust Blocks: Thrust blocks shall be limited to situations such as point repair where exposing several joints of pipe is not feasible due to existing ground conditions and also must be used with mechanical joint restraining devices when, in the judgment of the Engineer, the nature and criticality of an installation is such as to require positive assurance of stability. Concrete collars with tie rods may be used on dead end lines at the Contractors discretion. Concrete used for this purpose shall be 2,500 psi minimum. When applicable, schedule and details for the required thrust blocks are included on the drawings.

6.12.4 Pipe Trenches

All pipe shall be laid in trenches having a dry and stable bottom. Backfill shall be free of boulders and debris. Pipe shall be fully supported along its entire length. Sharp or rocky material or unsuitable material such as much encountered in the base shall be replaced a minimum of 6-inches below the pipe in order to achieve satisfactory bedding of the pipe.

6.12.5 Locate Wire

Locate wire shall be installed on all PVC and HDPE main piping. No wire shall be installed on above ground installations. Locate wiring shall be 10 gauge, single strand, UF rated (direct burial), copper wire 30 mil. (minimum) insulation. The wire shall be attached to the water line and services with plastic ties at 10-ft intervals and on each side of bell joints or fittings. Locate wire shall be brought to grade within a valve box or locating station box at 450-ft intervals maximum. Locate wire shall be installed either in the 1:00 or 11:00 position on the pipe. Splices or connections not in a location box will be prohibited unless it is unavoidable. If the connection is unavoidable the wire shall be first tied in a knot (to minimize future separation), then the ends connected utilizing an electric wire nut. Upon doing that the connection shall be made in a water tight condition by using either vinyl mastic tape (4" wide x 0.09" thick by 3M-Scotch 2210) or plastic enclosure (SnapLoc Model LV 9500/951-4 large by TKHP). The out side color of the wire shall be either white or yellow.

6.12.6 Separation Requirements

Horizontal separation from water mains shall be no less than ten (10) feet from edge of main to edge of main. In cases where it is not possible to maintain a ten (10) feet separation, the water main must be laid at an elevation so that the bottom of the water main is a minimum of 18 inches above the top of the sanitary sewer or force main.

Horizontal separations of 15 feet to buildings, top of banks and other structures shall be maintained.

Vertical separation from a water main shall be a minimum of 18 inches between the outside of pipes.

When a sanitary sewer, force main or storm sewer crosses a water main it should be laid below the water main with a minimum of 18 inches of separation. At the crossing, one full-length joint of water main shall be laid in such a way the both joints will be as far away from the sewer as possible.

Where it is not practical to design for these separations specific requirements from the regulatory agencies must be followed.

6.12.7 Cleaning and Flushing

Foreign material shall be kept out of all pipe or cleaned from the pipe prior to installation. Upon completion of installation, the mains shall be flushed and the water disposed of without creating a nuisance. If, in the opinion of the County there is insufficient water available for proper flushing, the Contractor shall clean the lines by pigging. Flushing must achieve a minimum water velocity of 2.5 feet per second in all portions of the pipe. The duration of the flushing shall be as directed by the County's representative or as required by industry standards and FDEP regulations.

6.12.8 Testing

Contractor and developer shall provide all equipment, materials and labor necessary for pressure and leakage testing. All mains and services shall be tested for leakage. Water shall be supplied to the main at the expense of the developer and/or Contractor and pumped to the required pressure of 150 psi. The main tested shall either be isolated from active lines or protected from leakage by a double valve arrangement. All water utilized for the pressure and leakage test shall be potable water with an adequate chlorine residual.

The maximum length of a line to be tested as one section is 1,500 feet. The maximum allowable leakage shall be as determined in accordance with the current AWWA leakage specifications. The standard test length is two hours. Testing procedures shall meet or exceed AWWA C600. The contractor shall successfully complete a pretest prior to scheduling the pressure and leakage test with the County. The pressure and leakage test must be observed by a County representative and the design Engineer. The Contractor shall replace or adjust components of the pipeline which fail the test. The pipeline shall then be tested as described above until it passes the test criteria. The pressure and leakage test shall be done concurrently.

SECTION 7.0 – WASTEWATER LIFT STATIONS

7.1 MINIMUM DESIGN CRITERIA

The standard wastewater lift station shall be a below ground installation with explosion proof submersible pumps. For flows of 1500 gpm or less, the lift stations shall have a minimum of two pumps with equal capacity. When pumping rates exceed 1500 gpm, three or more pumps are required. All stations will be designed for not less than 240 volt, 3 phase, 60 cycle electric service. The use of phase converters is not acceptable.

7.2 WASTEWATER LIFT STATION DESIGN FLOW

When data is available from an existing wastewater system the maximum 3-month Annual Average Daily Flow (AADF) and maximum 3-month Maximum Monthly Flow (MMF) can be determined by using at a minimum one years worth of actual data and calculating a rolling 3-month average of the AADFs and MMFs. The Maximum 3-month AADF is divided by the number of actual connections to be on the lift station to determine the gallons per day per connection (gpd/conn) that will be generated. When data is not available, AADF is estimated at 100 gallons per person per day with 3.0 persons per household and MMF and PHF are calculated using 1.5 and 4.0 peaking factors, respectively. This estimate should be modified as necessary based on specific zoning and land use data.

MMF and PHFs are determined as follows:

MMF = AADF x 1.5*

PHF = AADF x 4.0

*(If data is available the MMF peaking factor can be determined by dividing the Maximum 3-month rolling average of MMFs by the Maximum 3-month rolling average of AADF's. The PHF peaking factor can be determined by using the Ten States Standards for developing a peaking factor based on population projections per year.)

Ten States Standards:

$$\frac{Q_{PEAK}}{Q_{AVG}} = \frac{(18+\sqrt{P})}{(4+\sqrt{P})}, \text{ where P = population in thousands}$$

7.3 PUMPS

The pump station shall be capable of pumping the peak hourly flows at the maximum total dynamic head (TDH) with the largest pumping unit out of service.

Pumps shall be capable of meeting all system hydraulic conditions without overloading the motors.

Pumps shall be designed to pass a sphere three inches in diameter. Pump suction and discharge shall be at least four inches in diameter.

Pumps shall be designed to operate under a positive suction head. Pumps shall seat into self-seating bases and be explosion proof. All fixtures and fasteners, including non-sparking guide rails and bracket shall be 316 stainless steel.

Pumps shall be installed with guide rails, discharge connections, and SST lifting chains or cables.

Pump and capacity curves and specifications shall be submitted to the County before installation of the pumps. Curves will be based on the friction losses outlined in Section 5.1 of these specifications. Head capacity curves shall verify that the pumps are operating at peak efficiency and are suitable for the design flow application. Only pump brands approved by the County are acceptable.

Master lift stations that will have initial minimal flows shall be equipped with temporary pumps with reduced capacity, though not less than 50 percent of the permanent pumps.

Approved Manufacturers:

- Flygt
- Or Approved Equal

7.4 DESIGN CALCULATIONS

The Developer's Engineer shall submit signed, sealed and dated design calculations for all wastewater pump stations. Calculations shall include head capacity curves with copies of manufacturer's pump curves, hydraulic analysis of force main system, operating cycle calculations with wet well sizing and buoyancy calculations. The calculations of the pump total dynamic head shall be by the Hazen-Williams method. The "C" factor for PVC and HDPE for force mains shall not exceed 130. "C" factor for DI force main shall not exceed 120.

7.5 WET WELL AND VALVE VAULT

Wet wells shall have a minimum inside diameter of 6 feet. The floor of the wet well shall have a minimum slope of one to on to the pump intake. Station structures shall be of pre-cast concrete (Class II, 28 day compressive strength of 4000 psi, minimum).

Wet well top slab elevation shall be set to protect electrical components from physical damage by a 2-feet-above 100-year flood and be able to remain fully functional during a 25-year, 3-day flood.

Buoyancy calculation shall be performed and submitted to the County for review. The calculations shall not take into consideration the wet well interior fillets, top slab, pumps and piping. Ground water elevations shall be assumed at natural ground level, unless special circumstances dictate otherwise and approval is granted by the County.

Effective operational capacity of the wet well shall provide a holding period not to exceed a 10 minute pump cycle (maximum 6 pump starts per hour).

Low water cutoff and alarm level shall be set 3-inches above the top of the pumps to provide complete submergence of pumps. The pump "off" level shall be located 6-inches above the low water cutoff and alarm level. All pump control elevations shall be a minimum of 6-inches apart. Operational water-level shall generally be set two feet above the low water-level. The high water alarm shall be set at the invert elevation of the lowest influent pipe.

Valve vaults shall be sized to accommodate the force main pipe size and associated valves. The bottom floor of the vault shall have grout placed at a 1% slope (minimum) to a 2-inch PVC pipe drain with trap connected to the wet well.

The pumping station shall be readily accessible by maintenance vehicles during all weather conditions. The access road to the pumping station shall be paved.

7.6 COATINGS

The exterior, including the outside bottom for precast stations and valve vaults shall be coated as required for manholes with coal tar epoxy, excluding the above ground portion. The interior including the valve vault and underside of tops shall be coated with Ultra-Glass Plus or equal.

7.7 VALVES AND PIPING

A plug valve is required on the discharge line of each pump. A check valve with outside weighted lever is required between the pump and plug valve. The valves shall be located inside a lockable vault adjacent to the lift station. A 4-inch diameter pressure gauge with SS diaphragm guard and shut off ball valve (brass ¼ turn) shall be provided on the discharge line of each pump. Discharge side of pumps shall be Ductile Iron, suitably coated to minimize corrosion.

An emergency pump connection shall be provided and shall be the same size as the pump discharge piping.

7.8 FLOW METERS

Indicating, totalizing and recording flow measurement shall be provided at pumping stations designed to handle peak flows of 1000 gpm or more.

7.9 CONTROLS

The pump control panel shall be a 316 stainless steel enclosure, rated NEMA 3R with all exterior hardware stainless steel and a drip shield. The panel shall include a non-resettable type elapsed time meter for each starter. A totalizer to record running time of all pumps shall also be provided. The panel shall have a 30-amp Ground Fault Interrupter (GFI) type receptacle mounted on the inner door to provide 120V power with ground fault protection. The panel shall include a seal failure indicator for each pump and have three-phase transient voltage lightning arrestor/surge suppressor protection. The control circuitry within the panel shall provide for automatic alternation of each pump during each cycle. Hand-Off-Automatic (HOA) control switches shall provide means to operate each pump manually or automatically. An audible high level alarm, in addition to a high level red warning light shall be provided at the panel. Control panels shall have a main and emergency circuit breaker. A generator power receptacle shall be provided on the exterior of the pump control panel and shall match the county's standard.

Wet well levels shall be detected using float type switches. The switches shall be located as not to be affected by flows into the wet well or by the pump suction.

The lift station control panel shall be opposite the side of the wet well where vehicle access is provided.

7.10 EMERGENCY OPERATION

All pump stations shall be provided with emergency power receptacles. The generator receptacles shall be externally mounted and sized as required to operate both pumps under normal pump station conditions.

7.11 WATER SERVICE

Each pumping station shall be provided with a minimum one 1½-inch potable water supply. The potable water supply will be provided with reduced pressure zone backflow preventer, 1-inche meter and 1½ -inch isolation ball valve 36 inches above ground surface.

7.12 SITE SIZING AND EASEMENTS

The Developer shall dedicate pump station site by warranty deed or plat to the County. Dedicated easements shall also be required around the site. In general, the site for the paved access road shall also be dedicated to the County by warranty deed or plat. An exception to this requirement may be allowed on a case-by-case basis in the form of an ingress/egress easement for the access road.

7.13 ENCLOSURES

All lift stations shall be enclosed by fencing (10 gauge chain link, 6 feet high with 3 strands of barbed wire at top) with a 12-foot wide (minimum) double gate centered on the wet well. Easements and/or right-of-way of sufficient size shall be provided for vehicle access to the station. An easement or deed for the lift station site will be required.

The fenced area shall be laid with a minimum of 6 inches of ¾" washed rock. In areas that connect to a paved road, concrete or asphalt driveways are required. The paved area will be required to support all anticipated loads and provide driveway culverts if necessary.

7.14 PRIVATE OWNED STATIONS

Privately owned wastewater force mains and lift stations are discouraged. The owner of a privately owned force main or lift station is responsible for all maintenance and operation. The County assumes no responsibility for changes in pumping capacity due to decreasing or increasing pressures within the County force main network at the point of connection.

Owners of all private lift stations and force mains must upgrade all components to County standards if and when they wish to convey the system to the County.

SECTION 8.0 - WATER TREATMENT PLANT DESIGN STANDARDS

8.1 GENERAL

The criteria contained herein are intended to assure uniformity and quality of construction of any potable water facilities to be constructed in Putnam County. Water treatment facilities shall be designed to adequately meet or exceed current water quality standards. The process utilized shall be reviewed by Putnam County or their designated representative as part of the review process detailed in Section 2.0 of this Manual. The design shall meet all the requirements set forth in the most current Florida Administrative Code (FAC).

8.2 DESIGN FLOWS

Design flows for the water treatment plant will be based on the criteria set forth in Section 4.0 of this Manual.

8.3 SITE DEVELOPMENT

8.3.1 Stormwater Management Plan

The developer shall be responsible for the Stormwater Management Plan (SMP) associated with the Water Treatment Plant (WTP) site which should incorporate the total buildout of the site. The SMP shall address the stormwater treatment and conveyance associated with the construction and operation of the proposed facility. The SMP shall meet all the requirements set forth in rule 40C-42 of the St. Johns River Water Management District (SJRWMD) and the Suwannee River Water Management District (SRWMD).

8.3.2 Wetland Impacts

Impacts to existing wetlands shall be evaluated as part of the SMP. All efforts shall be made by the developer to minimize the impacts to wetlands on the proposed WTP site.

8.3.3 Site Plan

The site plan shall address at a minimum the following issues.

8.3.3.1 Initial and Future Construction

The site plan shall show the location and layout of facilities for the initial development phase and shall show the proposed location and layout of future expansions as anticipated by additional development phases or requirements as determined by the County. Future expansion may include both expansion in plant capacity, as well as the construction of additional treatment processes.

The site plan shall also identify access to the WTP. Access to the WTP shall be restricted to operational personnel by use of using fencing and gates. The entry gate shall be located far enough inside the property line to allow the largest anticipated vehicle (typically, chemical delivery trucks) to pull completely out of the public access road so as not to restrict traffic.

8.3.3.2 Access Roads

The access road may be designed for two lanes of traffic. The road may be designed for single-direction traffic with prior County approval. A paved perimeter road around the entire site is recommended, although not specifically required; however, all onsite roadways shall be asphaltic concrete. Paving of roadway access to future facilities may be postponed until construction of those facilities, although the layout of these future access roadways shall be shown as part of the site plan development. Roadway geometry and turning radii must allow all large chemical delivery vehicles (WB-50) to negotiate the entire site.

Roadway access shall be provided to all raw water well sites. As appropriate, this access may be established from the WTP property to the well site or from some other access point to the well site. Roadway access to the well sites need not be paved; however, design of the road shall be sufficient to withstand the loads associated with maintenance vehicles which may be necessary to pull a well pump. Non-paved roadways shall be constructed of 8 inches of crushed stone (FDOT No. 57 stone) underlain with geotextile fabric.

8.4 WATER SUPPLY WELLS

8.4.1 General

The minimum size for a well site shall be a 200 feet by 200 feet parcel. The developer shall meet the local wellhead protection requirements and those established by the SJRWMD. As part of the well permitting process, potential impacts to adjacent existing wells shall be evaluated.

Wellhead, piping supports, panels, and instruments shall be located on a concrete slab. Backup power shall be provided by a standby generator mounted on a concrete pad near the wellhead. All surface facilities and backup power shall be enclosed within a chain link fence topped with three strands of barbed wire. Figures 1 and 2 present a typical water supply well, wellhead, and supply well site plan.

8.4.2 Regulatory Requirements

The Developer shall meet all of the set back and regulatory requirements specified by the SJRWMD and Florida Department of Environmental Protection (FDEP). The Developer shall be responsible for attaining the required Consumptive Use Permit (CUP) from the SJRWMD. The County may require that future flow capacity be included in the CUP application.

8.4.3 Potable Water Supply Well Capacity

Well Capacity for the WTP shall be provided in accordance with the "Recommended Standards for Water Works, 1991" Ten State Standards and FDEP as follows:

- The total developed groundwater source capacity shall equal or exceed the design maximum day demand and equal or exceed the design average day demand with the largest producing well out of service.
- A minimum of two wells shall be provided.

- All wells shall have a back-up power supply.

8.4.4 Potable Water Supply Well Design Criteria

Potable water supply wells installed in Putnam County shall at a minimum have a 20-inch steel surface casing installed through the shallow unconsolidated sediments and 16-inch PVC or steel final casings installed to the top of the upper Floridian aquifer. The 16-inch final casings should extend from land surface into competent limestone for a minimum of 5 feet. The final casing material shall be determined by the extent of the corrosive properties of the soil. Construction shall be completed by drilling a nominal 12-inch-diameter open borehole section through the upper Floridian. Actual casing diameters, lengths and final well depths shall depend on site-specific hydrologic conditions. In some instances, the final casing may be less than 16-inches in diameter. Casings less than 16-inches shall be approved by the County or it's designated representative. A copy of the well design, proposed pump curve and dimensions, static water elevation and any test well information shall be submitted to the County or it's designated representative prior to installation for review. Figure 3 presents a typical well construction detail.

8.4.5 Potable Water Supply Well Pump

The well pumping system shall consist of either a vertical turbine or submersible turbine motor and pump, pump column discharge piping (flanged or coupled), check valve, motor lead, wellhead flange and discharge head.

The well pump shall be driven by a 1,800 rpm, 3-phase 60 Hz, 480 volt, oil-filled motor with double mechanical seals. Pump shall be constructed with cast iron bronze fitted bowls, shaft, collets, and couplings of stainless steel. Pump column piping, check valve, and discharge head shall have standard epoxy coating NSF approved for potable water use.

The pump motor cable shall be of appropriate size per horsepower that meets the intended design conditions (flow and head) and meet NEC standards. The cable shall have male and female watertight connectors for field fitting and removal.

All components of the well pumping system (the pump, motor, column piping, motor lead, check valve, wellhead flange, and discharge head) shall be provided by the pump supplier.

Vertical turbine pumps shall be utilized for most installations; however, submersible pumps shall be used in areas where the well is within 300-ft of any residence.

Acceptable Manufacturers for the potable water supply well pumps are:

- Goulds,
- Floway
- Crown, or approved equal

The acceptable manufacturers periodically change and should be verified with the County prior to purchasing.

8.4.6 Potable Water Supply Well Instrumentation and Control Standards

Potable water supply wells are to be controlled and monitored remotely from the WTP SCADA system. Well remote monitoring shall include pumping rates, discharge pressures, pumping water levels, well pump run time (daily), and measurements of raw water conductivity. Also, continuous pump motor amp draw shall be monitored whenever the pumps are running. The following is a list of acceptable manufacturers for monitoring equipment:

Magnetic Flow Meter and Transmitter

- Toshiba,
- Sparling Instruments: Tiger Mag
- Krohne
- Endress & Houser

Pressure Transmitter

- Rosemount,
- Foxboro
- Or approved equal

Pressure Gauges

- Dresser Ashcroft
- Ametek US Gauge

Conductivity Element and Transmitter

- Roesemount
- Yokogawa
- Hach
- Or approved equal

Level Element and Transmitter

- Druck
- Drexelbrook
- Or approved equal

Programmable Logic Controller

- Siemens
- Or approved equal

8.5 GROUND STORAGE TANKS

8.5.1 General

A minimum of one ground storage tank shall be provided at each WTP for aeration and disinfectant contact. Piping shall be arranged to accommodate a by-pass from the well pumps to the high service pump station for tank maintenance purposes.

Space for future tanks shall be reserved on the site if a future expansion is anticipated and additional storage volume will be required.

Ground storage tanks shall be designed as pre-stressed concrete tanks. The tanks shall be located essentially at grade to allow WTP operators to completely drain the tanks for cleaning. Drainage of the tanks, as well as any tank overflows, shall be diverted to the WTP's stormwater system.

Acceptable manufacturers include:

- Crom Corporation
- PreCon Corporation
- Or approved equal.

8.5.2 Ground Storage Tank Sizing Criteria

The tank size shall be determined by evaluating the minimum holding time for oxidation of hydrogen sulfide not removed by aeration, storage for peak demand periods and chlorine contact time.

The calculation for sizing storage facilities based on sulfide oxidation is as follows:

Storage Capacity for Sulfide Oxidation = MDF (MGD) x 4/24

(MDF in MGD)

The calculation for sizing the storage facilities based on peak demand periods when demands exceed the capacity is as follows:

Storage Capacity for Peak Demands = 2 x (PHF – MDF) x 6/24

(PHF and MDF in MGD)

Both sizing calculations shall be performed and the largest calculated storage capacity of the two methods shall be utilized.

In addition, the tanks shall provide a minimum of 15 minutes of contact time (with chlorine) at PHF or 30 minutes at MDF at a minimum.

If two or more ground storage tanks are required, one tank shall be used for aeration and the second tank shall be used for chlorine contact. In this case, the aeration tank shall be sized to meet the sulfide oxidation capacity requirement and the chlorine tank shall be sized to meet both the chlorine contact time requirement and provide any balance of peak storage capacity not provided by the aeration tank. Figures 4 and 5 present a general layout of an aeration tank and a contact tank.

8.5.3 Ground Storage Tank Accessories

At a minimum the following accessories shall be provided with each ground storage tank:

- Aluminum outside ladder with safety cage and gate. The ladder shall conform to all OSHA requirements.
- A fiberglass interior tank ladder with stainless steel safety post and safety climb device, belt and rail extension. The side rails shall be punched to receive rungs and rungs shall be glued and mechanically secured to the side rails. The ladder shall conform to all OSHA requirements.
- A fiberglass roof hatch with a main clear opening of 6-feet square and an internal, hinged, 3-foot square clear opening hatch.
- Precast concrete roof overflows with No. 24 mesh polypropylene insect screen. The minimum clear opening of each overflow shall be 675 square inches. The number of overflows for each tank shall be sufficient to meet the total raw water-pumping rate assuming no water is being withdrawn from the tanks by the high service pumps.
- A locking aluminum box adjacent to the roof hatch to store the safety climb device rail extension and safety climb belt.
- Two stainless steel wall manway frames and covers. Manways shall have a minimum clear opening of 1 foot 5 inches high by 4 feet 4 inches wide.
- Aluminum handrails shall be two-rail system with toeboard around the entire perimeter of the domed roof and should be a minimum of 42".
- Concrete curbs in the dome for mounting of the ventilators (see Section 8.5.5 of this manual).
- A concrete curb in the dome for mounting a 4-inch flanged by plain end stainless steel roof pipe. The roof pipe shall have a blind flange on the exposed end above the roof. The roof pipe shall be used for insertion of probes into the storage tank.
- A concrete curb in the dome for mounting a permanently installed ultrasonic level transmitter. The curb shall be located so as to provide the appropriate clearance angle for the ultrasonic signal to the water surface inside the storage tank.
- A tray aerator mounted at the peak of the dome, for hydrogen sulfide reduction (see Section 8.5.4 of this manual).
- Circular baffling installed inside the tank to minimize dead zones (see Section 8.5.6 of this manual).
- A stainless steel vortex baffle at the entrance to the outlet pipe.

8.5.4 Ground Storage Tank Tray Aerators

A perforated tray natural drift aerator shall be provided at the peak of the dome of each aeration storage tank. If more than one tank is constructed at the site and one is used as a contact tank, tray aerators are not required. The aerators shall be constructed of

fiberglass-reinforced plastic (FRP), approved for contact with potable water. All fasteners shall be of type 316 stainless steel. The base of each aerator shall be a watertight circular FRP catch basin of such height and diameter as will ensure adequate capacity and proper ventilation at all tray levels and preclude splashing of water outside the basin. A drain shall be provided for ease in cleaning the catch basin.

The aerator shall be capable of treating the Maximum Daily Flow. The trays shall surround and shall be anchored to the inlet pipe. Each aerator shall have a minimum of three tiers, with a minimum vertical separation of 15 inches between tiers. In addition, the minimum of 15 inches of vertical separation shall also be provided between the aerator roof and the top tier of trays, as well as between the bottom tier of trays and the catch basin floor. Each tier shall form a complete circle. The number of trays per tier shall be sufficient for the structural loading associated with the diameter of the aerator and the volume of water loaded onto each tier. The total surface area of the aerator shall be sufficient to provide a loading rate of less than 46.2 gallons per minute per square foot of surface area.

A minimum clearance of 50 inches shall be provided between the catch basin curb and the outer edge of the trays. This clearance area shall be covered in FRP grating for operator access to the trays. The entire area out to the catch basin curb shall be covered with a roof as provided by the aerator manufacturer. The circular sidewalls of the aerator shall consist of the roof columns together with 24 by 24 mesh vinyl coated FRP screening, resulting in a complete screened enclosure capable of preventing entry of birds, animals, and insects. Each screen panel shall be removable to provide operator access into the aerator enclosure.

The raw water supply pipe shall extend up through the center of the tray aerator. This pipe shall include a flanged connection below the aerator assembly to facilitate its removal in the future if an ozonation system is installed. In addition, a flanged connection shall be located at the desired future inlet elevation inside the tank. The future inlet elevation shall be based on the modified hydraulic profile for the WTP following installation of the future ozonation system. Figure 5 presents a typical section of the tray aerators. Tray aerator shall be supplied by the tank manufacturer.

8.5.5 Ground Storage Tank Ventilators

Each storage tank shall be provided with axial flow roof ventilators. These ventilators shall be designed to run continuously to replenish the atmosphere above the water in the storage tank so as to promote additional hydrogen sulfide removal through volatilization. Design of the ventilators shall be done by the developer's engineer and reviewed by the County or it's designated representative.

Ventilators shall be self-supporting vertical-discharge, FRP, belt-driven units. The unit shall be designed to protect the shaft, drive, and bearings from the corrosive nature of moist hydrogen sulfide-laden air. All ventilators shall include FRP stack cap with automatic damper. The stack cap shall direct the discharge air stream upward. The damper shall close against a soft neoprene gasket to provide a weatherproof, insect-proof seal when the fan is not operating. A weep hole shall be provided in the recessed gutter to drain rainwater from the stack cap. The unit shall include an FRP motor cover to protect the motor and V-belt drive. Figure 4 shows the typical location of the roof ventilators. Tray aerator shall be supplied by the tank manufacturer.

8.5.6 Ground Storage Tank Baffling

A minimum of two concentric circular baffles shall be provided to minimize dead flow zones in the storage tank. Straight wall baffles shall be included to force the flow of water in opposite directions in each subsequent concentric circle. Baffle walls shall be free standing, and foundations for the walls shall be designed to resist all forces from the wall. Baffle walls shall be constructed with an internal steel diaphragm with a shotcrete cover on both sides of the diaphragm. Cast-in-place concrete or shotcrete pilasters shall be provided as required to support design loads.

Each storage tank shall be drained through a single drainpipe. However, separate inlets shall be provided in each of the concentrically baffled areas of the tank to facilitate draining of the tank. The tank overflow pipe shall connect into the drainpipe downstream from its isolation valve. Knockouts shall be provided in the baffle walls to facilitate draining and cleaning.

Sample piping shall be provided to the outside of each storage tank to facilitate collection of water samples at high, mid, and low water elevations inside each of the three concentric segments of the baffled storage tank. Figures 4 and 5 show a typical layout of the baffling. Baffles shall be supplied by the tank manufacturer.

8.5.7 Protective Coatings

All interior and exterior surfaces of ground storage tanks shall be painted. The complete interior of tanks, including the underside of the dome, floor, side walls and baffles shall be coated with a polyamide epoxy to a thickness of 16 mills, obtained in three coats. All interior coatings shall be approved for contact with potable water and conforming to NSF 61.

All exterior surfaces shall be primed with a Thoroseal primer coat and top coated with acrylic latex, to a minimum thickness of 10 mils, obtained in two coats.

Manufacturers' recommendations for surface preparation, primer and coatings shall be strictly adhered to. Should the county elect no to have an epoxy coating on the interior of the tank, all tank materials shall meet NSF 61 requirements.

8.5.8 Ground Storage Tank I&C Equipment

Each ground storage tank will be equipped with a level element and transmitter to indicate tank level and transmit the information to the main control panel. In addition, the tanks will be equipped with a level element and switch for the high level alarm. This switch will be used to disable the well pumps in the event that the level in the tanks reach the high level alarm set points.

Acceptable equipment includes:

Level Element and Transmitter

- Miltronics Ultrasonic Probe
- Or approved equal

Level Element and Switch Electrodes

- B/W Controls, Inc.
- Or approved equal

8.6 HIGH SERVICE PUMPS

High Service Pumps deliver pressurized finished water into the distribution system. Design criteria for selecting High Service Pumps shall be approved by the County's Engineer or designated representative as discussed on Section 2.0 of this Manual. The Design criteria shall include future flow demand projections. Minimum criteria for High Service Pumps selection and design shall consist of the following:

- Initial Average Daily Flow (ADF) requirements
- Initial Peak Hourly Flow (PHF) requirements
- Future ADF requirements
- Future PHF requirements
- Minimum flow conditions for one pump running
- Discharge pressure range
- Firm capacity pump redundancy requirements
- Motor Drives (Constant Speed, Variable Frequency Drives (VFD), or a combination as approved by the County)

8.6.1 Preliminary Pump Selection

The High Service Pumps shall be capable of meeting minimum and maximum day flows during the initial phase of construction. Firm capacity shall be provided for the maximum flows. A plan shall be developed to enable the pump station to meet future phase minimum and maximum day flows. Future flows can be met by changing out smaller pumps to large pumps or leaving empty slots for future pumps in the initial construction phase. Initial and future WTP flows developed for the WTP will be reviewed by the County or its designated representative and must be consistent with the County's criteria for establishing flow demands found in Section 3.0 of this manual. If fire flows are not included in the water storage facilities, it shall be added to the capacity of the high service pumps.

8.6.2 Design Criteria

The High Service Pumps shall be located in a High Service Pump Room of the High Service Pump/Chemical Building. The room will be sized to meet the space requirements for initial and future pump requirements. A typical pump layout is shown on the high service pump/chemical building layout on Figure 6. The following sections describe the elements of design to be considered when selecting High Service Pumps for the WTP. All appropriate design shall meet Hydraulic Institute Standards. Future design velocities in the pipes shall not exceed 8.0 feet per second (fps). The initial piping design shall not exceed 4.0 fps.

8.6.2.1 Piping Layout

Piping to and from the High Service Pumps shall consist of ductile iron pipe. The piping layout between the storage tanks and the suction manifold of the pumps will allow for finished water to enter the suction manifold from two directions. Piping for the discharge manifold will allow the finished water to be pumped in two directions. This piping sequence will provide a bypass on the suction and discharge side of the pumps, which can be used during maintenance.

8.6.2.2 Pump Types

The pumps shall be horizontal, split-case, double suction centrifugal pumps. Vertical turbine can-type pumps with multiple stages will be considered as an alternate on a case-by-case basis. Each pumping unit shall be complete with a pump, electric motor, constant speed or variable frequency drive (VFD) where indicated, and all necessary equipment required for proper operation. Shaft seals shall be of the mechanical type, by the John Crane Company, or equal. Baseplates, and appurtenant equipment shall be as recommended by the equipment manufacturer and as approved by the County.

If vertical turbine can-type pumps are approved for use, pump column diameters, heights, and stages shall be determined according to manufacturer recommendations and approved by the County. Pump discharge heads shall be fabricated, machined and well seal flanged. Can pumps shall be fitted with basket strainers of Type 316 Stainless Steel. Mechanical seals, as manufactured by the John Crane Company, or equal such as Flow Serve QBS Style, will be used and lubricated with pumped liquid. Pump cans shall be steel and have a flanged inlet and a flange set at the top to connect to the pump discharge header. The pump can shall have a minimum thickness of 0.375 inches, and be fitted with anti-vortex baffles and bottom floor plate.

All pumps shall be designed to provide water service at sea level, between 40 and 140 degrees F at 100% humidity.

Acceptable Manufactures:

<u>Horizontal Split Case Pumps</u>

- Fairbanks Morse
- Goulds
- Flowserve Durco

<u>Vertical Turbine Pumps</u>

- Goulds
- Floway
- Fairbanks Morse

8.6.2.3 Pump Equipment

Horizontal split case centrifugal pumps shall be equipped with a combination vacuum/pressure gauge assembly on the suction line, and a pressure gauge, air release valve, and pressure indicator on the discharge line. The pressure indicator will be capable of sending a signal to the main control room in order to monitor discharge pressures. Isolation butterfly valves shall be located on both the suction and discharge sides of the pump. A reducing expansion joint shall be connected to the suction and discharge of the pump for flexibility.

Can type pumps shall be equipped with a pressure indicator and air release valve mounted on the pump discharge. The pressure indicator and air release valve shall be mounted using a double strapped service saddle. The pressure indicator will be capable of sending a signal to the main control room in order to monitor discharge pressures. The air release valve will release air trapped in the pump and piping system.

In addition, a slanting disc check valve and isolation butterfly valve shall be installed along the pump discharge. The check valve will prevent water from rushing back into the pump during shutdown and the isolation butterfly valve will be used to isolate the pump. The check valve shall be manufactured by Val-Matic or approved equal.

Piping arrangements, use of standard or long radius elbows, valve placement and shaft orientation, and appurtenant equipment installation for both Horizontal split case centrifugal and Can type pumps shall be as recommended by the Hydraulic Institute and the equipment manufacturer.

A magnetic flow meter with a solid state transmitter with local indication, totalization and current output of flow shall be installed on the discharge piping out side of the High Service Pump Building.

The magnetic flow meter shall be manufactured by:

Flow Meter

- Sparling Instruments: Toshiba,
- Tiger Mag
- Krohne
- Endress & Houser

All fittings, valves and equipment shall be in accordance with this manual.

8.6.2.4 Drives

At least two pumps shall be furnished initially with variable frequency drives (VFD). The other pumps shall be designed as constant speed units. At least one motor on the constant speed units shall be designed to accommodate the addition of a VFD in the future. Space for one additional VFD shall be provided in the Electrical Room. The design of each adjustable frequency drive shall be coordinated with the requirements of each pumping unit. The pump manufacturer shall be responsible for furnishing VFDs, that match the motor and the drive, and for coordinating the installation of the units. All

pumps equipped or having the potential to be used with VFDs shall have a computer structural frequency analysis to ensure no damaging critical or resonant frequencies occur within the proposed operating speed range.

8.6.2.5 Motors

Motors shall be 460V, 3 phase, squirrel-cage, induction type. Motors for Horizontal Split Case Centrifugal pumps shall be mounted with the pump by the manufacturer. Motors for Can Type pumps shall be nonreverse ratchet type high-efficiency motors. Motors shall come with thermisters for thermal protection and 120V single phase space heaters. Brake horsepower of the driven equipment at any head capacity on the pump curve shall not exceed the motor nameplate horsepower rating, excluding any service factor. Service factor for motors shall be 1.15 at ambient temperature. Motors shall use manufacturer's standard lubrication for 350 horsepower and smaller. Motors larger than 350 horsepower shall use oil lubrication.

8.6.2.6 Pump Mounting

Each pump shall be provided with lifting eyebolts or lugs, plugged gauge cock connections at the suction and discharge flanges, tapped and plugged openings for casing and bearing housing vents and drains, and appropriate fittings for adding lubricant.

The pump coupling shall be sized for continuous operation at full load and at maximum rpm when the misalignment is within the manufacturer's tolerance limit. Coupling design shall permit removal of the pump rotating element without disconnecting the piping, moving the drive unit, or causing axial movement of the coupling halves on the shafts.

Anchor bolts shall be accurately located and centered in pipe sleeves having an inside diameter approximately 2½ times the bolt diameter and a length approximately 8 times the bolt diameter. A square anchor plate with a thickness of approximately ½ times the bolt diameter and side dimensions 4 times the bolt diameter shall be welded to the bottom of each sleeve, with the anchor bolt extended through the plate and welded thereto. Base plates shall be provided with adequate openings to facilitate grouting.

The sole plate for Can Type pumps shall be machined flat to within a tolerance of 0.005 inches.

8.6.3 High Service Pumps I&C Equipment

For horizontal split case pumps the combination pressure/vacuum gauge and transmitter shall be manufactured by Bristol Babcock or an approved equal. The gauge shall have a combination scale in feet of water and PSI and will transmit discharge pressure to the main control panel. In addition, each pump shall be equipped with a pump check valve and limit switch to indicate flow through the valve with will send a signal to the main control panel. The switch shall be provided by the valve manufacturer.

For can-type pumps the pressure indicator and transmitter will be manufactured by Bristol Babcock or an approved equal. A signal indicating discharge pressure will be sent to the main control panel. In addition, each pump shall be equipped with a pump check valve and limit switch to indicate flow through the valve with will send a signal to the main control panel. The switch shall be provided by the valve manufacturer.

8.7 DISINFECTION SYSTEM

Bulk liquid sodium hypochlorite will be used as the chlorinating agent for disinfection. Design considerations to be determined consist of the following:

- Initial Peak Hour WTP Flow
- Initial Maximum Daily WTP Flow
- Initial Average Daily WTP Flow
- Initial Minimum Daily WTP Flow
- Future Peak Hour WTP Flow
- Future Maximum Daily WTP Flow
- Future Average Daily WTP Flow
- Future Minimum Daily WTP Flow
- Disinfection Injection Points
- Maximum, Average and Minimum Dosing Concentrations

All tanks, pipes, valves, etc. that come in contact with the sodium hypochlorite must be NSF approved. All tanks, pipe, valves, and appurtenances shall be compatible with a minimum 15% trade solution of commercial grade sodium hypochlorite.

8.7.1 Flows

Initial and future WTP flows shall be determined based on the criteria shown in Section 4.0 of this manual. If the system is constructed for future flows, the future maximum daily WTP flow will be used to size the hypochlorite system. The future WTP peak hourly flow (PHF) and the initial minimum flow will be used to determine the sizing the chemical feed pumps.

For phased systems, a construction plan shall be developed for initial and future conditions.

8.7.2 Disinfection Injection Points

Two separate points for sodium hypochlorite addition shall be provided. Since sodium hypochlorite will react with hydrogen sulfide to produce elemental sulfur particulate, most, if not all, of the sulfide must be removed prior to the sodium hypochlorite injection. For a WTP with one storage tank, the primary injection point will be installed in a proceeding the aeration trays and the tank volume for sulfide oxidation as discussed in Section 8.5 Ground Storage Tanks. Hypochlorite will be injected into the system through a diffuser system as shown on Figure 7. A by-pass injection point shall be installed near the beginning point of the by-pass to be used during maintenance of the tanks and the diffusers. For WTPs with more than one tank a primary injection point will be located between the Aeration Tank and the Contact Tank with by-pass piping for maintenance. The secondary injection point will be located downstream of all by-pass piping and upstream of the high service pumps. The secondary injection point shall be located in a concrete vault upstream of the High Service Pumping System as shown on Figure 8.

8.7.3 Chlorine Residual Analyzer

Two chlorine residual analyzers shall be provided to measure the free chlorine residual after primary chlorine injection and as it leaves the plant. The chlorine residual analyzers shall continuously measure and transmit free chlorine residual concentrations. The analyzer shall be microprocessor based, reagentless NEMA 4x, with automatic temperature correction and self-diagnostics. The chlorine sensors shall be of the amperometric type, flow-through design with a low flow cell, and pressure and temperature corrected.

Acceptable manufacturers are:

- Rosemount
- Hach

The units shall be wall mounted in the High Serve Pump Room.

8.7.4 Dosing Requirements

Dosing requirements for maximum, minimum and average chlorine dosages needed to continuously maintain a minimum residual of 1.0 mg/L throughout the system shall be determined as part of a raw water pilot test. The dosing levels will be used to size tanks and pumps associated with the sodium hypochlorite system.

8.7.5 Commercial Grade Bulk Sodium Hypochlorite System

The preferred method of storing sodium hypochlorite is to locate the tanks inside an air-conditioned room to reduce product degradation from UV light and heat as shown in Figure 6. However, other types of shelters that reduce UV and heat may be used as approved by the County or its designated representative.

The storage tanks will be located inside a concrete containment basin, sized to hold 120% of the largest tank volume. The containment area floor shall slope to a dry sump pit sized to receive a portable pump. The pump can be installed whenever a leak or spill occurs within the containment. The pump shall be capable of pumping out of the sump and into a tanker truck or other approved disposal method.

If the system is designed within a build, it shall have access doors for removing the tanks.

Chemical feed pumps and control panels shall not be located within the containment area; however, they shall be located near the tanks in the building or on a slab under the alternative UV reducing shelter .

The required pound per day (ppd) of chlorine shall be determined for each plant based on future Maximum Daily WTP Flow at maximum dose. The required gallons per day of sodium hypochlorite expressed in equivalent chlorine shall be determined using a 1:1 ratio (10% trade sodium hypochlorite) of the required ppd chlorine. Therefore, the following calculation shall be used to determine the volume of required sodium hypochlorite per day.

MDF (MGD) x Maximum Dose (mg/L) x 8.34 x 1 (gpd/ppd) = Hypochlorite (gpd)

The bulk sodium hypochlorite storage tanks shall be sized for two criteria; first they shall hold a 14-day supply of sodium hypochlorite at MDF demands when the tank is 85% full; second they shall hold a 30-day supply of sodium hypochlorite at ADF demands when the tanks are full.

The storage facilities shall consist of two flat bottom, vertical, vented tanks, each holding one half the required capacity for 14 days at 85% full. The tanks shall be High Density Polyethylene (HDPE). All connections to the tank fittings shall have a flexible pipe ction. At a minimum, one primary and one back-up sodium hypochlorite compatible mechanical actuated metering pump shall be provided for both primary and secondary chlorine feed points. Flow requirements will dictate the size and quantity of metering pumps. Metering pumps shall have the following minimum associated equipment: calibration columns, anti-siphon devises, pressure relief valves, isolation valves, check valves, by-pass piping and venting. Venting shall be place on both the suction and discharge lines such that no section of the line can be isolated without venting.

Acceptable Manufacturers are:

Tanks

- Synder Tanks
- Or approved equal

Metering Pumps

- Aldoss
- Pulsa Feeder
- Prominex

8.7.6 Piping and Associated Equipment

Piping, valves, fittings, meters, pumps and all other associated equipment for commercial grade sodium hypochlorite system shall be compatible with a minimum 15% trade percent solution of commercial sodium hypochlorite. Sodium Hypochlorite pipe installed underground shall be double wall containment with a leak detection system.

Acceptable manufacturers include:

Pipe

- Ashahi/America
- Ipex Guardian

Leak Detection Systems

- PermAlerts' Liquid Watch
- Ipex Centra-Guard

8.7.7 Special Construction Requirements

The following sub-sections describe special construction requirements that should be considered during the design of the bulk-commercial grade system.

8.7.7.1 Leak Prevention

To reduce the potential of scaling, leaks should be prevented by using a manufacturer recommended method and specification for pipe installation. The installation method shall include a specification for installation and pipe preparation, primer application, type of primer, glue application, glue application and type of glue.

8.7.7.2 Special Equipment and Design Considerations Due to Off Gassing

O&M problems can be created by off gassing of the commercial grade sodium hypochlorite as it naturally decomposes. Problems that frequently occur include the rupturing of ball valves, plastic strainers, PVC pipes, and back pressure devices. Ruptures are cause by gas trapped in an isolated space along the piping system and pressures rise to above working pressure ratings of the equipment. To reduce the build up of gas, venting shall be located along the product delivery lines at high points and along segments that have the potential of being isolated. Also, diaphragm valves shall be used to reduce the possibility of pressure buildup in valves. Ball valves can be used if they are equipped with air release mechanisms. Pumps such as diaphragm and flooded suction pumps can be damaged if pressure is allowed to build up within the pumps. Vacuum dosing systems shall be used for chemical feed in the delivery system. Piping lengths should be kept to a minimum and high points, where gasses can be collected, should be avoided.

Approved manufacturers for sodium hypochlorite ball valves include:

Ball Valves

- Nibco
- ASAHI
- Spears

Diaphragm Valves

- ASAHI
- Spears

8.7.7.3 NSF Approval

All materials of construction shall be NSF approved.

8.7.8 Sodium Hypochlorite Disinfection I&C Equipment

I&C for the sodium hypochlorite disinfection system will consist of level measurement in the storage tanks and pressure measurement on the discharge side of the metering pumps. The following minimum equipment and approved manufacturers shall be provided:

Approved manufacturers:

Level Element and Transmitter

- Miltronics Ultrasonic Probe
- Or Approved equal

Diaphragm pressure Transmitter

- Rosemount
- Or Approved equal

Pressure Indicators

- Dresser Ashcroft
- Ametech US Gauge
- Or Approved equal

Diaphragm Seals

- Dresser Ashcroft
- Ametech US Gauge

8.8 pH ADJUSTMENT

The target pH for the finished water shall be between 7.8 and 8.2 to meet the requirements of the Putnam County Health Department and the FDEP. Depending on the local raw water quality and the disinfectant being used, the pH of the finished water may have to be adjusted. This adjustment shall be determined on a case-by-case basis by pilot testing of the local raw water supply. If the pH in the raw water source is high sulfuric acid at a concentration of 93% shall be used to adjust the pH downwards. If the pH in the raw water source is low a 50% concentration of sodium hydroxide (caustic soda) shall be used to adjust the pH upwards.

8.8.1 pH Injection Points

The pH injection point will be installed in the chlorine secondary injection vault located between the tank and the high service pumps. as shown on Figure 8. If acid is used, the flow rate is likely to be low; therefore, "carrier water" may be required to dilute the acid prior to injection into the process stream. If carrier water is used, Teflon lined steel pipe shall be provided to withstand the high temperature generated when water and acid is mixed. The diluted water will be added downstream of the metering pumps. If sodium hydroxide is used, no carrier water will be used. The injection point for the pH adjustment will be located immediately downstream of the sodium hypochlorite injection point and within the zone of influence of induction mixer, in the primary chlorine injection vault.

8.8.2 Storage Tank

The pH adjustment tank shall be HDPE and compatible with both a 93+% concentrated sulfuric acid and a 50% concentration sodium hydroxide. Depending on the results of the raw water pilot tests either sulfuric acid or sodium hydroxide will be stored in the tank to adjust pH. The tank will be sized based on having a 30 day supply of the required adjusting agent as required by the 10 State Standards. Depending on the volume needed two tanks may be required. The tanks will be located in a concrete containment area to meet secondary containment.

In the event that sodium hydroxide is used as the pH adjustment agent, heating shall be provided using insertion heaters (recommended) or heat tracing of the tank (pad type) and piping shall be provided. Control heating shall start at 65 F and shall be designed to keep at 65 F when ambient temperature is at the lowest temperature expected.

Secondary concrete containment for sulfuric acid shall be coated with Novolac Epoxy. Secondary concrete containment for sodium hydroxide shall be coated with Vinyl Ester with Graphite. Secondary concrete containment for a combined acid/caustic containment shall be coated with Protecto-Flex 100XT. All containment shall have a volume of 120% of the tank volume.

All tanks, pipes, valves, etc. that come in contact with the pH adjustment chemical shall be NSF approved.

Approved manufacturers include:

Storage Tanks

- Synder
- Or approved equal

8.8.3 pH Analyzer and Transmitter

Two analyzers for pH will be mounted inside the high service pump station. One analyzer will measure the pH of the sulfide stripped water after the primary chlorine addition. The second analyzer will measure the pH of the water leaving the plant. Approved manufacturers include:

pH Meter

- Rosemount
- Foxboro
- Or approved equal

8.8.4 Piping

Piping, fittings, valves and appurtenances shall be compatible with sulfuric acid, and sodium hydroxide. Use Carpenter 20-Cb3 pipe for all sulfuric acid piping and for above ground installations for and sodium hydroxide. CPVC pipe can be used for all buried pipe. Solvent cement for CPVC piping shall be IPS "Weld-On" 724.

Sulfuric acid and sodium hydroxide piping shall be double-wall containment pipe. Buried installations shall provide observation points at low points will alarms connected to the SCADA system.

8.8.5 Valves

Diaphragm valves shall be used for the sulfuric acid and sodium hydroxide system.

Diaphragm Valves

- ASAHI
- Spears

8.8.6 Metering Pumps

A minimum of two metering pumps shall be provided. One pump will be used for daily operation with one as standby. The capacity of each pump will be based on the dosing requirements as determined for the WTP.

Acceptable Manufactures include:

- LMI or equal
- Or Approved equal

8.8.7 pH Adjustment I&C Equipment

I&C for the pH Adjustment system will consist of level measurement in the storage tanks and pressure measurement on the discharge side of the metering pumps. The following minimum equipment and approved manufacturers shall be provided:

Approved manufacturers:

Level Element and Transmitter

- Miltronics Ultrasonic Probe
- Or Approved equal

Diaphragm Pressure Transmitter

- Rosemount
- Or Approved equal

Pressure Indicators

- Dresser Ashcroft
- Ametech US Gauge
- Or Approved equal

Diaphragm Seals

- Dresser Ashcroft
- Ametech US Gauge

8.9 PRESSURE-DRIVEN MEMBRANE SYSTEMS

Membrane filtration systems act as selective barrier, allowing some constituent to pass through the membrane while blocking the passage of others. Membrane processes commonly employed in drinking water applications are classified in four categories of pressure-driven membranes:

- Microfiltration (MF)
- Ultrafiltration (UF)
- Nanofiltration (NF)
- Reverse Osmosis (RO)

Membrane systems shall be selected and designed based on water quality and their ability to remove specific constituents such as inorganic and organic compounds or the removal of particulate and microbial contaminants.

The following raw water quality parameters shall be assessed to appropriately select a membrane.

Table 1
Raw Water Quality Constituents

Constituents			
Ca	F	Mn (Total & Dissolved)	Algae
Mg	SiO2 (Reactive)	Al	Suspended Solids
Na	Sr	H2S	Turbidity (NTU)
K	Ba	Alkalinity (as CaCO3)	Silt Density index (SDI)
NH4	Br	Hardness (as CaCo3)	Temperature (C)
HCO3	TDS	Color (CU)	Gross Alpha (pCi/L)
SO4	pH (units)	TOC	Gross Beta (pCi/L)
NO3	Fe (Total & Dissolved)	SUVA	Radium-226 (pCi/L)
Cl	Total ions = Silica	Conductivity (uS/cm)	Radium-228 (pCi/L)

Approved membrane manufacturers for RO systems include:

- Aerex Industries

- Harn RO Systems, Inc.
- GE/Ionics

8.9.1 Pretreatment

Pretreatment shall be determined based on the need to condition the treated water source prior to membrane processing. In cases in which the quality of the feedwater is poor some solids clarification process, lime softening, metal oxide removal, pH adjustment and removal dissolved organics may be necessary. The degree and complexity of the pretreatment equipment will be determined by the water quality of the feedwater and the requirements of the membrane.

A typical pretreatment process for groundwater sources is cartridge filters. This treatment process is primarily used to protect downstream pumps and membrane modules from damage by particulates in the water. Also common are source waters that are either corrosive or high in alkalinity requiring the addition of either an acid and/or scale inhibitor for stabilization.

Temperature may need to be adjusted as part of the pretreatment process. Lower temperatures decrease membrane productivity and high temperatures causes increased compaction of cellulose. The raw water may need to be preheated or pre-cooled to meet temperature stability.

The pretreatment system shall be designed based on the feedwater water quality the pretreatment system shall be reviewed by the County or its designated representative.

8.9.2 Booster Pumping

Booster pumps may be required to provide the necessary head to overcome losses through the pretreatment equipment and associated piping. For MF/UF system applications a commons set of feed pumps may be adequate to pump the feedwater from the source, through the pretreatment system and through the membrane equipment. For RO systems a common set of feed pumps can not be utilized due to the higher pressure requirements.

Booster pumps shall be selected to provide a firm capacity meeting MDF plus the membrane concentrate volume with one pump out of service.

8.9.3 Membrane Feedwater Pumping

For MF/UF system applications where a commons set of booster pumps can not be utilized the membrane feedwater pumps shall be single-stage centrifugal pumps. For RO/NF system applications membrane feedwater pumps shall be multi-stage split case centrifugal pumps.

Feedwater pumps shall be selected to provide a firm capacity meeting the system MDF plus the membrane concentrate volume with one pump out of service. For RO/NF system, if feedwater pressures are expected to vary over the life of the membrane due to fouling, temperature or if more than one membrane train is being driven, then variable frequency drives (VFDs) shall be used. For MF/UF systems that are expected to vary over the life of the membrane additional membrane area shall be provided to compensate for the lower water flow.

8.9.4 Post-Treatment

RO membrane permeates are corrosive and require some type of post-treatment to achieve corrosion control. Depending on the corrosive nature and other dissolved gases that may be present in the permeate, degasification and/or chemical addition may be required for the finished water stability.

If MF/UF feed water is pretreated using a coagulant or polyaluminum chloride some post treatment corrosion control may be necessary.

The degasification and chemical treatment system design shall be evaluated and reviewed by the County or its designated representative.

8.9.5 Disinfection

Sodium hypochlorite shall be used to stabilize the permeate prior to distribution and the system shall be designed in accordance with Section 8.7 of this Manual.

8.10 ELEVATED STORAGE TANKS

Elevated Tanks may be required within the system to meet fluctuating demands, fire flow and to equalize operating pressures. Tanks shall be sufficiently designed to meet the local flow and storage requirements for fire flow.

The minimum capacity of a storage tank shall be 150,000 US gallons. The maximum operating range of the tank from high to low shall not be greater than 30-ft.Tanks shall be designed to meet the local wind load requirements in accordance with AWWA D100-96.The minimum thickness of any part of the steel tank not in contact with water shall be 3/16-inch and ¼-inch for parts in contact with water. The structure shall be designed for water tight construction.

Tanks accessories shall include a tower ladder from the base of the tank to a connecting platform, an outside tank ladder from the platform to the roof hatch, an inside ladder from the roof hatch to the inside bottom of the tank, a tank platform and handrail, a tank vent, riser manhole and an overflow designed to carry the maximum design flow of 350 gpm.

8.11 EMERGENCY POWER GENERATION

A backup generator shall be provided for emergency power to the facility. The generator must be sufficiently sized to keep all electrical units in operation in the event of a power outage, and ensure that the WWTF can operate at 100% of its capacity. The generator shall be equipped with an automatic transfer switch and a fuel tank that will allow the generator to operate for a minimum of 24 hours.

8.12 OTHER REQUIREMENTS FOR WATER TREATMENT FACILITIES

- Lighting – Provide sufficient light to illuminate plant area and equipment.
- Operating Equipment – Provide a complete outfit of tools, accessories, and spare parts necessary for plant operations.
- Painting – All equipment and process units shall be painted as per this Manual for County owned or operated facilities.

- Operation and Maintenance Manual – Provide four (4) copies of complete operation and maintenance manuals of the plant, equipment, and effluent disposal facilities owned or operated by the County.
- Landscaping – Landscaping requirements for private and County-owned or -operated facilities will be reviewed on an individual project basis.
- Lightning Protection Mechanism, booster pumps and emergency generator hookup, etc.

SECTION 9.0 - WASTEWATER TREATMENT PLANT DESIGN STANDARDS

9.1 GENERAL

The criteria contained herein are intended to assure uniformity and quality of construction of any Wastewater Treatment facilities to be constructed in Putnam County. The wastewater treatment facilities shall be designed to provide secondary or higher levels of treatment. The facilities to be constructed shall be detailed by the Developer's engineer in a Preliminary Engineering Report (PER) submitted to and approved by the FDEP. The process used shall meet all the requirements set forth in Chapter 62-4, 62-600, 62-601, 62-610, 62-620, and 62-640, FAC. Plans and specifications shall be certified by a Professional Engineer registered in the State of Florida.

Within the various sections that follow, specifications and/or recommendations for certain unit processes and equipment are provided. Developers and their engineers may propose the use of alternatives not specifically discussed herein, however any such alternatives proposed must meet the requirements of the various FDEP rules listed above, as well as comply with *Recommended Standards for Wastewater Facilities*, also known as *10 States Standards*. In all cases, the County reserves the right of final approval to use any such alternatives.

It is the intent of these Standards for any developer-proposed WWTP to be designed for 100% effluent disposal via a public access reuse system to supply irrigation water within the proposed development. New facilities proposed by the County are proposed to maximize effluent reuse, but may utilize the County's existing limited-access reuse disposal system for partial effluent disposal, as appropriate and feasible based on available remaining design capacity of the existing reuse system.

In the event a development cannot achieve 100% reuse, then the WWTP design shall include provisions for a back-up effluent disposal method that is approved of and permitted by FDEP.

9.2 DESIGN FLOWS AND LOADS

The Developer's Engineer shall submit signed, sealed and dated design calculations with the Plans for all WWTP projects to adequately demonstrate that the WWTP facilities shall meet the required effluent quality.

Design flows for the wastewater treatment plant will be based on the criteria set forth in Section 4 and 5 of this Manual. Design loadings for the WWTP shall be detailed in the FDEP approved PER. At a minimum, WWTP design shall be on the basis of 0.17 pounds of BOD_5 per day per capita and 0.20 pounds of TSS per day per capita, unless information is submitted to justify alternate designs.

9.3 SITE DEVELOPMENT

9.3.1 Stormwater Management Plan

The developer shall be responsible for a Stormwater Management Plan (SMP) associated with the Wastewater Treatment Plant (WWTP) site, which shall incorporate the total buildout of the site. The SMP shall address the stormwater treatment and conveyance associated with the construction and operation of the proposed facility. The SMP shall

meet all the requirements set forth in rule 40C-42 of the St. Johns River Water Management District (SJRWMD).

9.3.2 Wetland Impacts

Impacts to existing wetlands shall be evaluated as part of the SMP. All efforts shall be made to minimize the impacts to wetlands on the proposed WWTP site.

9.3.3 Site Plan

The site plan shall address the following issues.

9.3.3.1 Initial and Future Construction

Site plan development shall include facilities for the initial development phase and the future development phases that would impact the WWTP. Future expansion may include both expansion in plant capacity, as well as the construction of additional treatment processes.

Access to the WWTP shall be restricted to operational personnel by use of fencing and gates. The entry gate shall be located far enough inside the property line to allow the largest anticipated vehicle (typically, chemical delivery trucks) to pull completely out of the public access road so as not to restrict traffic.

9.3.3.2 Access Roads

The access road shall be designed for two lanes of traffic. Road may be designed for single-direction traffic with prior County approval. A paved perimeter road around the entire site is recommended, although not specifically required; however, all onsite roadways shall be asphaltic concrete. Paving of roadway access to future facilities may be postponed until construction of those facilities, although the layout of these future access roadways shall be shown as part of the site plan development. Roadway geometry and turning radii must allow all large chemical delivery vehicles (WB-50) to negotiate the entire site.

9.4 PRETREATMENT PROCESSES

9.4.1 General

The WWTP shall be designed to efficiently process anticipated wastewater flows during peak, average and low flow periods. It is essential to evaluate the low flows anticipated during the initial phases of the development construction to minimize operational problems. The design peak hourly flows shall be considered in evaluating the hydraulics of unit processes, pumping, and piping.

Design flow criteria shall be estimated based on Sections 5.0 and 6.0 of this manual and approved by the County or the County's designated representative.

9.4.2 Screening

Screening shall be provided to protect pumps and other equipment by providing a mechanical screen and auxiliary manually cleaned bar screen. Dual channels shall be

provided, equipped with appropriate isolation gates for both screens, and each channel provided with a drain. Channels shall be designed to provide a minimum flow velocity of 1.25 feet per second (fps) at design average flows and a maximum of 3.0 fps at the peak hourly flow rate.

For WWTPs with design flows in excess of 1.0 MGD, two identical mechanical screens shall be provided each sized to handle the peak hourly plant flow so one unit can be taken out of service without compromising the hydraulic capacity of the WWTP.

Clear opening on manually cleaned bar screens shall be no less than one-inch. Manually cleaned screens shall be provided with a drip plate positioned over the flow channel for dewatering screenings.

Mechanically cleaned screens shall be a step screen type with a clear opening between bars of no more than ¼-inch.

Acceptable step screen manufacturers include:

- Huber
- Franklin Miller

If the WWTP includes the use of a membrane treatment process, in lieu of a step screen and auxiliary manually cleaned bar screen, the design shall utilize a fine screening system as recommended by the membrane manufacturer. In these circumstances, for WWTPs of all plant design flows a minimum of two fine screens shall be installed that provide firm hydraulic capacity to handle the peak hourly flow to the WWTP. Design shall provide for each screen to be isolated with gates or valves.

Acceptable fine screen manufacturers include:

- Headworks
- JWC
- Brackett-Gren

Any screens located in pits or channels greater than 4 feet shall be provided with stairway access.

For all mechanically cleaned bar screens or fine screens, screenings collected from the screening systems shall be transferred to a conveyor/compactor or chute system provided or approved by the screen manufacturer, which will dump into a dedicated rolloff container for ultimate disposal.

9.4.3 Comminutors/Grinders

Under no circumstances shall comminutors or sewage grinder systems be utilized in any WWTP facilities

9.4.4 Grit Removal

Grit removal shall be provided for all wastewater treatment plants. Grit removal facilities shall be located ahead of pumps and flow equalization basins.

Grit removal shall be accomplished using a vortex type technology.

Acceptable manufacturers include:

- Headcell System by Eutek,
- Teacup System by Eutek,
- Pista Grit System by Smith and Loveless,
- AS Grit Collection System by Envirex/US Filter

All grit chambers shall be designed to include provisions for bypass so units can be taken off line for maintenance.

Grit Pump: Grit chambers shall be provided with a dedicated grit pump as recommended by the grit chamber equipment manufacturer, to periodically remove grit from the grit chamber and deliver it to a grit classifier. When all flows to the WWTP are pumped (no gravity influent), the grit pump shall be equipped with a control loop tied to the influent flow meter to prevent grit pump operations when there is no influent flow to the WWTP. This is to prevent the grit pump from completely dewatering the grit chamber and having the grit pump run "dry".

Grit Classifier: Grit systems shall be provided with grit classifier recommended by grit chamber equipment manufacturer and sized appropriately to handle flow rate delivered by the grit pump. Classifier shall be designed to separate grit, air and water discharged from the grit pump and discharge a concentrated grit/water solution to a dedicated rolloff container.

9.5 FLOW EQUALIZATION

9.5.1 Equalization Basins

Flow equalization shall be required where significant variations in organic and hydraulic loadings can be expected. Equalization basins shall be located downstream of pretreatment facilities such as bar screens and grit chambers.

Flow equalization can be provided by using separate basins or on-line treatment units, such as aerations tanks. Equalization basins may be designed as either in-line or side-stream units, as approved by the County. Unused treatment units, such as sedimentation or aeration tanks, may be utilized as equalization basins during the early period of design life. The capacity should be sufficient to effectively reduce expected flow and load variations to the extent deemed to be economically advantageous. With a diurnal flow pattern, the volume required to achieve the desired degree of equalization can be determined from a cumulative flow plot over a representative 24-hour period.

If a dedicated equalization basin is proposed to be used, the tank shall be divided into two separate cells equipped with isolation gates so the cells can be used simultaneously or independently. Each basin shall be provided with aeration or mechanical equipment to maintain adequate mixing.

If aeration is utilized for mixing, dedicated aeration equipment (separate from any other WWTP air supply systems) shall be sufficient to maintain a minimum dissolved oxygen level of 1.0 mg/l at all times. Air supply rates should be a minimum of 1.25 CFM/1,000 gallons of storage volume.

If mechanical equipment for mixing is used, it shall be sized to deliver a minimum of 0.5 Hp/1,000 ft^3 of storage volume.

Access to the equalization basin shall be provided for cleaning and maintenance of equipment.

9.5.2 Equalization Basin Pumps

Non-clog dry-pit horizontal end-suction pumps, with a minimum firm pumping capacity equal to the peak hourly flow shall be installed to transfer wastewater from the equalization basin to the biological treatment process. A minimum of two pumps shall be required. Pumps shall be mounted on concrete bases on an exterior concrete slab/pad.

Acceptable pump manufacturers include:

- Cornell Pump Company
- Fairbanks Morse

Pump discharge piping shall be equipped with isolation valves to allow each unit to pump flow from either or both cells of the equalization basin, and to allow each pump to be taken out of service for maintenance.

9.6 BIOLOGICAL TREATMENT

The WWTP processes shall be designed using one of the following biological treatment processes.

- Modified Ludzack-Ettinger (MLE) Process
- Membrane Bioreactor Filtration Process (MBR)
- Sequencing Batch Reactor (SBR)

The County reserves the right to dictate which process shall be used for design.

Manufacturers for package plants and equipment for these processes shall be approved by the County or its designated representative. The Developer's Engineer shall coordinate with the County and its designated representative at a pre-design meeting held to discuss the Developer's process to be used. At 30% design completion, the County and its designated representative shall review the Developer's design documents for comment. Approval of the design will not be issued until 100% design documents are submitted.

9.6.1 Aeration

Any biological treatment process utilizing activated sludge shall be equipped with multiple aeration basins in order to prevent short circuiting of flow, with proper width and depth to achieve efficient mixing. Working tank depths should be a minimum of 10

feet and no more than 30 feet. The total tank volume required should be split equally among two or more tanks, each capable of independent operation and each equipped with a drain to facilitate tank dewatering. Tank design shall include appropriate valves, gates, stops, and/or weirs to permit control of water depths, as well as provide a minimum freeboard of 18 inches.

The aeration used shall be capable of providing adequate mixing of the aeration basin, as well as meeting the oxygen demand of the system at a maximum month average daily load while maintaining a minimum dissolved oxygen concentration at all times of 2.0 mg/l. The system design shall be capable of meeting the effluent BOD5 and TSS limits as established in the WWTP operating permit issued by the FDEP.

Aeration systems shall also be designed in accordance with the recommendations contained in *10 States Standards*.

Processes utilizing diffused air shall employ fine-bubble aeration systems to maximize the energy efficiency of the aeration process be furnished on the proposed trains in order to optimize the oxygen transfer rate (absorption).

Acceptable diffused aeration system manufacturers include:

- Sanitaire, Inc.
- Wilfey-Weber, Inc.

The air supply shall be provided by centrifugal blowers. A minimum of one blower per aeration tank plus one standby blower shall be provided.
Acceptable blower manufacturers include:

- Hoffman Air and Filtration Systems
- Lamson/Gardner Denver

When SBRs are proposed to be used, a minimum of two complete SBR units shall be provided. The actual number of SBRs shall be established by the equipment manufacturer, taking into consideration flows, loads and system cycle times.

Acceptable SBR manufacturers include:

- U.S. Filter Corporation
- Aqua Aerobics Systems, Inc.
- Fluidyne

9.6.2 Settling

Multiple settling tanks or clarifiers capable of independent operation shall be provided and be designed in accordance with the recommendations contained in *10 States Standards*. In addition, the clarifiers shall be sized and designed to meet the reliability standards as specified in 62-600.300, F.A.C. Unless stated elsewhere, the facility shall meet the requirements of Class III reliability, requiring that the clarifiers must have

capacity for at least 50% of the design flow with the largest unit out of service. When using MBR or SBR systems, clarifiers are not needed. The function of a clarifier is performed by these systems.

All clarifier shall be center-feed type and have the following equipment and structures:

- Influent column
- Energy dissipation well
- Feedwell
- Mechanical sludge collection rake arms
- Sludge density current baffles
- Adjustable v-notch effluent weirs
- Scum baffles and skimming facilities.

Recovered scum shall be pumped to the sludge holding/aerobic digester tank.

Acceptable clarifier equipment manufacturers include:

- EIMCO
- Westech Engineering, Inc.

9.6.3 Membrane Filters

Membrane filtration will separate treated effluent from the mixed liquor of the biological treatment process. The membrane system shall consist of membrane elements assembled in common units, piping and multiple valves, permeate pumps, air scour blowers, backpulse tank and pump as required, mixed liquor recycle pumps, waste activated sludge pumps, drain pumps, membrane cleaning systems and control system. The equipment and configuration will vary depending on the membrane manufacturer utilized for the project.

Acceptable membrane filtration system manufacturers include:

- G.E. Water & Process Filtration Technologies
- Siemens Water Filtration/US Filter
- Parkson Corporation
- Enviroquip, Inc./Kubota

The membrane system design and configuration shall be in accordance with the manufacturer's recommendations. The County reserves the right to accept or reject the proposed process configuration.

9.6.4 Effluent Filters

When membrane filtration is not utilized and effluent is proposed to be fully disposed of to a public-access reuse system, the WWTP shall be equipped with effluent filters.

The filter system shall consist of multiple filter elements assembled in common units, piping and valves, backwash pumps, reject pumps and a control system. A minimum of two filter units shall be provided. The equipment and configuration will vary depending on the filter type and manufacturer utilized for the project.

Acceptable filtration system types and manufacturers include:

Sand Filters

- Parkson Corporation

Cloth Filters

- Aqua Aerobics
- Parkson

9.6.5 Return Activated Sludge/Waste Activated Sludge Pumping Station

A Return Activated Sludge/Waste Activated Sludge (RAS/WAS) pumping station shall be provided to maintain the desired mixed liquor suspended solids concentration in the biological treatment process.

The pumping station shall consist of end-suction non-clog centrifugal pumps mounted on a slab-on-grade located adjacent to the clarifiers, the SBR tanks or to the membrane tanks, as appropriate.

A minimum of three RAS pumps (one standby) and a minimum of two WAS pumps shall be provided. RAS pumps shall be designed to deliver a range of flows of 50 to 150% of the WWTP's design average daily flow. WAS pumps shall be designed to pump 25% of the WWTP's design average daily flow.

RAS/WAS pumping station shall be equipped with valving to isolate each pump. RAS pumps shall be provided with variable frequency drives to control the pumping rate. RAS and WAS pipe lines shall be equipped with magnetic flow meters, acceptable manufacturers are listed in Section 9.9.1.

Acceptable pump manufacturers include:

- Cornell Pump Company
- Fairbanks Morse

9.6.6 Sludge Holding

Periodic sludge pump out from the clarifiers, SBR, and MBR systems is necessary to remove the high proportion of inert material and a portion of the active biological population that settles less readily than the other solids. This thickened sludge shall be sent to the sludge holding tanks. Sludge holding tanks shall be designed to hold a minimum 7 days of sludge storage at 1%. Sludge tanks shall be pre-stressed concrete

tanks with open tops. Aeration shall be accomplished by coarse bubble diffusers and the sludge holding tank shall be designed as a complete mix basin.

Air shall be supplied be positive displacement blowers designed to deliver a minimum of 30 scfm/1,000 ft^3 of tank storage volume and maintain between 1.0 to 2.0 mg/l of dissolved oxygen in the sludge. A minimum of two blowers shall be provided.

Acceptable diffused aeration system manufacturers include:

- Sanitaire, Inc.
- Wilfey-Weber, Inc.

Acceptable blower manufacturers include:

- Dresser Roots
- Gardner Denver

Facilities shall be provided for the effective separation or decanting of supernatant. The supernatant drawoff shall be designed to prevent recycle of grease and scum and shall provide the ability to withdraw supernatant from multiple levels of the supernatant withdrawal zone.

Sludge Transfer Pumps shall be closed-coupled end-suction centrifugal pumps. A minimum of two pumps, one operational and one stand-by, shall be provided.

- Cornell
- Aurora
- Fairbanks Morse

9.6.7 Disinfection

The effluent shall be treated with chlorine solution to inactivate all, or most of the harmful disease germs prior to discharge. This will be accomplished by introducing sodium hypochlorite into the effluent at the chlorine contact basin (CCB). Sodium hypochlorite will be injected into the CCBs by chemical metering pumps.

The CCBs shall be sized in accordance with F.A.C. 62-600.440 and *10 States Standards* to provide sufficient contact time to allow the chlorine to condition the effluent. CCBs shall be designed as dual channel units with isolation valves/gates. Each channel shall include a drain line to facilitate dewatering of the channel for cleaning/maintenance.

Sodium hypochlorite will be used for disinfection and for disinfectant residual. All tanks, pipe, valves and appurtenances shall be compatible with 15% trade solution of commercial grade sodium hypochlorite. Sodium hypochlorite will be fed at the inlet end of the CCB. In addition, provisions shall be provided for an alternative injection point downstream of the storage tank(s), placed inside a concrete vault.

9.6.7.1 Disinfection System

In addition to meeting the general standards specified in Section 8.7 for disinfection systems, the sodium hypochlorite system shall include HDPE (HDPE) storage tanks and mechanically actuated metering pumps pumping to both the CCB and the Ground Storage Tank (if included in WWTP design). Feed pumps shall be capable of delivering a chlorine dose of 0 to 10 mg/l.

Manufacturers include:

Sodium Hypochlorite Tanks

- Synder Tanks
- Or approved equal

Pumps

- Aldoss
- Pulsa Feeder
- Prominex

9.6.7.2 UV Alternative

An acceptable alternative to sodium hypochlorite for disinfection is Ultraviolet (UV) disinfection with sodium hypochlorite used as a residual disinfectant for biological growth.

UV systems shall be designed in compliance with the 2000 National Water Research Institute (NWRI) guidelines that provide detailed guidance for the design of UV systems that meet high-level disinfection. The 2000 NWRI guidelines include a well-defined testing protocol, and are applicable to UV systems designed to meet FDEP standards.

The County will accept UV designs that comply with the 2000 NWRI guidelines, and are supported with validation testing reports as a means for providing reasonable assurance that the WWTP can meet the high-level disinfection criteria specified in 62-600.440, F.A.C.

Acceptable manufacturers for UV disinfection include:

- Trojan
- Calgon

9.7 RECLAIMED GROUND STORAGE TANKS

Reclaim ground storage tanks shall be pre-stressed concrete tanks. The tanks will be designed to hold a minimum of 3 days of AADF from the WWTP.

Acceptable manufacturers include:

- Crom Corporation
- Pre-Con Corporation

All tanks shall be provided with the following:

- Valved drain lines to facilitate tank dewatering for cleaning/maintenance.
- Access hatches for maintenance
- Screened ventilation

9.8 RECLAIMED HIGH SERVICE PUMP STATION

Reclaim high service pumps for the project will be horizontal, split case, double suction centrifugal pumps. All pumps shall be provided with adjustable speed drives. The total number, size, and capacity of the pumps, as well as the size of the drives shall be based on the following criteria:

- Minimum flow conditions
- Average Daily Flow (ADF)
- Maximum Daily Flow (MDF)
- Peak Hourly Flow (PHF)
- Firm capacity pump redundancy requirements

Pump and variable frequency drives manufacturers shall be approved by the County or its designated representative. Information shall be provided to the County to document that the total dynamic head of the pumps is able to meet the pressure requirements of the County's reclaimed water system.

9.9 FACILITY OPERATIONS

9.9.1 Flow Metering and Sampling Provisions

Influent and effluent flow metering will be provided by magnetic flow meters. The RAS and WAS flows shall also be metered. Flow metering shall also be required downstream of the High Service Reclaim Pumps. A circular chart recorder shall be used to record the flow continuously. In addition, continuous sampling and recording equipment shall be provided to monitor both the chlorine residual and turbidity. An influent sampling point shall be provided for BOD and TSS. An effluent sampling point shall be located after the CCBs to facilitate safe sampling for BOD, TSS, chlorine residual, total nitrate nitrogen and pH. Influent and effluent sampling is to be flow proportioned from the effluent flow meter.

An influent flow meter shall be provided upstream of any pretreatment unit processes. Upstream and downstream piping shall conform to meter manufacturer's recommendations. Flow meter shall have isolation valves and a bypass line such that the meter can be removed without interrupting flow.

Acceptable manufacturers include:

Flow Meter

- Sparling Instruments: Tiger Mag
- Rosemount
- Foxboro

TSS or Turbidity, Nitrate, pH, Dissolved Oxygen, Ammonia

- Cerlic (TSS only)
- Hach

Chlorine Residual

- Rosemount
- Wallace & Tieman

9.9.2 Plant Staffing and Operations Strategy

Per Chapter 62-699, F.A.C., a class C or higher operator must be on staff at the site ½ hour per day, five (5) days per week and one visit each weekend as a minimum.

9.9.3 Reliability

The WWTP shall be designed to provide Class III reliability throughout the plant, in accordance with Chapter 62-600.400(1)(b), F.A.C., which states that new, expanded, or modified wastewater treatment and domestic wastewater residuals treatment, handling, and dewatering facilities shall be designed to provide a minimum Class III reliability and the Class II reliability requirements shall apply to the new, expanded, or modified portions of the facilities.

9.9.4 Emergency Power Generation

A backup generator shall be provided for emergency power to the facility. The generator must be sufficiently sized to keep all electrical units in operation in the event of a power outage, and ensure that the WWTF can operate at 100% of its capacity. The generator shall be equipped with an automatic transfer switch and a fuel tank that will allow the generator to operate for a minimum of 24 hours.

9.9.5 Other Requirements for Wastewater Facilities

On-site Lift Station – The on-site lift station shall meet all requirements of wastewater pumping stations as specified in this Manual for County owned or operated facilities.

Lighting – Provide sufficient light to illuminate plant area and equipment. A minimum of 1.0 lumen/square foot of plant area shall be provided at the site.

Operating Equipment – Provide a complete outfit of tools, accessories, and spare parts necessary for plant operations. Provide one year's supply of spare parts and disposable materials (charts, chart pens, oil & grease, gaskets, etc.).

Painting – All equipment and process units shall be painted as per this Manual for County owned or operated facilities. Operation and Maintenance Manual – Provide four (4) copies of complete operation and maintenance manuals of the plant, equipment, and effluent disposal facilities owned or operated by the County.

Landscaping – Landscaping requirements for private and County owned or operated facilities will be reviewed on an individual project basis. Prior to County taking over responsibility for the WWTP, all chemical storage tanks shall be filled to capacity.