City of Everglades City
Utilities Standards Handbook

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1.01 GENERAL

A. These standards and specifications are intended to establish minimum acceptable standards for the design and construction of wastewater collection and transmission facilities, and reclaimed water distribution facilities owned and operated by the City of Everglades City. Such facilities include reclaimed water mains, gravity sewers, wastewater force mains, wastewater lift stations, and miscellaneous related appurtenances associated with such systems. The Standards set forth in this Utilities Standards Handbook ("Handbook") are meant to provide minimum Standards for the design and construction of facilities which meet the following conditions:

1. Public and private facilities, to be constructed within both the City's corporate limits and utility service area.

2. Facilities to be dedicated to the City for ownership.

3. Facilities to become future additions to the City's utilities systems.

B. The title of this document is "Utilities Standards Handbook". Additional City of Everglades City documents that supplement this document include the Everglades City Land Development code, and various City Utilities Ordinances. The purpose of this Handbook is to describe minimum acceptable Standards of construction. Should any design be submitted which varies appreciably from the Standards set herein or uses materials other than those recommended, it must be accompanied by appropriate supporting documentation or engineering studies for review and is subject to the approval of the City Public Works Director or its Designee.

C. This Handbook shall apply to all proposed wastewater and reclaimed water facilities to be owned, operated or maintained by the City of Everglades City. This Handbook shall not take the place of regulations imposed by the Florida Department of Environmental Protection (FDEP) or the Collier County Health Dept. (Health Dept.). This Handbook is intended to add further detail to how to comply with these regulations. In the event of a conflict, the more stringent requirement applies.

D. All Plans submitted for review must be in conformance with all Federal, State and City regulations and codes. In no case shall minimum standards be less than those established by recognized governmental agencies, unless stated otherwise in these Specifications.

E. Where a certain manufacturer is specified for a particular piece of equipment, non-specified product equals may be approved by the City Public Works Director or its Designee after submittal of a request in writing and accompanied by supporting documentation. An approved Manufacturer's List is attached as part of this Handbook to assist the Engineer and the Contractor.

F. Pre-application meetings are recommended and preconstruction conferences are mandatory between the Owner/Developer, their Engineer, their Contractor(s), all utilities, and the City Staff when City facilities are involved.

2.01 ABBREVIATIONS

A. Unless otherwise stated, the most recent publications of the following organizations shall be referred to as required. Other publications may be used in the implementation of the Standards.

1. American Association of State Highway and Transportation Officials - AASHTO
2. American Concrete Institute - ACI
3. American National Standards Institute - ANSI
4. American Society for Testing Materials - ASTM
5. American Water Works Association – AWWA
6. Collier County Health Dept. - Health Dept.
7. Ductile Iron Pipe Research Association - DIPRA
8. Energy Equipment and Infrastructure Alliance - EEIA
9. Environmental Protection Agency - EPA
10. Florida Administrative Code - FAC
11. Florida Department of Environmental Protection - FDEP
12. Florida Department of Transportation - FDOT
13. Florida Statutes - FS
14. Industry Standard Architecture - ISA
15. Institute of Electrical and Electronics Engineers - IEEE
16. Insurance Services Office - ISO
17. Manual on Uniform Traffic Control Devices - MUTCD
18. National Electrical Manufacturers Association - NEMA
19. National Fire Protection Association - NFPA
20. National Pollutant Discharge Elimination System - NPDES
21. National Sanitation Test Laboratory Foundation - NSF
22. South Florida Water Management District - SFWMD
23. Sunshine State One Call System Of Florida - SSOCSOF
24. United States Occupational Safety and Health Administration - OSHA
25. Water Environmental Federation - WEF

2.02 DEFINITIONS

Architect: Architect registered with the State of Florida Department of Business and Professional Regulation to provide professional architectural services.

As-Built Survey or As-Built Drawings: Surveyor shall obtain field measurements of vertical and horizontal dimensions of constructed improvements so that the constructed facilities can be delineated in such a way that the location of the construction may be compared with the construction Plans. All surveys shall be in State Plane.

Backfill: refilling an excavation, and in pipeline or conduit trenches is defined as the material above the top of pipe to the topsoil, paving sub-grade, or foundation level.

Bedding: the area from bottom of the pipeline trench to the centerline of the pipe.

Boundary Survey: Boundary survey, map and report certified by a Surveyor that meets the requirements of Chapter 61G17-6 'Minimum Technical Standards', FAC.

Business Day: Monday through Friday, excluding City holidays.

City: the City of Everglades City, Florida, Collier County Florida, and/or its designated representative(s).

Contractor: the person, firm, or corporation with whom the contract for work has been made by the Owner, the Developer, or the City.

County: Collier County Florida, and/or its designated representative(s).

Developer: the person, firm, or corporation engaged in developing or improving real estate for use or occupancy.

Developer's Engineer: a Professional Engineer Licensed by the Florida State Board of Professional Engineers or Engineering firm registered with the Florida State Board of Professional Engineers, retained by the Developer to provide professional engineering services for a project.

Director: City of Everglades City Public Works Director or his/her designated representative.

Drawings: engineering drawings prepared by an Engineer to show the proposed construction.

Engineer: a Professional Engineer Licensed by the Florida State Board of Professional Engineers or engineering firm registered with the Florida State Board of Professional Engineers, other than direct employees of the City of Everglades City, retained to provide professional engineering services for a project.

ERU: equivalent residential unit. This meaning shall be synonymous with Equivalent Dwelling Units (EDU) and Equivalent Residential Connection (ERC).

Floatation: the stress or forces on a pipeline, manhole, wet well or other structure which tends to fill or float the pipeline or structure.

Force Main: a pipe that carries wastewater under pressure from the discharge side of a pump to a point of gravity flow downstream.

Gallons Per Capita Per Day (GPCD): a measurement of the average number of gallons of water used by the average person each day in a water system. The calculation is made by dividing the total gallons of water used each day by the total number of people using the water system.

Geotechnical / Soils Engineer: a Professional Engineer Licensed by the Florida State Board of Professional Engineers, retained to provide professional engineering services for the project, whose experience and services relate 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.

Gravity Flow: water or wastewater flowing from a higher elevation to a lower elevation due to the force of gravity.

Handbook: the City of Everglades City Utilities Standards Handbook.

Influence Area: the area within lines sloped downward at 45 degrees from the outer edges of paving, foundations, and utility lines. As a minimum, the influence area shall extend 5 feet beyond the edge of pavement (where there is no curb) or 5 feet beyond the back of curb.

Inspection Hours: City inspection hours are 8:00 a.m. to 4:00 p.m., Monday through Friday, excluding holidays, except for wet taps and line stops, which shall be scheduled to commence between 8:00 a.m. and 2:00 p.m. on the scheduled day.

Inspection Notification: The City required inspection notification is a minimum of forty-eight (48) hours advance notice.

Land Development Code (LDC): the current City of Everglades City Land Development Code.

Lateral Cleanout: a capped opening in a building lateral, usually located on the property line, through which the pipelines can be cleaned.

Lift Station: a wastewater pumping station that lifts the wastewater to a higher elevation when continuing the sewer at reasonable slopes would involve excessive depths of trench or lifts wastewater from areas too low to drain into available sewers.

Listed: equipment, materials, or services included in a list published by an organization acceptable to the authority having jurisdiction and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states either that the equipment, material, or service meets identified standards or has been tested and found suitable for a specified purpose.

Master Plan: For projects to be constructed in multiple phases, a master plan for water, wastewater and/or reclaimed water is required. The master plan consists of a utility system layout superimposed on a topographic map, calculations for potable water demand, reclaimed water demand and wastewater flow, as well as a pipe network analysis for flow and pressure distribution.

Normal Working Day: Monday through Friday, excluding City holidays.

Normal Working Hours: Hours are between the hours of 7:00 a.m. to 4:00 p.m. of a Normal Working Day or Business Day.

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

Plans: Drawings as defined herein above.

Potable Water: water that does not contain pollution, contamination, objectionable minerals, or infective agents and is considered satisfactory for domestic consumption.

Record Drawings: As-Built Drawings that have been certified by the Engineer that the Record Drawings depict the horizontal and vertical locations of installed utilities for the completed Work.

Reclaimed Water: water that has received at least secondary treatment, sand filtration and high-level disinfection, and is reused after flowing out of a wastewater treatment plant and is non-potable water provided through a separate distribution system meeting FDEP standards.

Reclaimed Water System: Reclaimed water transmission and distribution piping, pump stations, fittings, valves, services, meters and miscellaneous related appurtenances.

Right-Of-Way Use Permit: the City of Everglades City Right-of-Way Use Permit.

Sanitary Sewer: Pipeline and appurtenances that transport wastewater by gravity flow.

Shop Drawings: All drawings, diagrams, illustrations, schedules, and other data or information, which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

Specifications: the specifications contained in this Utilities Standards Handbook.

Standards: the minimum design standards contained in this Utilities Standards Handbook.

Standard Construction Details: the City of Everglades City Common, Wastewater Collection and Lift Stations, and Reclaimed Water Distribution Details. Copies of the Standard Construction Details are contained in the Appendix to this Utilities Standards Handbook and the City's website. In case of conflict between the Standard Construction Details in the Utilities Standards Handbook and on the City's website, the most up to date detail governs.

Standard Specifications: the Florida Department of Transportation, Standard Specifications for Road and Bridge Construction, latest edition.

Standard Plans: the Florida Department of Transportation, Plans for Road Construction, latest edition.

Subcontractor: the person, firm, or corporation having a direct contract with the Contractor or with any other Subcontractor for the performance of a part of the Work.

Substantially Completed: that date when the work is completed in accordance with this Utilities Standards Handbook, with the exception of the minor items identified during the inspection process. Upon substantial completion, the Work can be utilized for the purposes for which it is intended if the public's health, safety, and welfare will not be endangered.

Surveyor: A person licensed by the State of Florida as a professional surveyor and mapper pursuant to Chapter 472, FS.

Transmission Mains: those pipelines that convey liquids under pressure that have been pumped.

Wastewater System or Wastewater Collection System: Wastewater transmission pipes including gravity sewers and force mains, wastewater pump stations, fittings, valves, service laterals and miscellaneous related appurtenances.

Water System or Water Distribution System: Water transmission and distribution pipes, water pump stations, fittings, valves, hydrants, services, meters and miscellaneous related appurtenances.

Work: Labor, materials, equipment, supplies, services and other items necessary for the execution, completion and fulfillment of the approved Plans.

2.03 SURVEY

A. The survey shall show the location of easements, property lines, lot lines, and rights-of-way.

B. The Project shall be vertically based on the North American Vertical Datum 88 (NAVD 88). The project will be referenced to these published elevations by field locating published benchmarks. The National Geodetic Survey and Collier County benchmarks shall be researched and verified in the field. Horizontal and vertical control points both will be established for the project as required by the Standards of Practice of the State of Florida Rule Chapter 5J-17, Florida Administrative Code 5J-17.052 (3)(b)1b. and 5J-17.052 (3)(d).

C. The Project coordinate system will be based horizontally on the North American Datum 83 (NAD83) (1990 adjustment). The Project shall be referenced to state plane coordinates by field locating published control points. The National Geodetic Survey and Collier County control points shall be researched and verified in the field. This base of

reference shall be used to establish the horizontal coordinate system (control points) for the project.

2.04 BENCHMARKS AND MONUMENTS

A. Permanent Reference Monuments (PRMs) and Permanent Control Points (PCPs) shall be placed as required by Florida Statutes. A letter from a Florida registered Land Surveyor certifying that all monuments, PCPs, PRMs are in place as of the date of the project acceptance shall be required of all developments.

B. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of the Owner and City. All benchmarks, property corners, and other survey monuments that are lost, damaged, or destroyed shall be replaced by a Licensed Surveyor at the Contractor's expense.

2.05 EASEMENTS

A. Where utility easements are necessary, the easements shall of suitable width for access and maintenance as required and determined by the City. All utilities to be owned and maintained by the City located outside of dedicated rights-of-way shall require a minimum 20-foot easement, and if a utility is located adjacent to a road right-of-way, a minimum 10-foot easement shall be provided. Additional easement widths shall be provided when the pipe size or depth of cover so dictate.

B. No existing easement shall be occupied without first obtaining a Right-of-Way Utilization Permit. When encroachment is desired, the applicant shall contact all utilities doing business within the City, prior to the City granting a permit. Easements for all facilities must be shown on construction drawings and approved by the City.

2.06 SOIL BORINGS AND SUBSURFACE INVESTIGATIONS

The Engineer shall examine the site and undertake subsurface investigations including soil borings before commencing the Work. The results of the geotechnical exploration will need to be presented in one overall geotechnical engineering report, which will address the following items: Existing site conditions; Exploration, testing, and sampling methods; Subsurface soil conditions encountered and soil classifications; Depth to groundwater at the time of the exploration and estimated seasonal high groundwater levels; excavation and fill recommendations and pertinent soil parameters, and whether the existing soils are suitable for use during construction; Construction recommendations (site preparation, use of unsuitable soils, dewatering, bedding, backfill) will also be included in the report.

2.07 PLANS AND SPECIFICATIONS

A. Plans for any review and submittal shall be complete. All submitted Plans shall be standard size sheet (22”x34”, 24" x 36", 30”x42”) with title block. Graphic scale(s) shall be provided on each sheet and all lettering shall be scaled to permit photographic reproduction. Submittal of Specifications shall only be required when special facilities outside the scope of this Handbook are proposed. All Plan sheets, detail sheets and the title page of submitted and Bound Specifications must be signed, sealed and dated by the Engineer of Record licensed in the State of Florida.

B. The Plans shall include all applicable City of Everglades City Standard Construction Details, and where applicable FDOT Standard Plans. Special details shall be prepared by the Owner/Developer’s Engineer.

C. Whenever possible, the entire water, reuse, and wastewater systems shall be shown on a single Master Plan. The Master Plan shall indicate the general locations of all mains, manholes, valves, hydrants, services and service laterals with respect to the proposed development improvements and the existing water and wastewater systems. Main sizes shall be indicated on the Master Plan. The Master Plan shall be prepared at a scale not to exceed l" to 200' (the City reserves the right to require larger scale drawings). Master Plan sheets shall include street names, stationing, legends and match lines and the Cover Sheet shall contain a vicinity map

D. All utilities including gravity sewers, all wastewater force mains, storm sewers and off-site water mains shall be drawn in plan and profile, with the plan view and profile view on the same sheet. Plan and profile sheets shall not exceed a scale of l" to 50' horizontally and 1' to 5' vertically the City reserves the right to require larger scale drawings). Special details shall be of sufficiently large scale to show pertinent construction information.

E. Whenever possible, on-site water and wastewater systems shall be shown on the same Plan sheets, in both the plan view and profile view (stationing along the plan view and profile view shall match). As a minimum, the plan and profile drawings shall include the following information:

1. General information such as north arrow, names of Designer and Engineer, revision block with dates, graphic scale(s) and sheet number.
2. Plan and profile with elevations at 100-foot intervals, or more frequently if required by good design practice.
3. Development layout with horizontal and vertical controls.
4. All conflicts with other utility and drainage systems.
5. Existing ground elevations along all proposed pipelines.
6. All manhole locations, rim elevations, and invert elevation for all manholes. For connections to existing manholes, include the existing manhole rim elevation, existing pipeline diameters, and existing pipeline inverts.

7. Pipe data including size, lengths, material, and slopes.
8. Size, type, and locations of fittings, valves, hydrants, air release/vacuum relief, and other related appurtenances.
9. For jack and bore construction, show the proposed top of casing elevation at each end of the casing, the casing pipe diameter, and the carrier pipe material and diameter.
10. For pipeline that is to be directional drilled, clearly identify the beginning and end points at each end of the drilled pipeline, the proposed elevations at each end, and the minimum and maximum proposed depths along the drilled pipeline.
11. Details of connection to existing systems.
12. Location(s) and general layout of wastewater pumping stations.
13. Construction notes regarding cover, horizontal and vertical control, special construction requirements, and references to standard and special details.
14. Point of Service for fire sprinkler system and location of fire department connection.
15. Standard Construction Details
16. Special details shall be prepared by the Engineer for aerial and underwater crossings of rivers, streams, canals and ditches. Other special details shall be prepared by the Engineer as required by the City.

2.08 PRECONSTRUCTION CONFERENCE

It shall be required that a preconstruction conference between the Owner/Developer, their Engineer, their Contractor, all utilities, and the City Staff be held at least 7 days before commencement of any construction within the corporate limits of the City. All applicable City, State and Federal Agency permits are required to be in the possession of the Owner/Developer prior to the preconstruction meeting.

2.09 UTILITY COORDINATION

It shall be up to the Owner/Developer to coordinate all utilities concerning development.

2.10 INSPECTION

Representatives of the City shall periodically visit the project site to make a visual inspection of the progress of the work and methods of construction. All inspections shall be scheduled to provide a minimum of two (2) business days advance notice. The City can come out at any time without prior notice.

2.11 TRANSFER OF PRIVATE OWNERSHIP

When transfer of private utilities to City ownership is desired and the City Public Works Director concurs, all such private facilities shall be brought up to the current City Standards at no cost to the City, in so far as construction and maintenance are concerned, before the City will accept such facilities. Proof of satisfactory completion of the facilities, approved construction Plans as

Record Drawings, the 2-year maintenance bond with itemized construction costs, Bill of Sale for improvements dedicated to the City, and the appropriate legal documents shall be furnished to the City prior to acceptance. Acceptance of private utilities shall be in the sole discretion of the City Council.

2.12 PROPERTY OWNERSHIP

All facilities to be owned and maintained by the City shall be located on City property, within City rights-of-way, or in easements dedicated to the City for the uses intended.

2.13 LAYING OUT WORK

A. Base lines, property lines, and easement lines, are shown on the Drawings. Bench marks utilized are also shown on the drawings. If the bench marks are disturbed as a result of construction activities, reestablish such items by utilizing a surveyor licensed in the state where the project is located.

B. Stake out the construction, establish lines and levels, temporary bench marks, batter boards, centerlines and reference points for the work, and verify all dimensions relating to interconnection with existing features.

C. Report any inconsistencies in the proposed grades, lines and levels, dimensions and locations to the Engineer before commencing work.

D. Contain all construction activities within the right-of-way, easements, and property secured by the Owner, as shown on the drawings. Do not disturb surrounding properties or travel on surrounding properties without written consent from the property owner. Repair or reconstruct damaged areas on an immediate basis. All costs for repairs shall be the responsibility of the Contractor.

2.14 RELOCATION OF UTILITIES

Coordinate with each utility and pay all costs associated with the protection of existing facilities during construction. Also coordinate necessary relocations or other construction related matters with each utility.

2.15 RECORD DRAWINGS (AS-BUILT DRAWINGS)

A. As the Work progresses, the Contractor shall be responsible for recording information on the City approved Plans concurrently with construction progress. The Contractor shall mark on the City approved Plans all changes in direction and location of structure, piping, equipment, electrical, and mechanical work.

B. All Record Drawings shall be prepared by the Contractor in ACAD format using construction plan sheets provided by the Engineer. As-built information shall be field

the Engineer, and certified, signed and sealed by the Contractor's licensed Surveyor who will be responsible for the accuracy of all dimensions and elevations. Sheet sizes and the scale of the Record Drawings shall match sheet sizing and scale of the City approved Plans. Add blowup details if necessary.

C. The X, Y and Z location based on the coordinate system Florida East Zone State Plane Coordinate Feet NAD 83, of all valves (center of pipe) and valve boxes (grade), hydrants (grade), blow offs (grade), sample points (grade) and meter boxes (grade) etc. shall be clearly shown. Acceptable position accuracy shall be sub-meter or better for compatibility with Global Positioning System (GPS) equipment. The vertical datum used shall be NAVD 88 unless otherwise shown on the construction Plans.

D. In addition to the ACAD file, the Contractor shall provide an Excel spreadsheet showing the collected X, Y and Z coordinate of assets (hydrants, top of pipes, fittings, valves, meters, blow offs etc.) included in the Record Drawing submittal. The spreadsheet data shall include a unique identifier connecting the assets listed in the data sheet to the Record Drawing), the name of the asset and the coordinate information for each asset.

E. The surveyed as-built location of the newly constructed facilities shall be in an ACAD overall base drawing which is in State Plane. Providing "paper space" views that are not in State Plane of the constructed facilities is not acceptable. Providing northing and easting point tables on separate new sheets added to the construction Plans is not acceptable. The as-built northing and easting data must be on the individual construction plan sheets to which the data applies.

F. The Record Drawings shall be signed, sealed and dated by the Engineer as being "Record Drawings". Construction Plans simply stamped "As-Builts" or "Record Drawings" and lacking the requirements will not be accepted, and will be returned to the Developer's Engineer. The City will not certify the project to be complete until correct Record Drawings have been submitted. Submit one hard copy of the Record Drawings signed and sealed, and submit on a CD PDF and ACAD files of the Record Drawings.

G. Record Drawings shall include the following:

1. Horizontal locations (state plane coordinates and stations and offsets) and vertical elevations for all utility and storm structures including but not limited to manholes, inlets and cleanouts, including structure top and invert elevations and invert elevations of all connecting pipes.

2. Distance along pipelines between structures.

3. Horizontal locations (state plane coordinates and stations and offsets) and vertical elevations of all utility valves, fittings, connection points, etc.

4. Grade elevation above utility pipeline where vertical elevations are required at all utility valves, fittings, connection points, etc. Where construction is in an area where there is no proposed fill or excavation, then the grade elevation shall be existing grade. Where construction is in an area where there is proposed construction, then the grade elevation shall be finish grade.

5. Utility pipeline horizontal locations (state plane coordinates and stations and offsets) and tied horizontally to edge of pavement and right-of-way lines or property lines, located every 200-ft plus all changes in horizontal offset.

6. Vertical elevations of the top of casing and top of carrier pipe measured at each end of crossings that have been jack and bored.

7. Horizontal locations (state plane coordinates and stations and offsets) of each end of steel casing pipe (also provide distance from edge of pavement and adjacent right-of-way lines).

8. Pipeline that is directional bored is to be horizontally and vertically located every 20’ along the bore. Provide this information by submitting boring logs and by drawing the as-built vertical and horizontal locations of the bored pipeline on the record drawings based on the boring logs. Survey the existing grade above the bored pipeline. Provide state plane coordinates at each end of directional bored pipeline.

9. The new lift station wet well top and inside bottom elevations, plus inverts of all connecting pipelines.

10. Lift station surveyed layout (horizontal and vertical) of all structures, valves, panels, conduits, piping, corners of all concrete pads, slabs, and driveways.

11. Valve vault top elevation, inside bottom elevation, and top of pipe elevations.

12. Lift station fence corners, property lines, and easement lines.

13. Lift station generator pad (where required).

14. The horizontal location (state plane coordinates) at the lift station wet well and valve vault.

15. Horizontal and vertical data for any construction that deviates from the construction drawings.

16. Where the Plans contain specific horizontal location data, such as station and offset, the as-built drawings are to reflect the actual horizontal location.

17. Where the Plans contain specific vertical elevation data, the as-built drawings are to reflect the actual measured vertical elevation.

2.16 LIST OF MATERIALS AND APPROVED MANUFACTURERS

A list of Approved Products and Manufacturers for the various products specified in this Utilities Standards Handbook is included in the Appendix to this Handbook. It is the intent of the City to review and update the list as appropriate to ensure efficient operation of the services and facilities under the jurisdiction of this Handbook. If the Developer/Contractor intends to use materials not listed in this Handbook, Shop Drawings shall be required to be submitted and shall be reviewed by the City to ensure the materials are equal to those specified.

3.01 WASTEWATER SYSTEM DESIGN

The following design criteria shall pertain to the general requirements of all sanitary manholes, gravity sanitary sewers, lift stations, and force mains. Additionally, the Water Environmental Federation (WEF), Manual of Practice No. 9, entitled "Design and Construction of Sanitary and Storm Sewers", latest edition, may generally be used as a design guide, if not in conflict with State, local, or other regulatory agency requirements or with any material presented herein.

3.01.01 Design Period

Sewer systems shall be designed for the estimated ultimate tributary population as derived for the City's approved future land uses or as delineated in the approved City of Everglades City Wastewater Master Plan, latest edition, except when considering parts of the systems that can be readily increased in capacity.

3.01.02 Location

Gravity sewers and sewer force mains shall be located in dedicated rights-of-way or utility easements. Whenever possible, gravity sewers shall be located under pavement in dedicated rights-of-way. When installed in rights-of-way, sewer force mains shall, in general, maintain a consistent alignment with respect to the centerline of the road, located outside the pavement, as far from the edge of pavement as possible, preferably no closer than five (5) feet from the right-of-way line. All gravity sewers and sewer force mains located outside of dedicated rights-of-way shall be located in a utility easement (refer to Chapter 2 for Easement requirements). Gravity sewers and sewer force mains shall not be placed under buildings, retention ponds, tennis courts, or other structures. Additionally, gravity sewers and sewer force mains shall not be located along rear lot lines. Gravity sewers and sewer force mains along retention pond berms are generally not acceptable, but will be considered by the City on a case by case basis.

3.01.03 Design Calculations

Owner's/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. In lieu of calculation, the Engineer may submit design computer model and associated information including inputs, assumption, model run result(s) that indicate system is designed to comply with City requirements and signed and sealed design report. The model shall be integrated into City model for simulations.

3.01.04 Average Daily Flow (ADF)

The average daily flow is the standard base reference in the design of all wastewater systems. It represents the annual average daily flow of wastewater generation. All service area generators such as domestic, commercial, institutional, and industrial shall be included in the determination of the total average daily flow. Either per capita unit flows, fixture unit methods, and/or historical

flows shall be used by the designer in determining the ultimate project flow in accordance with those rates currently in effect and available at the City.

3.01.05 Peak Flow

A. The peak flow is used in the design of all wastewater systems. It is the product of a peaking factor and the average daily flow. The peaking factor is a ratio of the average daily flow and the peak discharge, occurring during the maximum daily flow of the year. The selection of the peaking factor is based upon the following table for flows (ADF) up to 3.0 MGD. Peaking factors for flows with larger average daily flows will be evaluated by the Engineer on an individual basis.

Flow Range	Minimum Peak Factor
Flows to 100,000 GPD	4.0
100,000 GPD to 250,000 GPD	3.5
250,000 GPD to 1,000,000 GPD	3.0
Flows greater than 1,000,000 GPD	2.5

B. For design average daily flows above 2,000,000 GPD, peaking factors less than 2.5 may be considered if substantiated by extensive data. Under no circumstances shall peaking factors less than 2.0 be allowed.

3.01.06 Gravity Sewer

A. No gravity sewer main conveying wastewater shall be less than 8 inches in diameter.

B. The minimum cover over gravity sewers shall be no less than 4 feet calculated from the finished grade. Exceptions to this requirement may be approved by the City on a case by case basis for a short length of pipe where structural considerations are incorporated in the design (such as using upgraded pressure pipe). The depth shall be sufficient to serve proposed lots, utilizing minimum slopes for service laterals.

C. Gravity sewers shall not exceed 12 feet in depth, as measured from the top of pipe to finish grade. Deeper sewers shall only be allowed if approved by the City.

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

E. In general, all sewer extensions for future connections shall terminate at a manhole. The City may allow such extensions without a terminal manhole on a case by case basis subject to all of the following conditions: 1) Total sewer extension length shall be limited to 15 feet; 2) Sewer extension location at the initiating manhole shall be plugged to the satisfaction of the City; 3) Such sewer extensions shall not be a part of the accepted sewer

facilities. This shall be clearly delineated on the Plans; 4) All such sewer extensions shall be inspected and accepted as part of the future construction phase.

F. Sewers of 15" in diameter and less shall be designed to not exceed ½ pipe depth full at peak design flow. Sewers greater than 15" shall be designed to not exceed ¾ pipe depth full at peak design flow.

G. The velocity in sanitary sewer pipe shall be a Minimum - 2 feet per second at the design flow, and a maximum of 7 feet per second.

H. All sewers shall be designed and constructed to give minimum velocities, when flowing full, of not less than 2.0 feet per second, based on Manning's formula using an "n" value of no less than 0.013, regardless of pipe material. The following minimum slopes shall be provided; however, slopes greater than these are desirable:

Sewer Size	Minimum Slope in Feet Per 100 Feet
8 inch	0.40
10 inch	0.28
12 inch	0.22
15 inch	0.15
18 inch	0.12
21 inch	0.10
24 inch	0.08
27 inch	0.067
30 inch	0.058

I. Slopes slightly less than those required for the velocity of 2.0 feet per second may be permitted under special conditions, when pipe is flowing full, if detailed justifiable reasons are given. Such decreased slopes shall only be considered where the depth of flow will be 0.3 of the diameter or greater for design average flow. Whenever such decreased slopes are selected, the Developer's Engineer must furnish computations of the depths of flow in such pipes at minimum, average, and peak rates of flow.

3.01.07 Manholes

A. Manholes shall be installed at the end of each gravity sewer; at all changes in grade, size or alignment; at all sewer intersections; and at distances not greater than 350 feet. When Private sewer systems must be separated from the City sewer system, a manhole shall be required at change of ownership.

B. An outside drop pipe shall be provided for a sewer entering a manhole where its invert elevation is 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer invert and the manhole invert is less than 24 inches, the manhole invert shall be filleted to prevent solids deposition.

C. For sewers 24 inches in diameter and smaller, the minimum inside diameter of manholes shall be 48 inches. For sewers between 24 inches and 36 inches, the minimum inside diameter shall be 60 inches. For sewers larger than 36 inches in diameter, a 72 inch inside diameter manhole shall be provided.

3.01.08 Service Connections

A. Service connections that connect the gravity sewer to the house or establishment being served, shall be through a lateral and miscellaneous appurtenances, all as specified in the City Standard Construction Details.

B. Service laterals and fittings shall be a minimum of 6 inches in diameter and shall be less than 100 feet in length.

C. Service laterals shall have a minimum slope of 1%.

D. In general, service laterals shall not be allowed to discharge into sanitary manholes, except at terminal manholes. A case-by-case exception to this requirement may be allowed if the lateral discharges at the same elevation as the manhole invert.

3.01.09 Sewer Force Mains

A. At design pumping rates, a cleansing velocity of at least 2.5 feet per second shall be maintained. Maximum velocity at design pumping rates should not exceed 5 feet per second.

B. The minimum force main diameter shall be four inches. Only 4, 6, 8, 12, 16, 20, 24, 30, 36, 42, 48 and 54-inch diameter force mains shall be permitted.

C. Design Friction Losses for sewer force mains shall be determined using the Hazen-Williams friction coefficient of C = 120 for PVC and HDPE pipe and C = 100 for ductile iron pipe.

D. The sewer force main and fittings, including all restrained joint fittings shall be designed to withstand pump operating pressures and pressure surges, but not less than 100 psi.

E. Force mains shall not terminate directly into a gravity sewer line. Force mains shall enter the terminal facility, gravity sewer manhole, lift station wet well or other, at a point equal to the operational water level of said receiving unit and not more than 1 foot above the flow line.

F. The interior surfaces of the receiving manhole and the first immediate downstream manhole shall have a protective coating or lining.

3.01.10 Air Release and Vacuum Relief Valves

Air release valves or air/vacuum relief valves shall be provided along sewer force main, as necessary, to prevent air locking and vacuum formation. All such valves are required at the high points if the vertical change in elevation is two feet or greater. Valves shall be clearly delineated on the force main profile in the Drawing. The Developer's Engineer shall submit calculations to the City justifying the valve sizing.

3.01.11 Valves

Valves shall be located on force main systems to facilitate effective isolation of the pipe system for repairs and maintenance. On straight runs of force mains, valve spacing shall not exceed 2,000 feet. Additional valves shall be provided where force mains intersect to facilitate isolation of pipe segments. Valves shall also be provided at the division of UTILITIES versus private ownership such as at the right-of-way line. Plug valves at the right-of-way shall have a minimum size of 4".

3.01.12 Grease Traps

A. All Food Preparation/Service Establishments shall have outside grease traps sized as indicated herein. All wastewater flow from the kitchen areas of these establishments must flow through approved grease traps prior to entering the City system. In addition all food preparation/service establishments must comply with Department of Health and Florida Department of Environmental Protection Regulations.

B. Single grease trap capacity of Fast Food Restaurants shall be sized at the rate of 10 gallons per seat. If two grease traps are used in series, total capacity of the grease traps shall be based on 5 gallons per seat.

C. Single grease trap capacity for General Restaurants shall be sized at the rate of 20 gallons per seat. If two grease traps are used in series, total capacity of the grease traps shall be based on 10 gallons per seat.

D. Single grease trap capacity for 24 Hour Restaurants shall be sized at the rate of 30 gallons per seat. If two grease traps are used in series, total capacity of the grease traps shall be based on 15 gallons per seat.

E. Single grease trap capacity for Convention Center and Manufacturing Cafeterias shall be sized at the rate of 3 gallons per meal based on permitted capacity. If two grease traps are used in series, total capacity of the grease traps shall be based on 1.5 gallons per meal.

F. For Miscellaneous Food Preparation / Service Establishments, the Developer's Engineer shall consult with the City before finalizing the design.

3.01.13 Lift Stations

A. Lift Station sites shall be sized as delineated in the City Standard Construction Details. The lift station shall be readily accessible by maintenance vehicles during all weather conditions. All access to the pumping station shall be paved. The facility shall not be located in road rights-of-way. In a phased development, a stabilized access road may be accepted during the initial phase with paving to be accomplished in the later phase.

B. The Developer shall dedicate pump station site by warranty deed and plat to the City. Dedicated easements shall also be required around the site as delineated on the "Pump Station Site Plan" in the City Standard Construction Details. In general, the site for the access road shall also be dedicated to the City 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. The “Lift Station Site Plan,” shows the minimum area required. The size of the lift station site may increase depending on the size and depth of the station and gravity sewer.

C. Wastewater lift station structures and electrical and mechanical equipment shall be protected from physical damage by the 100 year flood by setting the top slab elevation a minimum of one foot above the 100 year flood elevation determined for the site and shall not be located within the flood way. Lift stations shall remain fully operational and accessible during the 100 year flood event. Regulations of Local, State and Federal agencies regarding flood plain obstructions shall be considered.

D. Fencing at the lift station site perimeter shall comply with the City Standard Construction Details. In general, all lift station sites shall be fenced. However, exceptions to this requirement may be made for lift stations serving residential areas only, on a case by case basis and subject to sufficient security and landscape screening. Signs (minimum 12” x 18”) shall be provided at all lift stations indicating the name and contact phone number for the Owner and name and contact number for the maintenance company.

E. Buoyancy of the lift station structures shall be considered and adequate provisions shall be made for protection. Signed and sealed calculations shall be provided to the City by the Engineer.

F. The lift station site shall be graded so as to direct runoff away from structures and appurtenances and the electrical system. Pavement slopes shall not be less than 0.6% or exceed 2% within station confines. Earth grading extending from pavement for the first 10 feet shall not exceed 10: 1 cross slope and thereafter not exceed 3:1.

G. All parts and equipment shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed

and the units and equipment are ready for operation. Finished surfaces of all exposed pump openings shall be protected by wooded planks, strongly built and securely bolted thereto. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

3.01.14 Lift Station Wet Wells

A. The base slab and top slab shall be constructed to the dimensions specified in the City Standard Construction Details. The wall thickness and inside diameter of the wet well shall be constant over its full depth. Generally, the minimum acceptable inside diameter for a wet well shall be 6 feet; however, sufficient space for installed equipment, required suction pipe submergence and spacing shall be provided.

B. A minimum of 24 inches between shut off and lead pump start levels shall be provided. Low water level shall provide adequate submergence to prevent pump inlet from vortexing, air binding, or other operational problems.

C. A minimum 5 foot depth from the wet well invert and the lowest sewer inflow invert shall be provided.

D. The maximum high water level shall be less than the low pipe influent invert, with the high water alarm no higher than the mid-depth point of said pipe.

E. Brick construction is not be acceptable.

F. New wet wells shall be lined in accordance with Chapter 8.

G. The wet well floor (fillets) shall have a minimum slope of 1 to 1 to the hopper bottom. The horizontal area of the hopper bottom shall be no greater than necessary for proper installation and function of the pump inlet.

H. No interior ladders shall be permitted in the wet well.

3.01.15 Lift Station Pipes, Valves, and Fittings

All Lift Station Pipes, Valves, and Fittings shall be in accordance with Chapters 7 and 8 of this Handbook.

3.01.16 Lift Station Pumps

A. Pumps shall be submersible and of a dual rail system - dual rail pumps with dual rails. The Lift station shall be capable of pumping the peak design flow with any one pumping unit out of service. Pumps shall be capable of meeting all system hydraulic conditions without motors overloading. In addition, a minimum 5 HP motor shall be required. Head-capacity (performance) curves shall verify that pumps are operating at peak efficiency for

application. The system head-capacity analysis shall provide the following and be subject to review by the City Engineer:

1. System operation under peak flow conditions, with one pump or multiple parallel pumping, as designed. If the receiving force main system is interconnected to additional pumping stations, hydraulic modeling conditions shall also include said pumping systems operating at rated capacity.

2. Pumping capability with one pump running, all units operating in parallel and other combinations, if applicable.

3. The Engineer shall provide Hydraulic Analysis for peak, average and low pressure conditions and verify that new station will not adversely impact existing stations.

B. All parts shall be so designed and proportioned as to have liberal strength and stiffness, and to be especially adapted for the work to be done. Ample space shall be provided for inspection, repairs, and adjustment. All necessary foundation bolts, plates, nuts, and washers shall be furnished by the equipment manufacturer, and shall be of Type 316 stainless steel. Brass or stainless steel nameplates giving the name of the manufacturer, voltage, phase, rated horsepower, speed, and any other pertinent data shall be attached to each pump. The nameplate rating of the motors shall not be exceeded.

C. Two pumps shall be required for all stations discharging 1,500 gallons per minute or less. Additional pumps shall be required as necessary for larger flows. A minimum 5 minutes run time and no more than 8 successive starts of pumps must be maintained for peak flow conditions. Pumps shall alternate operation automatically. The pumps shall be capable of handling raw unscreened domestic wastewater and minimum 3 inch diameter solid spheres. Pump operation shall be controlled automatically by means of a SCADA Control System with a float back-up system. Pumps shall be mounted in the wet well as specified in the City Standard Construction Details.

D. Lift Station pumps and equipment shall be installed in accordance with approved shop drawings and manufacturer's instructions to operate as intended by the manufacturer. Shop drawings shall be sent to the City for review prior to installation of equipment. Upper guide rail holders shall be located exactly as required.

E. Refer to Chapter 8 of this Handbook for additional pump requirements.

3.01.17 Lift Station Water System

All wastewater lift stations shall be provided with a water system with adequate capacity and pressure for station wash down and other requirements. The station water system shall be completely separated from the potable water supply by means of a reduced pressure type backflow preventer or other City approved system. Reclaimed water if available shall be used for station wash down.

3.01.18 Lift Station Controls

A. The lift station shall be equipped with a control system designed by a supplier regularly engaged in that type of work, and has a minimum of five years experience. Wet well level for duplex (two pump) lift stations shall be maintained by a 5 float system (provide an additional float for triplex lift stations). The floats shall be as follows:

1. Emergency Off (Alarm)
2. Low Level - All pumps off
3. Lead Pump On
4. Lag Pump On
5. Emergency High Level (Alarm)

B. The alarm conditions shall activate a light and horn mount on the side of the central panel. Alarm conditions shall also provide signals for an RTU to signal the central monitoring/S.C.A.D.A. system. For lift stations with average daily flows in excess of 100,000 gpd, a RTU as required in Chapter 7 of this Handbook is required to be provided in the control panel.

3.01.19 Lift Station Generators

A. All Lift Stations that are to be dedicated to the City shall have an emergency generator installed on site, above the FEMA base flood elevation, or the Developer / Contractor shall pay the City for the cost to purchase a trailer mounted generator.

B. The generator system shall be provided for electrical power during the loss of normal power.

C. At private lift stations, a permanently installed generator will be required as determined by the City. Permanently installed generators will be required at 1) Lift stations that receive flow from other lift stations; 2) Stations that have three or more pumps; or 3) Stations that serve critical users as determined by the City.

D. The generator set shall consist of a diesel engine directly coupled to an electric generator, together with the necessary controls and accessories to provide continuous electric power to the lift station for the minimum duration of a 48 hour failure of the normal power supply.

E. Refer to Chapter 8 of this Handbook for additional generator requirements.

3.02 RECLAIMED WATER SYSTEM DESIGN

3.02.01 Design Period

Reclaimed water mains shall be designed for the estimated ultimate tributary population, as derived for the City's approved future land uses and/or historical flows. Reclaimed water mains shall not include considerations for flows for fire protection demand and shall be subject to system or area shut downs.

3.02.02 Location

Reclaimed Water mains shall be located in dedicated rights-of-way or utility easements (refer to Chapter 2 for Easement requirements). When installed in rights-of-way, reclaimed water mains shall, in general, maintain a consistent alignment with respect to the centerline of the road, located outside the pavement, as far from the edge of pavement as possible, preferably no closer than five (5) feet from the right-of-way line. Reclaimed Water mains shall not be placed under buildings, retention ponds, tennis courts, or other structures. Additionally, reclaimed water mains shall not be located along rear lot lines. Reclaimed water main along retention pond berms are generally not acceptable, but will be considered by the City on a case by case basis.

3.02.03 Average Daily Flow and Peak Flow

Reclaimed water peak hourly flow shall be used as the design basis for the neighborhood and commercial (local) reclaim systems. Reclaimed water peak-hour flow shall be based on the application of a 1" depth of irrigation per week applied over two days a week from 5 P.M. to 7 A.M. (15 hours), multiplied by a factor of safety. The factor of safety shall be 3 divided by any alternating irrigation days per address for the area to be serviced..

3.02.04 Pressure

A. The reclaimed water system shall be designed to maintain a minimum pressure of 40 psi 98% of the time. The normal working pressure in the distribution system should be approximately 60 psi. For pressures points greater than 90 psi, special provisions may be required. Design Friction Losses for reclaimed water mains shall be determined using the Hazen-Williams friction coefficient of C = 120 for PVC and HDPE pipe. Peak flow shall not exceed 5 fps.

B. Friction losses through mains shall be based on the Hazen Williams or Darcy-Wiesbach formula. In the use of Hazen Williams formula, the value for "C" shall be 120 for PVC and HDPE pipe and 100 for D.I. pipe.

3.02.05 Diameter

Only 4", 6", 8", 12", 16", 20", 24", 30", 36", 42", 48" and 54" diameter reclaimed water mains shall be permitted. Reclaimed water mains with a 4" diameter shall be permitted in cul-de-sac

areas with a maximum length of 800 feet of pipe. As a minimum, 6" looped systems shall be required in low density residential projects. Where looping of mains is not practical, 8" minimum mains shall be required, unless detailed calculations are submitted to substantiate the sufficiency of a 6" main. In commercial, industrial, and high density residential areas, minimum 8" looped mains shall be required.

3.02.06 Dead Ends

In order to provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins wherever practical, as determined by the City. System looping is required wherever possible to increase overall capacity and service. Where dead-end mains occur, they shall be provided with a hydrant or if approved blow-off for flushing purposes. Flushing devices shall be sized to provide flows which will give a velocity of at least 2.5 feet per second in the reclaim main being flushed. No flushing device shall be directly connected to any sewer.

3.02.07 Valves

Valves along reclaimed water mains shall be provided for all branch connections, loop ends, or other locations as required to provide an operable, easily maintained, and repairable reclaimed water distribution system. Valves are to be placed so that the maximum allowable length of reclaimed water main required to be shut down for repair work shall be 500 feet in commercial, industrial or multi-family residential areas, or 800 feet in other areas.

3.02.08 Air Relief Valves

At high points in reclaimed water mains where air can accumulate, provisions shall be made to remove the air by means of hydrants or automatic air relief valves. Automatic air relief valves shall not be used in situations where flooding of the manhole or vault may occur.

3.02.09 Below Grade Vaults

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

3.02.10 Reclaimed Water Metering

A. All reclaimed water service connections shall be metered. In general, the method of metering shall follow the guidelines listed below. However, the Owner's/Developer's Engineer must obtain approval before finalizing the design of the metering system. Master metering for irrigation for common grounds shall be reviewed and approved by the City Engineer on a case-by-case basis..

B. For Single Family, Duplex, and Multi-Family Subdivisions, Each unit's private irrigation areas shall be individually metered. Joint common irrigation areas shall be master metered. Single and double services shall be installed at property lines as specified in the Standard Construction Details attached as part of this Handbook.

C. For Commercial, Industrial, and Institutional Projects, in general, each building shall be individually metered. Meter(s) shall be located in the public rights-of-way at the property line.

D. At Shopping Centers, common irrigation areas shall be master metered. Each unit's private irrigation area shall be individually metered. The meters shall be located either in the right-of-way or within a Utility Easement. The meters shall be located within an unpaved area to facilitate removal, repair and/or replacement without damage to paved surfaces.

E. All meter boxes shall be installed by the Contractor at finished grade and level. All meters 2 inches and smaller will be installed by the City after payment of applicable fees and charges. All meters 2 inches in size and smaller shall be installed underground in an approved meter box. Meters larger than 2 inches shall be installed above ground. In general, meters larger than 2 inches shall be located in a meter easement located adjacent to the public right-of-way.

F. Size of all meters shall be determined by the Owner's/Developer's Engineer and approved by the City Engineer. The Owner's/Developer's Engineer shall provide sufficient information on estimated peak flows and low flows so that meter size can be evaluated. The Owner's/Developer's Engineer shall include head-losses through metering device when designing the reclaim water system.

4.01 GENERAL CONSTRUCTION REQUIREMENTS

4.01.01 Construction Layout

A. Base lines, property lines, and easement lines, are shown on the Drawings. Benchmarks utilized are also shown on the Drawings. All benchmarks, property corners, and other survey monuments that are lost, damaged, or destroyed shall be replaced by a Licensed Surveyor at the Contractor's expense.

B. Stake out the construction, establish lines and levels, temporary bench marks, batter boards, centerlines and reference points for the work, and verify all dimensions relating to interconnection with existing features.

C. Report any inconsistencies in the proposed grades, lines and levels, dimensions and locations to the Engineer before commencing work.

D. Contain all construction activities within the right-of-way, easements, and property secured by the Owner, as shown on the drawings. Do not disturb surrounding properties or travel on surrounding properties without written consent from the property owner. Repair or reconstruct damaged areas on an immediate basis. All costs for repairs shall be the responsibility of the Contractor.

4.01.02 Existing Utilities

A. The Contractor shall locate existing utilities in the areas of Work in accordance with Chapter 556 F.S., "Underground Facility Damage Prevention and Safety", including contacting "Sunshine State, One-Call" by dialing "811" at least two business days prior to commencing excavation or demolition activities in an area. The Contractor is responsible for subsurface verification of all existing utilities prior to construction, including those utilities that are not members of the Sunshine One Call system.

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

C. The Contractor shall proceed with caution with all excavation and demolition activities until the exact location of underground utilities may be determined.

D. The Contractor shall protect all existing utilities. In the event of damage to an existing utility, the Contractor shall immediately notify the responsible official of the organization operating the interrupted utility. The Contractor shall lend all possible assistance in

restoring services and shall assume all cost, charges, or claims connected with the interruption and repair of such services.

E. The City is not responsible for unknown or incorrectly located utilities.

F. Changes to the proposed construction due to obstructions encountered during the progress of the Work and interfere to such an extent that an alteration in the Plans is required, the Engineer is responsible for determining a resolution to the conflict and shall bring the proposed construction change to the City's attention and obtain City approval in writing. If a change in line or grade of a gravity sewer is necessary, the City may require the addition of any manholes needed to maintain the integrity of the sewer system.

4.01.03 Maintenance of Traffic and Closing of Streets

A. The Contractor shall carry on the Work in a manner which will cause a minimum of interruption to traffic. Where traffic must cross open trenches, the Contractor shall provide suitable bridges at street intersections and driveways. The Contractor shall post suitable signs indicating that a street is closed and necessary detour signs for the proper maintenance of traffic. Prior to closing of any streets, the Contractor shall notify and obtain the approval of responsible authorities and the City.

B. Unless permission to close a street is received in writing from the roadway jurisdictional agency (City, County, FDOT, etc.), all excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the Contractor's operations cause traffic hazards, the Contractor shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the roadway jurisdictional agency and the City.

C. Detours around construction will be subject to the approval of the roadway jurisdictional agency and the City. Where detours are permitted, the Contractor shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured, the Contractor shall expedite construction operations. Periods when traffic is being detoured shall be in accordance with the requirements of the roadway jurisdictional agency and the City.

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

4.01.04 Protection of Public and Property - Barricades, Guards and Safety Provisions

A. The Contractor shall be solely responsible for adhering to the rules and regulations of OSHA, the Trench Safety Act and appropriate authorities regarding safety provisions. To

protect persons from injury and to avoid property damage, adequate barricades, construction signs, lights and guards as required shall be placed and maintained by the Contractor at his expense during the progress of the Work and until it is safe for traffic to use the roads and streets. All material piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor.

B. Signage and barricades shall be in accordance with applicable FDOT Standard Plans.

C. During construction, pedestrian corridors shall be maintained in a safe, passable, and stabilized manner. Measures utilized shall include, but not be limited to, boardwalks or stabilized pathways. The Contractor shall be solely responsible for coordination with Collier County Schools for potential construction impacts to schools, bus stops, sidewalks used by students, or crossings. Closure of any sidewalks and/or school crossings near schools shall require coordination with and shall be approved by Collier County Schools.

4.01.05 Protection of Utility Structures

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

4.01.06 Open Excavation

All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges with hand railings and other crossings for accommodating travel by pedestrians and Workmen. Bridges provided for access to private property during construction shall be removed when no longer required. The length of open trench will be controlled by the particular surrounding conditions, but shall be limited to 300 feet unless otherwise approved by the City. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the City may require special construction procedures, such as limiting the length of open trench, fencing, prohibiting excavated material in the street and requiring that the trench shall not remain open overnight. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment or other obstacles which could be dangerous to the public shall be well lighted at night.

4.01.07 Protection of Trees and Shrubs

All trees and shrubs not shown to be removed on the Plans shall be protected by the Contractor at his expense. No excavated materials shall be placed so as to injure such trees or shrubs. Trees

or shrubs destroyed by negligence of the Contractor or his employees shall be replaced by him with new stock of similar size and age at the sole expense of the Contractor.

4.01.08 Protection of Lawn Areas

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

4.01.09 Restoration of Fences

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

4.01.10 Erosion and Sediment Control

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

B. Contractor shall respond to erosion and sediment control maintenance requirements or implement additional measures to control erosion ordered by the City or governing authorities within 48 hours or sooner if required at no additional cost to the City.

C. Contractor will be required to incorporate permanent erosion control features into project at earliest practical time to minimize need for temporary controls.

4.01.11 Access to Public Services

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

4.01.12 Public Nuisance

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

04.01.13 Construction Hours, City Inspection Hours and Inspection Notification

A. Work shall be performed during Normal Working Hours and Normal Working Days, as defined in Chapter 2 of this Handbook, unless written authorization has been granted by the City.

B. Work requiring inspection by the City is to be scheduled for 8:00 a.m. to 4:00 p.m., Monday through Friday, excluding holidays, except for wet taps and line stops, which shall be scheduled to commence between 8:00 a.m. and 2:00 p.m. on the scheduled day.

C. Provide a minimum of forty-eight (48) hours advance notice for all City inspections.

D. The Contractor is responsible for reimbursing the City for overtime pay of City inspectors for any City required inspections that are to be performed outside the City Inspection Hours.

4.01.14 Construction in Easements and Rights-Of-Way

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

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

C. Work in County right-of-way shall be governed by the County.

D. Work in City right-of-way shall be reviewed and permitted with the City of Everglades City.

4.01.15 Suspension of Work Due to Weather

During inclement weather, all Work which might be damaged or rendered inferior by such weather conditions shall be suspended. During suspension of the Work from any cause, the Work shall be suitably covered and protected so as to preserve it from injury by the weather or otherwise.

4.01.16 Use of Chemicals

All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either United States Environmental Protection Agency or United States Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict conformance with label instructions.

4.01.17 Cooperation with Other Contractors and Forces

During construction progress, it may be necessary for other Contractors and persons employed by the City to Work in or about the site. The City reserves the right to put such other Contractors to Work and to afford such access to the construction site and at such times as the City deems proper. The Contractor shall not impede or interfere with the Work of such other Contractors and shall cooperate with the other Contractor(s) for proper prosecution of the Work.

4.01.18 Soil Borings and Subsurface Exploration

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

4.01.19 Cleaning

A. During construction, the Contractor shall, at all times, keep the construction site and adjacent premises as free from material, debris and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of the City, such material, debris, or rubbish constitutes a nuisance or is objectionable.

B. At the conclusion of the Work, all tools, temporary structures and materials belonging to the Contractor shall be promptly taken away. The Contractor shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances.

4.01.20 Salvage

Any existing City-owned equipment or material including but not limited to valves, pipes, fittings, meters, couplings, etc., which is removed or replaced as a result of construction may be

designated as salvage by the City and, if so, shall be carefully removed and delivered to the City, to the location designated by the City.

4.01.21 Shop Drawings and Samples

A. For utilities and lift stations to be owned and operated by the City, submit shop drawings (PDF format) to the City for review and approval. The Contractor's responsibility for errors and omissions in submittals is not relieved by the City's review of submittals. Shop drawings are required for all materials including but not limited to piping, valves, fittings, pumps, precast structures, manhole covers, hatches, fencing, gates, and electrical equipment.

B. The data shown on the shop drawings shall be complete with respect to dimensions, design criteria, materials of construction and the like to enable review of the information as required.

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

4.02 SITE PREPARATION, SURFACE REMOVAL AND RESTORATION

4.02.01 Clearing, Grubbing, and Stripping

A. The Contractor shall clear and grub all of the areas within the limits of construction as shown on the Plans and approved by the City prior to the beginning of any Work. All site Work shall conform to the applicable site clearing, landscaping and tree protection requirements of the City of Everglades City codes and ordinances.

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

C. Grubbing shall consist of the complete removal of all stumps, roots larger than 1.5 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18 inches below the sub-grade. All depressions excavated below the original ground surface for or by the removal of such objects shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

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

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

4.02.02 Dust Control

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

4.02.03 Surface Removal

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

4.02.04 Stabilization and Restoration

A. Stabilization measures shall be initiated as soon as practicable, but in no case more than seven days after disturbance, in portions of the site where construction activities have temporarily or permanently ceased.

B. Restoration of all surfaces including road sub-base, soil cement, limerock base, asphaltic concrete surface, Portland cement concrete pavement and driveways, sidewalks and concrete curbs shall be in strict accordance with City of Everglades City codes and ordinances.

C. All sodding, seeding, and mulching shall be in accordance with the approved Plans and the City of Everglades City codes and ordinances.

4.03 MATERIALS USED FOR BEDDING, BACKFILLING, AND FILL

4.03.01 General

Materials for use as bedding and backfill shall be as described under this Section. The Contractor shall, upon request by the City, make an appropriate sample of this material available for testing by the City or its designated representative.

4.03.02 Structural Fill

Materials for structural fill shall be bedding rock or select common fill as specified herein or other suitable material as approved by the City.

4.03.03 Common Fill

A. Common fill shall consist of mineral soil, substantially free of clay, organic material, muck, loam, wood, trash and other objectionable material which may be compressible or which cannot be compacted properly. Generally, common fill shall be classified as AASHTO M145 classification A-1, A-3, A-2-4, or A-2-6; ASTM D2487 classification GW, GP, GM, SM, SW, SP; unless otherwise disapproved within the Project Geotechnical report. Common fill shall not contain stones larger 3.5 inches in any dimension in the top 12 inches or six inches in any dimension in the balance of the fill area. Common fill shall not contain asphalt, broken concrete, masonry, rubble or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling. Additional common fill shall be no more than l2 percent by weight finer than the No. 200 mesh sieve, unless finer material is approved for use in a specific location by the City.

B. Material falling within the above specifications that is encountered during the excavation may be stored in segregated stockpiles for reuse. All material which in the opinion of the City is not suitable for backfill or fill shall be disposed as unsuitable materials.

4.03.04 Select Common Fill

Select common fill shall be as specified above for common fill, except that the material shall contain no stones larger than 1.5 inches in largest dimension, and shall be no more than 5% by weight finer than the No. 200 mesh sieve.

4.03.05 Bedding Rock

Bedding rock shall conform to FDOT No. 57 aggregate.

4.04 SHEETING AND BRACING IN EXCAVATIONS

4.04.01 General

If required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction and to protect adjacent structures, existing piping and/or foundation material from disturbance, undermining or other damage, the CONTRACTOR shall construct and maintain sheeting and bracing. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.

4.04.02 Miscellaneous Requirements

A. For trench sheeting for pipes, no sheeting is to be withdrawn if driven below mid-diameter of any pipe and no wood sheeting shall be cut off at a level lower than one foot above the top of any pipe unless otherwise directed by the City. If, during the progress of the Work, the City decides that additional wood sheeting should be left in place, it may direct the Contractor to do so. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given by the City for an alternate method of removal. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction of other structures, utilities, existing piping or property. Unless otherwise approved or indicated on the Drawings or in the Specifications, all sheeting and bracing shall be removed after completion of the substructure. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools specially adapted to that purpose, by watering or otherwise as may be directed.

B. The right of the City to order sheeting and bracing left in place shall not be construed as creating an obligation on its part to issue such orders, and its failure to exercise its right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

C. The Contractor shall construct the sheeting outside the neat lines of the foundation unless indicated otherwise to the extent he deems it desirable for his method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting, bracing and cofferdams shall be adequate to withstand all pressures to which the structure will be subjected. Pumping, bracing and other work within the cofferdam shall be done in a manner to avoid disturbing any construction already performed. Any movement or bulging, which may occur, shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.

4.05 DEWATERING, DRAINAGE AND FLOTATION

4.05.01 General

A. The Contractor shall excavate, construct and place all pipelines, concrete work, fill, and bedding rock, in-the-dry. In addition, the Contractor shall not make the final 24 inches of excavation until the water level is a minimum of 1 foot below proposed bottom of excavation. For purposes of these Specifications, “in-the-dry” is defined to be within 2% of the optimum moisture content of the soil. The City reserves the right to ask the Contractor to demonstrate that the water level is a minimum of 1 foot below proposed bottom of excavation before allowing the construction to proceed.

B. Discharge water shall be clear with no visible soil particles and must be in compliance with all Regulatory Agency Requirements. Discharge from dewatering shall be disposed of in such a manner that it will not interfere with the normal drainage of the area in which the work is being performed, create a public nuisance, or form ponding. The operations shall not cause injury to any portion of the work completed, or in progress, or to the surface of streets, or to private property. The dewatering operation shall comply with the requirements of appropriate regulatory agencies. Additionally, where private property will be involved, advance permission shall be obtained by the Contractor. All dewatering activities shall comply with the current standards of the SFWMD and FDEP.

4.05.02 Additional Requirements

A. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.

B. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

C. It is expected that well points or other engineered dewatering systems will be required for pre-drainage of the soils prior to final excavation for some of the deeper in-ground structures, or piping and for maintaining the lowered groundwater level until construction has been completed to such an extent that the structure, pipeline or fill will not be floated or otherwise damaged. Well points shall be surrounded by suitable filter sand and negligible fines shall be removed by pumping.

D. The Contractor shall furnish all materials and equipment and perform all work required to install and maintain the drainage systems for handling groundwater and surface water encountered during construction of structures, pipelines and compacted fills.

E. During backfilling and construction, water levels shall be measured in observation wells located as directed by the City.

F. Continuous pumping shall be required as long as water levels are required to be below natural levels.

4.06 EXCAVATION

4.06.01 General

A. Excavation consists of removal, storage and disposal of material encountered when establishing required grade elevations and in accordance with the notes shown in the

Contract Documents. Authorized earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, and other materials encountered that are not classified as rock excavation or unauthorized excavation. Unauthorized excavation consists of removal of material beyond the limits needed to establish required grade and subgrade elevations without specific direction of the City. Unauthorized excavation, as well as remedial work directed by the City, shall be at the Contractor's expense. Such remedial work shall be performed as directed by the City.

B. If requested by the City, when excavation has reached required subgrade elevations, a Geotechnical/Soils Engineer shall make an inspection of conditions. If the subgrade is unsuitable, Contractor shall carry excavation deeper and replace excavated material with select common fill or bedding rock, as directed by the City.

C. If the Contractor excavates below grade through error, for convenience, or through failure to properly dewater the excavation or disturbs the subgrade before dewatering is sufficiently complete, the Contractor may be directed by the City to excavate below grade and refill the excavation using select common fill or bedding rock.

D. Slope sides of excavations shall comply with Local Codes and Ordinances, and with OSHA requirements. Contractor shall shore and brace where sloping is not possible due to space restrictions or stability of the material excavated. Sides and slopes shall be maintained in a safe condition until completion of backfilling.

E. Contractor shall stockpile satisfactory excavated materials at a location approved by the City until required for backfill or fill. When needed in the work, material shall be located and graded at the direction of a Geotechnical/Soils Engineer. Stockpiles shall be placed and graded for proper drainage. All soil materials shall be located away from the edge of excavations. All surplus and/or unsuitable excavated material shall be legally disposed of by the Contractor. Any permits required for the hauling and disposing of this material shall be obtained by the Contractor prior to commencing hauling operations.

4.06.02 Excavation for Structures

All such excavations shall conform to the elevations and dimensions shown in the Contract Documents within a tolerance of plus or minus 0.10 foot and extending a sufficient distance from footings and foundations to permit placing and removing form work, installation of services and other construction, inspection or as shown in the Contract Documents. In excavating for footings and foundations, care shall be exercised not to disturb the bottom of the excavation. Bottoms shall be trimmed to required lines and grades to leave a solid base to receive concrete.

4.06.03 Trench Excavation

A. Excavation for all trenches required for the installation of utility pipes shall be made to the depths indicated in the Drawings, the City Standard Construction Details, and the

specifications in this Handbook, and in such manner and to such widths as will give suitable room for laying the pipe within the trenches, for bracing and supporting, and for pumping and drainage facilities. Trench bottoms shall be kept dry, compacted, and stable to a depth two feet below the bottom of the trench.

B. Excavation shall not exceed normal trench width as specified in the City Standard Construction Details attached as part of this Handbook. Any excavation which exceeds the normal trench width shall require special backfill requirements as determined by the City.

C. Where pipes are to be laid in bedding rock, select common fill or encased in concrete, the trench may be excavated by machinery to or just below the designated subgrade, provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

D. Where the pipes are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery. The last of the material being excavated shall be done manually in such a manner that will give a shaped bottom, true to grade, so that pipe can be evenly supported on undisturbed material, as specified in the City Standard Construction Details attached as part of this Handbook. Bell holes shall be made as required.

4.07 BEDDING AND BACKFILL

4.07.01 General

A. Material placed in fill areas under and around structures and pipelines shall be deposited within the lines and to the grades shown on the Drawings or as directed by the City, making due allowance for settlement of the material. Fill shall be placed only on properly prepared surfaces which have been inspected and approved by the City. If sufficient select common or common fill material is not available from excavation on-site, the Contractor shall provide fill as may be required.

B. All bedding and backfill material shall be common fill or select common fill. If a sufficient quantity of suitable material is not available from the trench or other excavations within the site, provide additional suitable material.

C. Fill shall be brought up in substantially level lifts starting in the deepest portion of the fill. The entire surface of the work shall be maintained free from ruts and in such condition that construction equipment can readily travel over any section. Fill shall be placed and spread in layers by a backhoe or other approved method, unless otherwise specified. The Contractor shall assign a sufficient number of men to this work to insure satisfactory compliance with these requirements.

D. All fill materials shall be placed and compacted "in-the-dry". The Contractor shall dewater excavated areas as required to perform the work and in such manner as to preserve the undisturbed state of the natural inorganic soils.

E. Prior to filling, the ground surface shall be prepared by removing vegetation, debris, unsatisfactory soil materials, obstructions and deleterious materials. Contractor shall plow strip or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with the existing surface. When existing ground surface has a density less than that specified for the particular area classification, Contractor shall break up the ground surface, pulverize, moisture-condition to the optimum moisture content and compact to required depth and percentage of maximum density.

F. Before compaction, material shall be moistened or aerated as necessary to provide the optimum moisture content. Material which is too wet shall be spread on the fill area and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits. If added moisture is required, water shall be applied by sprinkler tanks or other sprinkler systems, which will insure uniform distribution of the water over the area to be treated and give complete and accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued. The Contractor shall supply all hose, piping, valves, sprinklers, pumps, sprinkler tanks, hauling equipment and all other materials and equipment necessary to place water in the fill in the manner specified. Contractor shall compact each layer to required percentage of maximum dry density or relative dry density in accordance with this Handbook. Backfill or fill material shall not be placed on surfaces that are muddy, frozen or contain frost or ice. Contractor to Supply all materials and equipment necessary for proper installation.

4.07.02 Bedding and Backfill for Structures

A. Bedding rock shall be used for bedding under all structures as specified in Chapter 5 and the City Standard Construction Details. The Contractor shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed. Structural fill shall be used as backfill against the exterior walls of the structures. Fill shall be compacted sufficiently in accordance with these Specifications. If compaction is by rolling or ramming, material shall be wet down as required.

B. Backfilling shall be carried up evenly on all walls of an individual structure. No backfill shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength.

C. In locations where pipes pass through building walls, the Contractor shall take precautions to consolidate the fill up to an elevation of at least 1 foot above the bottom of the pipes. Structural fill in such areas shall be placed for a distance of not less than 3 feet either side of the center line of the pipe in level layers not exceeding 8 inches in depth.

D. The surface of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the Drawings. No soft spots or uncompacted areas shall be allowed in the work.

E. Temporary bracing shall be provided as required during construction of all structures to protect partially completed structures against all construction loads, hydraulic pressure and earth pressure. The bracing shall be capable of resisting all loads applied to the walls as a result of backfilling.

4.07.03 Bedding and Backfill for Pipes

A. Bedding for pipe shall be as shown on the plans and as specified in the City Standard Construction Details. The Contractor shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed.

B. Backfilling over and around pipes shall begin as soon as practical after the pipe has been laid, jointed and inspected as specified in the City Standard Construction Details.

C. Any space remaining between the pipe and sides of the trench shall be carefully backfilled and spread by hand or approved mechanical device and thoroughly compacted with a tamper as fast as placed, up to a level of 1 foot above the top of the pipe. The filling shall be carried up evenly on both sides. Compaction shall be in accordance with this Handbook.

D. The remainder of the trench above the compacted backfill, as just described above, shall be filled and thoroughly compacted in uniform layers. Compaction shall be in accordance with this Handbook.

4.08 COMPACTION

4.08.01 General

A. The Contractor shall control soil compaction during construction to provide the percentage of maximum density specified. The Contractor shall provide the City copies of all soils testing reports, prepared by a Geotechnical/Soils Engineer, demonstrating compliance with these Specifications.

B. When an existing trench bottom has a density less than that specified under these Specifications, the Contractor shall break up the trench bottom surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

4.08.02 Percentage of Maximum Density Requirements

A. The Contractor shall control soil compaction during construction to provide the percentage of maximum density specified. When utility work is conducted within FDOT right-of-way or other governing municipality, the more stringent minimum density standards shall apply.

B. Fill or undisturbed soil from the bottom of the pipe trench to one foot above the pipe to the finished grade elevation shall be compacted to a minimum density of 98 percent of the maximum dry density as determined by AASHTO T-180 or ASTM D-1557. Backfill or fill placed in other areas shall be compacted to a Minimum Density (AASHTO T-180 or ASTM D-1557) as follows:

1. Backfill or fill placed under and within the Influence Area of roadways, structures, slabs, foundations = 98 percent
2. Backfill placed within pond and road embankment outside the Influence Area = 95 percent
3. Backfill placed within public road right-of-way and utility easements outside the influence area = 95 percent
4. Backfill placed within all other areas = 90 percent

4.08.03 Compaction Tests

A. One compaction test location shall be required for each 300 linear feet of pipe and for every 100 square feet of backfill around structures as a minimum. The City may determine that more compaction tests are required to certify the installation depending on field conditions. The locations of compaction tests within the trench shall be in conformance with the following schedule:

1. One test at the spring line of the pipe.
2. At least one test for each 12 inch layer of backfill within the pipe bedding zone for pipes 24 inches and larger.
3. One test at an elevation of 1 foot above the top of the pipe.
4. One test for each 2 feet of backfill placed from 1 foot above the top of the pipe to finished grade elevation.

B. If, based on the Geotechnical/Soils Engineer testing reports and inspection, fill which has been placed is below specified density, Contractor shall provide additional compaction and testing prior to commencing further construction.

4.09 GRADING

A. All areas within the limits of construction, including transition areas, shall be uniformly graded to produce a smooth, uniform surface. Areas adjacent to structures or paved surfaces shall be graded to drain away from structures and pavement. Ponding shall be

prevented. After grading, the area shall be compacted to the specified depth and percentage of maximum density.

B. No grading shall be done in areas where there are existing pipelines that may be uncovered or damaged until such lines have been relocated.

4.10 MAINTENANCE

A. Contractor shall protect newly graded areas from traffic and erosion and keep them free of trash and debris. Contractor shall repair and reestablish grades in settled, eroded and rutted areas.

B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, Contractor shall scarify surface and reshape and compact to required density prior to further construction.

4.11 INSPECTION AND QUALITY ASSURANCE

4.11.01 Inspection

A. Contractor shall examine the areas and conditions under which excavating, filling and grading are to be performed, and not proceed with the work until unsatisfactory conditions have been corrected.

B. Contractor shall examine existing grade prior to commencement of work and report to the City if elevations of existing grade vary from elevations shown on Drawings.

4.11.02 Quality Assurance

A. All work shall be performed in compliance with applicable requirements of governing authorities having jurisdiction.

B. The City shall provide quality control testing during construction to ensure compliance with these Specifications.

C. Contractor shall allow the testing service to inspect and approve fill materials and fill layers before further construction is performed. The Contractor shall be given copies of all test results. Contractor shall be financially responsible for all failed and/or substandard material testing.

5.01 GENERAL CONSTRUCTION REQUIREMENTS

5.01.01 General Installation of Utility Lines

A. Standard construction for all utility lines including gravity sewer, sewer force mains, reclaimed water mains, and service lines is open cut construction, with the lines installed in a trench, with the trench backfilled and compacted.

B. Utility line construction across paved streets is typically either directional bore construction or jack and bore construction, and construction across railroad crossings is jack and bore construction. Open cut construction across City streets will be allowed on a case by case basis depending on the condition of the pavement and amount of traffic on the street. Approval of open cut construction across City streets is at the sole discretion of the City. Roadway crossings of non-City streets shall be in accordance with the requirements of the roadway jurisdictional agency.

C. Crossing of waterways shall be either directional bore construction or jack and bore construction. Aerial crossings of waterways will only be allowed on a case by case basis provided it can be shown that the aerial crossing best serves the interests of the City.

D. Except for directional drilled pipeline and jack and bore casing which are specified in this Chapter, all utility pipe, valves, fittings, and accessories shall be as specified for gravity sewer lines, sewer force mains, and reclaimed water mains within separate Chapters in this Handbook.

5.02 OPEN CUT CONSTRUCTION

5.02.01 General

Excavation and backfill including sheeting and bracing, dewatering, bedding and foundation, and furnishing and disposal of materials shall be as required in Chapter 4 of this Handbook.

5.02.02 Pipe Laying

A. All pipe shall be laid “in-the-dry” along straight lines and grades between fittings, manholes, or other defined points, unless definite alignment deflections or grade changes are necessary.

B. All materials shall be maintained and all coatings shall be protected from damage and kept clean. The interior of the pipe shall be maintained clean and free of dirt and debris. When work is not in progress, plug all open ends. Underground piping shall not be driven to grade by striking it with an unyielding object. Bell holes in the bedding shall be provided to allow uniform load bearing along the pipe barrel.

5.02.03 Pipe Cover

A. All pressure mains shall have a minimum cover of 36 inches (3.0 feet) and a maximum depth of 48 inches (4.0 feet) from final grade except at locations of utility crossings or with special approval when it is determined to be in the best interest of the City.

B. The standard minimum cover for gravity sewers is 48 inches (4.0 feet) and the maximum depth shall not exceed 12 feet, as measured from the top of pipe to finish grade. Deeper sewers shall only be allowed if approved by the City.

5.02.04 Separation of Non-Potable and Potable Water Lines

A. The horizontal separation between water mains and sanitary sewer, storm sewer, wastewater force mains, stormwater force mains, reclaimed water mains and onsite sewage treatment and disposal systems shall be in accordance with the following:

1. The outside of water mains shall be a minimum of three feet from the outside of any existing or proposed storm sewer, stormwater force main, vacuum type sanitary sewer and reclaimed water main.
2. The outside of water mains shall be a minimum of six feet from the outside of any existing or proposed gravity sanitary sewer and wastewater force main. The minimum horizontal separation distance between the outside of water mains and the outside of gravity sanitary sewers can be reduced to three feet where the bottom of the water main is at least six inches above the top of the sewer.
3. The outside of water mains shall be a minimum of ten feet from all parts of any existing or proposed onsite sewage treatment and disposal system such as septic tanks, drainfields, and grease traps. Onsite sewage treatment and disposal systems do not include package sewage treatment facilities and public wastewater treatment facilities.

B. The vertical separation between water mains and sanitary and storm sewer, wastewater or stormwater force mains, and reclaimed water mains shall be in accordance with the following:

1. Wherever possible, water mains shall cross over existing or proposed gravity sanitary sewer, vacuum type sanitary sewer, and storm sewer, so the outside of the water main is at least six inches above the outside of the sewer. Where it is not possible for the water main to cross over existing or proposed gravity sanitary sewer, vacuum type sanitary sewer, and storm sewer, then the water main can cross under these types of pipeline systems provided the outside of the water main is at least 12 inches below the outside of the pipeline. At the crossing, the proposed pipe joints shall be arranged so that all water main joints are at least three feet from vacuum type sanitary sewer or storm sewer joints, and at least six feet from gravity sanitary sewer joints.

2. Wherever possible, water mains shall cross over existing or proposed reclaimed water mains, wastewater force mains and stormwater force mains. Whether the water main crosses over or under these types of pipeline systems, the outside of the water main shall be at least 12 inches from the outside of the existing or proposed reclaimed water main, wastewater force main and stormwater force main. At the crossing, the proposed pipe joints shall be arranged so that all water main joints are at least three feet from reclaimed water main joints and stormwater force main joints, and at least six feet from the joints of wastewater force mains.

C. No water main shall pass through or come in contact with any part of a sanitary sewer manhole.

D. Exceptions from meeting the pipe separation requirements will be allowed by the City if approved by the Health Dept. in writing and the Contractor provides justification to the City that the City deems to be acceptable. Implementation of measures to mitigate reduced separation without the expressed written consent of the Health Dept. and the City could result in the requirement that the installed unapproved measures be removed and replaced at no cost to the City.

5.02.05 Push-on Joints

The pipe bell and spigot shall be thoroughly cleaned immediately prior to inserting the gasket and jointing. The gasket shall be properly faced and positioned. Lubrication shall be in accordance with the manufacturer's recommendations. Pipe shall be protected against damage from jointing equipment by using timber headers, etc.

5.02.06 Mechanical Joints

The socket and plain end shall be wiped clean. The plain end, socket, and gasket shall be washed with a soap solution immediately prior to joining. The joint shall be kept straight during assembly with the gasket pressed firm and even into the recess. Bolts shall be tightened such that the gland remains reasonably parallel to the flange by alternating from bolt to bolt in cycles.

5.02.07 Flange Joints

Make all flanged joints tight, without applying undue strain upon the joint or other appurtenances. Joints shall be fitted such that contact surfaces bear uniformly on the gasket with relatively uniform bolt stresses.

5.02.08 Connections at Structures

Where pipes are to extend into or through structures, Link Seal-Type penetration seals shall be provided at the wall face. Openings in existing structures shall be made with a circular core boring machine.

5.02.09 Pipe Cutting

Cutting of pipes for the insertion of valves, fittings, or closure pieces shall be done in a neat, workmanlike manner without damaging pipe coatings or linings. The pipe shall be cut with an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw, or milling wheel saw. Cut ends and rough edges shall be ground smooth and, for push-on joint connections, the cut end shall be beveled. Where castings or linings have been damaged, apply two coats of a pipe manufacturer approved coating. Where protective linings are provided within the interior of the pipe, repair of the lining shall be completed in accordance with the lining manufacturer's recommendations.

5.02.10 Pipe Restraint

A. All plugs, caps, tees, bends, and valves, unless otherwise specified, shall be restrained by the use of restrained glands, and/or restrained joints. Pipe and joint restraint shall be as specified for sewer force mains and reclaimed water mains within this Handbook.

B. The use of Thrust Blocks for pipe and fitting restraint is not allowed. The use of thrust collars where existing pressure pipe is cut and capped shall be in accordance with the City's Standard Construction Detail.

C. Backfilling over pipe restraints shall not proceed until inspected by the City.

5.02.11 Polyethylene Encasement

A. Extra protection shall be provided for underground cast or ductile iron pipe and fittings within areas of severe corrosive conditions. The evaluation of the corrosiveness of soils shall be conducted by the Geotechnical / Soils Engineer in accordance the Soil Test Evaluation for Ductile Iron Pipe (10-Point System), in accordance with the DIPRA publication "Polyethylene Encasement - Effective, Economical Protection for Ductile Iron Pipe In Corrosive Environments".

B. Install 8 mil polyethylene encasement on all ductile iron pipe and fittings in accordance with ANSI/AWWA C105/A21.5 in areas of corrosive soils, as determined by the DIPRA soil test evaluation. Additionally, install polyethylene encasement on all ductile iron pipe and fittings located within 10 feet of gas mains.

5.02.12 Aboveground Pipe Support

Above grade pipelines shall be installed per the Standard Construction Pipe Support Detail.

5.02.13 Connections

Connections to existing pressure mains shall be made by tapping the pipeline using a tapping sleeve and valve installed with a tapping device designed for the pipe material.

5.03 DIRECTIONAL BORE CONSTRUCTION

05.03.01 General Requirements

A. The horizontal directional drilling (HDD) method of installation, also commonly referred to as directional boring or guided horizontal boring for pressure pipe is specified herein. Gravity sewer mains are not to be installed via directional drilling.

B. Typically, valves are to be installed at each end of a directional drilled pipeline at all road crossings and water crossings. Install air release valves at all high points along the installed main where elevation changes exceed five (5) feet. Valves and air release valves shall be as specified for sewer force mains and reclaimed water mains within this Handbook.

C. The Directional drilling Contractor (or Subcontractor) shall have a minimum of four years of experience of successful similar horizontal directional drilling installations of pressure mains that are the same or greater drill length and pipe diameter that the proposed directional drilling. If requested by the City, provide reference documenting successful similar horizontal directional drilling installations by Contractor or, if directional drilling is to be done by a Subcontractor, provide references of Subcontractor. Provide at least 3 references showing location of project, diameter of pipeline directional drilled, and length of bore. Provide contact names and e-mail addresses for each reference. Conventional trenching experience or jack and bore experience will not be considered applicable.

D. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in proper working order. The directional drilling equipment shall consist of the following:

1. A directional drilling rig of sufficient capacity to perform the bore and pull-back the pipe;
2. A drilling fluid mixing, delivery and recovery system of sufficient capacity to complete the crossing;
3. A drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be reused;
4. A magnetic guidance system to accurately guide boring operations;
5. A vacuum truck of sufficient capacity to handle the drilling fluid volume; and
6. Trained and competent personnel to operate the system.

E. The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure

and volume to power drilling operations. The hydraulic system shall be free of leaks. The rig shall have a system to monitor and record maximum pullback pressure during pullback operations. The rig shall be grounded during drilling and pullback operations. There shall be a system to detect electrical current from the drilling string and an audible alarm that automatically sounds when an electrical current is detected.

F. Prior to beginning Work, the Contractor must submit a Work plan to the City detailing the procedure and schedule to be used to execute the project. The Work plan should include the following.

1. A description of all equipment to be used;
2. Down-hole tools;
3. A list of personnel and their qualifications and experience;
4. List of Subcontractors;
5. A schedule Work activity;
6. A safety plan;
7. A traffic control plan (if applicable);
8. An environmental protection plan and;
9. Contingency Plan for possible problems.

5.03.02 Pipe and Fittings for Directional Drilled Pipeline

A. Polyethylene pipe and fittings for reclaimed water, sewer force main, or storm sewer shall be in accordance with AWWA C906, standard code designation PE 4710, DR 11, 200 psi. The manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements. The pipe sizing shall be in accordance with Ductile Iron Pipe Sizing System (DIPS).

B. Polyethylene pipe and tubing used for service lines ½-3 inch diameter shall be polyethylene in accordance with AWWA C901, standard code designation PE 4710, SDR 9 (outside diameter based dimension ratio), 250 psi. Pipe and fittings shall be NSF approved for the usage to which they are to be applied. Pipe and tubing shall be color coded purple for reclaimed water and green for sanitary sewer.

C. Polyethylene mechanical joint adapters and flange adapters shall be manufactured in accordance with AWWA C906. Mechanical joint adapters shall be fitted with gland rings pressure rated equal to or greater than the mating pipe, and shall be made with sufficient through-bore length to be clamped in a heat fusion joining machine without the use of sub-end holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves to provide gastketless sealing, or to restrain the gasket against blow-out.

D. Below grade HDPE pipe terminations shall be fitted with a mechanical joint adapter kit that will enable the HDPE pipe to be joined with mechanical joint fittings. The adapter shall be AWWA compliant, and the pressure rating for the adapter shall match the

pressure rating for the HDPE pipe. Mechanical Joint adapter kits shall be manufactured in standard DIPS sizes for connecting DIPS sized polyethylene pipe to mechanical joint fittings and shall contain a HDPE anchor fitting, stainless steel reinforcing collar, AWWA C110 ductile iron gland ring, gasket and extra length T-bolts.

E. HDPE mechanical joint adapter shall be joined to the HDPE pipe by butt fusion. HDPE mechanical joint adapter shall be molded or fabricated conforming to AWWA C906.

F. Glands, bolts, and gaskets shall be manufactured in accordance with AWWA C153. Bolts and nuts shall be grade 2 or higher.

5.03.03 Pipeline Identification

A. All polyethylene pipe shall be black, and shall contain a continuous colored stripe, 2 inches wide, located at no greater than 90 degree intervals around the pipe. Stripes shall be impregnated or molded into the pipe by the manufacturer. Application of the stripes after manufacture is not acceptable. Stripe color shall be:

1. Reclaimed Water Mains - purple stripes
2. Force Mains - green stripes
3. Sanitary Sewer - green stripes

5.03.04 Tracer Wire

Tracer wire shall be color-coded 10 gauge continuous insulated wire, with HDPE jacket (min. thickness of 45 mils) specifically manufactured for use in horizontal directional drill installations. The color of the wire jacket shall be similar to pipeline identification colors.

5.03.05 General Installation Requirements

A. Locate positions of entry and exit pits, establish elevation and horizontal datum for bore head control, and lay out pipe assembly area. Lay out and assemble pipe in a manner that does not obstruct adjacent roads, and commercial or residential activities adjacent to construction areas.

B. Proposed deviations from the bore path due to underground obstructions shall be approved by the Engineer and City prior to construction.

C. Changes to the proposed entry and exit points (including the length of the directional drilled pipeline) must be approved by the Engineer and City prior to construction.

D. Separation of Non-Potable and Potable Water Lines as described in this Chapter must be met.

E. As-built variance from the design borepath shall be within 2 feet in the horizontal plane. Vertically, install at road crossings at the minimum depth specified herein, and install at a maximum depth of no more than 3 feet deeper than the specified minimum depth.

5.03.06 Directional Drilling

A. The installation of pipeline by directional drilling shall be within the limits indicated on the drawings.

B. Install erosion control measures and dewater as required.

C. Steering of the bore must be performed with a method approved by the boring equipment manufacturer. Such methods include walkover, wire line, wire line with surface grid and other accepted methods. Use a locating and tracking system capable of ensuring that the proposed installation is installed as intended. The locating and tracking system must provide information on:

1. Clock and pitch information
2. Depth
3. Transmitter temperature
4. Battery status
5. Position (x,y)
6. Azimuth, where direct overhead readings (walkover) are not possible (i.e. subaqueous or limited access transportation facility)

D. Ensure proper calibration of all equipment before commencing drilling operation. Take and record alignment readings or plot points such that elevations on top of and offset dimensions from the center of the product to a permanent fixed feature are provided. Such permanent fixed feature must have prior approval of the Engineer/Owner. Provide elevations and dimensions at all bore alignment corrections (vertical and horizontal) with a minimum distance between points of 20 feet. Provide a sufficient number of elevations and offset distances to accurately plot the vertical and horizontal alignment of the installed product. A minimum of three elevation and plot points are required.

E. At road crossings within FDOT or Collier County right-of-way, the minimum cover shall be in accordance with FDOT and Collier County requirements.

F. At road crossings within City right-of-way, the minimum cover shall be as indicated in the Drawings. In no case shall mains 4” and larger have less than 4 feet cover at road crossings. Any proposed changes to the depth and length of the directional bore from what is shown on the Drawings must be approved by the City in writing, prior to commencement of drilling.

G. In road right-of-way in non-paved areas, the minimum directional bore depth shall be 4 feet minimum and 10 feet maximum (typical depth of 6-8 feet), as indicated on the Drawings.

H. Borings shall be conducted using a mechanical boring head, assisted by and cooled by drilling fluid of low pressure and volume. Material Safety Data Sheets must be provided and approved by the Engineer for all drilling slurry compounds.

I. Minimize potential damage from soil displacement or settlement by limiting the ratio of the bore hole to the product size. The size of the back reamer bit or pilot bit, if no back reaming is required, shall be limited relative to the product diameter to be installed as follows:

Maximum Pilot or Back-Reamer Bit Diameter When Rotated 360 Degrees	
Outside Pipe Diameter Inches	Maximum Bit Diameter Inches (Based on the Outside Pipe Diameter)
<8	Outside Diameter + 4
8 to 24	1.5 x Outside Diameter
>24	Outside Diameter + 12

J. Drilling fluids are to use a mixture of bentonite clay or other approved stabilizing agent mixed with potable water with a minimum pH of 6.0 to create the drilling fluid for lubrication and soil stabilization. Vary the fluid viscosity to best fit the soil conditions encountered. Do not use any other chemicals or polymer surfactants in the drilling fluid without written consent from the City. Certify to the City in writing that any chemicals to be added are environmentally safe and not harmful or corrosive to the facility. Water for mixing the drilling fluid shall be potable water, procured by the Contractor.

K. Ensure adequate removal of soil cuttings and stability of the bore hole by monitoring the drilling fluids such as the pumping rate, pressures, viscosity and density during the pilot bore, back reaming and pipe installation. Obtain the Engineer's approval of the location and all conditions necessary to construct relief holes to relieve excess pressure and ensure the proper disposition of drilling fluids is maintained.

L. Minimize heaving during pull back. The pull back rate used shall maximize the removal of soil cuttings without building excess down hole pressure. Contain excess drilling fluids at entry and exit points until they are recycled or removed from the site or vacuumed during drilling operations. Entry and exit pits are to be of sufficient size to contain the expected return of drilling fluids and soil cuttings.

M. Ensure that all drilling fluids are disposed of or recycled in a manner acceptable to the appropriate local, state, or federal regulatory agencies. If in the drilling process it becomes evident that the soil is contaminated, contact the City immediately. Do not continue drilling without the City's approval.

N. Install the carrier in the bore hole within the same day that the pre-bore is completed to ensure stability.

05.03.07 Pipe Joining

A. High density polyethylene pipe shall be heat fused and pressure tested as per manufacturer's guidelines before installation in the bore hole. During assembly and prior to pullback, pipe must be laid out in such a way as to minimize interference to pedestrian and vehicular traffic.

B. Branch connections to the main shall be made with polyethylene saddle fittings or mechanical joint ductile iron tees.

C. Joints between plain end polyethylene pipes and polyethylene fittings shall be made by butt fusion, and joints between the polyethylene main and saddle branch polyethylene fittings shall be made using saddle fusion using only procedures that are recommended by the pipe and fitting manufacturer. External and internal beads shall not be removed.

D. Connect polyethylene pipe to valves and ductile iron fittings using a mechanical joint adapter with a gland ring. Place gland ring behind adapter prior to fusing. Fuse using an electrofusion coupling in accordance with manufacturer’s recommendations. After fusing, connect to mechanical joint. Restrain all non-polyethylene pipe and pressure test connections as required in individual pipeline specification sections.

E. Connect polyethylene pipe to above grade valves and fittings using mechanical flange adapters. The flange adapters are to be self-restrained.

F. Install all mechanical joints and flange connections in accordance with the manufacturer's recommended procedure. At least 1 hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the manufacturer. The final tightening torque shall be 100 ft-lbs or less as recommended by the manufacturer.

G. Install two separate strands of the required tracer wire along polyethylene pipe prior to pulling through bore hole. Tape wires to pipe every 5 feet minimum along the pipeline.

H. After pulling pipe, clean exposed ends for installation of fittings, test locator wire for continuity.

05.03.08 Boring Failure

A. If an obstruction is encountered during boring which prevents completion of the installation in accordance with the drawings and specifications, either remove the pipe or abandon the pipe in place at the discretion of the City.

B. If pipe cannot be withdrawn and City approves abandoning the pipe in place, cut pipe off at least 3 feet below ground surface, fill annular space and pipe with excavatable flowable fill and cap ends of pipe with blind flange.

C. In the event of failure to install pipe, retain possession of pipe and remove it from the site.

D. Upon approval of the City, fill the abandoned bore hole with excavatable flowable fill.

E. Submit a new installation procedure and revised plans to the City for approval before resuming work at another location.

F. If, during construction, damage is observed to the facility, cease all work until resolution to minimize further damage and a plan of action for restoration is obtained and approved by the City.

G. If the submitted boring logs indicate the installed alignment does not meet vertical or horizontal alignment requirements, the boring is considered a failure, and the directional bored pipeline shall be either re-bored or otherwise remedied at the discretion of the Owner.

05.03.09 Disposal of Surplus Fluids

A. All drill fluid excess shall be contained in entry and/or exit pits and pumped as needed into additional on-site storage tanks, tanker trucks, vacuum trucks, etc. Dispose of excess drill fluid offsite as allowed by local rules and regulations.

B. Dispose of all material not needed or not suitable for backfilling over or around the entry and receiving pits. The disposal shall be subject to local codes and regulations.

05.03.10 Restoration

After extraction, drill fluids, pits, work areas, staging and storage areas are to be restored to equal or better condition than pre-construction condition.

05.03.11 Pressure and Leakage Testing (Polyethylene Mains)

A. Conduct hydrostatic pressure testing of installed polyethylene pipe in accordance with ASTM F2164 and as indicated herein. The ASTM F2164 defined one hour test and

passing test criteria (no visible leaks and the pressure is maintained within 5% of the test pressure) does not apply to this Project. The below identified testing and acceptance criteria in subparagraphs E-H below apply to this Project.

B. Test procedures and method of disposal of water shall be approved by the City. All tests shall be made in the presence of the City and utility. Preliminary tests made by the Contractor without being observed by the City will not be accepted. Notify the City and the utility companies at least 48 hours before any work is to be inspected or tested.

C. Provide all necessary test pumping equipment, water, and other equipment, material and facilities required for all pressure testing. All material used for testing including pumps and hoses shall be in good working order with no noticeable leaks.

D. Piping shall be slowly filled with water and all air expelled. Care shall be taken that all air valves are installed and open in the section being filled, and that the rate of filling does not exceed the venting capacity of the air valves.

E. Subject pipeline to be tested to a 4 hour expansion phase prior to commencing leakage testing. Pipeline expansion shall be accomplished by applying hydrostatic test pressure of 150 psi. In order to compensate for the initial expansion of the pipeline, add sufficient make-up water at hourly intervals to return to the required test pressure. At the end of the fourth hour, the test phase is to commence.

F. At the conclusion of the fourth hour of the expansion phase, fill the pipeline again with makeup water to return to the test pressure. The test phase shall consist of a two hour or three hour pressure test, as required by the Owner. At the end of the test phase, measure the amount of makeup water required to return to the test pressure. The pipeline passes the pressure test if the makeup water required does not exceed the following:

Nominal Pipe Size (In)	Allowable Makeup Water (Gallons / 100 Ft Of Pipeline)	
	Two Hour Test	Three Hour Test
4	0.25	0.40
6	0.60	0.90
8	1.0	1.5
12	2.3	3.4
16	3.3	5.0
18	4.3	6.5
20	5.5	8.0
24	8.9	13.3
28	11.1	16.8

G. If any defects or leaks are revealed, they should be corrected and the pipeline retested after a minimum 24 hour recuperation period between tests. Total testing conducted on a section of pipeline shall not exceed 8 hours within a 24 hour period.

H. If any defects or leaks are revealed, they should be corrected and the pipeline retested after a minimum 24 hour recuperation period between tests. Total testing conducted on a section of pipeline shall not exceed 8 hours within a 24 hour period.

05.03.12 Deflection / Deformation Testing - Polyethylene Mains

Perform mandrel testing through the entire length of the directional drilled pipeline. The mandrel size shall be 90 percent of the inside diameter of the pipe. If the Contractor is not successful with the mandrel pull, the City may require vide inspection of the directional drilled pipeline by the Contractor at no cost to the City. Final acceptance of the pipeline that fails the mandrel pull (or repair of the pipeline) is at the discretion of the City.

05.04 JACK AND BORE CONSTRUCTION

05.04.01 General Requirements

A. Typically, valves are to be installed at each end of all road crossings, water crossings, and railroad crossings that are jack and bored. Install air release valves at all high points along the installed main where elevation changes exceed five (5) feet. Valves and air release valves shall be as specified for sewer force mains and reclaimed water mains within this Handbook. Separation of Non-Potable and Potable Water Lines as described in this Chapter must be met.

B. The Jack and Bore Contractor (or Subcontractor) shall have a minimum of four years of experience of successful similar pipeline installations that have been jack and bored. If requested by the City, provide reference documenting successful similar jack and installations by Contractor or, if directional drilling is to be done by a Subcontractor, provide references of Subcontractor. Provide at least 3 references showing location of project, diameter of pipeline directional drilled, and length of bore. Provide contact names and e-mail addresses for each reference. Conventional trenching experience or directional drill experience will not be considered applicable.

05.04.02 Steel Casing Pipe and Joints

A. Steel casing pipe shall conform to ASTM A139 ASTM (straight seam pipe only), Grade "B" with minimum yield strength of 35,000 psi. Field and shop welds of the casing pipes shall conform to the American Welding Society (AWS) standard specifications. Field welds shall be complete penetration, single-bevel groove type joints. Welds shall be airtight and continuous over the entire circumference of the pipe and shall not increase the outside pipe diameter by more than 0.75-inch.

B. Interior lining of pipe shall be a coal tar lining conforming to AWWA C203.

C. Exterior coating of pipe shall be multiple coats of heavy duty coal tar base coating built up to 30 mils total dry thickness and applied in accordance with the coating manufacturer's recommendations.

D. Add on sections of casing pipe shall be full-ring welded to the preceding length, developing water-tight total pipe-strength joints.

E. The minimum casing pipe diameter shall be based on the size of the carrier pipe and the casing pipe wall thickness shall be as indicated below:

Carrier Pipe Nominal Diameter (In)	Casing Pipe Nominal Diameter (In)	Casing Pipe Minimum Wall Thickness (In)
4	14	0.250
6	16	0.250
8	20	0.250
10	24	0.250
12	24	0.250
14	30	0.312
16	30	0.312
18	36	0.375
20	36	0.500
24	42	0.500
30	48	0.500
36	54	0.500
42	60	0.500
48	66	0.500

05.04.03 Casing Spacers and Casing Pipe End Seals

A. Each casing spacer band shall be 8 inches wide (carrier pipe diameter 30 inches and smaller) or 12 inches wide (carrier pipe diameter greater than 30 inches) and manufactured of minimum 14 gauge T-304 stainless steel, lined with a minimum 0.90-inch thick PVC coating. All nuts and bolts shall be T-304 stainless steel.

B. Each casing spacer shall have a minimum of four stainless steel risers manufactured of minimum 10 gauge T-304 stainless steel. The runners shall be manufactured of a high molecular weight polymer plastic. Bottom risers that are 6-inches and greater in height shall be reinforced.

C. The casing spacers are to accommodate standard positioning within the casing pipe sized for installation of the carrier pipe near the bottom of the casing pipe.

D. Casing spacer end seals shall be a pull-over type construction and made from 0.090" (3/32") thick Neoprene with T304 stainless steel bands for securing the ends of the end seal to the casing pipe and carrier pipe.

E. Only approved casing spacers and casing pipe end seals listed in the List of Approved Products and Manufacturers contained in the Appendix to this Handbook are allowed.

05.04.04 Carrier Pipe

A. All carrier pipe installed in steel casing pipe at jack and bore crossings shall be ductile iron (PVC carrier pipe is not allowed). Ductile iron pipe, joints, and fittings shall be as specified for sewer force mains and reclaimed water mains within this Handbook.

B. Carrier pipes inside of steel casing pipe shall be supported by casing spacers.

C. Carrier pipe joints inside of steel casing pipe shall be restrained.

D. Spacers along ductile iron carrier pipe shall be placed no more than 2 feet from the end of the casing, with subsequent spacer placement at intervals of no more than 10 feet, or as recommended by the casing spacer manufacturer, whichever is more stringent.

E. The carrier may be pushed or pulled (depending upon piping material, joint type and method of pipe support) into the casing as pipe lengths are assembled. The carrier shall be adequately blocked all around to prevent any movement and to attain the specified grade for gravity lines. The proposed method of carrier pipe installation shall be approved by the Engineer prior to starting the crossing.

F. After successful testing has been performed, recheck alignment and grade.

05.05.05 Jack and Bore Installation

A. Required jacking and boring pits or shafts shall be excavated and maintained to the minimum dimension. All excavations shall be adequately barricaded, sheeted, braced and dewatered as required. Excavation adjacent to the roads shall be performed in a manner to adequately support the roads. Bracing, shoring, sheeting or other supports shall be installed as needed.

B. Contractor shall install suitable reaction blocks for the jacks as required. Jacking operations shall be continuous and precautions shall be taken to avoid interruptions which might cause the casing to "freeze" in place. Upon completion of jacking operations, the reaction blocks, braces, and all other associated construction materials shall be completely removed from the site.

C. Dewatering through the casing during construction shall not be permitted. All dewatering methods shall be approved by the City before construction work begins.

D. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe or coatings. Pipe shall not be dropped. All pipe shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe or coatings shall be repaired to the satisfaction of the City.

E. It shall be the Contractor's responsibility to perform the jack and bore work in strict conformance with the requirements of the agency in whose right-of-way or easement the work is being performed. Any special requirements of the agency, such as insurance, flagmen, etc., shall be strictly adhered to during the performance of work. The special requirements shall be performed by the Contractor at no additional cost to the City.

F. Correct line and grade shall be carefully maintained. Earth within the casing shall not be removed too close to the cutting edge in order to prevent the formation of voids outside the casing. If voids are formed, they shall be satisfactorily filled with grout by pumping.

G. The sections of steel casing shall be field welded in accordance with the applicable portions of AWWA C206 and AWS D-7.0 for field welded pipe joints. Contractor shall wire brush the welded joints and paint with a primer. After completion of jacking, Contractor shall clean the interior of the casing of all excess material.

6.01 SEWER LINES

6.01.01 General

A. These Specifications cover the pipe and manholes gravity sewer systems. The design of gravity sanitary sewer, service lines, and manholes shall be in accordance with Chapter 3 of this Handbook.

B. Generally, all pipe used in gravity sewer collection systems to be owned and maintained by the City shall be PVC pipe. In limited circumstances (such as sewer pipe installed within steel casing that has been jack and bored), the sewer pipe shall be ductile iron water pressure pipe with an approved lining as specified herein.

6.01.02 PVC (Polyvinyl Chloride) Sewer Pipe, Joints, and Fittings

A. PVC gravity pipe (6-inch to 30-inch), shall conform to ASTM D3034, SDR 26. Uniform minimum “pipe stiffness” at five percent deflection shall be 46 psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and ASTM F477.

B. In areas where minimum cover over the sewer as defined in Chapter 5 cannot be met, upgrade the sewer to pressure pipe to AWWA C-900 PVC DR 21.

C. Unless otherwise specified, wye branches shall be provided in the gravity main for service lateral connections. Wyes shall be six inches inside diameter. All fittings shall be of the same material as the pipe.

D. Service laterals and fittings shall be a minimum of 6 inches in diameter and shall be less than 100 feet in length. Service laterals shall have a minimum slope of 1%.

E. All PVC pipe shall bear the NSF-DW seal. The minimum standard length of pipe shall be 13 feet.

F. PVC pipe shall be color-coded green, stenciled "Sewer Pipe" (0.75-inch lettering on the pipe in at least three areas per pipe section).

G. In general, service laterals shall not be allowed to discharge into sanitary manholes, except at terminal manholes. A case-by-case exception to this requirement may be allowed by the City if the lateral discharges at the same elevation as the manhole invert.

6.01.03 Ductile Iron Gravity Sewer Pipe

A. The use of Ductile Iron (DI) pipe shall be limited to specific uses and shall be approved by the City.

B. Ductile iron pipe shall conform with ANSI/AWWA C150/A21.50 and C151/ A21.51, and shall have a minimum working pressure of 150 psi. Buried pipe shall comply with the following pressure class (PC) designations: 1) 12 inch diameter and smaller = PC 350; 2) 14 inch through 24 inch diameter = PC 250; 3) 30 inch through 64 inch diameter = PC 200.

C. Interior lining for ductile iron pipe shall be either: 1) Minimum 40 mils dry film thickness (60 mils nominal) of ceramic epoxy lining, as manufactured under the name of "Protecto 401", or equal; or 2) Minimum 40 mils dry film thickness (60 mils nominal) of fusion bonded epoxy and polyethylene lining, as manufactured under the name of "Polybond Plus", or equal.

D. Exterior coating for buried ductile iron pipe shall be a petroleum asphaltic coating in accordance with ANSI/AWWA C110/A21.10.

6.02 GRAVITY SEWER IDENTIFICATION

6.02.01 Pipeline Identification Tape

Identification tape shall be an inert plastic film specifically formulated for prolonged underground use. Minimum thickness 4 mils, width 6 inches, letter size 1 inch. Lettering shall be continuous. Tape shall be the standard product of a manufacturer regularly engaged in the supply of this tape. Provide tape with adhesive backing for attachment to pipe. Identification tape shall be color coded green with black lettering "SEWER PIPE".

6.02.02 Pipeline Warning Tape

Warning tape shall be 6 inch wide vinyl continuous tape, for identification and warning purposes. It shall be color coded GREEN with black lettering "CAUTION: SEWER BURIED BELOW".

6.03 SEWER MANHOLES

6.03.01 Precast Manhole

A. All new sanitary sewer manholes shall be precast, and shall conform to ASTM C478. Concrete shall be Class II and have a minimum compressive strength of 4,000 psi at 28 days. The minimum wall thickness shall be five inches. Precast manholes shall be constructed with a precast monolithic base structure and the minimum base thickness shall be eight inches as shown on the Standard Construction Detail. The top section shall be an eccentric riser. The barrel, top and base sections shall have tongue and groove joints. All jointing material shall be a cold adhesive preformed plastic gasket, conforming to ASTM C 443. All manholes shall be leak-free.

B. All new and modified sanitary sewer manholes shall be constructed with an inflow dish, sizing is dependent on inside and outside diameter of manhole cover.

C. For sewer pipe sizes 24 inches in diameter and smaller, the minimum inside diameter of the manhole shall be 48 inches. For sewer pipe sizes between 24 and 36 inches, the minimum inside diameter of the manhole shall be 60 inches. For sewer pipe sizes larger than 36 inches in diameter, a 72 inch inside diameter manhole shall be provided.

D. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on each precast section after coating of the exterior surface. Lift rings or non-penetrating lift holes shall be provided for handling precast manhole sections.

6.03.02 Flow Channel

Flow channel is to be Portland Cement Type II concrete, minimum compressive strength of 2,500 psi. Fillers of any other material will not be accepted. Flow channels shall be formed in the invert of the manhole and shall extend to the spring line of all connecting pipes (gravity sewer and force mains), conforming to the dimension of the adjacent pipe and providing changes in size, grade and alignment evenly.

6.03.03 Drop Connections

In general, manhole drop connections are not allowed. The City may allow such connections on a case by case basis. These connections shall only be considered when other alternatives are not feasible. If allowed, an outside drop pipe shall be provided for a sewer entering a manhole where its invert elevation is 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer invert and the manhole invert is less than 24 inches, the manhole invert shall be filleted to prevent solids deposition.

6.03.04 Force Main Connections

Force mains shall be oriented to facilitate flow, and shall enter the manhole such that the force main invert is no more than 12 inches above the invert of the effluent sanitary sewer line.

6.03.05 External Seal

The top of manholes, cone, riser rings, iron frame, cover and all joints shall be encapsulated with a heat shrink-wrap with a minimum thickness of 98 mils (2.5mm). The wrap shall have a cross-linked polyolefin backing coated with a protective heat activated adhesive. The wrap should effectively bond to the substrate via primer provided by the manufacturer, providing corrosion and moisture protection. The wrap shall be applied with a high intensity propane torch. Heat Shrink wrap for all barrel section joints of manholes shall be a minimum 9-inch width wrap and a minimum of 12-inch width wrap shall be applied to the top section, riser rings, and manhole ring and cover. Adhesive tape materials are not be allowed.

6.03.06 Manhole Frame and Cover

Frames and covers shall be gray iron per ASTM A48, Class 30B and shall be US Foundry Type 227AS, traffic bearing (AASHTO H-20 loading), or equal. Lifting or "pick" holes shall be provided, but shall not penetrate the cover. Lettering shall be "Sanitary". For those manholes that are to be owned and maintained by the City, the lettering shall also indicate "Everglades City" and "Florida" per the Standard Construction Detail.

6.03.07 Manhole Linings and Coatings

A. New sewer manholes shall be coated inside and out with two (2) coats of water based polyamine epoxy coating, installed at a minimum thickness of 8 mils per coat. Coatings shall be applied by the manhole manufacturer in strict accordance with the paint manufacturer's recommendations.

B. Manholes that receive force main discharge shall be lined. For new manholes, the interior liner shall be HDPE, minimum thickness of 3 mm, as manufactured by Agru America (Sure Grip liner) or approved equal. For existing manholes, the interior shall be coated with Raven 155 primer (min. 8 mils) and Raven 405 Liner (min. of 125 mils), or equal.

6.04 INSTALLATION

6.04.01 General

A. Sewer pipeline and manhole (small structure) installation including separation of non-potable and potable water lines, trenching, bedding backfilling, and compaction shall be in accordance with Chapters 4 and 5 of this Handbook. Gravity sewer mains are not to be installed via directional drilling.

B. The Contractor shall take all measures necessary to prevent floatation of manholes and pipe due to high ground water table.

6.04.02 Bypass Pumping

A. The Contractor shall provide and pay for bypassing or hauling of wastewater during approved interruptions of wastewater flows and connections.

B. Provide a bypass pumping plan including the location of bypass pumping equipment for each pump station or sewer line segment(s) around which flows are proposed to be bypassed. The plan shall include any proposed tanker(s), pump(s), bypass piping, suction and discharge points, and proposed monitoring.

C. The bypass pumping system shall consist of a primary pump and backup pump (equally sized) to handle peak flows. Provide pump truck(s) to prevent any spills during shut downs until the bypass pumps are in operation. The pumps can be either electrically powered or diesel powered. Diesel powered pumps shall be sound attenuated to have a maximum noise (sound) of 72 decibels (dB(A)) when measured at a distance of twenty-three feet (23-ft) from the bypass pumps when operating at night.

D. Bypass pumping shall be monitored twenty-four (24) hours per day, seven (7) days per week and shall include audible alarms tied to an auto-dialer (the auto-dialer shall be capable of dialing a minimum of three phone numbers).

E. The bypass pumping suction and discharge lines are to be located on the construction site or City owned property or within City easements or right-of-way.

F. Ingress and egress to adjacent properties shall be maintained at all times.

G. Ramps, steel plates or others methods shall be used to facilitate traffic over surface piping.

H. During bypass pumping, no wastewater shall be leaked, dumped, or spilled in or onto any area outside of the existing wastewater system. When bypass operations are complete, all bypass piping shall be drained into the wastewater system prior to disassembly.

I. Plug off and pump down the sewer manhole or line segment in the Work area and maintain the wastewater system so that surcharging does not occur.

6.04.03 Installation of Sewer Lines and Laterals

A. Sewer lines constructed between manholes shall follow a straight alignment. Bending of sewer pipe in any direction is prohibited.

B. Gravity sanitary sewer line construction shall be accomplished by the use of a laser instrument unless another method is previously approved by the City.

C. As a general rule, the number of joints between manholes shall be limited whenever possible. In special cases where a point repair to an 8" to 12" PVC gravity sewer line is required, the proper rigid wrap around sleeve such as a JCM-210 oversized ductile iron coupling or an approved equal may be allowed by special approval by the City.

D. Individual sanitary service on new construction shall not be connected directly into manholes, and must be connected to sewer main lines by use of wye connections, unless otherwise approved by the City.

E. For single family homes, single four inch sewer services laterals shall be constructed at each lot or unit and located on the downstream side of the lot center line. These services shall be extended 4 feet above ground at the property line with a PVC riser and plug being easily visible from the road. Rubber seal fittings shall be used on all lines. No glued joints are permitted on laterals.

F. All gravity sewer lines which are constructed outside of public rights-of-way within easements in side yards, backyards, and other poorly accessible areas shall be constructed using pressure rated C900 DR 21 PVC pipe. In the event fittings are required they shall be ductile iron in accordance with Chapter 7.

G. Sewer lateral locations shall be marked along the outside of the curb with a saw cut "S", or by a metal tab set into the pavement.

6.04.05 Manhole Installation

A. Base sections shall be placed on bedding rock or crushed stone conforming to the requirements in Chapter 4. The bedding rock shall be firmly tamped and made smooth and level to assure uniform contact and support of the precast base.

B. The precast base section shall be carefully placed on the prepared bedding so as to be fully and uniformly supported in true alignment and making sure that all entering pipes can be inserted on proper grade. Precast manhole sections shall be handled by lift rings or non-penetrating lift holes. Such holes shall be filled with non-shrink grout after installation of the manhole. The first pre-cast section shall be placed and carefully adjusted to true grade and alignment. All inlet pipes shall be properly installed so as to form an integral watertight unit. The sections shall be uniformly supported by the base structure, and shall not bear directly on any of the pipes.

C. Pre-cast sections shall be placed and aligned to provide vertical alignment with a 0.25-inch maximum tolerance per 5 feet of depth. The completed manhole shall be rigid, true to dimensions, and watertight.

D. The Contractor shall construct sanitary sewer manholes in such a way that sewer lines do not intersect sealed joints between sections of the manhole.

E. Install flow channels and drop connections as identified herein.

6.04.06 Installation of Castings

Castings shall be fully bedded in mortar with adjustment brick courses or HDPE adjusting rings placed between the frame and manhole. Manhole rims shall match flush with the finish grade elevation in paved areas and a minimum of 0.2 feet and maximum of 0.5 feet above grade generally in unpaved areas.

6.04.07 Pipe Connections

A. Rubber boots and 316 stainless steel bands shall be utilized in the connection of the sewer main to the manholes per the Standard Construction Detail. Special care shall be taken to see that the openings through which pipes enter the structure are provided with watertight connections. Connections shall conform with ASTM C923.

B. All coring of existing manholes shall be performed by the Contractor and witnessed by the City and requires a minimum 2 business days notification to the City. The connection shall be scheduled to commence between 8:00 a.m. and noon on the scheduled day. With respect to tie-in connections and coring operations, the City reserves the right to require connections to be performed during periods of low flow (midnight to 6:00 a.m.) in order to minimize service disruption to existing customers.

6.07 INSPECTION AND TESTING

A. Prior to inspections and testing, clean all installed lines and manholes.

B. After backfill has been placed, the Engineer shall visually inspect all gravity flow lines to check alignment and grade. All obstructions shall be removed.

C. The Contractor shall provide a light source and mirrors for lamping of sewer. Any sewer in which the direct light of a lamp cannot be viewed in either direction, full circle, between adjacent manholes shall be considered unsatisfactory, unless the line is designed with horizontal deflections, and shall be repaired by the Contractor without additional compensation.

D. The City may require all new sanitary sewer gravity systems to be smoke tested prior to final acceptance. All testing must be done in the presence of the City's designated site inspector, and shall be at the Contractor’s expense.

E. The City reserves the right to require the Contractor to perform vacuum testing of all sanitary manholes, air test sewer mains, and requires that all sanitary sewer main lines be televised prior to final acceptance. Laterals shall be televised upon demand by the City prior to final acceptance when it is suspected that a problem exists. All testing shall be at the Contractor’s expense.

F. All gravity sewer lines, prior to final acceptance by the City and prior to any final paving operations, shall be televised at the contractor’s expense and submitted to the City using a "pan and tilt camera" with depth gauge in front of the camera by a City approved contractor. The camera shall run from the downstream manhole to the upstream manhole. City inspector shall be notified in advance and be present during the televising of the sewer system. The video shall be non-stop with audio describing what is being reviewed. Written video logs describing the condition of the lines shall accompany the video

submission to the City prior to commencing any installation of asphalt or concrete pavement. The City may require additional video taping of the main or laterals, and/or infiltration/exfiltration tests if defects are apparent or workmanship is questionable.

G. The Contractor shall, at its expense, conduct deflection testing of gravity sewer pipeline after the final backfill has been in place at least 30 days. Maximum allowable pipe deflection is 5%. The City inspector shall be notified in advance and be present during the deflection testing. Measure deflection by manually pulling a mandrel through the pipe. The minimum mandrel diameter shall be in accordance with the following:

Sewer Pipe Nominal Size (In)	Base Inside Diameter (In) (ASTM D3034 SDR 35 for Pipe 6" to 15", ASTM F679 T-1 for Pipe 18" to 27")	Minimum Mandrel Outer Diameter (In) for 5% Deflection Test
6	5.742	5.45
8	7.665	7.28
10	9.563	9.08
12	11.361	10.79
15	13.898	13.20
18	16.976	16.13
21	20.004	19.00
24	22.480	21.36
27	25.327	24.06

H. Deflection testing is considered satisfactory if the mandrel can be pulled by hand through the pipe being tested. If the mandrel cannot be pulled through the pipe, replace or correct the pipe and retest until testing is satisfactory. Any pipe removed or corrected due to failing deflection testing shall also be re-tested for leakage.

7.01 SEWER FORCE MAINS

7.01.01 General

A. These Specifications cover the pipe, fittings, valves, and accessory items used for the sewer force main. Sewer Force Main design shall be in accordance with Chapter 3 of this Handbook.

B. Generally, all pipe sewer force mains to be owned and maintained by the City shall be PVC pipe. In limited circumstances (such as sewer pipe installed within steel casing that has been jack and bored or at lift station sites), the sewer pipe shall be ductile iron water pressure pipe with an approved lining as specified herein. Sewer force main pipe that is to be directional drilled shall be Polyethylene (PE) pipe.

7.01.02 PVC Pressure Pipe

A. Pipe 4 inch through 30 inch diameter shall conform to AWWA C900. Pipe shall conform to ASTM D1784, Type I, Grade I, 4000 psi design stress, and shall be National Sanitation Federation (NSF) approved.

B. Force main pipe shall be class 235 (DR18). Pipe barrel dimensions, pressure classes, and dimension ratios are to be for PVC pipe with Cast Iron Outside Diameter (CIOD). All pipe shall contain markings on each section showing conformance to the above specifications.

C. PVC pipes shall be color coded green and stenciled (0.75-inch lettering on the pipe in at least three areas per pipe section) “Sewer Force Main”.

D. Joints shall be rubber gasketed conforming to AWWA C900.

E. The bell shall be integral with the pipe and of equal or greater pressure rating. The bell of pipe and fittings using push-on joints shall have an integral groove to retain the gasket in place.

F. Provide adapters as required to join PVC pipe to pipe, fittings and equipment of other materials.

7.01.03 Ductile Iron Pipe

A. The use of Ductile Iron (DI) pipe shall be limited to specific uses and shall be approved by the City.

B. Ductile iron pipe shall conform with ANSI/AWWA C150/A21.50 and C151/ A21.51, and shall have a minimum working pressure of 150 psi. Buried pipe shall comply with the

following pressure class (PC) designations: 1) 12 inch diameter and smaller = PC 350; 2) 14 inch through 24 inch diameter = PC 250; 3) 30 inch through 64 inch diameter = PC 200.

C. Ductile iron pipe 4 inches and larger located above grade or in a concrete wet well shall be flanged and shall conform with AWWA/ANSI C115/A21.15, and shall have a minimum working pressure of 150 psi. Flanged pipe shall comply with the following thickness class (TC) designations: 1) 4 inch diameter = TC 54; or 2) 6 inch through 24 inch diameter = TC 53. All flanges shall be class 125, and shall be fully machine faced after being screwed tightly on the pipe. Bolts and nuts shall conform to ASTM A307, Grade B.

D. Interior lining for ductile iron pipe shall be either: 1) Minimum 40 mils dry film thickness (60 mils nominal) of ceramic epoxy lining, as manufactured under the name of "Protecto 401", or equal; or 2) Minimum 40 mils dry film thickness (60 mils nominal) of fusion bonded epoxy and polyethylene lining, as manufactured under the name of "Polybond Plus", or equal.

E. Exterior coating for buried ductile iron pipe shall be a petroleum asphaltic coating in accordance with ANSI/AWWA C110/A21.10.

F. Ductile iron pipe and fittings located above grade or in a concrete vault shall be painted with a three coat system. The first coat shall be primer, 2.5-3.5 mil Dry Film Thickness (DFT) Tnemec Series 135 ChemBuild or approved equal; the intermediate coat shall be 4.0-10.0 mil DFT Tnemec Color Hi-Build Epoxoline II Series N69 or approved equal, and the final coat shall be 2.0-3.0 mil DFT Tnemec EnduraShield Series 73 or approved equal. The final coat paint color shall be green as selected by the City.

7.01.04 Fittings for Ductile Iron and PVC Pipe

A. Fittings shall be manufactured of ductile iron, conforming to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53.

B. All full body (C110/A21.10) fittings shall be pressure rated to 250 psi, minimum. All compact fittings (C153/A21.53) shall be pressure rated to 350 psi, minimum.

C. Fitting joints shall be compatible with the type of pipe in use or specified, e.g., flange fittings for flange pipe and mechanical joint for mechanical joint pipe and push-on joint pipe.

7.01.05 Linings and Coatings for Ductile Iron Pipe and Fittings

A. Interior lining for pipes and fittings shall be either:

1. Minimum 40 mils dry film thickness (60 mils nominal) of ceramic epoxy lining, as manufactured under the name of "Protecto 401", or equal.
2. Minimum 40 mils dry film thickness (60 mils nominal) of fusion bonded epoxy and polyethylene lining, as manufactured under the name of "Polybond Plus", or equal.

B. Exterior coating for buried pipe and fittings shall be a petroleum asphaltic coating in accordance with ANSI/AWWA C110/A21.10.

C. All exposed pipe and fittings shall be painted with a three coat system. The first coat shall be primer, 2.5-3.5 mil Dry Film Thickness (DFT) Tnemec Series 135 ChemBuild or approved equal; the intermediate coat shall be 4.0-10.0 mil DFT Tnemec Color Hi-Build Epoxoline II Series N69 or approved equal, and the final coat shall be 2.0-3.0 mil DFT Tnemec EnduraShield Series 73 or approved equal. The final coat paint color shall be green as selected by the City.

7.01.06 Joints for Ductile Iron Pipe and Fittings

A. Mechanical and push-on joints shall be rubber gasketed, conforming to ANSI/AWWA C111/A21.11. Mechanical joint bolts and nuts shall conform to ASTM A307, Grade B. Ductile iron glands shall be provided with ductile iron pipe.

B. Lubricants other than that furnished by the pipe manufacturer with the pipe shall not be used.

7.01.07 PVC Pressure Pipe Joints

A. Joints shall be rubber gasketed conforming to AWWA C900.

B. The bell shall be integral with the pipe and of equal or greater pressure rating. The bell of pipe and fittings using push-on joints shall have an integral groove to retain the gasket in place.

C. Provide adapters as required to join PVC pipe to pipe, fittings and equipment of other materials.

7.01.08 Restrained Joints for Ductile Iron Pipe, Valves, and Fittings

A. Restrained joints for ductile iron pipe bell joints shall be as manufactured by American D.I. Pipe, EBAA Iron, Inc., Sigma, Smith Blair, Star, or U.S. Pipe per the List of Approved Products contained in Appendix B of this Handbook.

B. Restrained joints for ductile iron pipe, valve, and fitting mechanical joints shall be as manufactured by EBAA Iron, Inc., Sigma, Smith Blair, Star, or Tyler Union per the List of Approved Products contained in Appendix B of this Handbook.

C. Pipe joints shall be restrained upstream and downstream of fittings in accordance with the manufacturer's requirements or the table shown in the Drawings, whichever is greater.

7.01.09 Restrained Joints for PVC Pressure Pipe

A. Restrained joints for PVC pipe mechanical joints shall be as manufactured by EBAA Iron, Inc., Sigma, Smith Blair, Star, or Tyler Union per the List of Approved Products contained in Appendix B of this Handbook

B. Restrained joints for PVC pipe push on joints shall be as manufactured by EBAA Iron, Inc., Sigma, Smith Blair, or Star per the List of Approved Products contained in Appendix B of this Handbook

C. Pipe joints shall be restrained upstream and downstream of fittings in accordance with the manufacturer's requirements or the table shown in the Drawings, whichever is greater.

7.01.10 Tapping Sleeves

Tapping sleeves are to be 18-8 type 304 stainless steel and stainless steel outlet.

7.02 VALVES

7.02.01 General Valve Requirements

A. Where required for satisfactory operation of valves, provide valve operators, extension stems, stem guides, cast iron valve boxes, floor boxes, handwheels, operator stands, position indicators, and other valve appurtenances. Extension stems shall be complete with guide bearings, wrench nut, and tee handle wrench. All machinery stuffing boxes shall be packed with material selected for the service intended. Maintain all packing until final acceptance by the City.

B. Extension stems shall be provided for all valves in buried locations and in other locations where indicated on the Drawings. Extension stems shall be fabricated from solid steel shafting not smaller in diameter than the stem of the valve or from galvanized steel pipe having an internal diameter not smaller than the diameter of the valve stem. Stem couplings shall be both threaded and keyed to the coupled stems and shall be of standard design and construction. Pipe couplings will not be acceptable.

C. Stems for buried valves shall extend to within 6 inches of the surface of the ground. Each extension stem shall be connected to the valve operator with a suitable universal joint type coupling. All connections shall be pinned. Each extension stem shall be provided with spacers which will center the stem in a valve box having an inside diameter of approximately 5 inches, and shall be equipped with a standard AWWA wrench nut as described in AWWA C500, except where handwheels are indicated.

D. At each valve adjacent to the valve box, provide 2 inch schedule 80 PVC riser, female adapter coupling, and 2 inch brass plug with recessed nut to accommodate locate wires.

7.02.02 Linings and Coatings for Valves

A. The interior and exterior of the valve shall be coated with an NSF/ANSI 61 approved fusion bonded epoxy.

B. Exterior coating of exposed valves shall be factory applied rust inhibiting epoxy primer, minimum 3 mils dry film thickness.

C. After installation, exterior surfaces shall be painted with a two coat system. The first coat (intermediate coat) shall be 4.0-10.0 mil DFT Tnemec Color Hi-Build Epoxoline II Series N69 or approved equal, and the final coat shall be 2.0-3.0 mil DFT Tnemec EnduraShield Series 73 or approved equal. The final coat paint color shall be as green selected by the City.

7.02.03 Plug Valves

A. Plug Valves shall be Cast Iron suitable for wastewater service with pressures up to 250 psig, and shall be quarter-turn, non-lubricated, eccentric type with resilient faced plug, manufactured and tested in accordance with AWWA C517.

B. Port areas of not less than 100% of pipe area shall be supplied on all valves.

C. The valve seat shall be a welded overlay of 95% pure nickel applied directly to the body on a pre-machined, cast seating surface and machined to a smooth finish.

D. Shaft seals shall consist of V-type packing in a fixed gland with an adjustable follower designed to prevent over compression of the packing and to meet design parameters of the packing manufacturer.

E. Removable, slotted shims shall be provided under the follower flanges to provide for adjustment and prevent over tightening.

F. The valve body and cover shall be constructed of ASTM A126 Class B cast iron for working pressures up to 175 psig. The words "SEAT END" shall be cast on the exterior of the body seat end.

G. The plug shall be of one-piece construction and made of ASTM A536 Grade 65-45-12 ductile iron and fully encapsulated with a resilient facing.

H. Radial shaft bearings shall be constructed of self-lubricating type 316 stainless steel. The top thrust bearing shall be Teflon. The bottom thrust bearing shall be Type 316 stainless

steel. The packing shall be adjustable and replaceable and the bonnet shall be bolted. All bolts, nuts and washers shall be 316 stainless steel for buried, non-buried, and pit installed service.

I. Valves 4 inches in diameter and smaller shall be lever or wrench nut operated. Valves larger than 4 inches shall be equipped with totally enclosed worm gear actuators, except where automatic operation is specified.

7.02.04 Swing Check Valves

Below grade non-buried or above grade swing check valves shall be iron body, bronze mounted, with rubber faced disc, Class 125 flanged ends, removable inspection cover, O-ring sealed stuffing box, with an external weighted lever, and shall conform to AWWA C508.

7.02.05 Tapping Valves

Tapping valves shall be resilient seated gate valves and shall conform to the requirements of AWWA C509.

7.02.06 Air Release Valves

A. Air release valves shall be combination valves that permit automatic release of large quantities of air from an empty pipe during filling and to permit air to enter the pipeline when the line is being emptied. The valve shall be capable of discharging accumulated air in the line while the line is operating under a pressure of 150 psi.

B. Air release valves shall have a stainless steel body and the float material shall be stainless steel. Attachment shall be by means of threaded pipe connections. Valves shall be vented to the atmosphere by means of threaded piping and shall discharge into drainage areas.

7.02.07 Valve Boxes

A. All buried valves shall be provided with adjustable valve boxes approximately 5 inches in diameter and shall be heavy duty traffic rated.

B. Valve boxes shall be cast iron and shall be Screw Type. Valve box lids shall be cast iron H-20 load rated and shall be lockable.

C. Valve boxes shall be of sufficient length to operate all valves buried in the ground. Valve boxes shall consist of base, center section, and top section with cover. All valve box extensions shall be cast iron.

D. All valve box covers shall be painted with a three coat system. The first coat shall be primer, 2.5-3.5 mil Dry Film Thickness (DFT) Tnemec Series 135 ChemBuild or

approved equal; the intermediate coat shall be 4.0-10.0 mil DFT Tnemec Color Hi-Build Epoxoline II Series N69 or approved equal, and the final coat shall be 2.0-3.0 mil DFT Tnemec EnduraShield Series 73 or approved equal. The final coat paint color shall be Ultra Blue No. 124A or as approved by the City.

7.02.08 ARV Enclosures

A. Enclosures for air release valves shall be polyethylene with stainless steel hardware, and shall be provided with a tamper proof locking device. Enclosures shall be as manufactured by Water Plus Corporation (model 182635) or approved equal.

B. The enclosure shall have vents and shall be green in color.

7.02.09 Line Stops

A. Line stops shall consist of a line stop fitting, stopping plug/valve, blind flange for installation after stop is completed, and 1-inch equalization/purge fitting. The line stop fitting shall be 18-8 type 304 stainless steel. All hardware and accessories shall be 304 stainless steel. The blind flange shall be type 304 stainless steel.

B. Provide additional pipe restraining in the vicinity of the line stop for preventing pipe movement due to any unbalanced forces created by the line stop and subsequent cutting and removal of existing pipe adjacent to any line stop.

7.03 SEWER FORCE MAIN IDENTIFICATION AND LOCATE DEVICES

7.03.01 Pipeline Identification Tape

Identification tape shall be an inert plastic film specifically formulated for prolonged underground use. Minimum thickness 4 mils, width 6 inches, letter size 1 inch. Lettering shall be continuous. Tape shall be the standard product of a manufacturer regularly engaged in the supply of this tape. Provide tape with adhesive backing for attachment to pipe. Identification tape shall be color coded GREEN with black lettering "SEWER FORCE MAIN ".

7.03.02 Pipeline Warning Tape

Warning tape shall be 6 inch wide vinyl continuous tape, for identification and warning purposes. It shall be color coded green with black lettering “CAUTION: FORCE MAIN BURIED BELOW”.

7.03.03 Locating Wire and Tracer Wire

A. Locating wire shall be color-coded 10 gage continuous insulated wire. Color coding shall be green.

B. Tracer wire shall be color-coded 10 gauge continuous insulated wire, with HDPE jacket (min. thickness of 45 mils) specifically manufactured for use in horizontal directional drill installations. The color of the wire jacket shall be green.

7.03.04 Electronic Marker Balls

A. Marker balls shall consist of a passive device capable of reflecting a specifically designated repulse frequency tuned to the utility being installed.

B. Balls shall be four inches in diameter with a high density polyethylene shell and shall be color coded green (sewer).

7.04 GENERAL INSTALLATION REQUIREMENTS

7.04.01 General

A. All lengths of pipe shall be dimensioned accurately to measurements established at the site, and shall be worked into place without springing or forcing.

B. Cut all pipe and drill all holes that may be necessary. Cut sections of pipe shall be reamed or filed to remove all burrs. The pipe interior and joints shall be thoroughly cleaned before being installed and kept clean during construction.

C. All changes in direction shall be made with fittings or approved joint deflection. Bending of pipe, except polyethylene pipe, is prohibited. Joint deflection shall not exceed 75 percent of the manufacturer's recommended maximum deflection.

D. Any transition from one pipe size to another shall be made with a reducing fitting. Reducing bushings are prohibited except where specifically indicated on the Drawings or approved by the City.

E. Make adequate provision for expansion and contraction of piping.

F. Installed piping systems shall be temporarily plugged at the end of each day's work, or other interruption to progress on a given line. Plugs installed for pressure testing shall be blind flanges fully secured and blocked to withstand the test pressure. Where plugging is required because of contract division or phasing for later connection, the ends of such lines shall be equipped with a permanent type plug or blind flange. Installation or removal of such plugging shall be considered incidental to the work.

G. Pipe joints shall be restrained upstream and downstream of fittings in accordance with the manufacturer's requirements or the table shown in the Standard construction details, whichever is greater. Valves are to be restrained on each side of the valve at the connection to adjoining pipe.

H. Pipeline installation including separation of non-potable and potable water lines, trenching, bedding and backfilling and compaction shall be in accordance with Chapters 4 and 5 of this Handbook.

7.04.02 Buried and Exposed Valves

A. Buried valves 6 inch diameter and larger shall be set on a foundation of solid concrete or stone not less than 8 inches thick nor less than one cubic foot in volume. Foundations shall be set on firmly compacted ground. Valves are to be restrained on each side of the valve at the connection to adjoining pipe.

B. The height of the valve and its supporting foundation shall conform to the height of the connecting pipe. Valves shall be set in a vertical position, except where indicated herein or as determined in the field to require a horizontal installation as determined by the City. Where valves are required to be installed in a horizontal position, provide with a bevel gear side actuator.

C. Exposed valves shall be installed in a vertical position wherever possible. Unless otherwise indicated or directed by the City, valve stems shall never be below a horizontal position.

D. Open and close each valve observing full operation prior to installing successive lengths of pipe.

E. At each valve adjacent to the valve box, provide 2 inch schedule 80 PVC riser, female adapter coupling, and 2 inch brass plug with recessed nut to accommodate locate wires.

7.04.03 Wet Taps

All wet taps of existing water lines are to be coordinated with the City.

7.04.04 Valve Boxes

A. Boxes shall rest on the valve and shall be adjusted so that the cover may be set flush with paving; in areas without paving, set the cover as directed by the Engineer and as approved by the City. Boxes shall be set to allow equal movement above and below finish grade.

B. The base of the box shall be centered over the valve, and the top of the base section shall be approximately on line with the nut on top of the valve stem. The entire assembly shall be plumb.

7.04.05 Line Stops

A. All line stops and shut downs of existing water lines are to be coordinated with the City. The City reserves the right to require connections to be performed during periods of low flow (midnight to 6:00 a.m.) in order to minimize service disruption to existing customers. The installation of line stopping devices on pressure mains may be required by the city at its discretion to minimize interruption to existing utility customers.

B. Line stops shall be completed while the water system is pressurized.

C. A concrete encasement shall be poured for pipe support at the point of line stop.

D. Provide additional pipe restraining in the vicinity of the line stop for preventing pipe movement due to any unbalanced forces created by the line stop.

7.04.06 Electronic Marker Balls

A. Electronic markers shall be furnished and installed so that a marker will be located at one hundred foot (100') intervals along the pipeline length. Markers shall also be placed at all valves, changes in direction, tees, or other points of connection.

B. Marker balls shall be placed in a position directly above the pipe and hand backfilled one foot above the ball to prevent damage or movement during subsequent backfilling. Depth of burial shall not be less than 1.5 feet nor more than 2 feet.

7.04.07 Identification and Warning Tape

A. Install identification tape on all PVC and D.I. pipelines. Place tape from joint to joint on every section of pipe. Place tape as follows:

1. 2 inch through 8 inch diameter pipe - center along top half of pipe
2. 10 inch through 18 inch diameter pipe - place along both sides of the top half of pipe
3. 20 inch diameter and larger pipe - place on both sides of top half of pipe with a third strip centered along top half of pipe

B. Install warning tape along all pipelines. Install 2 feet above pipe, minimum of 1 foot below grade.

7.04.08 Locator Wire and Tracer Wire

A. Install locate wire and electronic marker balls along all PVC and D.I. pipe and tracer wire along all HDPE pipe per the standard construction detail.

B. Test the locate wire for continuity and submit report documenting the continuity testing. Repair or replace locate wire at failed test locations as directed by the City.

C. Install two tracer wires along polyethylene pipe prior to pulling through bore hole. Tape wire to pipe every 5 feet minimum along the pipeline.

D. After pulling pipe, clean exposed ends for installation of fittings, test tracer wire for continuity.

7.05 TESTING

7.05.01 Testing General Requirements

A. The constructed system shall be thoroughly cleaned of all material, sand, grit, gravel, stones, fluids, construction debris, and other items that can generally be construed as foreign material and that would not be found in a properly cleaned system. Clean the installed mains by conducting flushing. In cases where the City requires pigging, pig all lines, using new pigs, with launching and extraction points determined by the contractor (for larger lines that have a butterfly valve, pig before the valve is installed). All pigging operations shall be witnessed by the City. After pigging, the main is to be flushed.

B. Provide all temporary jumpers and taps for connecting the water source to the mains to be pigged and flushed. Provide proposed tap locations to the City for approval prior to placement of taps. Potable water provided by the City shall be metered and all meter and usage fees shall be paid by the Contractor.

C. Provide all necessary test pumping equipment, water, water meters, pressure gauges, and other equipment, material and facilities required for all hydrostatic, leakage, and pressure testing.

D. The Contractor shall notify the City's designated site inspector who shall coordinate with city personnel at the water treatment plant at least 2 business days prior to beginning flushing of the mains and prior to the commencement of pressure testing.

E. Hydrostatic testing shall be in accordance with AWWA C600 (Ductile iron water mains), AWWA C605 (PVC water mains).

F. All tests shall be made in the presence of the City.

G. All defects in piping systems shall be repaired and/or replaced and retested until acceptable. Repairs shall be made to the standard of quality specified for the entire system.

H. Sections of the system may be tested separately, but any defect which may develop in a section previously tested and accepted shall be promptly corrected and retested. Pressure tests shall be made between valves to demonstrate ability of valves to sustain pressure.

I. Tests for any exposed piping shall be made before covering and insulation is placed.

J. The pressure and leakage test for buried piping shall be made after all jointing operations are completed and restraints have been in place at least seven days. Lines tested before backfill is in place shall be retested after compacted backfill is placed.

K. All service connections to water mains shall be completed prior to testing.

L. Sections of piping between valves and other short sections of line may be isolated for testing. If shorter sections are tested, test plugs or bulkheads required at the ends of the test section shall be furnished and installed by Contractor, together with all anchors, braces, and other devices required to withstand the hydrostatic pressure without imposing any thrust on the pipe line. Contractor shall be solely responsible for any damage that results from the failure of test plugs or supports.

M. All items including valves and controls shall be given a thorough test. The entire system shall be operated for two days to prove compatibility of equipment and to achieve proper adjustment for operation. Valves, pipes, tanks, and other items that are non-operating or occasional-operating shall be tested for ability to meet design criteria.

7.05.02 Pressure and Leakage Testing (PVC and DI Mains)

A. Piping shall be slowly filled with water and all air expelled. Care shall be taken that all air valves are installed and open in the section being filled, and that the rate of filling does not exceed the venting capacity of the air valves.

B. Apply hydrostatic test pressure of 100 psi for 10 minutes and for such additional period necessary for the Engineer to complete the inspection of the line under test. Do not exceed pipe manufacturer's suggested time duration at the test pressure. If defects are noted, repairs shall be made and the test repeated until all parts of the line withstand the test pressure.

C. Apply leakage test pressure of 100 psi. Maintain pressure at a maximum variation of 5 percent during the entire leakage test. The duration of the leakage test shall be two hours minimum, and for such additional time necessary for the City to complete inspection of the section of line under test. Leakage measurements shall not be started until a constant test pressure has been established. The line leakage shall be measured by means of a water meter installed on the supply side of the pressure pump.

D. No leakage is allowed in exposed piping, buried piping with flanged, threaded, or welded joints or buried non-potable piping in conflict with potable water lines.

E. The testing allowance shall be defined as the quantity of water that must be applied to the pipe section being tested to maintain a pressure within 5 psi of the specified hydrostatic test pressure. No installation will be accepted if the quantity of makeup water is greater than that determined by the following formula:

$$L = \frac{S \times D \times P^{0.5}}{148{,}000}$$

L	=	Testing Allowance (quantity of makeup water) in gallons per hour
S	=	Length of line being tested, in feet
D	=	Nominal internal diameter (in inches) of the pipe.
P	=	The average test pressure during the pressure test, in pounds per square inch (gauge) This actual pressure shall be determined by finding the difference between the average elevation of all tested pipe joints and the elevation of the pressure gauge and adding the difference in elevation head to the authorized test pressure.

F. All leaks shall be repaired by removing and replacing defective pipe and joints with pipe and joints free of defects, after which the lines shall be retested. Such repair and retesting shall be done until the lines pass the specified retest.

G. All apparent leaks discovered within one year from the date of final acceptance of the work by the City shall be located and repaired by Contractor, regardless of the total line leakage rate.

7.05.03 Placing the Sewer Force Main Into Service

The force main can only be placed into service once clearance is received from the Florida Dept. of Environmental Protection, followed by approval by the City.

8.01 GENERAL

A. These Specifications cover the lift station construction including the wet well, pumps, controls, fencing, and generators. The lift station site and design shall be in accordance with Chapter 3 of this Handbook.

B. Pipe, fittings, and accessories at the Lift Station site shall be in accordance with Chapters 6 and 7 of this Handbook. Generally, all lift station pipe located in the wet well and above grade shall be ductile iron. The below grade force main discharge pipe shall be PVC.

C. Pipeline installation including separation of non-potable and potable water lines, plus precast structure installation, including trenching, bedding backfilling and compaction shall be in accordance with Chapters 4 and 5 of this Handbook.

D. Elevations of the wet well, electrical control panels, generators, and odor control units shall be constructed a foot above base flood elevation (BFE) per FEMA/FIRM flood maps.

8.02 WET WELL

8.02.01 General Requirements

Refer to Chapter 3 concerning wet well sizing and general wet well requirements. The Contractor shall take all measures necessary to prevent floatation of the wet well due to high ground water table.

8.02.02 Linings and Coatings

A. New wet wells shall be lined with HDPE, minimum thickness of 3 mm, as manufactured by Agru America (Sure Grip liner) or approved equal.

B. Existing wet wells that are required to be re-lined as determined by the City shall be coated with Raven 155 primer (min. 8 mils) and Raven 405 Liner (min. of 125 mils), or equal.

C. The exterior of new wet wells shall be coated with two (2) coats of water based polyamine epoxy coating, installed at a minimum thickness of 8 mils per coat. Coatings shall be applied by the manufacturer in strict accordance with the paint manufacturer's recommendations.

8.02.03 Access Hatches

A. Wet well access hatches shall be traffic bearing (AASHTO H-20 loading), hinged on the long side, with minimum 0.25 inch thick diamond plate, with a flush lifting handle, and T-316 stainless steel hold open arms and heavy duty hinges, T-316 tamper proof attaching hardware, automatic T-316 hold open arm with aluminum latch. All bolts, locknuts, and accessories shall be stainless steel.

B. Doors shall open to 90 degrees and automatically lock with a T-316 stainless steel hold open arms with release handles. The doors shall be equipped with stainless steel compression springs, a locking bar for a padlock, and fixed inside handle. Doors shall close flush with the frame.

C. Castings shall be smooth, clean, free from blisters, blowholes, shrinkage.

D. The access hatches shall be as manufactured by U.S. Foundry Fabrication, Halliday Products, or equal.

8.03 PUMPS

8.03.01 General

A. The pumps at private lift stations shall be standard pumping equipment of proven ability as manufactured by a reputable firm having at least 5 years experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods, and shall operate satisfactorily when installed as specified.

B. Pumps at lift stations that are to be owned and operated by the City shall be as manufactured by Xylem (Flygt) or ABS.

8.03.02 Shaft, Impeller, and Mechanical Seal

A. The pump shaft shall be of Series 300 or 400 series stainless steel or carbon steel. When a carbon steel shaft is provided, the manufacturer shall demonstrate that any part of the shaft which will normally come in contact with the wastewater has proven to be corrosion resistant in this application. The shaft and bearings shall be adequately designed to meet the maximum torque required for any start-up or operating condition and to minimize vibration and shaft deflection. As a minimum, the pump shaft shall rotate on 2 permanently lubricated bearings. The upper bearing shall be a single row ball bearing. The lower bearing shall be a 2 row angular contact ball bearing, if required, to minimize vibration and provide maximum bearing life.

B. The impeller shall be constructed of gray cast iron, ASTM A-48, class 30. All external bolts and nuts shall be of Type 304 stainless steel. Each pump shall be provided with a replaceable metallic wear ring system to maintain pump efficiency. As a minimum, one

stationary wear ring provided in the pump volute or one rotating wear ring provided on the pump impeller shall be required. A two part system is acceptable.

C. Each pump shall be provided with a tandem double mechanical seal running in an oil reservoir, composed of two separate lapped face seals, each consisting of one stationary and one rotating tungsten carbide ring with each pair held in contact by a separate spring, so that the outside pressure assists spring compression in preventing the seal faces from opening. The compression spring shall be protected against exposure to the pumped liquid. Silicone carbide may be used in place of tungsten carbide for the lower seal. The pumped liquid shall be sealed from the oil reservoir by one face seal and the oil reservoir from the air-filled motor chamber by the other. The seals shall require neither maintenance nor adjustment, and shall be easily replaceable. Conventional double mechanical seals with a single spring between the rotating faces, requiring constant differential pressure to effect sealing and subject to openings and penetration by pumping forces shall not be considered equal to tandem seal specified and required.

8.03.03 Pump Guides

A sliding guide bracket shall be an integral part of the pump casing and shall have a machined connecting flange to connect with the cast iron discharge connection, which shall be bolted to the floor of the wet well with stainless steel anchor bolts and so designed as to receive the pump discharge flange without the need of any bolts or nuts. Sealing of the pumps to the discharge connection shall be accomplished by a simple linear downward motion of the pump with the entire weight of the pumping unit guided by no less than 2 Type 316 seamless tubular stainless steel guides per pump, which will press it tightly against the discharge connection. No portion of the pump shall bear directly on the floor of the wet well and no rotary motion of the pump shall be required for sealing. Sealing at the discharge connection by means of a diaphragm or similar method of sealing shall not be accepted as an equal to a metal to metal contact of the pump discharge and mating discharge connection specified and required. Approved pump manufacturers, if necessary to meet the above specification, shall provide a sliding guide bracket adapter. The design shall be such that the pumps shall be automatically connected to the discharge piping when lowered into place on the discharge connection. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or fastenings to be removed for this purpose, and no need for personnel to enter the wet well. Each pump shall be fitted with a minimum ¼ inch 316 stainless steel cable, air craft rating, to remove the pumps from the wet well. The cable shall be of sufficient size to accommodate removal of the pump without breaking.

8.03.04 Pump Warranty

The pump manufacturer of the pumps at lift stations that are to be owned and operated by the City shall warrant the units being supplied to the City against defects in workmanship and material for a period of 5 years or 10,000 hours.

8.03.05 Pump Motors and Heat Sensors

A. All motors shall be built in accordance with latest NEMA, IEEE, ANSI and AFBMA Standards and be UL listed where applicable. Pump motors shall be housed in an air-filled, water-tight casing and shall have Class F insulated windings which shall be moisture resistant. Motors shall be NEMA Design B, rated 155□C maximum. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally, partially or non-submerged condition. The pump shall be capable of running continuously in a non-submerged condition under full load without damage, for extended periods. The motor shall be capable of a minimum of 10 starts per hour. If required by the City, and before final acceptance, a field running test demonstrating this ability, with 24 hours of continuous operation under the above conditions, shall be performed for all pumps being supplied. Motors below 20 horsepower shall be rated 240/480 volt, 3 phase. Motors 20 horsepower and greater shall be 480 volt, 3 phase.

B. Each motor shall incorporate a minimum of 1 ambient temperature compensated overheat sensing device. This protective device shall be wired into the pump controls in such a way that if excessive temperature is detected the pump will shut down. This device shall be self-resetting.

8.03.06 Pump Cables

A. Cables shall be designed specifically for submersible pump applications and shall be properly sealed. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the motor interior from foreign material gaining access through the pump top. Sealing systems utilizing epoxy potting compounds may be used. All cables shall be continuous without splices from the motor to the control panel, unless otherwise approved by the City.

B. The junction chamber, containing the terminal board, shall be leak proof.

8.03.07 Shop Painting

A. Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust, grease, dirt and other foreign matter. All pumps and motors shall be shop coated with a corrosion resistant paint proven to withstand an environment of raw wastewater. All nameplates shall be properly protected during painting.

B. Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to the City up to the time of the final acceptance test.

8.04 CONTROL PANELS

8.04.01 General

A. Control panels shall be supplied for each station containing all the electrical and mechanical equipment necessary to provide for the operation of designated number of electric submersible pumps. The panel as an assembly shall be UL rated at a minimum of SCCR of 14 KAIC. The panel shall be wall-mounted type and provide, low level cut off, high-level alarm and intermediate operating levels.

B. At lift stations that are to be owned and operated by the City, a combination lift station pump control panel and SCADA RTU to monitor and control lift station is required. All combination panels shall contain a SCADA PLC and display. The Panel shall be complete and Factory tested with floats, submersible transducer, and programming/startup.

C. The control panel shall consist of a main and emergency circuit breaker and a motor circuit protector and magnetic starter for each pump motor, and 15-ampere, 120-volt circuit breakers as required. A high level alarm and pump shutoff shall be accomplished by a float type liquid level control system with all control components mounted in one common enclosure. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control system shall provide means to manually select or automatically alternate the position of the "lead" and "lag" pumps after each pumping cycle.

8.04.02 Control Panels Enclosures

A. The control panel shall be NEMA 3R 304 stainless steel dead front construction with welded double locking hasps and dead front aluminum inner door, and oriented as shown on the Drawings. The control panel shall include thirty percent (30%) extra mounting space for additional equipment. The enclosure shall allow a minimum 8 inches (8") of clear space above the main circuit breakers and 10 inches (10") below the motor starters for making wire terminations. The control panel enclosure shall have a minimum 6 inches (6") of clear space along each side with bracing to allow strapping of the incoming power feeder from the electric service. The control panel enclosure shall be Underwriters Laboratories (US) 50 Type 3R listed.

B. All major components and sub-assembles shall be identified as to function with laminated, engraved, bakelite nameplates, or similar approved means. All enclosures shall include the correctly sized corrosion inhibitor device required to protect the interior panel components

C. The panel exterior shall have stainless steel heavy-duty pad locking door handle and three point latch. Mounted on the exterior enclosure shall be an alarm light and a high water level audible alarm with silencer pushbutton.

D. All exterior mounted accessories shall be constructed of corrosion proof materials such as stainless steel or aluminum.

E. Control wiring from the wet well shall enter the panel in a manner to prevent the possible entry of gases from the wet well.

F. The panel inner door shall be aluminum mounted on a continuous hinge, two pivot handles shall be furnished for protection against exposed wiring and shall have cutouts for access to all of the circuit breakers. The inner door shall include a restraining mechanism to fix the inner door in the open position. Mounted on the inner door will be pump run lights, high level alarm, run and level indication lights, hand-off automatic switches, elapsed time meters for each pump, a 20 ampere ground fault duplex receptacle, motor overload resets and alarm reset. The door shall include a 10" x 12" pocket for log sheet storage. The nameplate shall contain the voltage, phase, rated horsepower, speed, date of manufacture, pump and panel manufacturer's name, address, and telephone number, pump data, including impeller data, operating point and head, KW input, amps at the operating point and at least two (2) other points on the pump curve.

8.04.03 Control Circuits

All wet well (level sensor) circuits shall operate at 24 volts AC and be made intrinsically safe. The control circuit breaker shall operate on 115 volts.

8.04.04 Panel Components

A. Main, Emergency and Branch Circuit Breakers: All circuit breakers shall be heavy-duty industrial service molded case breakers with amperage rating as required. All circuit breakers shall have an appropriate locking device to meet OSHA lockout and tag-out rules. Both main and emergency breakers shall be equal in size. Circuit breakers shall be thermo- magnetic as manufactured by Square D.

B. An emergency power receptacle shall be installed on the side of the control panel and connected to the line side of the generator breaker. The receptacle shall be the JRS series as manufactured by Russellstoll, Model JRS 1044FR and Russellstoll angle adapter no. JAAB10. The panel manufacturer shall coordinate with the Owner to insure the receptacle will properly mate with the City's generator plug.

C. An eight-pin, plug-in solid-state alternator shall be provided to change the pump starting sequence on each pumping cycle. The alternation operation shall be wired to permit the Handbook selection of the lead, lag-pumping order. The plug base shall be keyed to allow for proper pin alignment.

D. The control relays shall operate from a 24-volt circuit. The relays shall be enclosed, eight-pin and/or eleven-pin plug-in type. The control relays shall contain test button and neon or LED energized indicator. The plug base shall be keyed to allow for proper pin

alignment. Control relay sockets shall be octal-style with clamp on screw terminals. These sockets shall be mounted on DIN railing and 600 VAC rating. All relay sockets shall be keyed to allow for proper pin alignment. The control panel shall include an adjustable time delay relay to prevent both pumps from starting simultaneously. Relays shall be AA Electric Company, Series AAE, or equal.

E. Duplex Service Receptacle: A duplex service receptacle supplying 20 amps at 115 volts shall be provided on the panel door. The duplex receptacle shall be provided with ground fault protection.

F. Lightning Arrestor and Surge Capacitor: A lightning arrestor and surge capacitor shall be installed and wired to protect motors and control equipment from lightning induced line surges and transient voltage surges.

G. Elapsed Time Meters: Elapsed time meters shall be 115-volt non-reset types and shall indicate pump running time in hours and tenths of hours to 99999.9 hours.

H. Across the Line Motor Starters: An open frame, across-the-line, NEMA rated, magnetic motor-starter, as manufactured by Square-D, shall be furnished for each pump motor. All motor starters shall be equipped to provide under- voltage release and individual overload protection on all three phases. Motor starter contacts shall be easily replaceable without removing the motor starter from its mounted position. Overload reset push-buttons shall be located on the exterior of the inner compartment door.

I. Each pump motor shall be protected by a 3-pole motor circuit protector. The motor circuit protector shall be operated by a toggle-type handle and contain a quick- make, quick-break, over center switching mechanism mechanically trip-free from the handle so contacts cannot be held closed against a short circuit and abnormal currents causing the motor circuit protector to trip. Tripping shall be clearly indicated by the handle automatically assuming a position midway between the normal "ON" and "OFF" positions. All latch surfaces shall be ground and polished. All poles shall be constructed to open, close, and trip simultaneously. The motor circuit protector shall be completely enclosed in a high-strength glass polyester molded case. Ampere ratings shall be clear and visible. Contacts shall be non-welding silver alloy. A Handbook push to trip button shall be provided for Handbook exercising of the trip mechanism. Each pole of these motor circuit protectors shall provide instantaneous short circuit protection by means of an adjustable magnetic-only element.

J. Phase Monitor: A 3-phase monitor shall be installed and wired to disconnect control power from the motor starters in the event of loss of power, phase reversal, loss of any phase or phase balance, or low voltage. The phase monitor shall automatically reset upon removal of any and all of the preceding conditions.

K. Indicator Lights: Indicator lamps shall be mounted in NEMA 4X, as manufactured by Square D, or equal. Lamp modules shall use LED lamps and be equipped to operate at

120-volt input. Lamps shall be easily replaceable from the front of the control compartment door without removing lamp module from its mounted position.

L. Pump Run Lights: A 120-volt pump run light shall be connected in parallel with each motor starter and indicate when a particular pump is running.

M. Control System: The control system shall consist of: 24-volt transformer; plug-in relays; solid state automatic alternator with test switch; plug-in three phase monitor (as required); and terminal strip for the installation of level regulators. All control wiring shall be color coded (minimum 18 colors) size 18, rated for 300 volts, 80 C stranded tinned copper, PVC insulated, and shall be installed in wiring duct with cover.

8.05 PROGRAMMABLE LOGIC CONTROLLER

8.05.01 General

A. The Programmable Logic Controller (PLC) shall be provided with configurable 1/0 to allow monitoring and control of the pump station. Interface to the PLC will be by 2 line display and keypad. Sample screens will be provided to the City of Everglades City for approval. Text messaging will be the primary means of communication.

B. The PLC shall contain ten (10) 24Vac input signals received from devices such as pushbuttons, selector switches, pressure switches, temperature switches, or limit switches and converts them into voltage logic levels that can be processed by the controller. Six (6), relay outputs switched, 120Vac output signals that can drive loads up to 1 amp such as relays, starters, and solenoid valves. Two (2) analog inputs shall accept 4-20mA DC signals. Input shall be set for Unipolar with Offset and Extended Resolution mode to detect loss of signal or low input indication. Resolution shall be 11 bit plus sign with a 10 ms conversion time.

C. The PLC shall be Sanders Company SciText Plus SCADA system Master RTU (PLC), including all Remote Telemetry Unit (RTU) panel information as transmitted via Text messaging.

D. Operation of the PLC processor shall be continuously monitored, and in the event the controller should stop functioning, or the branch circuit breaker is opened, an alarm from the SciText will be generated. If the level rises to the backup floats the pumps shall run as required.

8.05.02 PLC Ladder Logic Software

A. The System Integrator shall configure PLC to perform and warrant proper system operation as described in this document.

B. Control (Command) points shall be programmed such that control can be performed from HAND field devices (such as a selector switch) or from REMOTE by operator interface or MMI SCADA system, as described in contract. In some applications this will require that OR logic is in the program. The control description shall include how the MMI software should handle the commands.

C. The PLC shall include an integrated cellular text modem system that complies with all applicable FCC requirements. The cellular antenna shall be a multi-band external antenna as manufactured by Nearson, Model W765FL-36-XX-AGDPU Antenna, Frequency Range: 824-960/1710-1990 MHz, 2 dBi Gain.

D. A seal leak relay shall be furnished for each pump to sense a seal leakage condition. The control manufacture shall coordinate the relay furnished with the pump to ensure compatibility. A door mounted pilot light and seal leakage sensor shall be provided to indicate a pump seal failure alarm condition of each sewage pump.

8.05.03 Redundant (Backup) Level Control

A. An independent high level alarm and redundant (backup) pump control capability with features as hereinafter listed shall be provided in addition to the specified primary level control system. It shall be powered by a 24 vac transformer.

B. The independent alarm/control panel equipment shall be designed to UL508 Industrial Control Panel standards and shall incorporate 120 VAC input power transient protection, a fused primary and a DC power supply with limited 12 VDC to power the level sensing float circuits and dedicated redundant (backup) level control circuit.

C. The front face of the RTU control panel shall be accessible through an operator's swing out door and shall incorporate the previously specified red indicator lights and push buttons.

D. The following outlines the level function indicator lights and push buttons required for the redundant (backup) Lift Station wet well level controls:

1. High Level Float and Test
2. Low Level Float and Test

E. An Operator energized panel mounted Test pushbutton shall be included with each of the float indicator lights for the purpose of testing the indicator lights and redundant (back up) control circuits.

F. An alternator relay shall be included for the purpose of alternating Lift Station Pumps 1 and 2 in conjunction with the redundant (backup) float switch operation.

G. The redundant (backup) level control shall operate in conjunction with the required direct-acting float switches. The backup float switch system shall be mounted in the Lift Station wet well at the elevations required to ensure lift station pump control when the primary level controls fail for any reason (i.e. primary level transmitter fails, primary level controller fails, primary level relay fails, etc.) The Float system shall be 24Vac.

H. The float switch shall be mounted in the Lift Station wet well pit in accordance with the manufacturer's instructions or as shown on the plans.

I. The High Level float shall energize a high level relay and indicator light providing the Operator a level alarm status. This High Level status shall also energize the panel mounted Local Alarm System horn, strobe alarm light and shall record this alarm condition at the Microprocessor Controller/Telemetry Unit (MCT). The Operator must acknowledge this alarm condition to silence the horn.

J. The LEAD On float shall energize the lead on relay and indicator light. This level condition shall activate the Redundant (Backup) Level Controls and shall start the lead pump as designated by the alternator relay. This Lead On level status shall be recorded as an alarm condition at the Microprocessor Controller/Telemetry Unit (MCT).

K. The Redundant (Backup) Level Controls shall continue to operator. The LAG pump shall start as designated by the alternator relay when the Lag On float energizes the lag on relay and indicator light.

L. The Pump OFF float shall energize the pump off relay stopping all Lead and Lag pumps in operation.

M. The Redundant (Backup) Control and Alarm capability shall be completely integrated in the specified RTU control panel and system as described and in accordance with all applicable codes and job requirements.

N. Audible Alarm: The audible alarm shall consist of a weatherproof high intensity electronic horn mounted on the side of the enclosure. The audible alarm shall be equipped with a control panel mounted pushbutton silencer. The alarm circuit will automatically reset when the high liquid level condition is corrected and reset button pressed.

O. Alarm Light: The alarm light shall consist of a weatherproof light with lexan globe.

P. Alarm Control: An audible alarm shall sound and an alarm light shall flash. When alarm condition clears, light shall remain on until reset button is pressed.

Q. High level alarm: Provide dry alarm contact to activate alarm for remote indication.

8.06 INTERFACE

8.06.01 Signals

A. The control panel shall be constructed to interface with the telemetry system. As a minimum provide the following signals:

1. Pump Run Status (Each pump)
2. Pump In Auto (Each pump)
3. Pump in Hand (Each pump)
4. Pump Fail (Each pump)
5. Power Fail
6. High Level
7. Low Level
8. Odor Control Running
9. Odor Control Fail
10. Sanitary Instantaneous Flow

8.06.02 Identification Nameplates

A. Provide identification nameplates for the following equipment:

1. Breakers, circuit, enclosed.
2. Contactors, magnetic, enclosed.
3. Panelboards, distribution.
4. Panels, control.
5. Receptacles
6. Relays, enclosed.
7. Starters, magnetic motor, enclosed.
8. Starters, Handbook motor, enclosed.
9. Stations, control.
10. Switches, toggle, ac, except standard lighting control type.
11. Switches, toggle, motor starting.

8.06.03 Identification Markers

A. All circuit breakers, control switches, indicator lights, relays, and other control devices shall be identified with permanently affixed legend plates and lamicoid-type engraved nameplates where applicable. A black and red on white label stating "DANGER<HIGH VOLTAGE<240 or 480 (use applicable) VOLTS" shall be affixed to the face of the inner door unit.

B. Install nameplates using stainless steel drive pins or machine screws. Dymo type labels and labels fastened with adhesive only will not be accepted.

C. Install conductor identification markers on conductors at terminations and in junction and pull boxes through which the conductors pass. Color code power conductors by insulation or tape and identifies by markers in junction and pull boxes to indicate the conductor's panel and circuit number. Identify control conductors by markers at all locations.

D. Mark junction and pull boxes with a suitable permanent marking to indicate the type(s) of circuits enclosed by the boxes.

E. Identification markers that are not preprinted, such as panelboard indexes, terminal block marking strips, and special cable markers, shall be typewritten or otherwise mechanically printed, not hand lettered.

8.07 LEVEL SENSOR CONTROL SYSTEM

8.07.01 Float Switches

A. Furnish and install four (4) float switches which shall be tilt switches: SPOT, 4.5 amps, 120 VAC, encapsulated in a weighted float covered with chemical resistant polypropylene. Float shall be suspended on a cable that shall be connected directly to the control panel. Sufficient length of cable shall be provided to allow field adjustment of actuation level.

B. Float switches shall consist of a hermetically sealed switch in a stainless steel body. Floats shall be supplied with two conductor fine- stranded No. 14 AWG cable with heavy-duty neoprene jacket.

C. The float switches shall be Consolidated Electric Model 9G or equal.

8.07.02 Submersible Level Transducer:

A. The liquid level at the Lift Station shall be sensed by maintenance free Loop Powered Submersible Level Transducer system that uses reliable hydrostatic head pressure sensing principle to provide an accurate and reliable proportional 4-20 mA signal representing level/pressure.

B. The submersible level transducer system shall be a Birdcage Model BC001 Submersible Level Transmitter as manufactured by Blue Ribbon Corporation.

8.08 SPARE PARTS

A. The Control Panel manufacturer shall furnish the following parts for each panel supplied:

1. Phase Monitor
2. Alternator

3. Fuses of each size and type used
4. Bulbs of each size and type used

B. Spare parts shall be properly packaged and labeled for easy identification without opening the package and delivered at pump station start-up.

8.09 GENERATORS

8.09.01 General

A. All Lift Stations that are to be shall be dedicated to the City shall have an emergency generator installed on site or the Developer / Contractor shall pay the City for the cost to purchase a trailer mounted generator.

B. The generator system shall be provided for electrical power during the loss of normal power.

C. Generators shall be complete with all controls, automatic switchgear and shall produce 240 volts (AC), or 480 volts (AC), 3 phase, 4 wire power. Generator and controls shall be installed in a sound attenuating enclosure, with the sound attenuated to have a maximum noise (sound) of 72 decibels (dB(A)) when measured at a distance of twenty-three feet (23-ft) when operating at night.

D. The generator set shall consist of a diesel engine directly coupled to an electric generator, together with the necessary controls and accessories to provide continuous electric power to the lift station for the minimum duration of a 48 hour failure of the normal power supply.

E. A complete engine generator system shall be furnished and installed with fuel transfer pump, fuel day tank, battery, battery charger, muffler, radiator, control panel, remotely mounted automatic transfer switch (part of the control panel), and all other accessories required for an operational system. All materials and parts of the generator set shall be new and unused. Each component shall be of current manufacture from a firm regularly engaged in the production of such equipment. The set shall be of a standard model in regular production at the manufacturer's place of business. Units and components offered under the Specifications shall be covered by the manufacturer's standard warranty on new machines.

F. The emergency generator set and accessories shall be of a type that complies with the latest edition of the National Electrical Code and all applicable state and local building codes.

G. The material and workmanship used in the manufacture of this equipment shall be of the highest quality consistent with the current standards for like equipment, and the

equipment shall be manufactured in such a manner so as to conform to the latest applicable IEEE, ANSI, ISA, NEMA, and EEIA Standards.

H. The equipment supplier shall be liable for any latent defects due to faulty materials or workmanship in the equipment which may appear within 1 year from the date of equipment start-up.

I. Generators at lift stations that are to be owned and maintained by the City shall be manufactured by Generac.

8.09.02 Tests

A. Equipment shall be completely assembled and tested at the factory prior to shipment. Certified copies of the data obtained during these tests shall be submitted to the City.

B. Final tests, in the presence of the City's representative, shall be conducted at the site after installation has been completed. The emergency generator manufacturer shall furnish a service representative to operate the engine during the tests, to check all details of the installation and to instruct the City's representatives in proper equipment operation.

C. Field tests shall include operating the diesel generating set for 8 hours, carrying normal lift station loads. The Contractor shall refill the main fuel tank at the completion of the tests.

8.09.03 Ratings

The rating of the generator shall be as specified in the Drawings by an electrical engineer. These ratings must be substantiated by the manufacturer's standard published curves. Special ratings shall not be acceptable. The set shall be capable of supplying the specified usable KW for the specified duration, including the power required for the pump start-up, without exceeding its safe operating temperature.

8.09.04 Engine

A. The engine shall be water cooled, four stroke cycle, compression ignition diesel, LP or natural gas. The engine shall be equipped with fuel, lube oil and intake air filters; lube oil coolers, fuel transfer pump, fuel priming pump, and gear-driven water pump, where applicable. The engine and generator shall be torsionally compatible to prevent damage to either engine or generator.

B. An engine instrument panel shall be installed on the generator set in an approved location. The panel shall include oil and fuel pressure and water temperature gauges. A mechanically driven engine hour meter shall also be provided.

C. The engine governor shall be of the isochronous electronic type. Frequency regulation shall not exceed ±0.25% under steady state conditions. The engine shall start and assume its rated load within 10 seconds, including transfer time.

8.09.05 Generator

A. The generator shall be a 3 phase, 60 hertz, single bearing, synchronous type, built to NEMA Standards. Epoxy impregnated Class F insulation shall be used on the stator and the rotor.

B. The excitation system shall employ a generator-mounted, volts-per-hertz type regulator. Voltage regulation shall be ±2% from no load to full load. Readily accessible voltage drop, voltage level and voltage gain controls shall be provided. Voltage level adjustment shall be a minimum of ±5%.

8.09.06 Engine Generator Control Panel

A. A generator mounted NEMA 3R type 304, vibration isolated, 14 gauge stainless steel control panel shall be provided. Control equipment shall consist of all necessary exciter control equipment, generator voltage regulators, voltage adjusting rheostat, speed control equipment, and automatic starting controls, as required to satisfactorily control the engine/generator set. In addition, an automatic safety shut down shall be provided for low oil pressure and/or high temperature conditions in the engine. An emergency shut down lever switch shall be provided on the air intake.

B. Metering equipment shall include 3½ inch meters (dial or digital type frequency meter, 2% accuracy voltmeter, and ammeter and ammeter-voltmeter phase selector switch). The control panel shall also include the engine water temperature, lube oil pressure and hour meter.

C. Individual press-to-test fault indicator lights for low oil pressure, high water temperature, low water level, over speed, over crank, and for day tank high and low fuel level shall be provided.

D. A four position function switch marked “Auto”, “Handbook”, “Off/Reset”, and “Stop” shall be provided.

8.09.07 Battery Charger

The battery charger shall be so designed that it shall not be damaged and shall not trip its circuit protective device during engine cranking or it shall be automatically disconnected from battery

during cranking period. The charger shall be mounted in the emergency generator control panel. The charger shall have a 7 day/24 hour timer control.

8.09.08 Battery

The battery shall be lead-acid type with sufficient capacity to provide 90 seconds total cranking time without recharging. The battery shall be adequately rated for the specific generator set. The battery shall be encased in hard rubber or plastic and shall be furnished with proper cables and connectors, together with rack and standard maintenance accessories. The battery shall be provided with a 48-month warranty for replacement if found to be defective.

8.09.09 Base and Mounting

A suitable number of spring-type vibration isolators with a noise isolation pad shall be provided to support the set and its liquids.

8.09.10 Utility Connections

All connections to the generator set shall be flexible.

8.09.11 Cooling System

The generator set shall be equipped with an engine mounted radiator sized to maintain safe operation at 110-degree F maximum ambient at the pump station altitude. A blower type fan shall be used directing the air flow from the engine through the radiator. The entire cooling system shall be filled with 50% glycol-water solution.

8.09.12 Fuel Tank

A. Diesel fuel storage for the generator set shall be provided by a base mounted dual-wall fuel containment tank integral with the generator set. All fuel piping shall be internal to the unit.

B. The volume of the base mounted tank shall be as needed to provide a minimum continuous run duration of forty-eight (48) hours.

C. The tank shall include an automatic continuous leak detection monitoring system with test switch to detect fuel present between the primary tank and secondary containment. All components to the leak detection system shall be accessible for service. The tank shall include a fuel high-level alarm; fuel gauge; low level alarm; ½ inch stainless steel drain valve and fuel fill limiter. The tank instrumentation shall transmit a 4-20mA DC signal proportional to the level in the tank.

D. The following alarms and level signals shall be wired to a terminal panel for transmission to the City's SCADA system: 1) Fuel leak; and 2) Fuel Level (4-20mA).

8.09.13 Exhaust System

A. The generator set supplier shall provide a residential grade critical-type silencer, with minimum 25 DB reduction, with flexible exhaust fittings, properly sized and installed, according to the manufacturer's recommendation. The silencer shall be mounted so that its weight is not supported by the engine. The exhaust system shall not exceed residential noise limit requirements.

B. Exhaust pipe size shall be sufficient to ensure that measured exhaust back pressure does not exceed the maximum limitations specified by the generator set manufacturer. The exhaust system shall include a flexible, seamless, stainless steel connection between the engine exhaust outlet and the rest of the exhaust system. The exhaust system shall be a part of generator enclosure.

8.09.14 Weatherproof Enclosure

A. Enclosure and all other items shall be designed and built by engine manufacturer as an integral part of the entire generator set, and shall be designed to perform without overheating in the ambient temperature specified. The enclosure shall be sound attenuated to have a maximum noise (sound) of 72 decibels (dB(A)) when measured at a distance of twenty-three feet (23-ft) when operating at night.

B. Enclosure shall be constructed of 14 or 16 gauge sheet metal suitably reinforced to be vibration free in the operating mode. Four hinged doors shall be provided to allow complete access without their removal. Each door shall have at least 2 latch-bearing points. Side and rear panels shall be completely and simply removable for major service access. Roof shall be peaked to allow drainage of rain water. Baked enamel finish with primer and finish coat shall be painted before assembly. All fasteners shall be rust resistant. Unit shall have sufficient guards to prevent entrance by small animals. Padlocks shall be provided.

C. Batteries shall be designed to fit inside enclosure and alongside the engine. Batteries under the generator are not acceptable. Unit shall have coolant and oil drains outside the unit to facilitate maintenance. Each drain line shall have a high quality valve located near the fluid source. Fuel filter shall be inside the base perimeter and located so spilled fuel cannot fall on hot parts of engine or generator. A cleanable primary fuel strainer shall be used to collect water and sediment between tank and main engine fuel filter. Crankcase fumes disposal shall terminate in front of the radiator to prevent oil from collecting on the radiator core and reducing cooling capacity.

8.09.15 Automatic Transfer Switch

A. The automatic transfer switch shall be part of the control panel. The transfer switch shall be provided with the following features:

1. Complete protection, close differential voltage sensing relays monitoring all 3 phases (pick-up set for 95% of nominal voltage, drop-out set for 85% nominal voltage).

2. Voltage sensing relay on emergency source (pick-up set for 95% of nominal frequency).

3. Time delay on engine starting--adjustable from 1 second to 300 seconds (factory set at 3 seconds).

4. Time delay normal to emergency transfer--adjustable from 0 second to 300 seconds (factory set at 1 second). The Contractor shall request time delay settings in accordance with the priority rating or their respective loads.

5. Time delay emergency to normal transfer--adjustable 30 seconds to 30 minutes (factory set at 5 minutes), and time delay bypass switch shall be provided on door of the switch cabinet.

6. Unload running time delay for emergency engine generator cooling down-adjustable from 0 to 5 minutes (factory set at 5 minutes) unless the engine generator control panel includes the cool down timer.

8.09.16 Trailer Mounted Generators

A. Where the Contractor elects to provide a trailer mounted generator, the generator set shall be mounted and fully housed on a factory fabricated trailer with hinged side panels.

B. The trailer shall conform to all local, state, and federal highway and safety regulations.

C. The trailer shall be the two axle tandem type with the I.C.C. package and shall be of adequate size for the weight of the generator set, accessories, and shall contain a double walled, diesel fuel tank with mechanical fuel gauge and 3-way valve to allow connection of auxiliary fuel tank. The trailer shall be furnished with all standard accessories which shall include flat fenders welded to body, heavy duty jack stand with pneumatic tire for tongue, hydraulic surge brakes, retractable jacks for rear corners, 10 ply high speed tires, tail lights, stop lights, turn lights, license plate holder with light, safety chains with grab hooks, heavy duty bumper, side reflectors, and towing bar and ring with accessories necessary for attachment to the transporting vehicle. Storage tray(s) capable of securely storing two 50' portable cables shall be provided.

D. For 480-volt, 3-phase operation provide one (1) 200A, 4 pole, 5 wire receptacle on the rear of the trailer connected to the load side of a 200A breaker with 200A conductors, including ground wire. The receptacle shall be Russellstoll JRS Series (confirm model

number with the City). The receptacle box shall be installed inside the trailer housing and the adaptors outside. It shall be waterproof with a spring cover.

E. For 480-volt, 3-phase operation, provide one (1) 4 conductor portable cable with a #2 ground. Cable shall be 50 feet in length, rated 200 amps and shall be provided with a 200A plug on each end. Plug shall be Russellstoll JRS Series on each end of the cable. Confirm model numbers with the City.

F. The trailer hitch shall be as required by the City.

G. The Trailer Mounted Weatherproof Enclosure shall be constructed of removable side panels and end panels and shall be skid base. The weatherproof enclosure shall be sound attenuated to have a maximum noise (sound) of 72 decibels (dB(A)) when measured at a distance of twenty-three feet (23-ft) when operating at night. Engine exhaust shall discharge and be redirected by duct work to exhaust vertically.

H. The Trailer Mounted Weatherproof Enclosure top and end panels shall be made from galvanized steel, and the side panels from galvanized steel. The design of the enclosure shall prevent rodents from entering the unit. The unit shall have hinged side doors on each side and double hinged doors at the control end equipped with key expanded metal grating in front for the radiator grill and fixed key locks for ease of engine maintenance. There shall be louvered air intake ports on the shelter sides and rear for proper air circulation within the shelter. The complete generator set and shelter shall be prime painted and have two finish coats of protective enamel paint. Paint color shall be as selected by the City. Provisions shall be available for crane unloading by providing lifting eyes and spreader bar reinforcement.

8.09.17 Generator Testing

A. The Contractor shall provide all fuel for testing. Fuel tank shall be filled after completion of testing by Contractor before acceptance by the City.

B. Prior to acceptance of the generator set all equipment furnished shall be tested to show it is free of any defects and the generator set can operate satisfactorily under full load test using resistance type load banks (brine tanks not acceptable) for 3-hours. The Contractor shall correct any defects before acceptance by the City.

8.09.18 Warranty

Products shall be guaranteed to be free from defects in material and workmanship under normal use and service for a period of 1 year after start-up.

8.10 ELECTRICAL GROUNDING SYSTEM

A. A grounding system shall be installed as per National Electrical Code, Local Codes and Ordinances. The Drawings shall clearly show the Electrical Grounding System. An underground perimeter cable grounding system shall be installed with connections to at least the following equipment: Wet well cover; Control panels; Generator; Utility company transformer; Main disconnect switch; Fence.

B. The Drawings shall show details of material and installation to construct a completely functional and operational Electrical Grounding System.

8.11 FENCING

8.11.01 General

A. All standard perimeter fencing at lift stations shall be 6' high chain link fence vinyl coated black. Upgraded fencing if required and as approved by the Dept. Of Community Development in compliance with the architectural and landscape requirements of the LDC shall be installed by the contractor as detailed on the construction plans. Regardless of fence type, a minimum of 3-ft clearance from all above grade structures or equipment shall be provided.

B. All fence and gate material shall be FDOT Fence Type B, per the Florida Department of Transportation, Standard Specifications for Road and Bridge Construction)"Standard Specifications"), and Standard Plans for Road Construction, "Standard Plans".

8.11.02 Fence Posts

A. All fence posts shall be 2-inch diameter, zinc galvanized steel pipe (galvanized at 1.8 oz per square foot), Schedule 40, vinyl coated black, class A bonded.

B. Embed all posts in 3000 psi concrete bases. All posts to extend 3 feet minimum into concrete base. All concrete base diameters to be 12 inches, top of base to crowned 1 inch above grade, bottom of base to be 6 inches below bottom of the post.

C. Fence post anchor plates and anchors shall be galvanized steel per FDOT Index No. 802.

D. Zinc coated commercial grade steel.

8.11.03 Chain Link Fence Fabric

A. Chain link fence fabric shall be No. 9 gage steel wire zinc coated (coated at 1.8 oz per square foot). The gage requirement refers to the wire plus zinc coated diameter, and does not include any other coatings. The wire shall be vinyl coated black, class A bonded.

B. The top of the chain link fence shall be twisted and barbed, bottom to be knuckles.

8.11.04 Gates

A. Provide double swing gate, 12 feet opening, hinged to swing total of 180 degrees so gate can swing in or out. Also provide latches, locking device, and gate stop keeper (cane bolt and cane bolt anchor base embedded in concrete).

B. All gate materials are to match the fencing materials identified above, including the fence fabric and posts are to be vinyl coated black, class A bonded.

8.11.05 Tension Wire and Tie Wire

Tension wire shall be No. 7 gage and tie wire shall be No. 9 gage. All wire shall be steel wire zinc galvanized (galvanized at 1.8 oz per square foot). The gage requirement refers to the wire plus zinc coated diameter, and does not include any other coatings. Wire to be vinyl coated black, class A bonded.

8.11.06 Miscellaneous Hardware

Miscellaneous fence hardware shall be zinc coated commercial grade steel. Paint black or as directed by the City.

8.11.07 Lift Station Sign

A. Provide a Lift Station identification sign, attached to the gate or fence at a location selected by the City. The sign shall be no less than 12”x18” and shall include:

Name of Lift Station _____
Lift Station Owned By: _____
Lift Station Maintained By: _____
Maintenance Co. Phone No.: _____

B. All lettering shall be black on a white background, minimum letter height of two inches.

C. Submit all proposed signs as a submittal for the City to review. Signs shall not be ordered until the sign has been approved by the City.

8.12 SITE LIGHTING

A. Provide a 100 watt LED Type III light in a one piece die cast aluminum housing, anodized aluminum reflector, mounted on a fiberglass tapered round pole (light mounting height to be 25 feet above grade). Light to be UL rated for a wet location (outdoor installation). The pole and foundation shall be rated for 150 MPH wind speed (1.3 gust factor). Light fixture and pole finishes (colors) to be as selected by the City.

B. The lightning protection system shall include air terminals, bonding conductors, and ground electrodes.

8.13 TOOLS AND SPARE PARTS

One set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.

8.14 PUMP STATION WATER SYSTEM

All wastewater lift stations shall be provided with a water system with adequate capacity and pressure for station wash down and other requirements. The station water system shall be completely separated from the potable water supply by means of a metered, reduced pressure type backflow preventer

8.15 INSPECTION AND TESTING

A. A factory representative knowledgeable in pump operation and maintenance shall inspect and supervise a test run at the lift station in the presence of the City. The City shall be provided a minimum of 2 business days advance notice (not including holidays or weekends) before this inspection is to commence. A minimum of 1 working day shall be provided for the inspections. Additional time made necessary by faulty or incomplete work or equipment malfunctions shall be provided as necessary to meet the requirements in this Handbook at no additional cost to the City. Upon satisfactory completion of the test run, the factory representative shall issue the required manufacturer's certificate.

B. The test run shall demonstrate that all items of this Handbook have been met by the equipment as installed, and shall include, but not be limited to, the following tests:

1. That all units have been properly installed.

2. That the units operate without overheating or overloading any parts and without objectionable vibration.

3. That there are no mechanical defects in any of the parts.

4. That the pumps can deliver the specified pressure and quantity.

5. That the pumps are capable of pumping the specified material.

6. That the pump controls perform satisfactorily.

8.16 LIFT STATION UTILITY SERVICES

The necessary utility services (electrical power, water) shall be provided by the Owner/Developer and accounts for such services shall be transferred to the City prior to issuance of a Certificate of Completion for facilities that are to be dedicated to the City.

8.17 REQUIRED SUBMITTALS

A. Submittals shall be provided to the City, for any lift stations to be taken over by the City, that include the following:

1. As-Built Drawings as required per Chapter 2 of this Handbook.

2. Descriptive literature, bulletins, and/or catalogs of the equipment (PDF files).

3. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves, based on actual shop tests of similar units, which show that they meet the specified requirements for head, capacity, efficiency, NPSHR, submergence and horsepower. Curves shall be on 8½" by 11" sheets, at as large a scale as is practical. Curves shall be plotted from no flow at shut off head to maximum manufacturer recommended pump capacity. Catalog sheets showing a family of curves will not be acceptable.

4. Complete layouts, wiring diagrams, telemetry or control schematics, including coordination with other electrical control devices operating in conjunction with the pump control system. Suitable outline drawings shall be furnished for approval before proceeding with manufacture of any equipment. Standard preprinted sheets or drawings simply marked to indicate applicability will not be acceptable.

5. A drawing showing the layout of the pump control panel shall be furnished. The layout shall indicate all devices mounted on the door and the panel shall be completely identified.

6. The weight of each pump.

7. Complete motor data shall be submitted including:

   a. Nameplate identification.
   b. No-load current.
   c. Full load current.
   d. Full load efficiency.
   e. Locked rotor current.
   f. High potential test data.
   g. Bearing Inspection report

9.01 RECLAIMED WATER MAINS AND SERVICE LINES

9.01.01 General

A. These Specifications cover the pipe, fittings, valves, and accessory items used for reclaimed water distribution systems.

B. Pipe used in reclaimed water distribution systems to be owned and maintained by the City shall be either be ductile iron (DI) or PVC pipe. Pipe that is to be directional drilled shall be Polyethylene (PE) pipe and reclaimed water main carrier pipe installed in steel casings shall be ductile iron as specified in Chapter 5 of this Handbook.

9.01.02 Ductile Iron Pipe

A. Buried pipe shall conform with ANSI/AWWA C150/A21.50 and C151/ A21.51, and shall have a minimum working pressure of 150 psi. Buried pipe shall comply with the following pressure class (PC) designations unless otherwise indicated on the Drawings: 1) 12 inch diameter and smaller = PC 350; 2) 14 inch through 24 inch diameter = PC 250; 3) 30 inch through 64 inch diameter = PC 200.

B. Exposed pipe 4 inches and larger shall be ductile iron flanged and shall conform with AWWA/ANSI C115/A21.15, and shall have a minimum working pressure of 150 psi. Flanged pipe shall comply with the following thickness class (TC) designations unless otherwise indicated on the Drawings: 4 inch diameter = TC 54; 6 inch through 24 inch diameter = TC 53. All flanges shall be class 125, and shall be fully machine faced after being screwed tightly on the pipe. Bolts and nut shall conform to ASTM A307, Grade B.

9.01.03 PVC Pressure Pipe

A. Pipe 4 inch through 30 inch diameter shall conform to AWWA C900. Pipe shall conform to ASTM D1784, Type I, Grade I, 4000 psi design stress, and shall be National Sanitation Federation (NSF) approved.

B. Reclaimed water main pipe shall be class 235 (DR18), fire mains shall be class 305 (DR 14). Pipe barrel dimensions, pressure classes, and dimension ratios are to be for PVC pipe with Cast Iron Outside Diameter (CIOD). All pipe shall contain markings on each section showing conformance to the above specifications.

C. PVC pipes shall be color coded purple and stenciled (0.75-inch lettering on the pipe in at least three areas per pipe section) “Reclaimed Water Main”.

D. Joints shall be rubber gasketed conforming to AWWA C900.

E. The bell shall be integral with the pipe and of equal or greater pressure rating. The bell of pipe and fittings using push-on joints shall have an integral groove to retain the gasket in place.

F. Provide adapters as required to join PVC pipe to pipe, fittings and equipment of other materials.

9.01.04 Fittings for Ductile Iron and PVC Pipe

A. Fittings shall be manufactured of ductile iron, conforming to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53.

B. All full body (C110/A21.10) fittings shall be pressure rated to 250 psi, minimum. All compact fittings (C153/A21.53) shall be pressure rated to 350 psi, minimum.

C. Fitting joints shall be compatible with the type of pipe in use or specified, e.g., flange fittings for flange pipe and mechanical joint for mechanical joint pipe and push-on joint pipe.

9.01.05 Linings and Coatings for Ductile Iron Pipe and Fittings

A. Interior lining shall be standard thickness cement mortar lining and bituminous seal coat, conforming to ANSI/AWWA C104/A21.4.

B. Exterior coating for buried pipe and fittings shall be a petroleum asphaltic coating in accordance with ANSI/AWWA C110/A21.10.

C. All exposed pipe and fittings shall be painted with a three coat system. The first coat shall be primer, 2.5-3.5 mil Dry Film Thickness (DFT) Tnemec Series 135 ChemBuild or approved equal; the intermediate coat shall be 4.0-10.0 mil DFT Tnemec Color Hi-Build Epoxoline II Series N69 or approved equal, and the final coat shall be 2.0-3.0 mil DFT Tnemec EnduraShield Series 73 or approved equal. The final coat paint color shall be as selected by the blue as approved by the City.

9.01.06 Joints for Ductile Iron Pipe and Fittings

A. Mechanical and push-on joints shall be rubber gasketed, conforming to ANSI/AWWA C111/A21.11. Mechanical joint bolts and nuts shall conform to ASTM A307, Grade B. Ductile iron glands shall be provided with ductile iron pipe.

B. Lubricants other than that furnished by the pipe manufacturer with the pipe shall not be used.

9.01.07 PVC Pressure Pipe Joints

A. Joints shall be rubber gasketed conforming to AWWA C900.

B. The bell shall be integral with the pipe and of equal or greater pressure rating. The bell of pipe and fittings using push-on joints shall have an integral groove to retain the gasket in place.

C. Provide adapters as required to join PVC pipe to pipe, fittings and equipment of other materials.

9.01.08 Restrained Joints for Ductile Iron Pipe, Valves, and Fittings

A. Restrained joints for ductile iron pipe bell joints shall be as manufactured by American D.I. Pipe, EBAA Iron, Inc., Sigma, Smith Blair, Star, or U.S. Pipe per the List of Approved Products contained in Appendix B of this Handbook.

B. Restrained joints for ductile iron pipe, valve, and fitting mechanical joints shall be as manufactured by EBAA Iron, Inc., Sigma, Smith Blair, Star, or Tyler Union per the List of Approved Products contained in Appendix B of this Handbook.

C. Pipe joints shall be restrained upstream and downstream of fittings in accordance with the manufacturer's requirements or the table shown in the Drawings, whichever is greater.

9.01.09 Restrained Joints for PVC Pressure Pipe

A. Restrained joints for PVC pipe mechanical joints shall be as manufactured by EBAA Iron, Inc., Sigma, Smith Blair, Star, or Tyler Union per the List of Approved Products contained in Appendix B of this Handbook

B. Restrained joints for PVC pipe push on joints shall be as manufactured by EBAA Iron, Inc., Sigma, Smith Blair, or Star per the List of Approved Products contained in Appendix B of this Handbook

C. Pipe joints shall be restrained upstream and downstream of fittings in accordance with the manufacturer's requirements or the table shown in the Drawings, whichever is greater.

9.01.10 Service Lines

A. Polyethylene pipe and tubing used for service lines ½-3 inch diameter shall be purple polyethylene in accordance with AWWA C901, standard code designation PE 4710, SDR 9 (outside diameter based dimension ratio), 250 psi. Pipe and fittings shall be NSF approved for the usage to which they are to be applied.

B. Joints in SDR-PR PE pipe shall be butt heat fusion or socket heat fusion type.

C. Fittings shall be manufactured of the same material as the pipe and shall be of the same DR.

D. Provide adapters as required to join PE pipe-to-pipe, fittings and equipment of other materials.

9.01.11 Service Saddles

Service saddles shall meet the requirements of AWWA C800 and shall consist of epoxy coated ductile iron bodies in accordance with ASTM A536, with double stainless steel straps, bolts, washers and nuts. Stainless steel shall be Type 304, and nuts are to be Teflon coated. The ductile iron body is to be fusion bonded nylon coated, minimum thickness 12 mils, outlet of saddle is to have NPT threads.

9.01.12 Tapping Sleeves

Tapping sleeves are to be 18-8 type 304 stainless steel and stainless steel outlet.

9.02 VALVES

9.02.01 General Valve Requirements

A. Where required for satisfactory operation of valves, provide valve operators, extension stems, stem guides, cast iron valve boxes, floor boxes, handwheels, operator stands, position indicators, and other valve appurtenances. Extension stems shall be complete with guide bearings, wrench nut, and tee handle wrench. All machinery stuffing boxes shall be packed with material selected for the service intended. Maintain all packing until final acceptance by the City.

B. Extension stems shall be provided for all valves in buried locations and in other locations where indicated on the Drawings. Extension stems shall be fabricated from solid steel shafting not smaller in diameter than the stem of the valve or from galvanized steel pipe having an internal diameter not smaller than the diameter of the valve stem. Stem couplings shall be both threaded and keyed to the coupled stems and shall be of standard design and construction. Pipe couplings will not be acceptable.

C. Stems for buried valves shall extend to within 6 inches of the surface of the ground. Each extension stem shall be connected to the valve operator with a suitable universal joint type coupling. All connections shall be pinned. Each extension stem shall be provided with spacers which will center the stem in a valve box having an inside diameter of approximately 5 inches, and shall be equipped with a standard AWWA wrench nut as described in AWWA C500, except where handwheels are indicated.

D. Valves on reclaimed water mains that are 14" and smaller shall be gate valves, and valves on reclaimed water mains larger than 14" shall be butterfly valves.

E. At each valve adjacent to the valve box, provide 2 inch schedule 80 PVC riser, female adapter coupling, and 2 inch brass plug with recessed nut to accommodate locate wires.

9.02.02 Linings and Coatings for Valves

A. Exterior coating on buried valves shall be rust inhibiting epoxy primer, followed by a coal tar epoxy, total minimum dry film thickness of 16 mils, applied at the factory. Exterior coating of exposed valves shall be factory applied rust inhibiting epoxy primer, minimum 3 mils dry film thickness.

B. After installation, exterior surfaces of above grade valves or valves installed in vaults shall be painted with a two coat system. The first coat (intermediate coat) shall be 4.0-10.0 mil DFT Tnemec Color Hi-Build Epoxoline II Series N69 or approved equal, and the final coat shall be 2.0-3.0 mil DFT Tnemec EnduraShield Series 73 or approved equal. The final coat paint color shall be as purple as approved by the City.

C. The interior of valves with a cast iron or ductile iron body shall be coated with an epoxy protective coating meeting NSF International Standard 61 and AWWA C550.

9.02.03 Gate Valves

A. Standard gate valves 2½ inches and smaller shall be Class 150 bronze gate valves.

B. All gate valves 3 inches to 12 inches shall be resilient seat gate valves. Such valves shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C-515, latest revision, and in accordance with the following Specifications. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the connecting pipe.

C. The valve body, bonnet, and bonnet cover shall be ductile iron. All ferrous surface inside and outside shall have a fusion-bonded epoxy coating. A 2 inch wrench nut shall be provided for operating the valve. All valves are to be tested in strict accordance with AWWA C-515. The valve shall be operated opening counterclockwise.

D. The valves shall be non-rising stem with the stem made of cast, forged, or rolled bronze as specified in AWWA C-515. Two stem seals shall be provided and shall be of the O-ring type. The stem nut must be independent of the gate.

E. The resilient sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

F. The height of the valve and its supporting foundation shall conform to the height of the connecting pipe. All gate valves 12 inches and smaller shall be set in a vertical position.

9.02.04 Tapping Valves

Tapping valves shall be resilient seated gate valves and shall conform to the requirements of AWWA C509.

9.02.05 Butterfly Valves

A. Butterfly valves shall meet or exceed the design strength, testing and performance requirements of AWWA C504, Class 150, short body valves.

B. The valve body materials shall be epoxy coated inside and out per AWWA C550. The valve body shall be constructed of close grain cast iron per ASTM A126, Class B or equivalent material. All retaining segments and adjusting devices shall be of corrosion resistant material. Valves shall have the manufacturer's name and valve rating cast in the body.

C. Valve seats shall be EPDM (ethylene propylene diene terpolymer). Valve seats shall be field adjustable and replaceable without dismounting operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of corrosion resistant material. Valve seats shall be designed to be leak-tight in both directions at differential pressures up to, and including, the rated pressure of the valve class.

D. Valve disc shall be designed to withstand full differential pressures across the closed valve disc without exceeding a stress level equivalent to one fifth of the tensile strength of the material.

E. The valve shaft shall be turned, ground and polished constructed of 18-8 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft shall be of either a one-piece unit extending full size through the value disc and valve bearing or it may be of a stub shaft design.

F. Actuators shall be designed for input torques based on 150 psi valve pressure and 16 ft/s velocity with a maximum input of 80 ft-lb on 2” nuts and shall withstand 250 ft-lbs. The valve actuators shall conform to the requirements of AWWA standard specifications for “Rubber Seated Butterfly Valves, Designation C504”, as applicable. The rated torque capability of each actuator shall be sufficient to seat, unseat, and rigidly hold, in any intermediate position, the valve disc it controls.

G. The valves shall open left or counterclockwise and a ground level position indicator and extension stem / shaft for the 2” nut shall be provided for buried valves.

9.02.06 Air Release Valves

A. Air release valves along the below grade water transmission main shall be single body combination air release valves designed to release large quantities of air at start up, admit air on shut down and release air in operation. All parts shall be NSF 61 certified.

B. Air release valves shall be made of a stainless steel body, foamed polypropylene float, NBR 70 O-ring and stainless steel base.

C. Air release valves shall be capable of withstanding operating pressures of 150 psi.

9.02.07 Corporation Stops

Corporation stops shall be 1 inch, 1½ inch or 2 inch brass ball type, equipped with connections suitable for service piping. Conformance with AWWA C800 and C901 is required.

9.02.08 Curb Stops

Curb stops shall be manufactured of 85-5-5-5 bronze conforming to ASTM B62. Conformance with AWWA C800 and C901 Is required. Curb stops at meters shall be sized to match the meter size.

9.02.09 Valve Boxes

A. All buried valves shall be provided with adjustable valve boxes approximately 5 inches in diameter and shall be heavy duty traffic rated.

B. Valve boxes shall be cast iron and shall be Screw Type. Valve box lids shall be cast iron H-20 load rated and shall be lockable.

C. Valve boxes shall be of sufficient length to operate all valves buried in the ground. Valve boxes shall consist of base, center section, and top section with cover. All valve box extensions shall be cast iron.

D. All valve box covers shall be painted with a three coat system. The first coat shall be primer, 2.5-3.5 mil Dry Film Thickness (DFT) Tnemec Series 135 ChemBuild or approved equal; the intermediate coat shall be 4.0-10.0 mil DFT Tnemec Color Hi-Build Epoxoline II Series N69 or approved equal, and the final coat shall be 2.0-3.0 mil DFT Tnemec EnduraShield Series 73 or approved equal. The final coat paint color shall be purple as approved by the City.

9.02.10 Curb Boxes

Boxes for curb stops shall be manufactured of heavy cast iron and shall be of the telescopic type with a tar base enamel coating inside and outside. Base of curb boxes shall be Minneapolis type. Covers for curb boxes shall be marked "Reclaimed Water".

9.02.11 ARV Enclosures

Enclosures for air release valves shall be polyethylene with stainless steel hardware, and shall be provided with a tamper proof locking device. Enclosure color shall be purple.

9.02.12 Line Stops

A. Line stops shall consist of a line stop fitting, stopping plug/valve, blind flange for installation after stop is completed, and 1-inch equalization/purge fitting. The line stop fitting shall be 18-8 type 304 stainless steel. All hardware and accessories shall be 304 stainless steel. The blind flange shall be type 304 stainless steel.

B. Provide additional pipe restraining in the vicinity of the line stop for preventing pipe movement due to any unbalanced forces created by the line stop and subsequent cutting and removal of existing pipe adjacent to any line stop.

9.03 RECLAIMED WATER MAIN IDENTIFICATION AND LOCATE DEVICES

9.03.01 Pipeline Identification Tape

Identification tape shall be an inert plastic film specifically formulated for prolonged underground use. Minimum thickness 4 mils, width 6 inches, letter size 1 inch. Lettering shall be continuous. Tape shall be the standard product of a manufacturer regularly engaged in the supply of this tape. Provide tape with adhesive backing for attachment to pipe. Identification tape shall be color coded purple with black or yellow lettering "RECLAIMED WATER MAIN".

9.03.02 Pipeline Warning Tape

Warning tape shall be 6 inch wide vinyl continuous tape, for identification and warning purposes. It shall be color coded blue with black or yellow lettering “CAUTION: RECLAIMED WATER MAIN BURIED BELOW”.

9.03.03 Locating Wire and Tracer Wire

A. Locating wire shall be color-coded 10 gage continuous insulated wire. Color coding shall be purple.

B. Tracer wire shall be color-coded 10 gauge continuous insulated wire, with HDPE jacket (min. thickness of 45 mils) specifically manufactured for use in horizontal directional drill installations. The color of the wire jacket shall be purple.

9.03.04 Electronic Marker Balls

A. Marker balls shall consist of a passive device capable of reflecting a specifically designated repulse frequency tuned to the utility being installed.

B. Balls shall be four inches in diameter with a high density polyethylene shell and shall be color coded purple (reclaimed water).

9.04 GENERAL INSTALLATION REQUIREMENTS

9.04.01 General

A. All lengths of pipe shall be dimensioned accurately to measurements established at the site, and shall be worked into place without springing or forcing.

B. Cut all pipe and drill all holes that may be necessary. Cut sections of pipe shall be reamed or filed to remove all burrs. The pipe interior and joints shall be thoroughly cleaned before being installed and kept clean during construction.

C. All changes in direction shall be made with fittings or approved joint deflection. Bending of pipe, except polyethylene pipe, is prohibited. Joint deflection shall not exceed 75 percent of the manufacturer's recommended maximum deflection.

D. Any transition from one pipe size to another shall be made with a reducing fitting. Reducing bushings are prohibited except where specifically indicated on the Drawings or approved by the City.

E. Make adequate provision for expansion and contraction of piping.

F. Installed piping systems shall be temporarily plugged at the end of each day's work, or other interruption to progress on a given line. Plugs installed for pressure testing shall be blind flanges fully secured and blocked to withstand the test pressure. Where plugging is required because of contract division or phasing for later connection, the ends of such lines shall be equipped with a permanent type plug or blind flange. Installation or removal of such plugging shall be considered incidental to the work.

G. Pipe joints shall be restrained upstream and downstream of fittings in accordance with the manufacturer's requirements or the table shown in the Standard Construction Details, whichever is greater. Valves are to be restrained on each side of the valve at the connection to adjoining pipe.

H. Pipeline installation including separation of non-potable and potable water lines, trenching, bedding and backfilling and compaction shall be in accordance with Chapters 4 and 5 of this Handbook.

9.04.02 Buried and Exposed Valves

A. Buried valves 6 inch diameter and larger shall be set on a foundation of solid concrete or stone not less than 8 inches thick nor less than one cubic foot in volume. Foundations shall be set on firmly compacted ground. Valves are to be restrained on each side of the valve at the connection to adjoining pipe.

B. The height of the valve and its supporting foundation shall conform to the height of the connecting pipe. Valves shall be set in a vertical position, except where indicated herein or as determined in the field to require a horizontal installation as determined by the City. Where valves are required to be installed in a horizontal position, provide with a bevel gear side actuator.

C. Exposed valves shall be installed in a vertical position wherever possible. Unless otherwise indicated or directed by the City, valve stems shall never be below a horizontal position.

D. Open and close each valve observing full operation prior to installing successive lengths of pipe.

E. At each valve adjacent to the valve box, provide 2 inch schedule 80 PVC riser, female adapter coupling, and 2 inch brass plug with recessed nut to accommodate locate wires.

9.04.03 Wet Taps

All wet taps of existing water lines are to be coordinated with the City.

9.04.04 Valve Boxes and Curb Boxes

A. Boxes shall rest on the valve and shall be adjusted so that the cover may be set flush with paving; in areas without paving, set the cover as directed by the Engineer and as approved by the City. Boxes shall be set to allow equal movement above and below finish grade.

B. The base of the box shall be centered over the valve, and the top of the base section shall be approximately on line with the nut on top of the valve stem. The entire assembly shall be plumb.

9.04.05 Line Stops

A. All line stops and shut downs of existing water lines are to be coordinated with the City. The City reserves the right to require connections to be performed during periods of low flow (midnight to 6:00 a.m.) in order to minimize service disruption to existing customers. The installation of line stopping devices on pressure mains may be required by the city at its discretion to minimize interruption to existing utility customers.

B. Line stops shall be completed while the water system is pressurized.

C. A concrete encasement shall be poured for pipe support at the point of line stop.

D. Provide additional pipe restraining in the vicinity of the line stop for preventing pipe movement due to any unbalanced forces created by the line stop.

9.04.06 Electronic Marker Balls

A. Electronic markers shall be furnished and installed so that a marker will be located at one hundred foot (100') intervals along the pipeline length. Markers shall also be placed at all valves, changes in direction, tees, or other points of connection.

B. Marker balls shall be placed in a position directly above the pipe and hand backfilled one foot above the ball to prevent damage or movement during subsequent backfilling. Depth of burial shall not be less than 1.5 feet nor more than 2 feet.

9.04.07 Identification and Warning Tape

A. Install identification tape on all PVC and D.I. pipelines. Place tape from joint to joint on every section of pipe. Place tape as follows:

1. 2 inch through 8 inch diameter pipe - center along top half of pipe
2. 10 inch through 18 inch diameter pipe - place along both sides of the top half of pipe
3. 20 inch diameter and larger pipe - place on both sides of top half of pipe with a third strip centered along top half of pipe

B. Install warning tape along all pipelines. Install 2 feet above pipe, minimum of 1 foot below grade.

9.04.08 Locator Wire and Tracer Wire

A. Install locate wire and electronic marker balls along all PVC and D.I. pipe and tracer wire along all HDPE pipe per the standard construction detail.

B. Test the locate wire for continuity and submit report documenting the continuity testing. Repair or replace locate wire at failed test locations as directed by the City.

C. Install two tracer wires along polyethylene pipe prior to pulling through bore hole. Tape wire to pipe every 5 feet minimum along the pipeline.

D. After pulling pipe, clean exposed ends for installation of fittings, test tracer wire for continuity.

9.05 TESTING

9.05.01 Testing General Requirements

A. The constructed system shall be thoroughly cleaned of all material, sand, grit, gravel, stones, fluids, construction debris, and other items that can generally be construed as foreign material and that would not be found in a properly cleaned system. Clean the installed mains by conducting flushing. In cases where the City requires pigging, pig all lines, using new pigs, with launching and extraction points determined by the contractor (for larger lines that have a butterfly valve, pig before the valve is installed). All pigging operations shall be witnessed by the city. After pigging, the main is to be flushed

B. Provide all temporary jumpers and taps for connecting the water source to the mains to be pigged and flushed. Provide proposed tap locations to the City for approval prior to placement of taps. Potable water provided by the City shall be metered and all meter and usage fees shall be paid by the Contractor.

C. Provide all necessary test pumping equipment, water, water meters, pressure gauges, and other equipment, material and facilities required for all hydrostatic, leakage, and pressure testing.

D. The Contractor shall notify the City's designated site inspector who shall coordinate with city personnel at the water treatment plant at least 2 business days prior to beginning flushing of the mains and prior to the commencement of pressure testing.

E. Hydrostatic testing shall be in accordance with AWWA C600 (Ductile iron reclaimed water mains), AWWA C605 (PVC reclaimed water mains).

F. All tests shall be made in the presence of the City.

G. All defects in piping systems shall be repaired and/or replaced and retested until acceptable. Repairs shall be made to the standard of quality specified for the entire system.

H. Sections of the system may be tested separately, but any defect which may develop in a section previously tested and accepted shall be promptly corrected and retested. Pressure tests shall be made between valves to demonstrate ability of valves to sustain pressure.

I. Tests for any exposed piping shall be made before covering and insulation is placed.

J. The pressure and leakage test for buried piping shall be made after all jointing operations are completed and restraints have been in place at least seven days. Lines tested before backfill is in place shall be retested after compacted backfill is placed.

K. All service connections to reclaimed water mains shall be completed prior to testing.

L. Sections of piping between valves and other short sections of line may be isolated for testing. If shorter sections are tested, test plugs or bulkheads required at the ends of the test section shall be furnished and installed by Contractor, together with all anchors, braces, and other devices required to withstand the hydrostatic pressure without imposing any thrust on the pipe line. Contractor shall be solely responsible for any damage that results from the failure of test plugs or supports.

M. All items including valves and controls shall be given a thorough test. The entire system shall be operated for two days to prove compatibility of equipment and to achieve proper adjustment for operation. Valves, pipes, tanks, and other items that are non-operating or occasional-operating shall be tested for ability to meet design criteria.

9.05.02 Pressure and Leakage Testing (PVC and DI Mains)

A. Piping shall be slowly filled with water and all air expelled. Care shall be taken that all air valves are installed and open in the section being filled, and that the rate of filling does not exceed the venting capacity of the air valves.

B. Apply hydrostatic test pressure of 150 psi for 10 minutes and for such additional period necessary for the Engineer to complete the inspection of the line under test. Do not exceed pipe manufacturer's suggested time duration at the test pressure. If defects are noted, repairs shall be made and the test repeated until all parts of the line withstand the test pressure.

C. Apply leakage test pressure of 150 psi. Maintain pressure at a maximum variation of 5 percent during the entire leakage test. The duration of the leakage test shall be two hours minimum, and for such additional time necessary for the City to complete inspection of the section of line under test. Leakage measurements shall not be started until a constant test pressure has been established. The line leakage shall be measured by means of a water meter installed on the supply side of the pressure pump.

D. No leakage is allowed in exposed piping, buried piping with flanged, threaded, or welded joints or buried non-potable piping in conflict with potable water lines.

E. The testing allowance shall be defined as the quantity of water that must be applied to the pipe section being tested to maintain a pressure within 5 psi of the specified hydrostatic test pressure. No installation will be accepted if the quantity of makeup water is greater than that determined by the following formula:

$$L = \frac{S \times D \times P^{0.5}}{148{,}000}$$

L = Testing Allowance (quantity of makeup water) in gallons per hour

S = Length of line being tested, in feet

D = Nominal internal diameter (in inches) of the pipe.

P = The average test pressure during the pressure test, in pounds per square inch (gauge) This actual pressure shall be determined by finding the difference between the average elevation of all tested pipe joints and the elevation of the pressure gauge and adding the difference in elevation head to the authorized test pressure.

F. All leaks shall be repaired by removing and replacing defective pipe and joints with pipe and joints free of defects, after which the lines shall be retested. Such repair and retesting shall be done until the lines pass the specified retest.

G. All apparent leaks discovered within one year from the date of final acceptance of the work by the City shall be located and repaired by Contractor, regardless of the total line leakage rate.

9.05.03 Placing the Reclaimed Water Main Into Service

The reclaimed water main can only be placed into service approval by the City.

COMMON DETAILS

WASTEWATER COLLECTION AND LIFT STATIONS

RECLAIMED WATER DISTRIBUTION

OVERALL CONSTRUCTION GENERAL NOTES

1. THE CITY'S PUBLIC UTILITIES DEPARTMENT (386-775-5447) SHALL BE GIVEN A MINIMUM OF 2 BUSINESS DAYS ADVANCE NOTICE (NOT INCLUDING HOLIDAYS OR WEEKENDS) PRIOR TO BEGINNING ANY CITY UTILITY CONSTRUCTION. ALL TESTING, PROPOSED CONNECTIONS (SUCH AS WET TAPS AND LINE STOPS), WATER SAMPLING, INSTALLATION OF FIRE HYDRANTS, THRUST COLLARS AND RESTRAINTS, VALVE PADS, HYDRANT SHEAR PADS, AND METER BOXES AND SERVICES, ARE TO BE WITNESSED BY THE CITY AND REQUIRE A MINIMUM OF 2 BUSINESS DAYS ADVANCE NOTICE. WET TAPS AND LINE STOPS SHALL BE SCHEDULED TO COMMENCE BETWEEN 8:00 A.M. AND 2:00 P.M. ON THE SCHEDULED DAY.

2. ALL CONSTRUCTION CONTRACTORS SHALL BE LICENSED BY THE STATE OF FLORIDA AND REGISTERED WITH THE CITY. EXCEPT FOR LIFT STATIONS, CONSTRUCTION OF ALL UTILITIES SHALL BE CONSTRUCTED BY A CERTIFIED GENERAL CONTRACTOR OR A CERTIFIED UNDERGROUND UTILITY AND EXCAVATION CONTRACTOR. LIFT STATIONS SHALL BE CONSTRUCTED BY A CERTIFIED GENERAL CONTRACTOR.

3. ALL TESTING REQUIRED BY THE CITY SHALL BE PAID FOR BY THE CONTRACTOR.

4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LAYING OUT THE WORK, SHALL PROTECT AND PRESERVE THE ESTABLISHED REFERENCE POINTS AND PROPERTY MONUMENTS. ALL BENCHMARKS, PROPERTY CORNERS, AND OTHER SURVEY MONUMENTS THAT ARE LOST, DAMAGED, OR DESTROYED SHALL BE REPLACED BY A LICENSED LAND SURVEYOR AT THE CONTRACTOR'S EXPENSE.

5. FOR UTILITIES AND LIFT STATIONS TO BE OWNED AND OPERATED BY THE CITY, SUBMIT SHOP DRAWINGS (PDF FORMAT) TO THE CITY FOR REVIEW AND APPROVAL. THE CONTRACTOR'S RESPONSIBILITY FOR ERRORS AND OMISSIONS IN SUBMITTALS IS NOT RELIEVED BY THE CITY'S REVIEW OF SUBMITTALS. SHOP DRAWINGS ARE REQUIRED FOR ALL MATERIALS INCLUDING BUT NOT LIMITED TO PIPING, VALVES, FITTINGS, PUMPS, PRECAST STRUCTURES, MANHOLE COVERS, HATCHES, FENCING, GATES, AND ELECTRICAL EQUIPMENT.

6. THE ENTIRE PROJECT SITE SHALL BE THOROUGHLY CLEANED AT THE COMPLETION OF THE WORK. CLEAN ALL INSTALLED PIPELINES, STRUCTURES, SIDEWALKS, PAVED AREAS, ACCUMULATED SILT IN PONDS, PLUS ALL ADJACENT AREAS AFFECTED BY CONSTRUCTION, AS DIRECTED BY THE CITY. EQUIPMENT TO CLEAN THESE SURFACES SHALL BE SUBJECT TO APPROVAL BY THE CITY.

7. ALL MATERIALS AND EQUIPMENT INCORPORATED INTO THE PROJECT SHALL BE OF GOOD QUALITY AND NEW, EXCEPT WHERE RELOCATIONS OF CERTAIN MATERIALS HAVE BEEN SPECIFICALLY APPROVED BY THE CITY.

8. ALL PRESSURE MAINS SHALL HAVE A MINIMUM COVER OF 36 INCHES (3.0 FEET) AND A MAXIMUM DEPTH OF 48 INCHES (4.0 FEET) FROM FINAL GRADE EXCEPT AT LOCATIONS OF UTILITY CROSSINGS OR WITH SPECIAL APPROVAL WHEN IT IS DETERMINED TO BE IN THE BEST INTEREST OF THE CITY.

9. UPON CONSTRUCTION COMPLETION AND ACCEPTANCE OF THE SYSTEM, IT SHALL BE THE DESIGN ENGINEER'S RESPONSIBILITY TO ENSURE THAT THE SYSTEM IS PROPERLY CERTIFIED AND ACCEPTED BY THE DEPARTMENT OF HEALTH (WATER MAINS) AND FLORIDA DEPT. OF ENVIRONMENTAL PROTECTION (FORCE MAINS, SANITARY SEWER, AND LIFT STATIONS).

10. AS-BUILT DRAWINGS OF UTILITIES TO BE OWNED AND OPERATED BY THE CITY SHALL BE PROVIDED BY THE CONTRACTOR TO THE CITY AT LEAST TWO WEEKS PRIOR TO FINAL INSPECTION. ALL AS-BUILT DATA SHALL BE PROVIDED BY A FLORIDA LICENSED SURVEYOR, SIGNED, SEALED AND DATED BY THE RESPONSIBLE PARTY. REFER TO THE CITY UTILITIES STANDARDS HANDBOOK FOR ADDITIONAL AS-BUILT DRAWING REQUIREMENTS.

11. PROVIDE ALL TEMPORARY JUMPERS AND TAPS FOR CONNECTING THE WATER SOURCE TO THE MAINS TO BE PIGGED AND FLUSHED. PROVIDE PROPOSED TAP LOCATIONS TO THE CITY FOR APPROVAL PRIOR TO PLACEMENT OF TAPS. POTABLE WATER PROVIDED BY THE CITY SHALL BE METERED AND ALL METER AND USAGE FEES SHALL BE PAID BY THE CONTRACTOR.

12. THE CONSTRUCTED SYSTEM SHALL BE THOROUGHLY CLEANED OF ALL MATERIAL, SAND, GRIT, GRAVEL, STONES, FLUIDS, CONSTRUCTION DEBRIS, AND OTHER ITEMS THAT CAN GENERALLY BE CONSTRUED AS FOREIGN MATERIAL AND THAT WOULD NOT BE FOUND IN A PROPERLY CLEANED SYSTEM. CLEAN THE INSTALLED MAINS BY CONDUCTING FLUSHING. IN CASES WHERE THE CITY REQUIRES PIGGING, PIG ALL LINES, USING NEW PIGS, WITH LAUNCHING AND EXTRACTION POINTS DETERMINED BY THE CONTRACTOR (FOR LARGER LINES THAT HAVE A BUTTERFLY VALVE, PIG BEFORE THE VALVE IS INSTALLED). ALL PIGGING OPERATIONS SHALL BE WITNESSED BY THE CITY. AFTER PIGGING, THE MAIN IS TO BE FLUSHED.

13. PROVIDE ALL NECESSARY TEST PUMPING EQUIPMENT, WATER, WATER METERS, PRESSURE GAUGES, AND OTHER EQUIPMENT, MATERIAL AND FACILITIES REQUIRED FOR ALL HYDROSTATIC, LEAKAGE, AND PRESSURE TESTING.

14. THE CONTRACTOR SHALL NOTIFY THE CITY'S DESIGNATED SITE INSPECTOR WHO SHALL COORDINATE WITH CITY PERSONNEL AT THE WATER TREATMENT PLANT AT LEAST 2 BUSINESS DAYS PRIOR TO BEGINNING FLUSHING OF THE MAINS AND PRIOR TO THE COMMENCEMENT OF PRESSURE TESTING.

15. THE CITY RESERVES THE RIGHT TO REQUIRE CONNECTIONS TO BE PERFORMED DURING PERIODS OF LOW FLOW (MIDNIGHT TO 6:00 A.M.) IN ORDER TO MINIMIZE SERVICE DISRUPTION TO EXISTING CUSTOMERS. THE INSTALLATION OF LINE STOPPING DEVICES ON PRESSURE MAINS MAY BE REQUIRED BY THE CITY AT ITS DISCRETION TO MINIMIZE INTERRUPTION TO EXISTING UTILITY CUSTOMERS.

16. APPLY LEAKAGE TEST PRESSURE OF 150 PSI (WATER MAINS AND RECLAIMED WATER MAINS), 200 PSI (FIRE MAINS), OR 100 PSI (FORCE MAINS). MAINTAIN PRESSURE AT A MAXIMUM VARIATION OF 5 PERCENT DURING THE ENTIRE LEAKAGE TEST. THE DURATION OF THE LEAKAGE TEST SHALL BE TWO HOURS MINIMUM, AND FOR SUCH ADDITIONAL TIME NECESSARY FOR THE CITY TO COMPLETE INSPECTION OF THE SECTION OF LINE UNDER TEST.

17. ALL EXCAVATIONS SHALL BE MADE BY OPEN CUT UNLESS OTHERWISE INDICATED. SLOPE SIDES OF TRENCHES IN ACCORDANCE WITH OSHA REQUIREMENTS.

18. EXCAVATE TRENCHES TO DEPTH INDICATED OR REQUIRED FOR INDICATED FLOW LINES AND INVERT ELEVATIONS. OVER EXCAVATE TRENCHES A MINIMUM OF 2 FEET WHERE EXCAVATIONS OCCUR WITHIN UNSUITABLE SOILS, AND REPLACE OVER EXCAVATED MATERIAL WITH SUITABLE SOILS. DETERMINATION OF SUITABILITY OF SOILS SHALL BE AT THE CITY'S DISCRETION.

19. TRENCH BOTTOMS AND THE BOTTOMS OF ALL STRUCTURES SHALL BE KEPT DRY, COMPACTED, AND STABLE TO A DEPTH TWO FEET BELOW THE BOTTOM OF THE TRENCH OR STRUCTURE.

20. ALL BEDDING, FILL, AND BACKFILL MATERIAL SHALL BE SUITABLE SOILS OR FLOWABLE FILL. GENERALLY, SUITABLE SOILS ARE DEFINED AS ASTM D2487 CLASSIFICATION GW, GP, GM, SM, SW, OR SP. DETERMINATION OF SUITABILITY OF SOILS SHALL BE AT THE CITY'S DISCRETION.

21. THE MINIMUM DENSITY REQUIREMENT (ASTM D1557 OR AASHTO T180) FOR BACKFILL AND FILL SHALL BE AS FOLLOWS: BACKFILL AND FILL UNDER AND WITHIN FIVE (5) FEET OF ROADWAY EDGE OF PAVEMENT OR BACK OF CURB OR UNDER STRUCTURES, SLABS, FOUNDATIONS = 98 PERCENT; BACKFILL AND FILL PLACED WITHIN PUBLIC ROAD RIGHT-OF-WAY AND UTILITY EASEMENTS = 95 PERCENT; BACKFILL AND FILL PLACED WITHIN POND AND ROAD EMBANKMENT = 95 PERCENT; BACKFILL AND FILL PLACED IN ALL OTHER AREAS = 90 PERCENT.

22. THE CONTRACTOR IS RESPONSIBLE FOR ALL TESTING ASSOCIATED WITH CITY UTILITY CONSTRUCTION. THE CONTRACTOR SHALL EMPLOY AND PAY FOR AN INDEPENDENT, APPROVED SOILS AND MATERIALS TESTING LABORATORY TO PERFORM TESTING SERVICES. AS A MINIMUM, TESTING SHALL INCLUDE BEDDING AND BACKFILL MATERIALS AND DENSITY TESTS AND CONCRETE AND ASPHALT PAVING QUALITY CONTROL TESTING. PROVIDE ALL TEST RESULTS TO THE CITY. DENSITY TESTING SHALL CONSIST OF A MINIMUM OF ONE TEST FOR EACH 300 LINEAR FEET OF PIPELINE PER LIFT OF GENERAL BACKFILLING. WHERE LESS THAN 300 LINEAR FEET OF PIPELINE IS INSTALLED, PROVIDE ONE TEST PER LIFT OF BACKFILL, STAGGERED ALONG THE PIPELINE AT LOCATIONS DETERMINED BY THE CITY. CONDUCT A MINIMUM OF ONE TEST FOR EACH 100 SQUARE FEET OR FRACTION THEREOF OF BACKFILL AROUND AND UNDER STRUCTURES, WITH A MINIMUM OF TWO TESTS PER LIFT, AND ONE TEST PER LIFT PER EACH CHANGE IN TYPE OF FILL.

23. EXERCISE CARE IN TRANSPORTING AND HANDLING PIPE, VALVES, AND FITTINGS IN ORDER TO AVOID DAMAGE TO MATERIALS OR COATINGS. LIFTING SHALL BE BY HOIST OR ON SKIDS WHEN HAND LIFTING IS NOT FEASIBLE. DROPPING SHALL NOT BE PERMITTED. STORE PIPE AS RECOMMENDED BY THE MANUFACTURER. DAMAGED PIPE, VALVES, AND FITTINGS SHALL BE REPLACED.

24. PVC PIPE 4" - 30" SHALL CONFORM TO AWWA C900. PIPE SHALL CONFORM TO ASTM D1784, TYPE I, GRADE I, 4000 PSI DESIGN STRESS. PVC PIPE FOR POTABLE WATER MAINS SHALL ALSO BE NATIONAL SANITATION FEDERATION (NSF) APPROVED. PIPE SHALL BE CLASS 235 (DR18) PVC PIPE WITH CAST IRON OUTSIDE DIAMETER (CIOD). PVC PIPE SHALL BE COLOR CODED BLUE (WATER MAINS), PURPLE (RECLAIMED WATER MAINS), OR GREEN (FORCE MAINS) AND STENCILED (0.75-INCH LETTERING ON THE PIPE IN AT LEAST THREE AREAS PER PIPE SECTION) "POTABLE WATER MAIN", "RECLAIMED WATER MAIN", OR "FORCE MAIN" AS APPLICABLE. EACH LENGTH OF PIPE SHALL BEAR THE NAME OR TRADEMARK OF THE MANUFACTURER, THE CLASS OR STRENGTH CLASSIFICATION OF THE PIPE, AND, FOR WATER MAIN PIPE, THE NSF LOGO SHALL BE INCLUDED ON THE MARKINGS.

25. BURIED DUCTILE IRON PIPE SHALL CONFORM WITH ANSI/AWWA C150/A21.50 AND C151/ A21.51, AND SHALL HAVE A MINIMUM WORKING PRESSURE OF 150 PSI. BURIED PIPE SHALL COMPLY WITH THE FOLLOWING PRESSURE CLASS (PC) DESIGNATIONS UNLESS OTHERWISE INDICATED ON THE DRAWINGS: A) 12" DIAMETER AND SMALLER = PC 350; B) 14" THROUGH 24" DIAMETER = PC 250; C) 30" THROUGH 64" DIAMETER = PC 200. REFER TO THE UTILITIES STANDARDS HANDBOOK FOR COATING AND LINING REQUIREMENTS.

26. INSTALL WARNING TAPE, I.D. TAPE, LOCATE WIRE, AND ELECTRONIC MARKER BALLS ALONG ALL PVC AND D.I. PIPE AND TRACER WIRE ALONG ALL HDPE PIPE PER THE STANDARD CONSTRUCTION DETAIL AND THE REQUIREMENTS OF THE CITY UTILITIES STANDARDS HANDBOOK.

27. ALL FITTINGS SHALL BE MANUFACTURED OF DUCTILE IRON, CONFORMING TO ANSI/AWWA C110/A21.10 OR ANSI/AWWA C153/A21.53. ALL COMPACT FITTINGS (C153/A21.53) SHALL BE PRESSURE RATED TO 350 PSI, MINIMUM. REFER TO THE CITY UTILITIES STANDARDS HANDBOOK FOR COATING AND LINING REQUIREMENTS.

28. PIPE JOINTS SHALL BE RESTRAINED UPSTREAM AND DOWNSTREAM OF FITTINGS IN ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS OR THE TABLE SHOWN IN THE STANDARD CONSTRUCTION DETAILS, WHICHEVER IS GREATER. VALVES ARE TO BE RESTRAINED ON EACH SIDE OF THE VALVE AT THE CONNECTION TO ADJOINING PIPE. REFER TO THE CITY UTILITIES STANDARDS HANDBOOK FOR ADDITIONAL REQUIREMENTS AND THE APPROVED PRODUCTS LIST FOR ACCEPTABLE MANUFACTURERS.

29. POLYETHYLENE PIPE AND FITTINGS FOR POTABLE WATER MAINS, RECLAIMED WATER MAINS, OR SEWER FORCE MAIN SHALL BE IN ACCORDANCE WITH AWWA C906, STANDARD CODE DESIGNATION PE 3408 (WATER MAINS), STANDARD CODE DESIGNATION PE 4710 (200 PSI) (RECLAIMED WATER MAINS, AND SEWER FORCE MAIN), DR 11, 160 PSI (PE 3408), 200 PSI (PE 4710). THE PIPE SIZING SHALL BE IN ACCORDANCE WITH DUCTILE IRON PIPE SIZING SYSTEM (DIPS). ALL POLYETHYLENE PIPE SHALL BE BLACK, AND SHALL CONTAIN A CONTINUOUS COLORED STRIPE, 2 INCHES WIDE, LOCATED AT NO GREATER THAN 90 DEGREE INTERVALS AROUND THE PIPE. STRIPE COLOR SHALL BE EITHER BLUE (WATER MAINS), PURPLE (RECLAIMED WATER MAINS), OR GREEN (SANITARY SEWER AND FORCE MAINS).

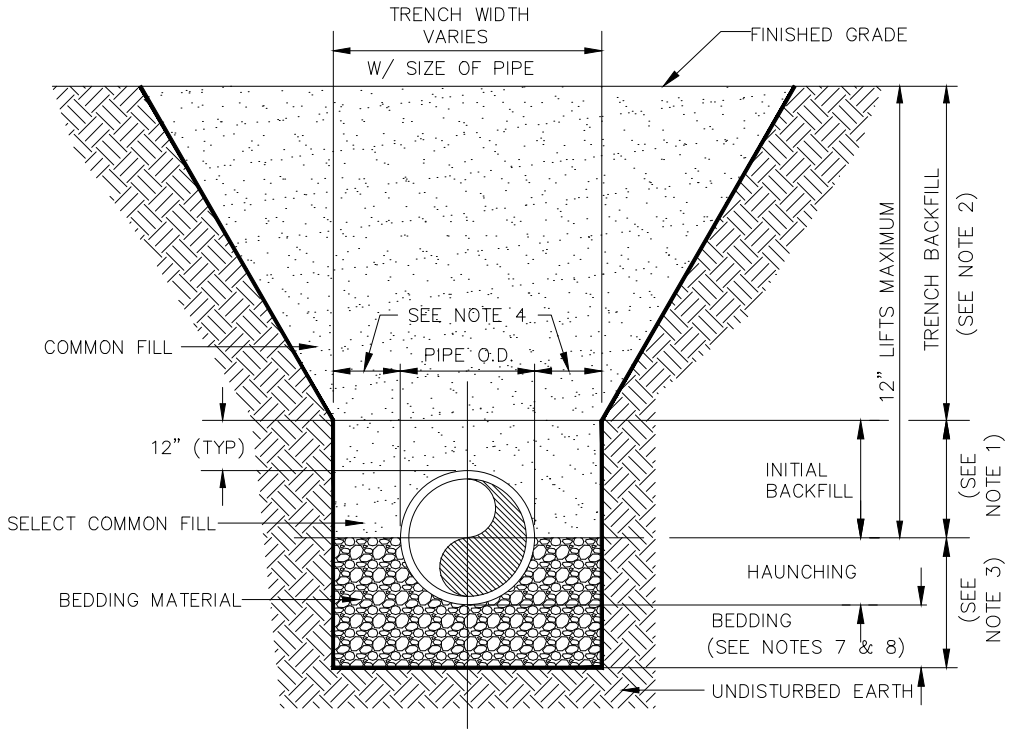
30. POLYETHYLENE PIPE AND TUBING USED FOR SERVICE LINES ½-3 INCH DIAMETER SHALL BE POLYETHYLENE IN ACCORDANCE WITH AWWA C901, STANDARD CODE DESIGNATION PE 4710, SDR 9 (OUTSIDE DIAMETER BASED DIMENSION RATIO), 250 PSI. PIPE AND FITTINGS SHALL BE NSF APPROVED FOR THE USAGE TO WHICH THEY ARE TO BE APPLIED. PIPE AND TUBING SHALL BE COLOR CODED BLUE FOR POTABLE WATER, PURPLE FOR RECLAIMED WATER, AND GREEN FOR SANITARY SEWER.

31. ALONG WATER MAINS AND RECLAIMED WATER MAINS, ALL VALVES 14 INCHES AND SMALLER SHALL BE GATE VALVES UNLESS OTHERWISE APPROVED BY THE CITY AND SHALL CONFORM TO AWWA C509 OR AWWA C515.

32. ALONG WATER MAINS AND RECLAIMED WATER MAINS, VALVES 16" AND LARGER SHALL BE BUTTERFLY VALVES. BUTTERFLY VALVES SHALL MEET OR EXCEED THE DESIGN STRENGTH, TESTING AND PERFORMANCE REQUIREMENTS OF AWWA C504, CLASS 150.

33. TAPPING SLEEVES ARE TO BE 18-8 TYPE 304 STAINLESS STEEL AND STAINLESS STEEL OUTLET. TAPPING VALVES SHALL BE RESILIENT SEATED GATE VALVES AND SHALL CONFORM TO THE REQUIREMENTS OF AWWA C509.

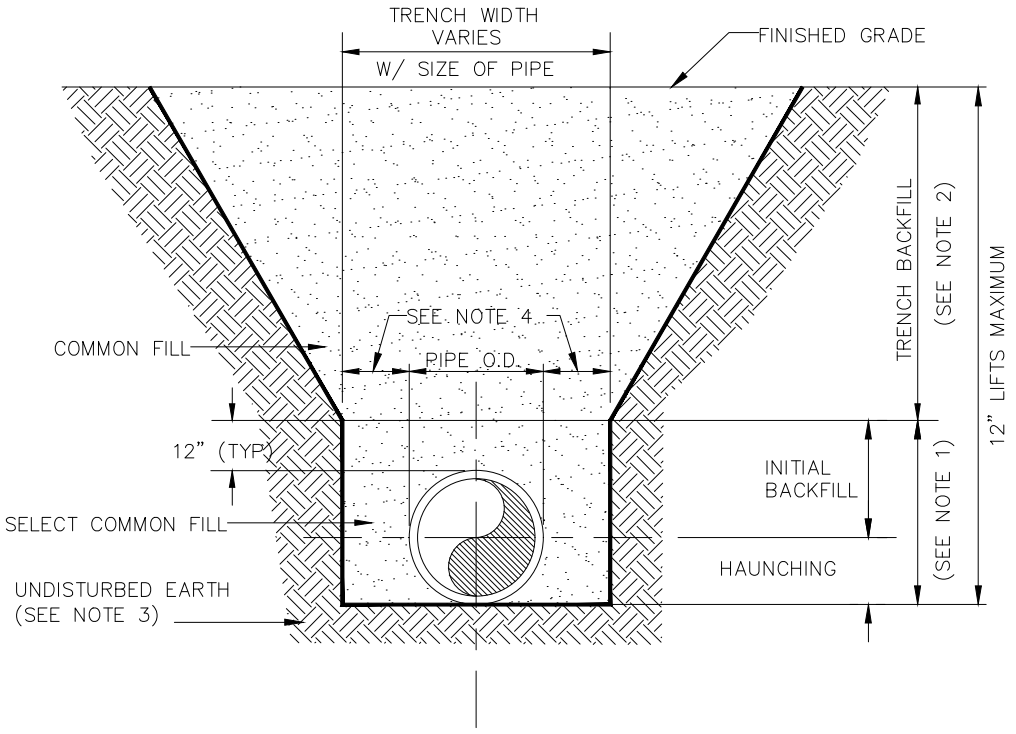
34. SERVICE SADDLES SHALL MEET THE REQUIREMENTS OF AWWA C800 AND SHALL CONSIST OF EPOXY COATED DUCTILE IRON BODIES IN ACCORDANCE WITH ASTM A536, WITH DOUBLE STAINLESS STEEL STRAPS, BOLTS, WASHERS AND NUTS. STAINLESS STEEL SHALL BE TYPE 304, AND NUTS ARE TO BE TEFLON COATED.



NOTES:

1. INITIAL BACKFILL: SELECT COMMON FILL COMPACTED TO 95% (98% UNDER PAVEMENT) OF THE MAXIMUM DENSITY AS PER AASHTO T-180.
2. TRENCH BACKFILL: COMMON FILL COMPACTED TO 95% (98% UNDER PAVEMENT) OF THE MAXIMUM DENSITY AS PER AASHTO T-180.
3. TYPE A BEDDING MATERIAL SHALL CONFORM TO FDOT NO. 57 AGGREGATE.
4. 15" MAX. (12" MIN.) FOR PIPE DIAMETER LESS THAN 24" AND 24" MAX (12" MIN) FOR PIPE DIAMETER 24" AND LARGER.
5. WATER SHALL NOT BE PERMITTED IN THE TRENCH DURING CONSTRUCTION.
6. ALL PIPE TO BE INSTALLED WITH BELL FACING UPSTREAM TO THE DIRECTION OF THE FLOW.
7. BEDDING DEPTH SHALL BE 4" MINIMUM FOR PIPE DIAMETER UP TO 12" AND 6" MINIMUM FOR PIPE DIAMETER 16" AND LARGER.
8. DEPTH FOR REMOVAL OF UNSUITABLE MATERIAL SHALL GOVERN DEPTH OF BEDDING ROCK BELOW THE PIPE. UTILITIES SHALL DETERMINE IN THE FIELD REQUIRED REMOVAL OF UNSUITABLE MATERIAL TO REACH SUITABLE FOUNDATION.
9. FINAL RESTORATION IN IMPROVED AREAS SHALL BE IN COMPLIANCE WITH ALL APPLICABLE REGULATIONS OF GOVERNING AGENCIES. SURFACE RESTORATION WITHIN CITY RIGHT-OF-WAY SHALL COMPLY WITH CITY REQUIREMENTS.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL BEDDING & TRENCHING - TYPE A	DATE: 5/2023 DETAIL NO: C-2



NOTES:

1. INITIAL BACKFILL AND HAUNCHING: SELECT COMMON FILL COMPARED TO 95% (98% UNDER PAVEMENT) OF THE MAXIMUM DENSITY AS PER AASHTO T-180.
2. TRENCH BACKFILL: COMMON FILL COMPACTED TO 95% (98% UNDER PAVEMENT) OF THE MAXIMUM DENSITY AS PER AASHTO T-180.
3. PIPE BEDDING UTILIZING SELECT COMMON FILL OR BEDDING ROCK IN ACCORDANCE WITH TYPE A BEDDING AND TRENCHING DETAIL MAY BE REQUIRED AS DIRECTED BY UTILITIES.
4. 15" MAX. (12" MIN.) FOR PIPE DIAMETER LESS THAN 24" AND 24" MAX (12" MIN) FOR PIPE DIAMETER 24" AND LARGER.
5. WATER SHALL NOT BE PERMITTED IN THE TRENCH DURING CONSTRUCTION.
6. ALL PIPE TO BE INSTALLED WITH BELL FACING UPSTREAM TO THE DIRECTION OF THE FLOW.
7. FINAL RESTORATION IN IMPROVED AREAS SHALL BE IN COMPLIANCE WITH ALL APPLICABLE REGULATIONS OF GOVERNING AGENCIES. SURFACE RESTORATION WITHIN CITY RIGHT-OF-WAY SHALL COMPLY WITH CITY REQUIREMENTS.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL BEDDING & TRENCHING - TYPE B	DATE: 5/2023 DETAIL NO: C-3

PROPOSED UTILITY	MINIMUM HORIZONTAL AND VERTICAL SEPARATION REQUIREMENTS									
	POTABLE WATER		RECLAIMED WATER		SANITARY SEWER FORCE MAIN		SANITARY SEWER GRAVITY MAIN		STORM SEWER OR VACUUM TYPE SANITARY SEWER	
	HORIZONTAL	VERTICAL	HORIZONTAL	VERTICAL	HORIZONTAL	VERTICAL	HORIZONTAL	VERTICAL	HORIZONTAL	VERTICAL
POTABLE WATER	–	–	3'	12"	6'	12"	6' **	6" ABOVE 12" BELOW	3'	6" ABOVE 12" BELOW
RECLAIMED WATER	3'	12"	--	--	3'	12"	3'	12"	--	–
SANITARY SEWER FORCE MAIN	6'	12"	3'	12"	–	–	–	--	--	–
SANITARY SEWER GRAVITY MAIN	6' **	6" ABOVE 12" BELOW	3'	12"	–	–	–	--	--	–
FIRE HYDRANT W/UNDERGROUND DRAINS	–	–	3'	--	6'	–	6'	--	3'	–
STORM SEWER OR VACUUM TYPE SANITARY SEWER	3'	6" ABOVE 12" BELOW	--	--	–	–	–	--	--	–

1. THE TABLE REPRESENTS THE MINIMUM SEPARATION REQUIREMENTS AS DESCRIBED IN FDEP RULES PER THE FLORIDA ADMINISTRATION CODE (F.A.C.). THESE SEPARATION REQUIREMENTS SHALL APPLY BETWEEN NEWLY PROPOSED UTILITY LINES AND EXISTING OR PROPOSED UTILITY LINES.

2. FOR THE PURPOSE OF THIS TABLE RECLAIMED WATER SHALL MEAN UNRESTRICTED PUBLIC ACCESS REUSE WATER AS DEFINED BY F.A.C. 62-610. OTHER TYPES OF RECLAIMED WATER ARE CONSIDERED RAW SEWAGE AND SEPARATION LISTED FOR SANITARY SEWER SHALL APPLY.

3. ALL SEPARATION DISTANCES ARE FROM OUTSIDE OF PIPE TO OUTSIDE OF PIPE.

4. THE MINIMUM HORIZONTAL SEPARATION BETWEEN POTABLE WATER AND GRAVITY SANITARY SEWER MAY BE REDUCED TO 3 FEET IF THE BOTTOM OF THE WATER MAIN IS LOCATED AT LEAST 6 INCHES ABOVE THE TOP OF THE GRAVITY SEWER.

5. AT UTILITY CROSSINGS ONE FULL LENGTH OF WATER MAIN SHALL BE CENTERED ABOVE OR BELOW THE OTHER UTILITY PIPELINE MAXIMIZING THE SEPARATION OF PIPELINE JOINTS. ALTERNATIVELY, WATER MAIN JOINTS MUST BE:
   A. AT LEAST 3' FROM ALL JOINTS IN VACUUM TYPE SANITARY SEWERS, STORM SEWERS, STORM WATER FORCE MAINS, OR UNRESTRICTED PUBLIC ACCESS RECLAIMED WATER.
   B. AT LEAST 6' FROM ALL JOINTS IN GRAVITY OR PRESSURE SANITARY SEWERS. WASTEWATER FORCE MAINS, AND ALL OTHER TYPES OF RECLAIMED WATER.

6. NO WATER PIPE SHALL PASS THROUGH OR BE CONSTRUCTED TOUCHING ANY PART OF A SANITARY MANHOLE OR STORM SEWER MANHOLE OR INLET STRUCTURE.

7. NEW OR RELOCATED WATER MAINS AND FIRE HYDRANTS WITH UNDERGROUND DRAINS MUST BE AT LEAST 10 FEET FROM ANY EXISTING OR PROPOSED "ON-SITE SEWAGE TREATMENT SYSTEM" (OSTADS) AS DEFINED IN SECTION 381.00659(2), F.S., AND RULE 64E-6.002 F.A.C. EXAMPLES OF OSTADS INCLUDE SEPTIC TANKS, DRAIN FIELDS, AND GREASE TRAPS.

8. THE FOLLOWING ARE ACCEPTABLE ALTERNATIVE CONSTRUCTION VARIANCES WHERE IT IS NOT POSSIBLE TO MEET THE SEPARATION REQUIREMENTS, AND ARE ONLY TO BE IMPLEMENTED UPON RECEIPT OF EXPRESSED WRITTEN CONSENT FROM THE ENGINEER AND APPROVAL FROM FDEP ON A CASE BY CASE BASIS. IMPLEMENTATION OF THESE MEASURES WITHOUT THE EXPRESSED WRITTEN CONSENT OF THE ENGINEER AND APPROVAL BY FDEP COULD RESULT IN THE REQUIREMENT THAT THE INSTALLED UNAPPROVED MEASURES BE REMOVED AND REPLACED AT NO COST.

   A. WHERE A WATER MAIN IS BEING LAID LESS THAN THE REQUIRED MINIMUM HORIZONTAL DISTANCE AND/OR WHERE A WATER MAIN CROSSING HAS LESS THAN THE MINIMUM REQUIRED DISTANCE BETWEEN JOINTS:
      1. USE OF PRESSURE RATED PIPE CONFORMING TO AWWA STANDARDS, FOR A GRAVITY OR VACUUM TYPE PIPE LINE.
      2. USE OF WELDED, FUSED OR OTHERWISE RESTRAINED JOINTS FOR EITHER PIPE.
      3. USE OF WATERTIGHT CASING PIPE OR CONCRETE ENCASEMENT AT LEAST 4" THICK FOR EITHER PIPE.

   B. WHERE A WATER MAIN IS BEING LAID LESS THAN 3 FEET HORIZONTALLY FROM ANOTHER PIPE LINE AND/OR WHERE A WATER MAIN IS BEING LAID WITH LESS THAN THE REQUIRED MINIMUM VERTICAL SEPARATION:
      1. USE OF PIPE OR CASING PIPE, HAVING HIGH IMPACT STRENGTH (AT LEAST EQUAL TO 0.25" THICK D.I.P.), OR CONCRETE ENCASEMENT AT LEAST 4" THICK FOR THE WATER MAIN AND THE OTHER PIPELINE IF THE OTHER PIPE LINE CONVEYS WASTEWATER OR RECLAIMED WATER.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL MINIMUM HORIZONTAL AND VERTICAL SEPARATION REQUIREMENTS	DATE: 5/2023 DETAIL NO: C-4

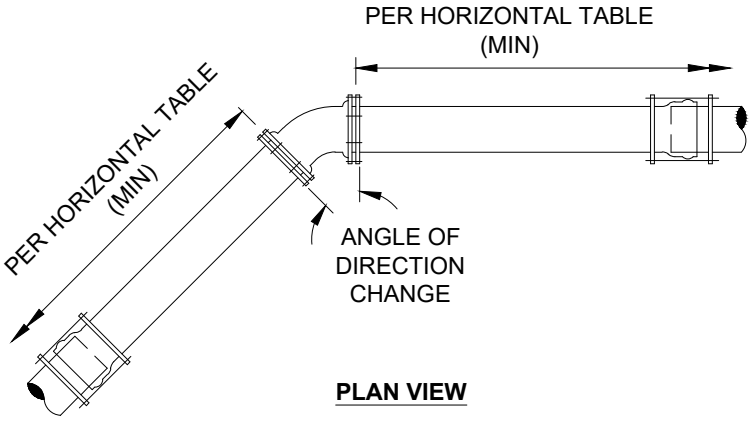
MINIMUM LENGTH (FT) TO BE RESTRAINED ON EACH SIDE OF FITTING(S)

	TYPE	PVC AND DUCTILE IRON PIPE SIZE (IN)													
		4	6	8	12	16	20	24	30	36	42	48	54	60	64
HORIZONTAL	90° BEND	21	29	37	52	65	78	104	122	143	154	167	180	188	195
	45° BEND	9	12	16	22	27	33	43	51	60	64	70	75	78	81
	22-1/2° BEND	5	6	8	11	13	16	21	25	29	31	34	36	38	39
	11-1/4° BEND	2	3	4	6	7	8	11	12	15	16	17	18	19	20
	5 5/8° BEND OR MJ SLEEVE	1	2	2	3	4	4	6	6	8	8	9	9	10	10
	PLUG OR BRANCH OF TEE OR DEAD END	43	59	78	109	139	167	277	330	415	424	465	506	529	551
	VALVE OR LINE STOP	22	30	39	55	70	84	139	165	208	212	233	253	265	276
	HDPE CONNECTION	19	26	34	49	62	75	125	151	174	203	223			

NOTES:

1. FITTINGS SHALL HAVE RESTRAINED JOINTS UNLESS OTHERWISE INDICATED.
2. INSTALL FULL LENGTH JOINTS WITH TOTAL LENGTH EQUAL TO OR GREATER THAN LENGTH SHOWN IN THE TABLE.
3. WHERE TWO OR MORE FITTINGS ARE IN SERIES, SELECT FITTING RESTRAINT LENGTH THAT YIELDS THE LONGEST RESTRAINT DISTANCE.
4. ALL INLINE VALVES SHALL BE RESTRAINED.
5. WHERE INTERNAL RESTRAINED JOINTS ARE USED, THE ENTIRE BELL SHALL BE PAINTED RED.
6. LENGTHS SHOWN IN THE TABLE WERE CALCULATED IN ACCORDANCE WITH PROCEDURES OUTLINED IN "THRUST RESTRAINT DESIGN FOR DUCTILE IRON PIPE" GUIDELINES PUBLISHED BY DIPRA, USING THE ASSUMPTIONS SHOWN BELOW:
   - WORKING PRESSURE: 150 PSI
   - SOIL DESIGNATION: SM (SAND SILT)
   - LAYING CONDITIONS: 3
   - DEPTH OF COVER: 3-FT
   - SAFETY FACTOR: 1.5

   THE DESIGN ENGINEER SHALL INCREASE THE VALUES IN THE TABLE AS WARRANTED BY SITE-SPECIFIC PARAMETERS, SUCH AS SOIL DESIGNATIONS AND LAYING CONDITIONS.
7. 90° BENDS ON VERTICAL PIPE ARE SUBJECT TO REVIEW AND APPROVAL OF UTILITIES.
8. IF 4-IN THRU 20-IN PIPE IS POLYETHLYENE ENCASED, USE 1.25 MULTIPLIER ON RESTRAINT LENGTH.
9. RESTRAINING REQUIREMENTS APPLY TO BOTH EXISTING AND PROPOSED MAINS.



PLAN VIEW

CITY OF EVERGLADES CITY

STANDARD CONSTRUCTION DETAIL

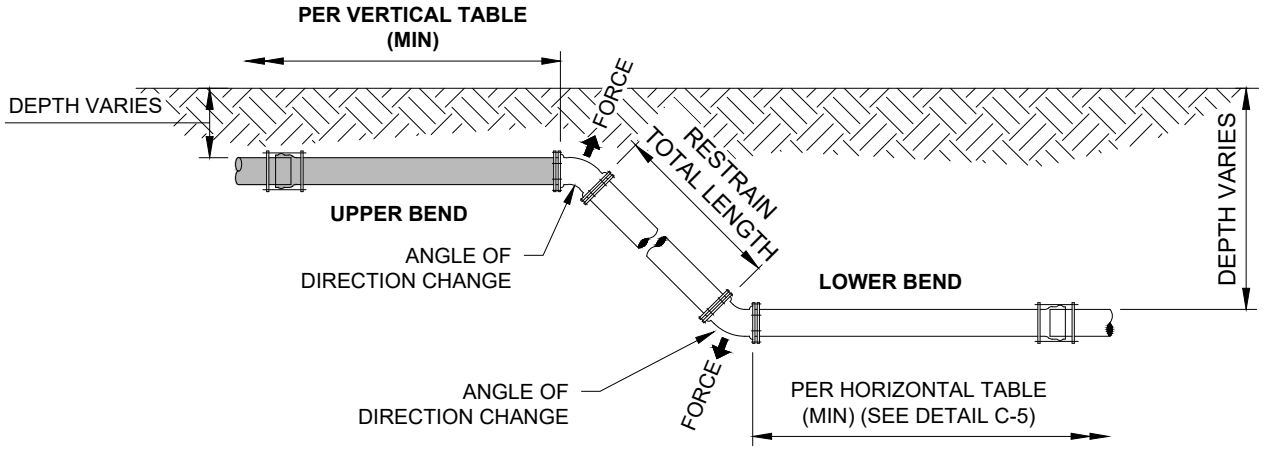
RESTRAINED HORIZONTAL PIPE -
WASTEWATER FORCE & RECLAIMED WATER
MAINS (150 PSI)

DATE:
5/2023

DETAIL NO:
C-5

MINIMUM LENGTH (FT) TO BE RESTRAINED ON EACH SIDE OF FITTING(S)

	TYPE	PVC AND DUCTILE IRON PIPE SIZE (IN)													
		4	6	8	12	16	20	24	30	36	42	48	54	60	64
VERTICAL (UPPER)	90° BEND	43	59	78	109	139	167	277	330	415	424	465	506	529	551
	45° BEND	18	25	32	45	58	69	115	137	172	176	193	210	219	229
	22-1/2° BEND	9	12	16	22	28	34	56	66	83	85	93	101	106	110
	11-1/4° BEND	5	6	8	11	14	17	28	33	41	42	46	50	53	55
	5 5/8° BEND OR MJ SLEEVE	3	3	4	6	7	9	14	17	21	21	23	25	26	28



PROFILE VIEW

NOTES:

1. FITTINGS SHALL HAVE RESTRAINED JOINTS UNLESS OTHERWISE INDICATED.
2. INSTALL FULL LENGTH JOINTS WITH TOTAL LENGTH EQUAL TO OR GREATER THAN LENGTH SHOWN IN THE TABLE.
3. WHERE TWO OR MORE FITTINGS ARE IN SERIES, SELECT FITTING RESTRAINT LENGTH THAT YIELDS THE LONGEST RESTRAINT DISTANCE.
4. ALL INLINE VALVES SHALL BE RESTRAINED.
5. WHERE INTERNAL RESTRAINED JOINTS ARE USED, THE ENTIRE BELL SHALL BE PAINTED RED.
6. LENGTHS SHOWN IN THE TABLE WERE CALCULATED IN ACCORDANCE WITH PROCEDURES OUTLINED IN "THRUST RESTRAINT DESIGN FOR DUCTILE IRON PIPE" GUIDELINES PUBLISHED BY DIPRA, USING THE ASSUMPTIONS SHOWN BELOW:
   - WORKING PRESSURE: 150 PSI
   - SOIL DESIGNATION: SM (SAND SILT)
   - LAYING CONDITIONS: 3
   - DEPTH OF COVER: 3-FT
   - SAFETY FACTOR: 1.5

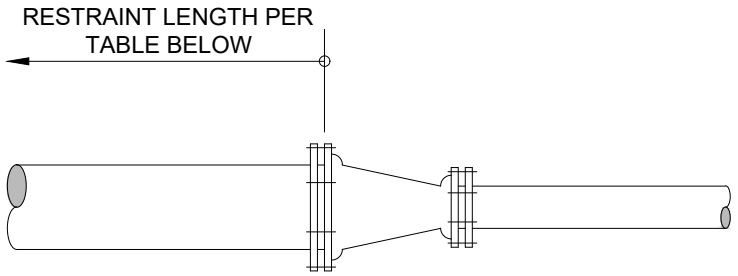
   THE DESIGN ENGINEER SHALL INCREASE THE VALUES IN THE TABLE AS WARRANTED BY SITE-SPECIFIC PARAMETERS, SUCH AS SOIL DESIGNATIONS AND LAYING CONDITIONS.
7. 90° BENDS ON VERTICAL PIPE ARE SUBJECT TO REVIEW AND APPROVAL OF UTILITIES.
8. IF 4-IN THRU 20-IN PIPE IS POLYETHYLENE ENCASED, USE 1.25 MULTIPLIER ON RESTRAINT LENGTH.
9. RESTRAINING REQUIREMENTS APPLY TO BOTH EXISTING AND PROPOSED MAINS.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL RESTRAINED VERTICAL PIPE - WASTEWATER FORCE & RECLAIMED WATER MAINS (150 PSI)	DATE: 5/2023 DETAIL NO: C-6

MINIMUM LENGTH (FEET) TO BE RESTRAINED ON LARGE SIDE OF REDUCER

PVC & DI PIPE	REDUCER SMALL SIZE (IN)										
DIA (INCH)	4	6	8	12	16	20	24	30	36	42	48
6	31										
8	56	33									
12		79	58								
16			101	59							
20				105	59						
24				205	151	83					
30					233	180	116				
36						259	208	115			
42							281	205	110		
48								281	201	109	
54									282	204	112
60										253	170
64											222

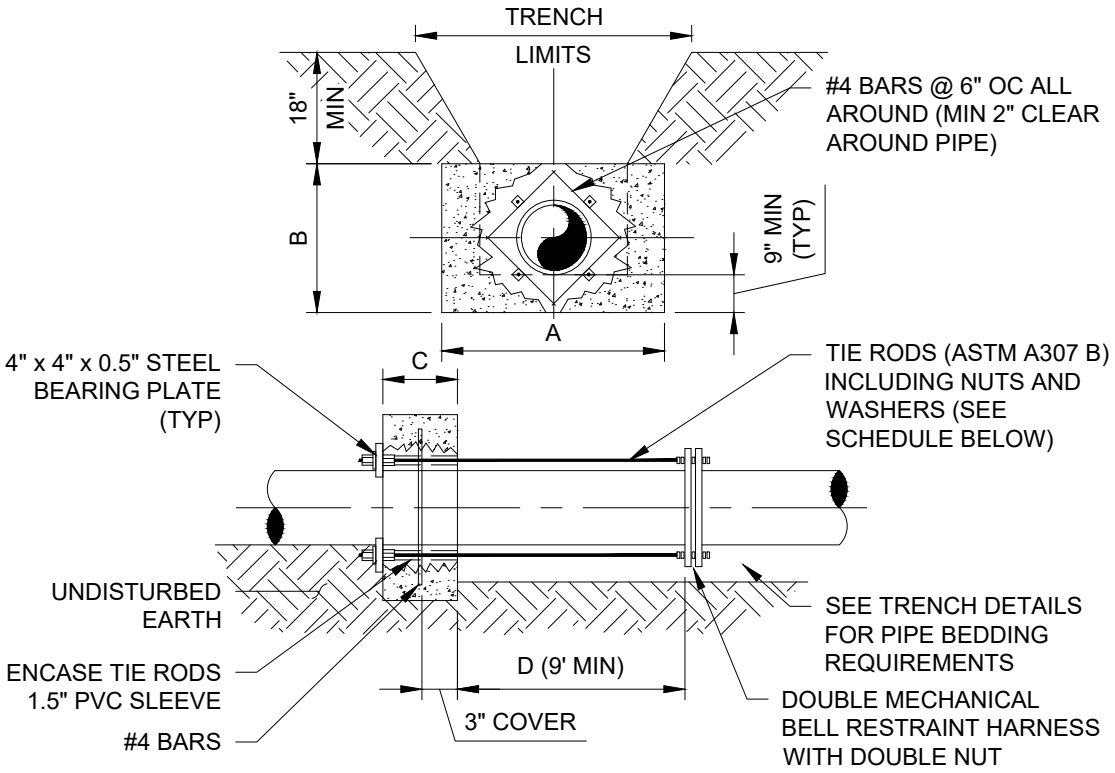
* BASED ON WORKING PRESSURE 150 PSI



NOTES:

1. LENGTHS SHOWN IN THE TABLE WERE CALCULATED IN ACCORDANCE WITH THE PROCEDURES IN "THRUST RESTRAINT DESIGN FOR DUCTILE IRON PIPE", GUIDELINES PUBLISHED BY DIPRA AND AWWA M23 "PVC PIPE - DESIGN AND INSTALLATION.
2. THE DESIGN ENGINEER SHALL INCREASE THE VALUES IN THE TABLE AS WARRANTED BY SITE-SPECIFIC PARAMETERS, SUCH AS SOIL DESIGNATED AND LAYING CONDITIONS.
3. WHERE TWO OR MORE FITTINGS ARE IN SERIES, SELECT FITTING RESTRAINT LENGTH THAT YIELDS THE LONGEST RESTRAINT DISTANCE.
4. RESTRAINING REQUIREMENTS APPLY TO BOTH EXISTING AND PROPOSED MAINS.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL RESTRAINED PIPE TABLE - REDUCERS - WASTEWATER FORCE & RECLAIMED WATER MAINS (150 PSI)	DATE: 5/2023 DETAIL NO: C-7

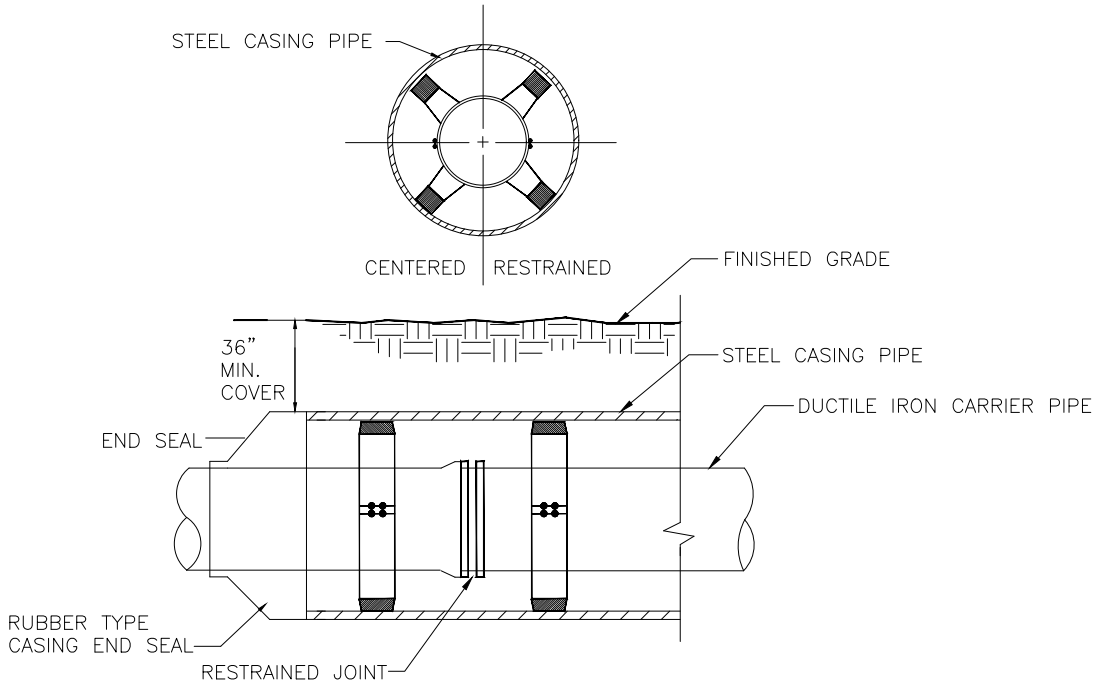


SCHEDULE OF DIMENSIONS AND MATERIALS						
PIPE SIZE (IN)	PIPE SIZE					
	DIMENSIONS (FT)				TIE RODS REQ'D	
	A	B	C	D	DIA	NO.
6	2.0	2.0	1.0		0.75	2
8	2.5	2.5	1.0		0.75	2
10	3.5	3.0	1.0		0.75	4
12	5.0	3.0	1.0		0.75	4
16	6.0	4.0	1.5		0.75	4
20	8.0	5.0	1.5		0.75	6
24	9.0	6.0	1.5		0.75	10
30	12.0	7.0	1.5		1.0	10
36	15.0	8.0	1.5		1.0	14
42	16.0	9.0	2		1.0	16
48	19.0	10.0	2		1.0	20
54	22.0	10.0	3		1.0	24
60	27.0	10.0	3		1.125	24
64	31.0	10.0	3		1.25	20
NOTE: THRUST COLLAR AREAS TO BE COMPUTED ON BASIS OF 2000 LBS/SF SOIL RESTRAINT BEARING.						

NOTES:

1. ADDITIONAL REINFORCEMENTS SHALL BE AS SPECIFIED BY THE ENGINEER.
2. MINIMUM COMPRESSIVE STRENGTH FOR CONCRETE SHALL BE 3,000 PSI.
3. BEDDING, BACKFILL AND COMPACTION SHALL BE AS SPECIFIED ELSEWHERE IN THE STANDARD DRAWINGS.
4. ALL FORM BOARDS SHALL BE REMOVED PRIOR TO BACKFILL.
5. NO ALLOWANCE SHALL BE MADE FOR FRICTION BETWEEN THE PIPE WALL AND THE THRUST COLLAR.
6. DESIGN PRESSURE: 150 PSI.
7. REQUIRED FOR LINE STOPS IF RESTRAINT TABLE REQUIREMENTS CANNOT BE MET.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL THRUST COLLAR - WASTEWATER FORCE & RECLAIMED WATER MAINS (150 PSI)	DATE: 5/2023 DETAIL NO: C-8

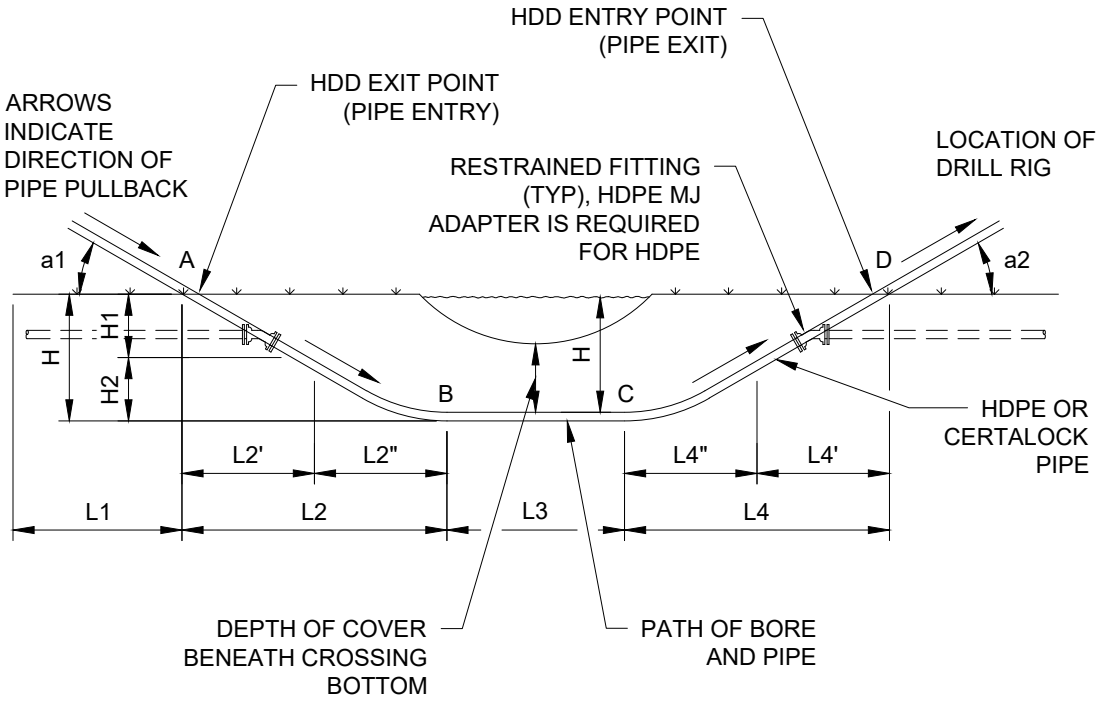


CARRIER PIPE NOM. DIA (IN)	4	6	8	10	12	14	16	18	20	24	30	36	42	48
MIN. CASING PIPE NOM. DIA. (IN)	14	16	20	24	24	30	30	36	36	42	48	54	60	66
MIN. CASING PIPE WALL THICKNESS (IN)	0.250	0.250	0.250	0.250	0.250	0.312	0.312	0.375	0.375	0.500	0.500	0.500	0.500	0.500

NOTES:

1. THE STEEL CASING SHALL EXTEND A MINIMUM OF SIX FEET BEYOND THE EDGE OF PAVEMENT.
2. ALL CARRIER PIPE IN THE CASING SHALL BE D.I. AND ALL PIPE JOINTS WITHIN THE STEEL CASING SHALL BE RESTRAINED.
3. SPACERS ALONG DUCTILE IRON CARRIER PIPE SHALL BE PLACED NO MORE THAN 2 FEET FROM THE END OF THE CASING. WITH SUBSEQUENT SPACER PLACEMENT AT INTERVALS OF NO MORE THAN 10 FEET, OR AS RECOMMENDED BY THE CASING SPACER MANUFACTURER, WHICHEVER IS MORE STRINGENT.
4. CASING SPACERS SHALL BE AS MANUFACTURED BY ADVANCE PRODUCTS MODEL SSI8 OR SSI12, CASCADE WATERWORKS SERIES CCS, OR CCI PIPELINE SYSTEMS MODEL CSS8 OR CSS12.
5. STEEL CASING PIPE END SEALS SHALL ACCOMMODATE THE CARRIER PIPE AND SHALL BE AS MANUFACTURED BY ADVANCE PRODUCTS, CASCADE WATERWORKS OR CCI PIPELINE SYSTEMS.
6. FOR CROSSINGS OF FDOT ROADWAYS, ALL JACK AND BORE CONSTRUCTION, INCLUDING MINIMUM DEPTH REQUIREMENTS, LOCATION OF CASING ENDS FROM THE EDGE OF PAVEMENT, AND MINIMUM STEEL CASING WALL THICKNESS SHALL COMPLY WITH FDOT REQUIREMENTS.
7. FOR RAILROAD CROSSINGS, ALL JACK AND BORE CONSTRUCTION, INCLUDING MINIMUM DEPTH REQUIREMENTS, LOCATION OF CASING ENDS, MINIMUM STEEL CASING WALL THICKNESS, AND VENT PIPES SHALL COMPLY WITH SOUTH FLORIDA RAIL CORRIDOR REQUIREMENTS.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL JACK AND BORE	DATE: 5/2023 DETAIL NO: C-9

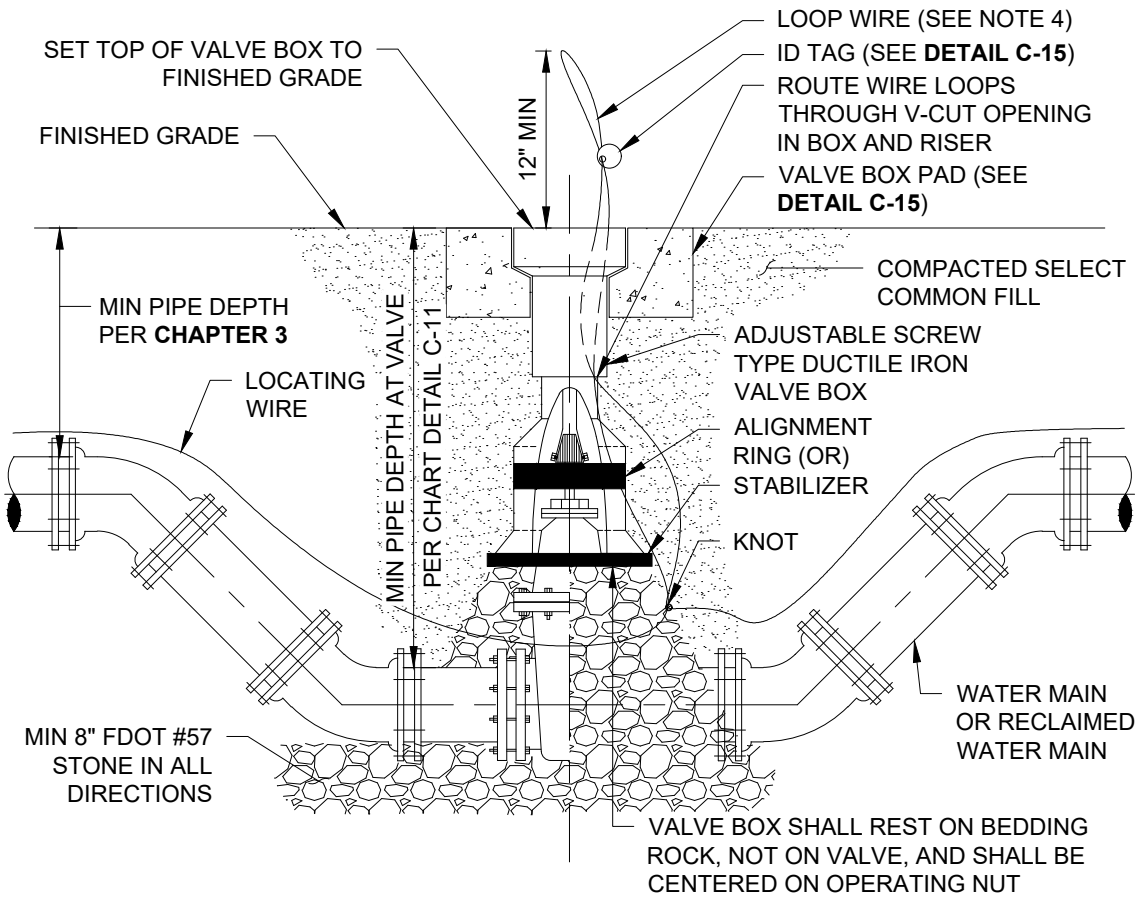


PROFILE VIEW

NOTES:

1. SHALL BE DESIGNED PER ASTM F1962-11.
2. POINTS A, B, C & D PULL FORCE ON PIPE.
3. L1 - ADDITIONAL LENGTH OF PIPE REQUIRED FOR HANDLING AND THERMAL CONTRACTION.
4. L2 - HORIZONTAL DISTANCE TO ACHIEVE DESIRED DESIGN DEPTH.
5. L3 - ADDITIONAL DISTANCE TO TRAVERSE AT DESIRED DESIGN DEPTH.
6. L4 - HORIZONTAL DISTANCE TO RISE TO SURFACE.
7. H - DEPTH OFF BORE HOLE FROM GROUND ELEVATION.
8. a1 - PIPE ENTRY ANGLE SHALL NOT EXCEED 15 DEGREES AND THE MANUFACTURERS RECOMMENDATIONS ON DEFLECTION.
9. a2 - PIPE EXIT ANGLE SHALL NOT EXCEED 12 DEGREES AND THE MANUFACTURERS RECOMMENDATIONS ON DEFLECTION.
10. MANDREL TESTING SHALL BE PERFORMED THROUGH THE ENTIRE LENGTH OF THE INSTALLED PIPE, FOR ALL PIPE 16-IN IN DIAMETER AND LARGER. THE MANDREL SIZE SHALL BE 90% OF THE INSIDE DIAMETER OF THE PIPE. MANDREL TESTING ON SMALLER PIPE MAY BE REQUIRED BY UTILITIES.
11. ISOLATION VALVES SHALL BE DESIGNED AND INSTALLED AT BOTH ENDS OF THE DIRECTIONAL DRILL.
12. ALL WORK TO BE PERFORMED WITHIN ROW OR EASEMENT.
13. ENTIRE DIRECTIONAL DRILL TO BE SHOWN IN PLAN VIEW AND PROFILE VIEW ON CONSTRUCTION PLAN.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL DIRECTIONAL DRILL	DATE: 5/2023 DETAIL NO: C-10



NOTES:

1. PVC PIPE OR DUCTILE IRON PIPE SHALL NOT BE USED AS VALVE BOX.
2. THE VALVE ACTUATING NUT SHALL BE EXTENDED TO BE WITHIN 3-FT OF FINISHED GRADE.
3. PROVIDE A STABILIZER OR PLASTIC DEBRIS SHIELD / ALIGNMENT RING WHICH INSTALLS BELOW THE VALVE ACTUATING NUT. THE DEVICE SHALL CENTER THE RISER VALVE BOX OVER THE ACTUATING NUT AND MINIMIZE DEBRIS.
4. LOCATING WIRE SHALL BE CONTINUOUS WITH NO SPLICES AND SHALL EXTEND 12-IN ABOVE TOP OF COLLAR. WIRE SHALL BE COLOR CODED TO MATCH THE UTILITY INSTALLED. WIRE SHALL BE COILED BACK INTO BOX AWAY FROM VALVE STEM.
5. FOR NEW CONSTRUCTION, THE VALVE BOX SHALL BE ADJUSTED TO MIDRANGE TO ALLOW FOR FUTURE BOX ADJUSTMENTS.
6. REFER TO **DETAIL C-12** FOR INSTALLATIONS WHERE THE OPERATING NUT IS DEEPER THAN 36-IN BELOW FINISHED GRADE.
7. DRILL HOLE IN ID TAG AND INSTALL ON TRACING WIRE.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL GATE VALVE & BOX - RECLAIMED WATER MAINS	DATE: 5/2023 DETAIL NO: C-11

APPROVED PRODUCTS VALVE SIZE (INCHES)	AMERICAN FLOW CONTROL	CLOW COMPANY	MUELLER COMPANY
	MIN COVER TO TOP OF PIPE (INCHES)	MIN COVER TO TOP OF PIPE (INCHES)	MIN COVER TO TOP OF PIPE (INCHES)
16	53	54	54
20	57	72	62
24	63	75	66
30	80	81	80
36	89	88	89
42	102	102	101
48	109	102	110
54	106		
60	122		
66	119		

NOTES:

1. MINIMUM COVER OVER PIPE IS CALCULATED BASED ON INSTALLATION OF THE GATE VALVE OPERATING NUT AT 24-IN BELOW GRADE.
2. ADDITIONAL DEPTH MAY BE REQUIRED BASED ON SITE CONDITIONS OR ROAD DESIGN.
3. REFERENCE DETAIL C-10 FOR TYPICAL GATE VALVE STANDARD DRAWING.

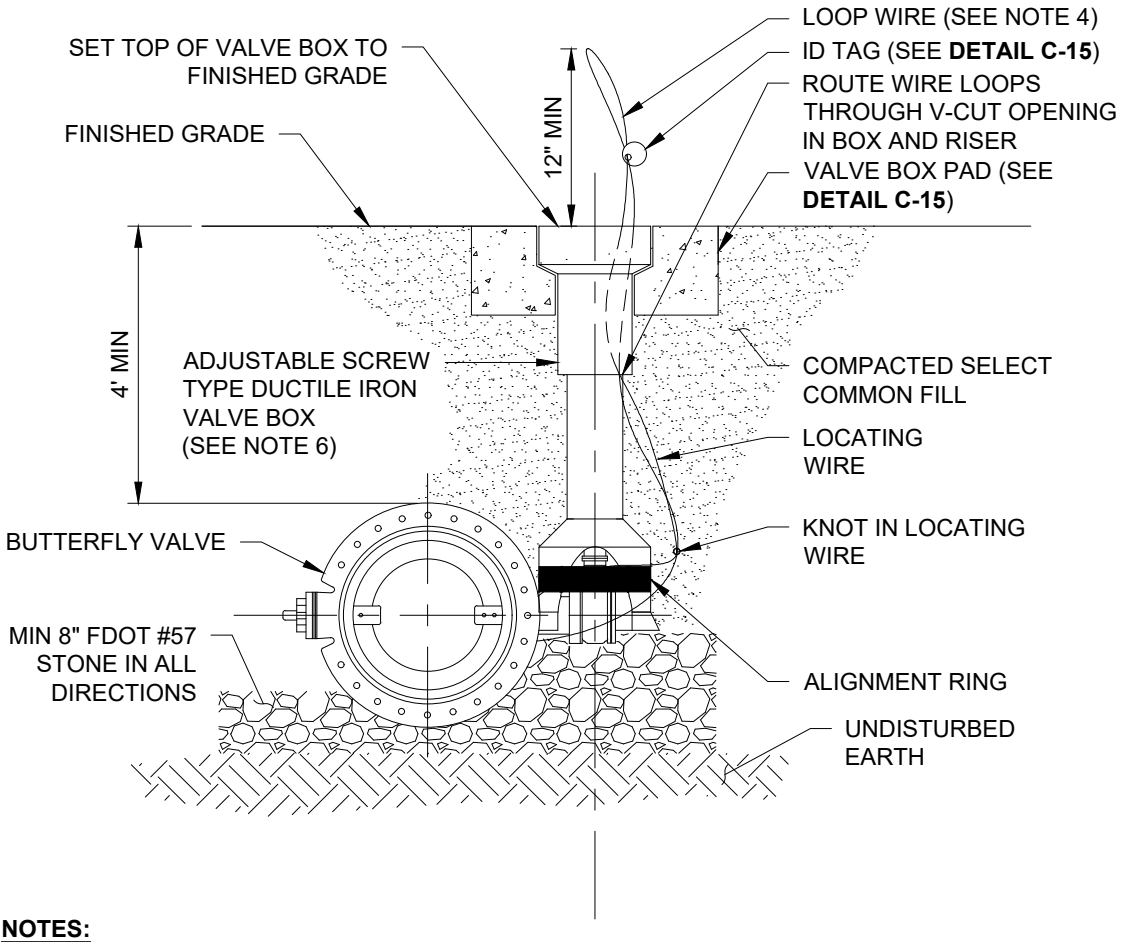
CITY OF EVERGLADES CITY

STANDARD CONSTRUCTION DETAIL

GATE VALVE & BOX -
MINIMUM PIPE DEPTH AT VALVE PER MANUFACTURER

DATE: 5/2023

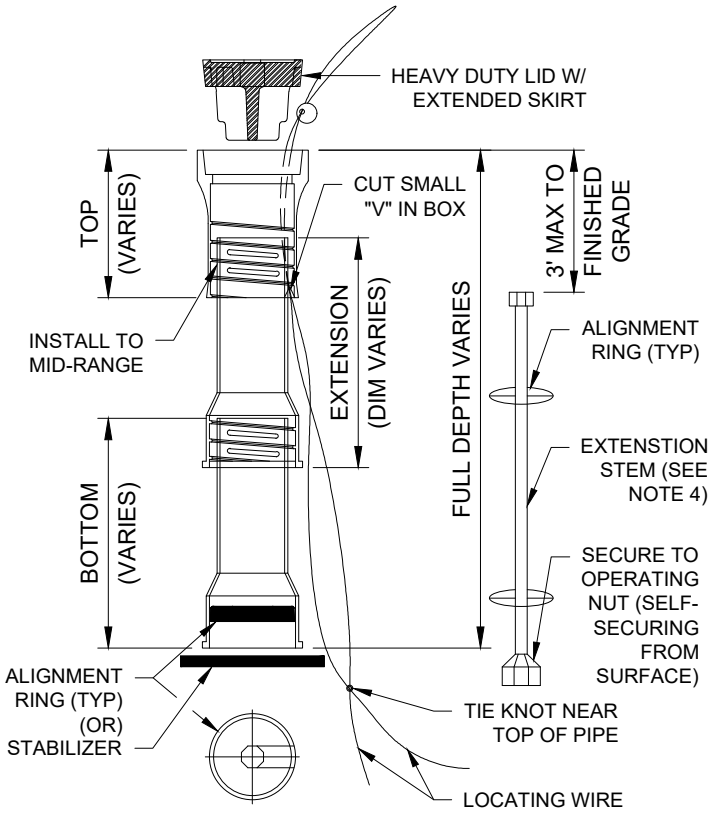
DETAIL NO: C-12



NOTES:

1. PVC PIPE OR DUCTILE IRON PIPE SHALL NOT BE USED AS VALVE BOX.
2. THE VALVE ACTUATING NUT SHALL BE EXTENDED TO BE WITHIN 3-FT OF FINISHED GRADE.
3. PROVIDE A STABILIZER OR PLASTIC DEBRIS SHIELD / ALIGNMENT RING WHICH INSTALLS BELOW THE VALVE ACTUATING NUT. THE DEVICE SHALL CENTER THE RISER VALVE BOX OVER THE ACTUATING NUT AND MINIMIZE DEBRIS.
4. LOCATING WIRE SHALL BE CONTINUOUS WITH NO SPLICES AND SHALL EXTEND 12-IN ABOVE TOP OF COLLAR. WIRE SHALL BE COLOR CODED TO MATCH THE UTILITY INSTALLED. WIRE SHALL BE COILED BACK INTO BOX AWAY FROM VALVE STEM.
5. FOR NEW CONSTRUCTION, THE VALVE BOX SHALL BE ADJUSTED TO MIDRANGE TO ALLOW FOR FUTURE BOX ADJUSTMENTS.
6. REFER TO **DETAIL C-12** FOR INSTALLATIONS WHERE THE OPERATING NUT IS DEEPER THAN 36-IN BELOW FINISHED GRADE.
7. DRILL HOLE IN ID TAG AND INSTALL ON TRACING WIRE.

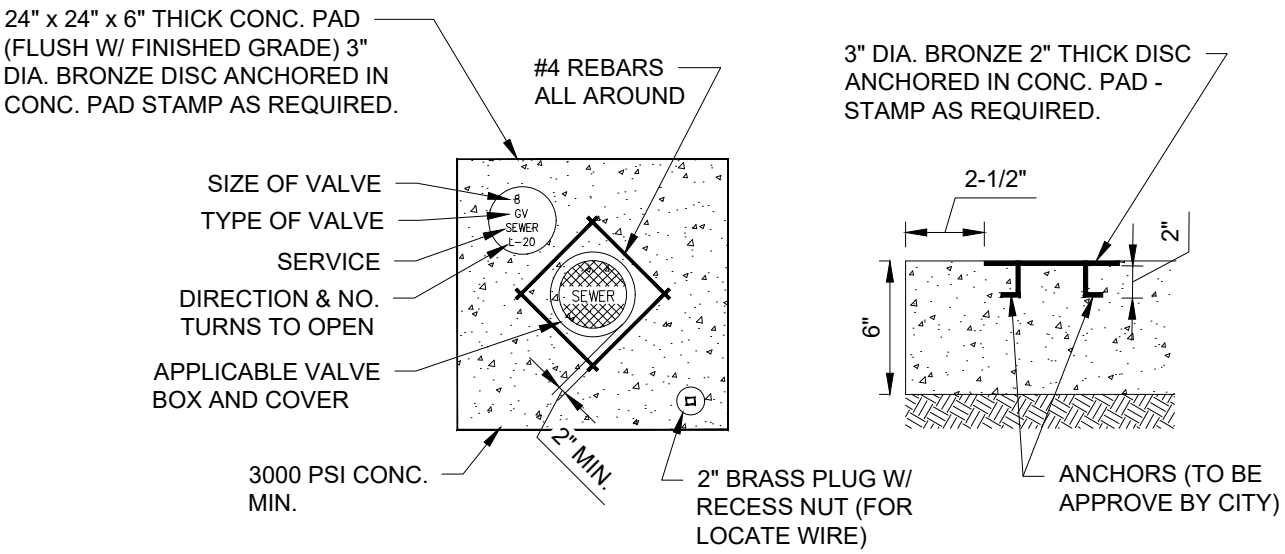
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL BUTTERFLY VALVE & BOX - RECLAIMED WATER MAINS	DATE: 5/2023 DETAIL NO: C-13



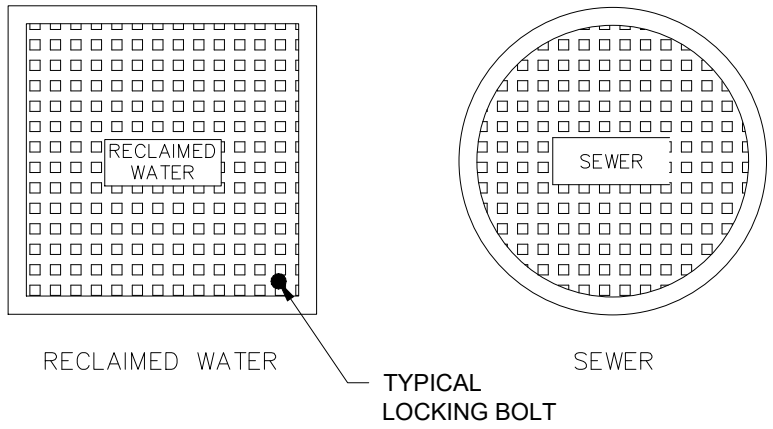
NOTES:

1. HEAVY DUTY VALVE BOX LIDS ARE REQUIRED FOR ALL VALVE BOXES.
2. TOP SECTION SHALL BE INSTALLED AT MID-RANGE FOR FUTURE ADJUSTMENT.
3. HEAVY DUTY VALVE BOX LID SHALL HAVE A 5-IN MIN DEPTH AND WEIGH A MINIMUM OF 22-LBS. LID SHALL HAVE POWDER COATING PAINT AT A MIN OF 3 MILL.
4. EXTENSION STEMS AND ALIGNMENT RING/WALL BRACKETS SHALL BE PROVIDED ON ALL BURIED VALVES SO THAT THE OPERATING NUT SHALL BE NO MORE THAN 36-IN BELOW FINISHED GRADE. MATERIAL SHALL BE MINIMUM 304 SST.
5. ADD ADD'L SCREW EXTENSION AS REQUIRED AFTER SCREW EXTENSION EXCEEDS 24-IN.
6. STACKING OF VALVE BOX BOTTOM SECTIONS IS NOT PERMITTED.
7. VALVE BOX SHALL REST ON BEDDING ROCK, NOT ON VALVE, AND SHALL BE CENTERED ON OPERATING NUT.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL TYPICAL VALVE BOX	DATE: 5/2023 DETAIL NO: C-14



CONCRETE PAD - VALVES 3 INCHES AND LARGER

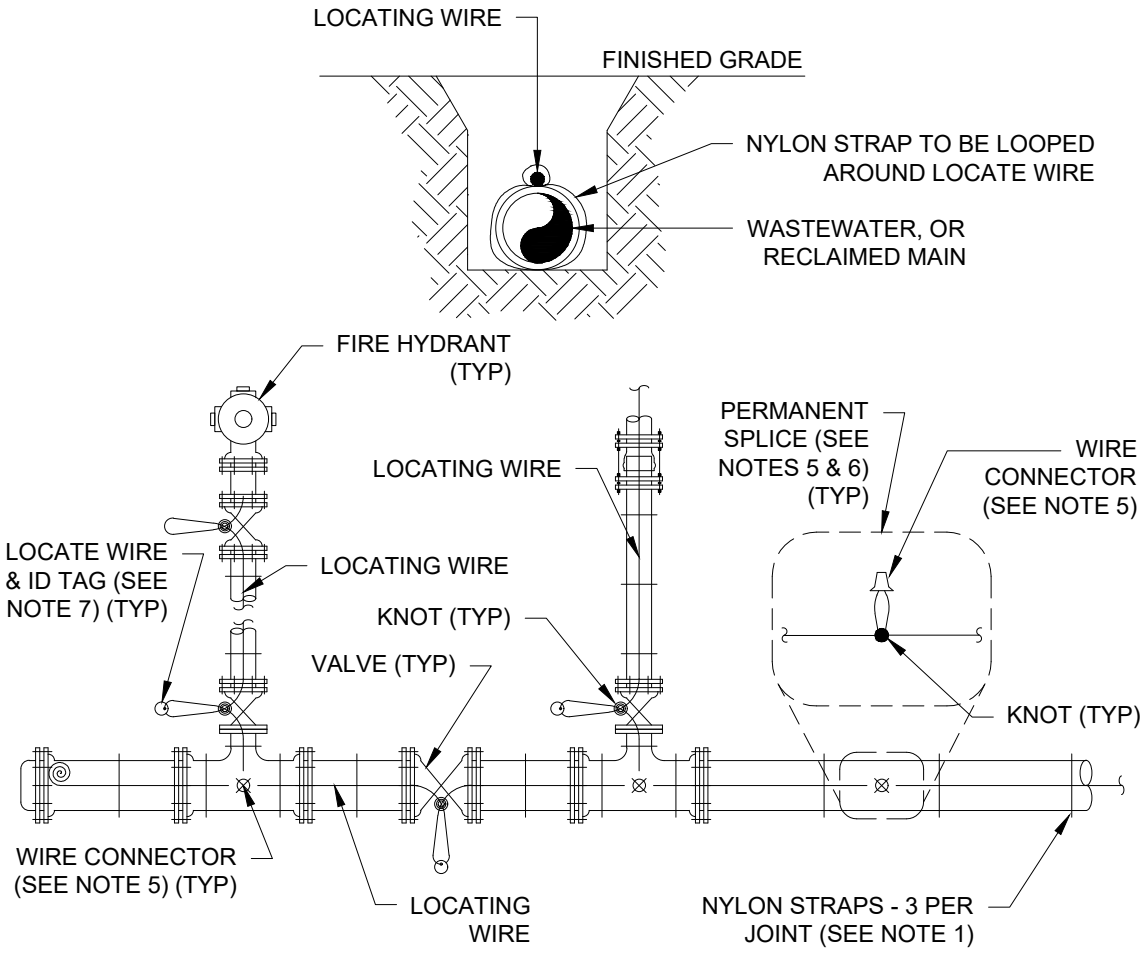


VALVE COVER

NOTES:

1. APPLY TWO COATS OF EXTERIOR ENAMEL PAINT:
   PURPLE - RECLAIMED WATER
   GREEN - SEWER
2. BRONZE, BRASS, OR STAINLESS STEEL IDENTIFICATION DISC SHALL BE REQUIRED FOR ALL VALVES.
3. LOCATING WIRE SHALL BE CONTINUOUS WITH NO SPLICES AND SHALL EXTEND 12-IN WIRE SHALL BE COILED BACK INTO BOX AWAY FROM VALVE STEM.
4. NO VALVE SHALL BE DESIGNED OR INSTALLED WITHIN THE CURB.
5. ROUND OR SQUARE VALVE PAD TO BE UNIFORM PER PROJECT.

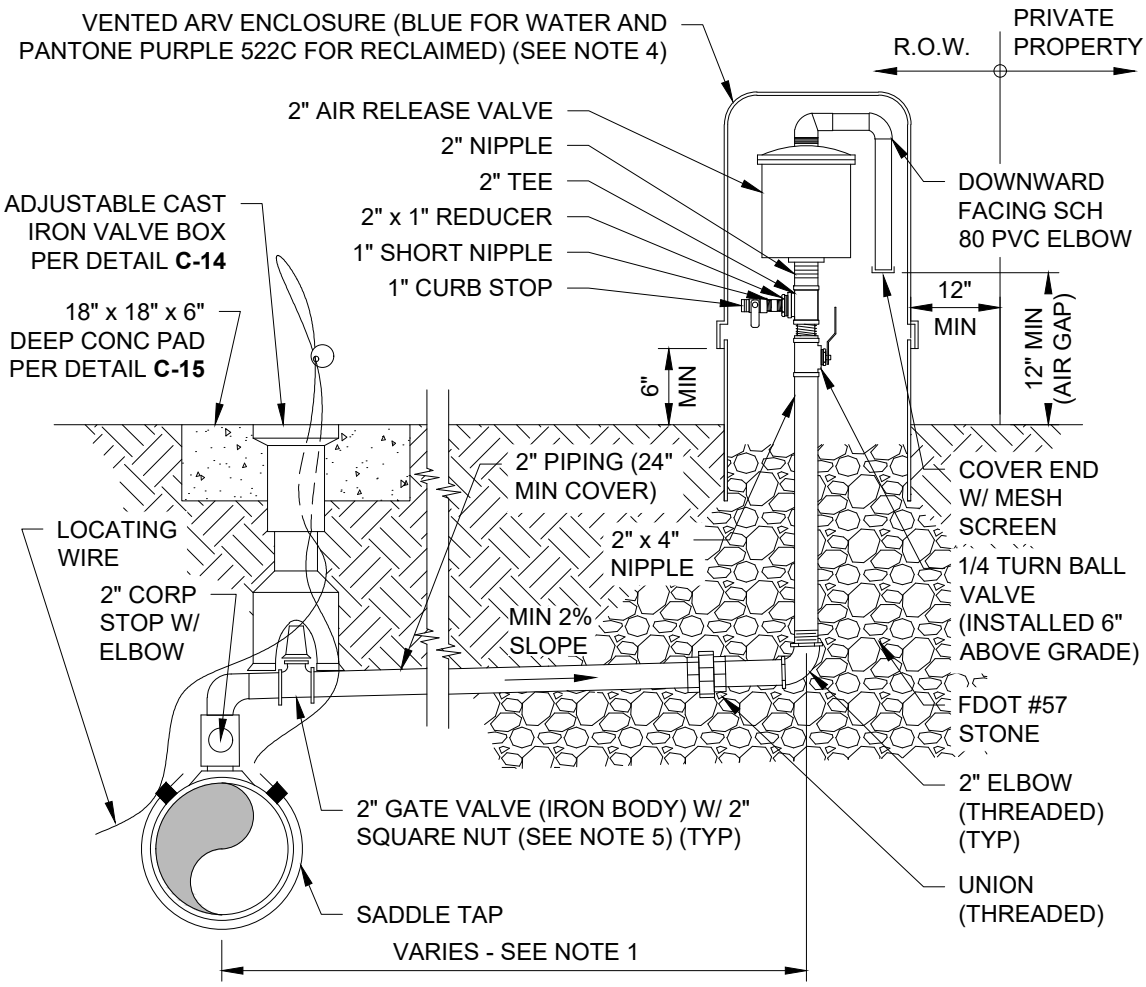
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL TYPICAL VALVE BOX COVER AND PAD	DATE: 5/2023 DETAIL NO: C-15



NOTES:

1. ALL PIPE SHALL REQUIRE INSULATED LOCATING WIRE (10 GAUGE SOLID COPPER) CAPABLE OF DETECTION BY A CABLE LOCATOR AND SHALL BE WRAPPED WITH NYLON STRAPS, LOOPED AND SECURED TO TOP CENTERLINE OF THE PIPE.
2. LOCATING WIRE SHALL BE CONTINUOUS INSIDE VALVE BOXES AND SHALL EXTEND 12-IN ABOVE TOP OF COLLAR.
3. WIRE INSULATION SHALL BE COLOR CODED FOR THE TYPE OF PIPE BEING INSTALLED.
4. WIRE SHALL BE CONTINUOUS AND CONNECTED FOR LOCATING IN ALL DIRECTIONS.
5. PERMANENT SPLICES MUST BE MADE IN THE LENGTH OF THE WIRE USING WIRE CONNECTORS SPECIFICALLY DESIGNED FOR DIRECT BURIAL, DIELECTRIC SILICONE GEL OR MOISTURE-RESISTANT GREASE FILLED.
6. AT ALL TRACING WIRE SPLICES, TEES, AND VALVE COLLARS, A KNOT IN THE WIRE SHALL BE MADE TO PREVENT THE WIRE FROM COMING APART.
7. REFER TO VALVE DETAILS FOR LOCATE WIRE UP AND IN VALVE BOX.

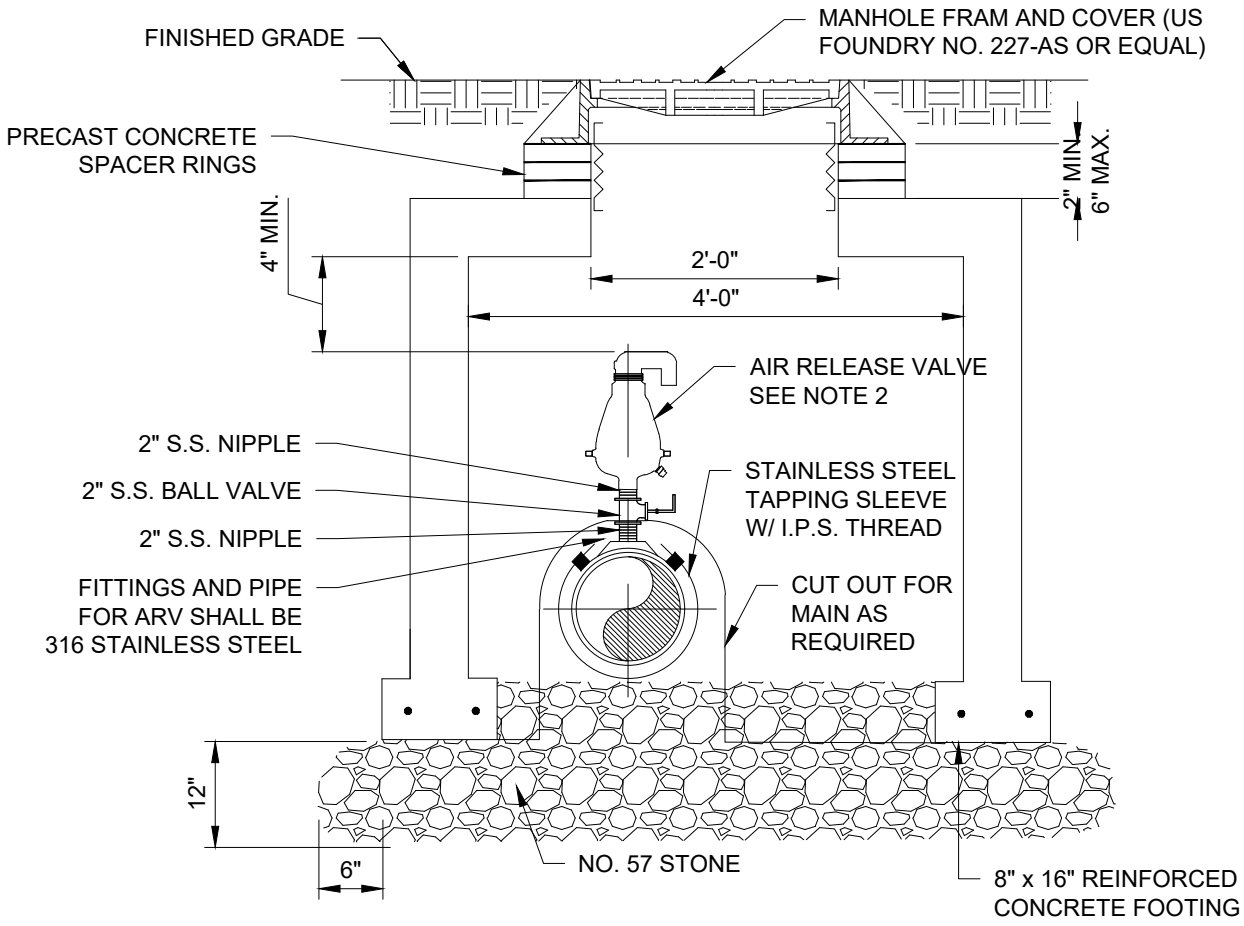
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL PIPE LOCATING WIRE	DATE: 5/2023 DETAIL NO: C-16



NOTES:

1. OFFSET DISTANCE TO BE FIELD DETERMINED AND AS CLOSE TO THE RIGHT OF WAY AS POSSIBLE AND CLEAR OF PEDESTRIAN WALKWAYS. IF PIPE IS AT RIGHT OF WAY LINE, NO OFFSET IS REQUIRED.
2. ABOVE DETAIL APPLIES TO A 2-IN ARV. IF A LARGER ARV IS REQUIRED, THIS SHALL BE SUBMITTED AND APPROVED BY UTILITIES PRIOR TO INSTALLATION.
3. ALL PIPING AND FITTINGS SHALL BE SCH 40 BRASS OR 316 SST. ALL VALVES AND APPURTENANCES SHALL BE BRASS OR 316 SST.
4. THE ENCLOSURE VENTS MUST BE CAPABLE OF ALLOWING AT LEAST THE SAME AMOUNT OF AIRFLOW AS THE VALVE.
5. VALVES SHALL BE INSTALLED WITHIN 18-IN FROM 90° AT TAP AT MAIN.

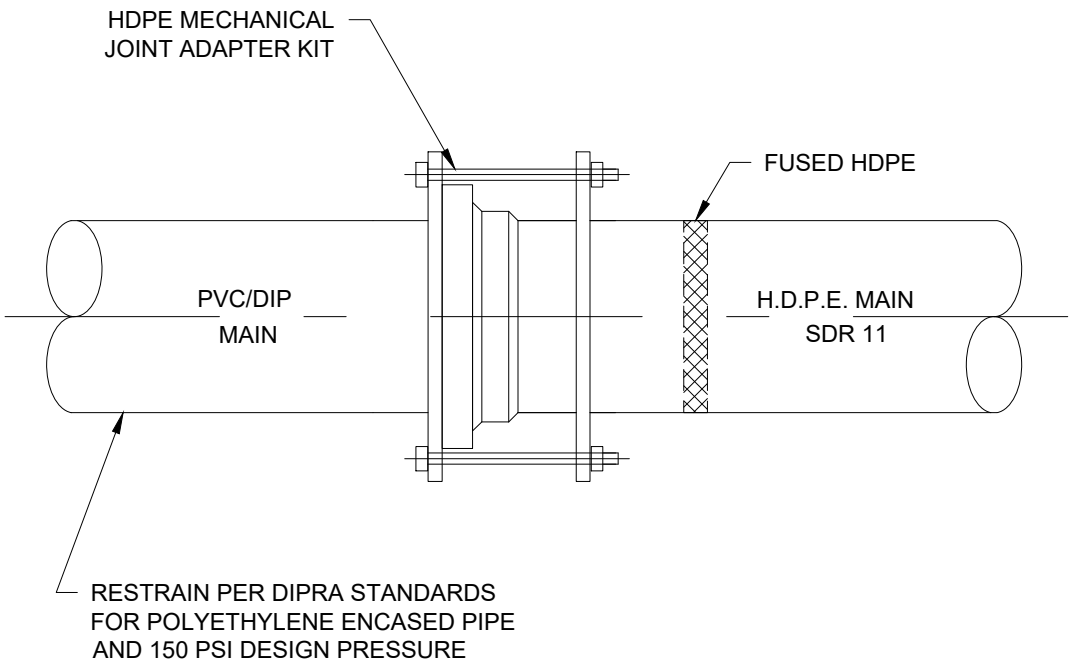
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL ABOVE GROUND AIR RELEASE VALVE - RECLAIMED WATER MAINS	DATE: 5/2023 DETAIL NO: C-17



NOTES:

1. ABOVE DETAIL IS BASED ON 2" AIR RELEASE VALVE. CHANGE PIPE AND FITTINGS ACCORDINGLY FOR OTHER VALVE SIZES. VALVE SIZES SHALL BE DETERMINED BY THE ENGINEER AND APPROVED BY THE CITY PRIOR TO INSTALLATION.
2. AIR RELEASE VALVES SHALL BE AS FOLLOWS:
   RECLAIMED WATER MAINS: COMBINATION AIR VALVE ARI D-040 ST-ST (2") OR EQUAL
   FORCE MAINS: COMBINATION AIR VALVE ARI D-025 ST-ST (2") OR ARI D-26 ST-ST (2") OR EQUAL
3. THE INTERIOR AND EXTERIOR OF MANHOLE SHALL BE GIVEN THREE COATS/ TWO COATS (EACH COAT 4 MILS) RESPECTIVELY, OF A WATER-BASED CONCRETE COATIG EQUIV. TO CONCEAL CS-55 AS MFR'D. BY CONCRETE SEALANTS, INC. DO NOT COAT JOINT OR PIPE OPENING SURFACES.
4. PRECAST MANHOLE SECTION TO BE MANUFACTURED IN ACCORDANCE WITH LATEST EDITIONS OF ASTM C478 WITH 4000 PSI CONCRETE, TYPE II CEMENT.
5. TOPS OF MANHOLE FRAME AND COVERS SHALL BE SET TO THE FINISHED ROADWAY ELEVATION, FINISHED GRADE OR AS OTHERWISE NOTED.
6. ADJUST THE TOP OF THE MAIN AS REQUIRED TO FIT SELECTED ARV IN THE MANHOLE.
7. NO PENETRATING HOLES THROUGH MANHOLES.

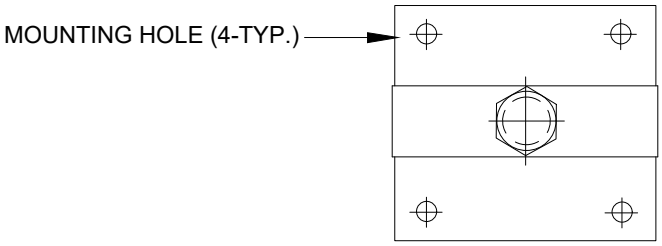
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL BELOW GRADE AIR RELEASE VALVE	DATE: 5/2023 DETAIL NO: C-18



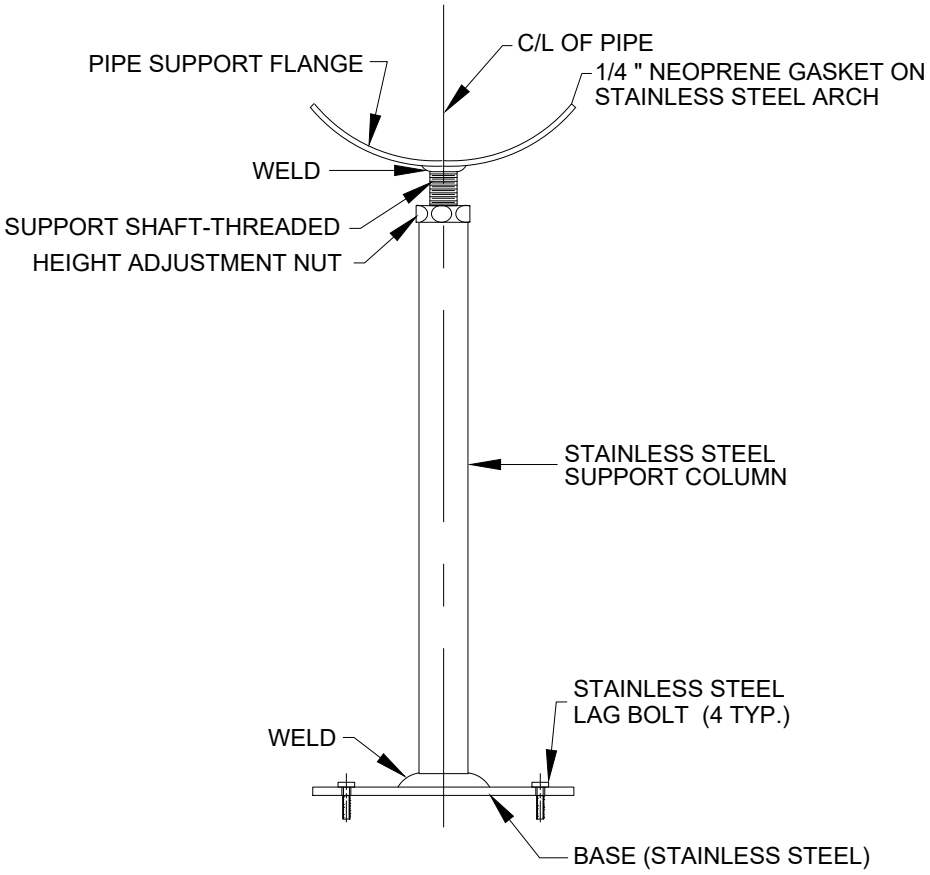
NOTES:

1. THE MJ ADAPTER KIT CONSISTS OF :
   - HDPE MJ ADAPTER WITH METAL INSERT
   - METAL GLAND
   - GASKET
   - ATTACHMENT BOLTS AND NUTS

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL PVC TO HDPE RESTRAINED JOINT	DATE: 5/2023 DETAIL NO: C-19

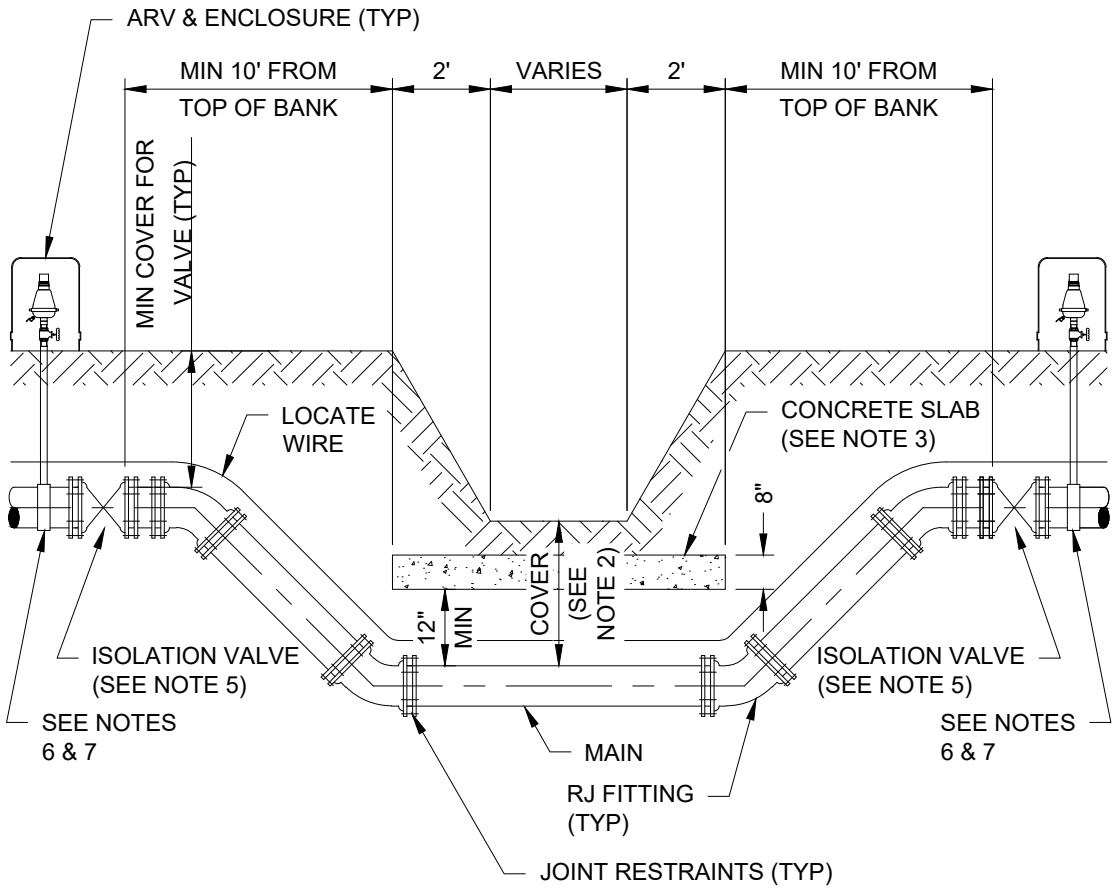


PLAN VIEW



SECTION VIEW

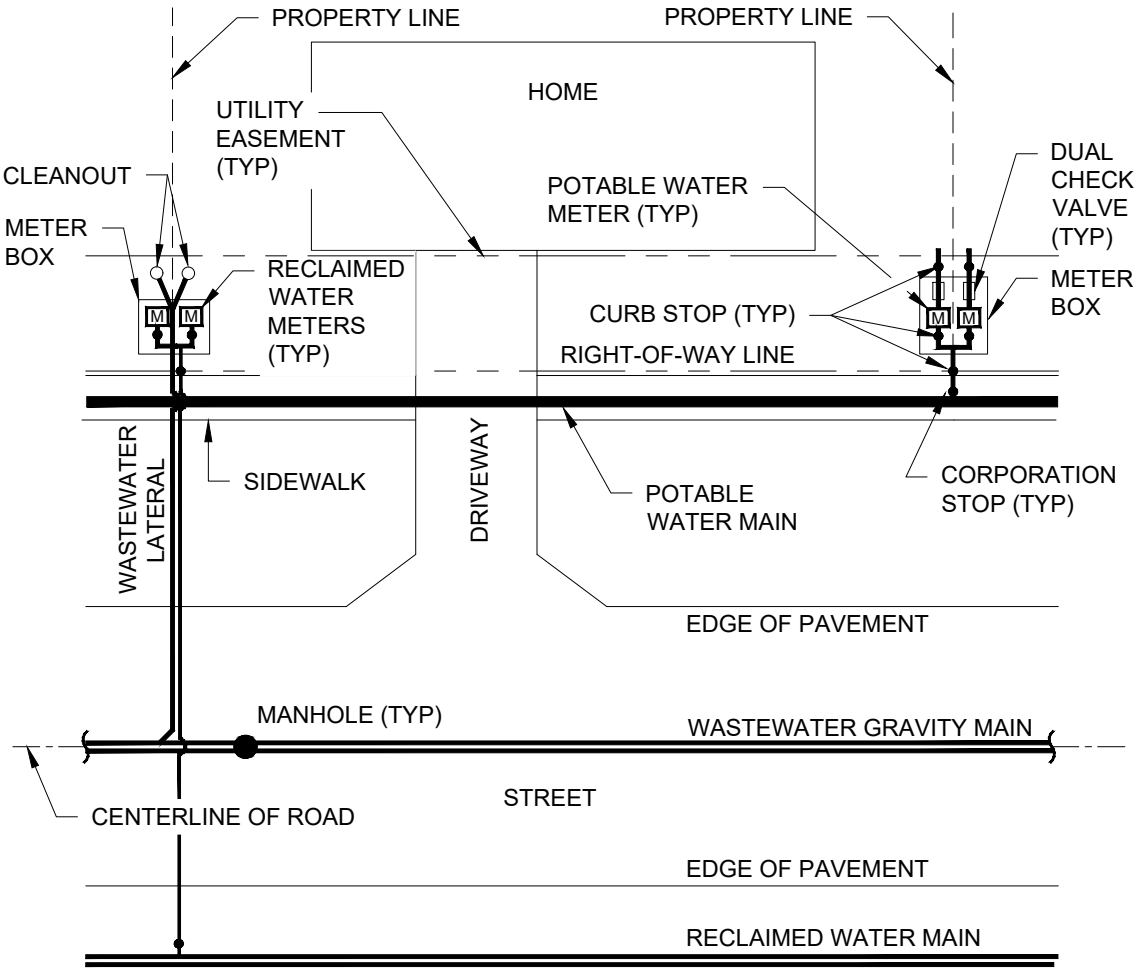
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL PIPE SUPPORT	DATE: 5/2023 DETAIL NO: C-20



NOTES:

1. MAIN SHALL BE INSTALLED WITH MINIMUM NUMBER OF JOINTS WITHIN THE CANAL OR DITCH. ALL JOINTS WITHIN THE CANAL OR DITCH SHALL BE RESTRAINED.
2. CONCRETE IS REQUIRED WHEN COVER IS LESS THAN 5-FT FOR DRY AND WET CROSSINGS. COVER WITH SLAB SHALL NOT BE LESS THAN 3-FT.
3. CONCRETE SLAB SHALL BE A MINIMUM OF 8-IN THICK AND 10-FT WIDER THAN THE PIPE O.D.
4. CONCRETE SHALL BE MINIMUM 2,500 PSI COMPRESSIVE STRENGTH.
5. ISOLATION VALVES REQUIRED ADJACENT TO CANAL/DITCH FOR WET CROSSINGS.
6. AIR RELEASE VALVES ARE REQUIRED IN ACCORDANCE WITH THE MANUAL SPECIFICATIONS FOR ELEVATION CHANGES.
7. ADDITIONAL TAPS MAY BE REQUIRED ON WATER MAINS CROSSING SURFACE WATER PER RECOMMENDED STANDARDS FOR WATER WORKS (RSWW PART 8.9).

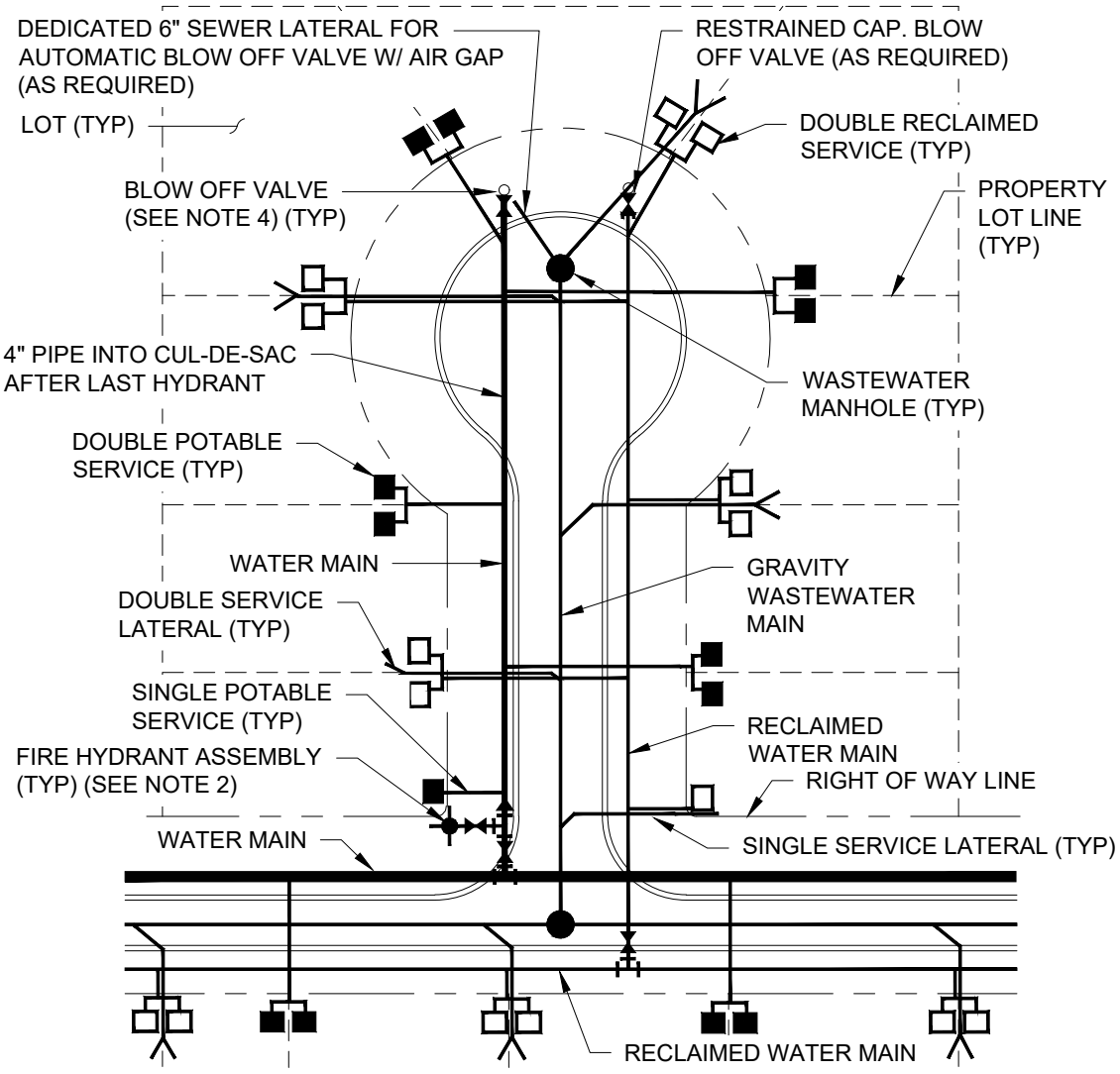
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL CANAL OR DRAINAGE DITCH CROSSING	DATE: 5/2023 DETAIL NO: C-21



NOTES:

1. EACH POTABLE WATER SERVICE WILL SERVE TWO LOTS IF RECLAIMED WATER IS AVAILABLE.
2. SITEWORK CONTRACTOR TO INSTALL RECLAIMED WATER SERVICES PER **DETAIL C-24** AND WASTEWATER LATERALS PER **DETAIL S-5**.
3. METER, BOX, AND DUAL CHECK VALVE BACKFLOW PREVENTER TO BE INSTALLED BY CITY AFTER ALL APPLICABLE PERMITS AND FEES ARE FULFILLED.
4. WASTEWATER LATERAL CLEAN-OUTS TO BE INSTALLED BY DEVELOPMENT PLUMBING CONTRACTOR.
5. SERVICES SHALL BE INSTALLED AT 90° FROM MAIN TO PROPERTY LINE.
6. IF A CONFLICT AT THE PROPERTY LINE EXISTS, TWO SINGLE WATER, RECLAIM, OR SEWER SERVICES SHALL BE INSTALLED IN AN APPROVED LOCATION BY UTILITIES.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL RESIDENTIAL SERVICE LOCATIONS WITH RECLAIMED WATER	DATE: 5/2023 DETAIL NO: C-22



NOTES:

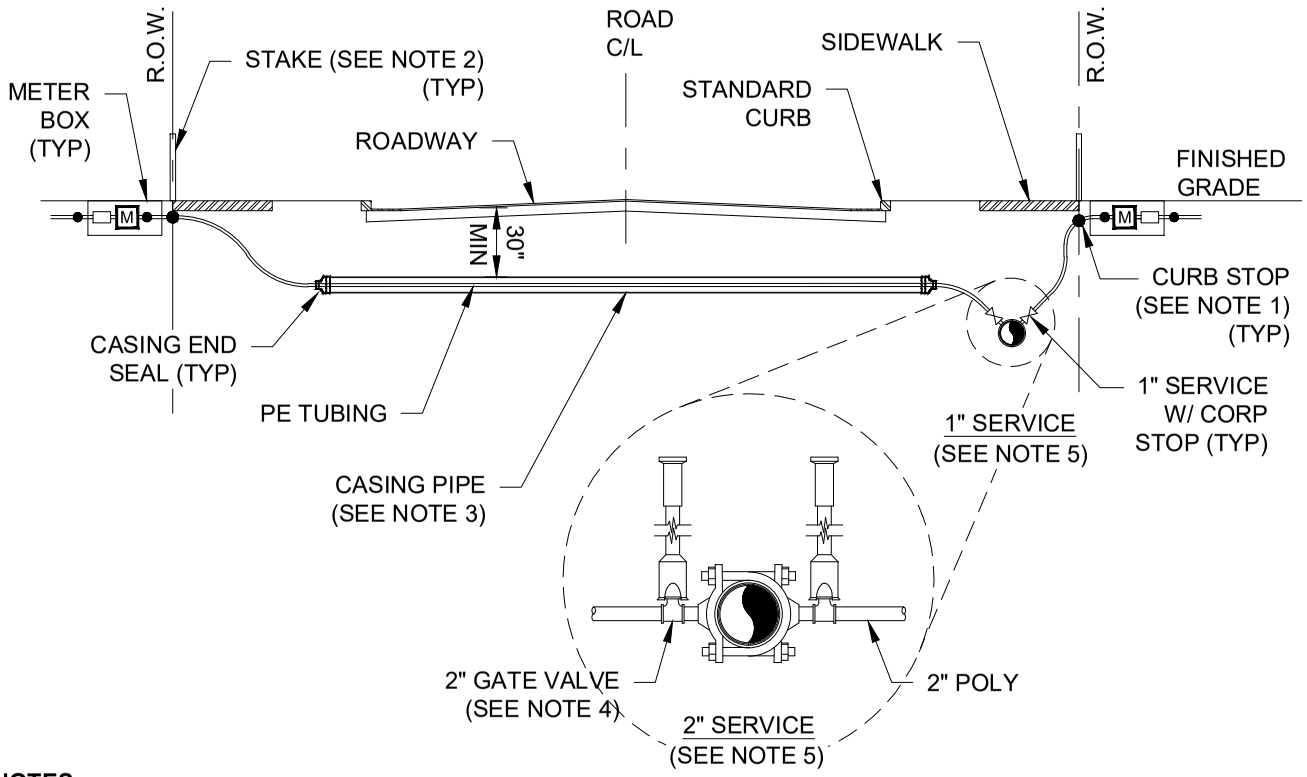
1. A MAXIMUM OF TWO WASTEWATER SERVICE LATERALS MAY CONNECT DIRECTLY TO A TERMINAL MANHOLE.
2. HYDRANT SHALL NOT BE PLACED AT THE END OF THE CUL-DE-SAC / DEAD END AND NO LESS THAN 500 FEET FROM THE LAST RESIDENT OR DEAD END. LAST HYDRANT SHALL BE LOCATED AS CLOSE TO THE INTERSECTION AS POSSIBLE WHILE MAINTAINING PROPER FIRE CODE.
3. RECLAIM SERVICE IS VERTICAL ON TOP OF SEWER SERVICE AT PROPERTY LINE. DRAWN SLIGHTLY OFFSET FOR CLARITY.
4. BLOW OFF VALVE SHALL BE LOCATED AT THE PROPERTY LOT LINE AND AVOID DRIVEWAY.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL SINGLE FAMILY RESIDENTIAL CUL-DE-SAC UTILITY PLAN WITH RECLAIMED WATER	DATE: 5/2023 DETAIL NO: C-23

CITY OF EVERGLADES CITY

STANDARD CONSTRUCTION DETAIL

RECLAIMED WATER SERVICES (TYPICAL)

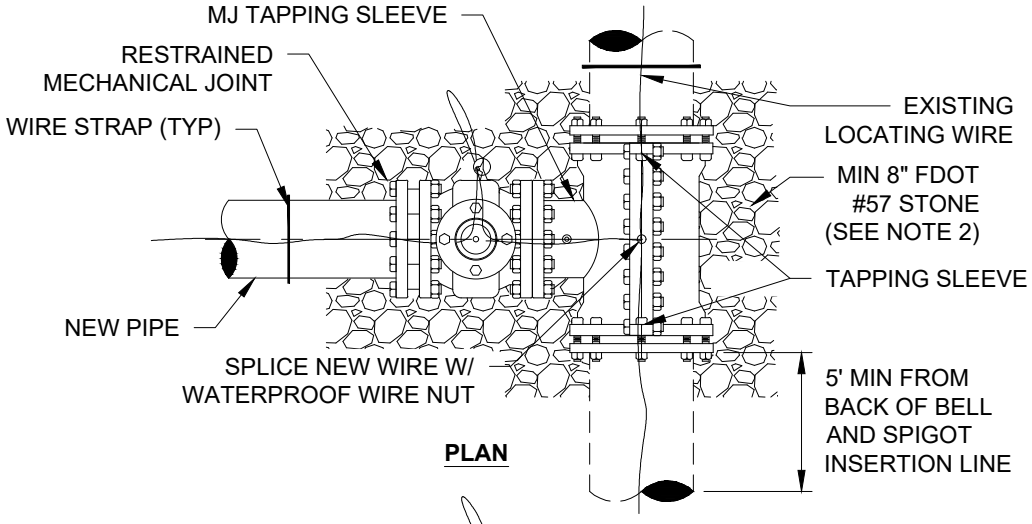


NOTES:

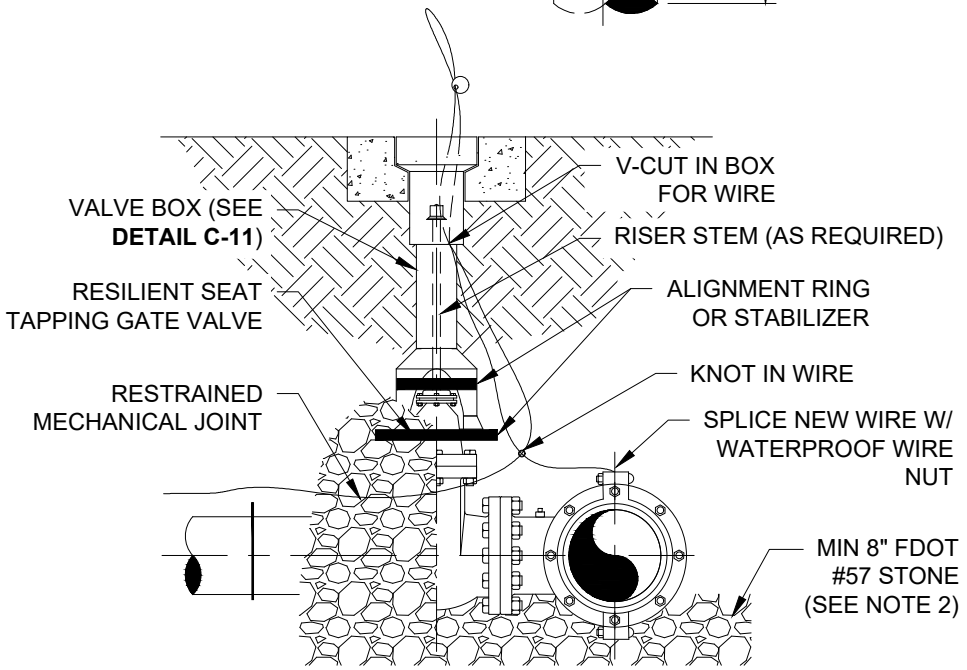
1. CURB STOP SHALL BE INSTALLED AT THE R.O.W. LINE.
2. CONTRACTOR TO LOCATE CURB STOP BY PLACING A 2-IN x 2-IN SQUARE STAKE RISING 24-IN ABOVE THE GROUND. TOP OF STAKE SHALL BE PAINTED THE COLOR OF THE UTILITY SERVICE AND LABELED WITH THE LOT NUMBER(S) IT SERVES.
3. CASING PIPE WITH END SEALS REQUIRED FOR SERVICES UNDER NON-LOCAL ROADS. CASING PIPE SHALL BE 2-IN PE FOR 1-IN SERVICE AND 4-IN HDPE FOR 2-IN SERVICE. EXTEND CASING A MINIMUM OF 24-IN BEYOND CURB. CASING PIPE NOT REQUIRED FOR LOCAL ROADS.
4. 2-IN SERVICE LINE REQUIRES 2-IN GATE VALVE W/ VALVE BOX TO FINISH GRADE.
5. 1-IN SERVICE, THE SADDLE AND CORPORATION STOP SHALL BE INSTALLED AT 10 OR 2 O'CLOCK FACING OUTWARDS TOWARDS THE SERVICE LOCATION. 2-IN SERVICE, THE SADDLE AND CORPORATION STOP SHALL BE INSTALLED AT 9 OR 3 O'CLOCK FACING OUTWARDS TOWARDS THE SERVICE LOCATION.

DATE: 5/2023

DETAIL NO: C-24



PLAN

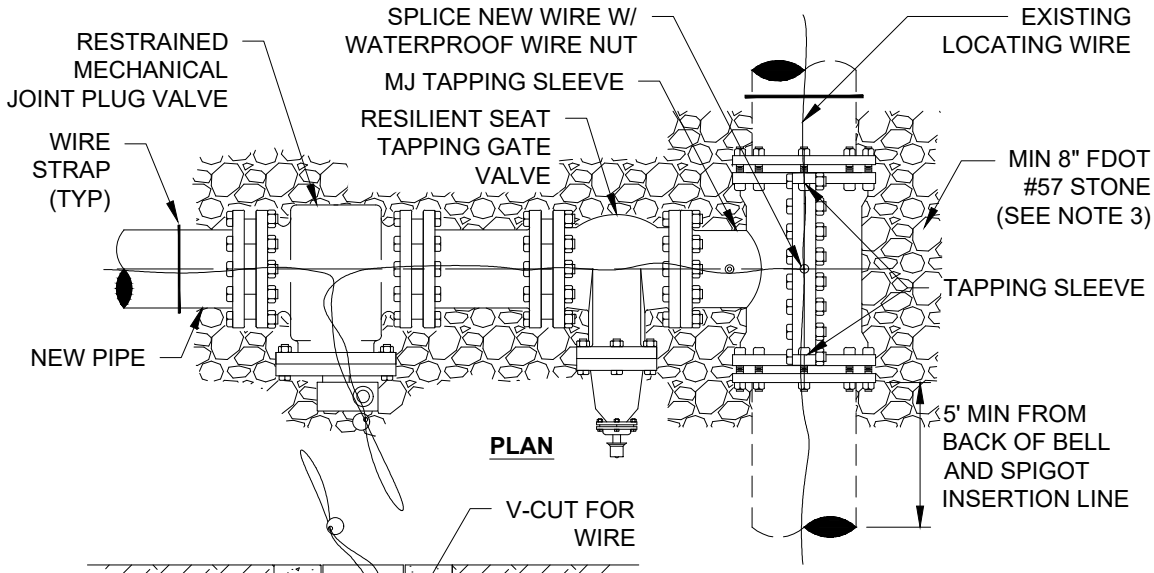


PROFILE

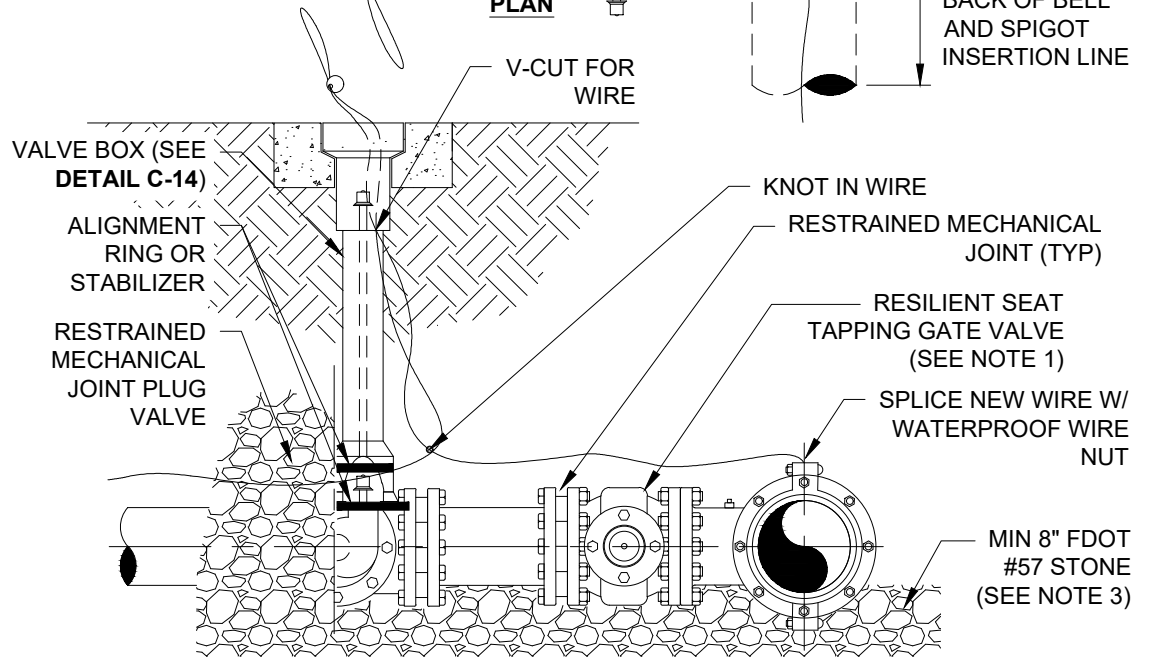
NOTES:

1. TAPPING SLEEVE INSTALLATION SHALL BE IN ACCORDANCE WITH THE UTILITIES STANDARDS HANDBOOK.
2. BEDDING ROCK SHALL BE FULLY AND UNIFORMALLY SUPPORTING THE TAPPING SLEEVE & VALVE AT A MIN OF 8-IN IN ALL DIRECTIONS.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL MJ TAPPING SLEEVE & GATE VALVE ASSEMBLY- RECLAIMED WATER MAINS	DATE: 5/2023 DETAIL NO: C-25



PLAN

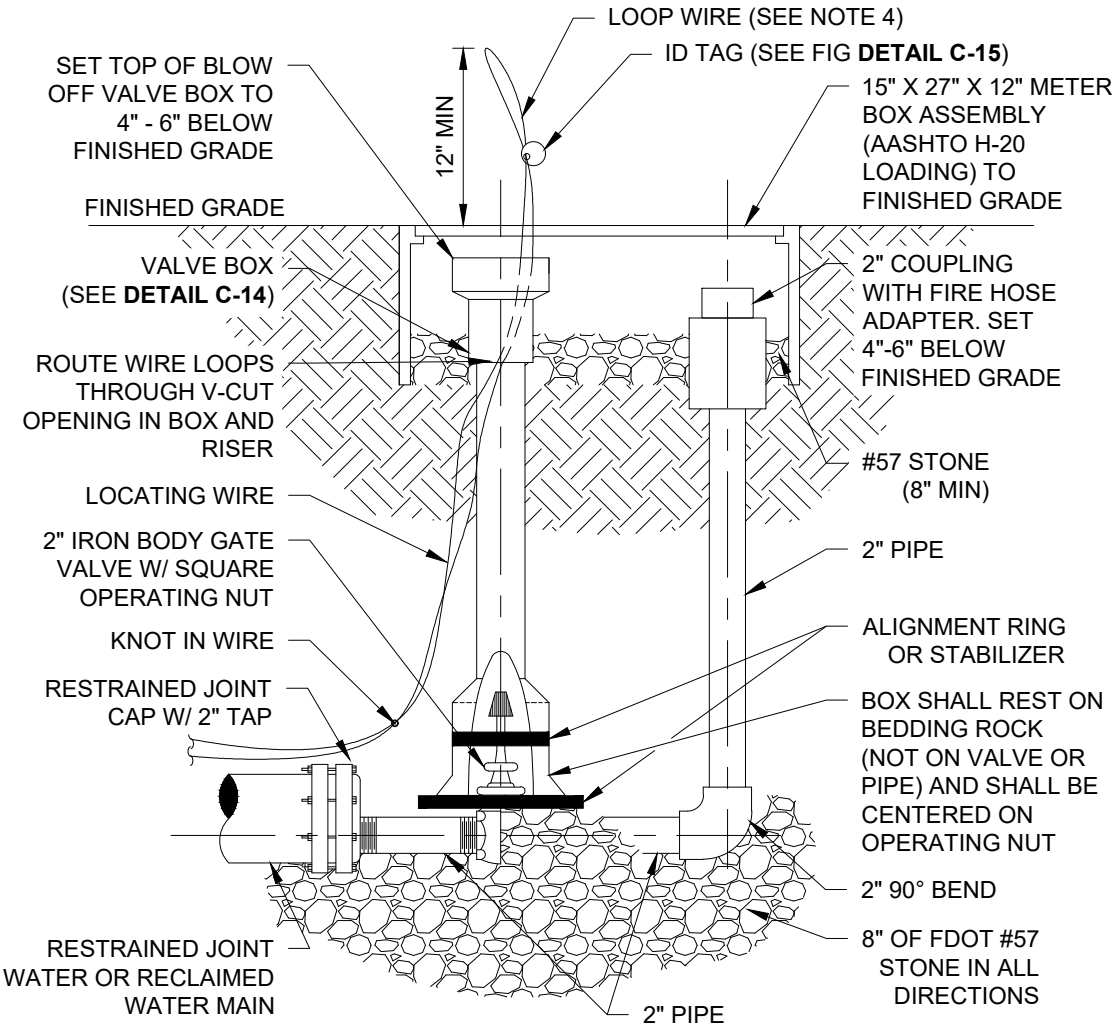


PROFILE

NOTES:

1. TAPPING GATE VALVE TO BE INSTALLED HORIZONTALLY AND ABANDONED IN THE OPEN POSITION.
2. TAPPING SLEEVE INSTALLATION SHALL BE IN ACCORDANCE WITH THE UTILITIES STANDARDS HANDBOOK.
3. BEDDING ROCK SHALL BE FULLY AND UNIFORMALLY SUPPORTING THE TAPPING SLEEVE & VALVE AT A MIN OF 8-IN IN ALL DIRECTIONS.

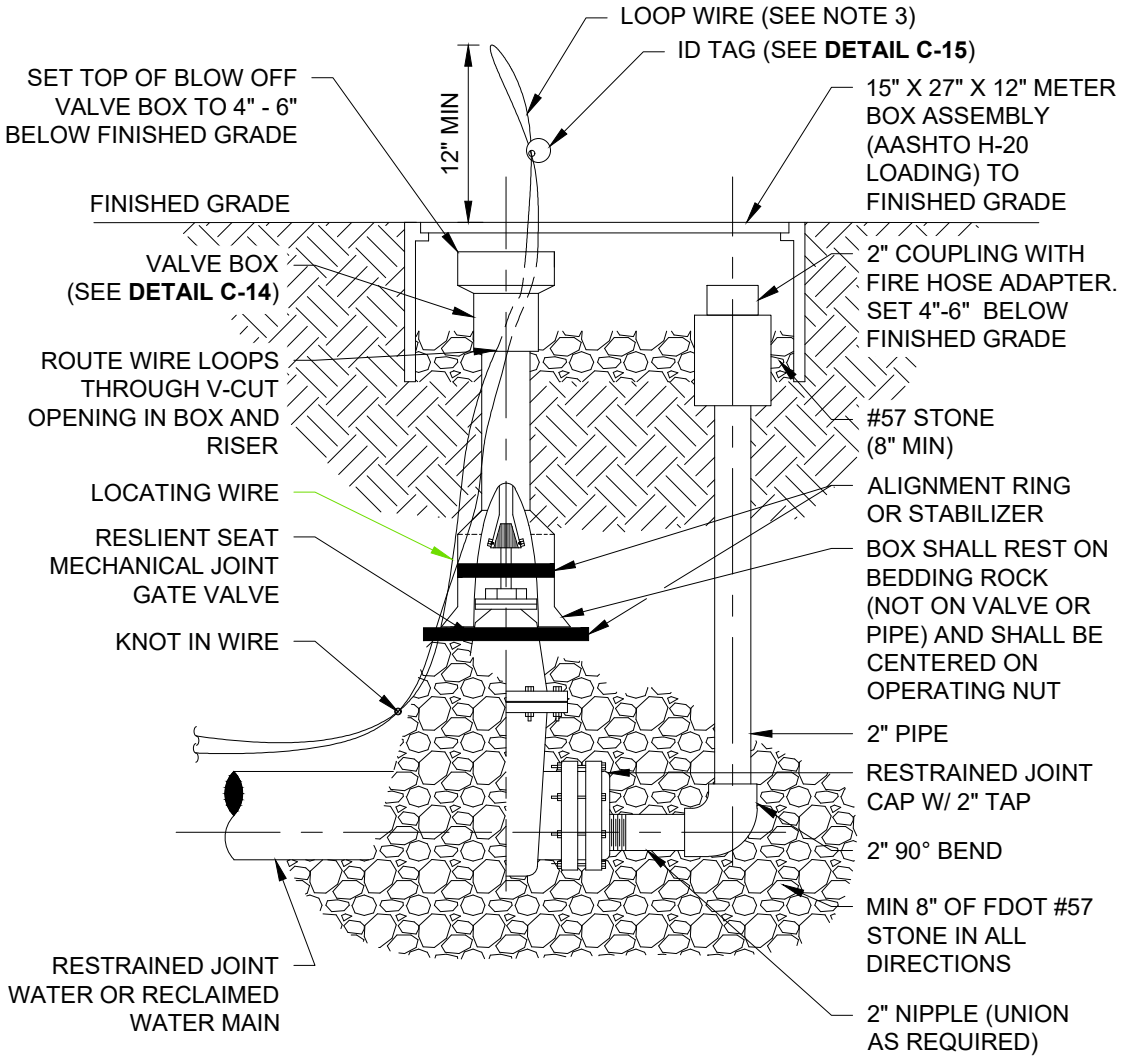
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL MJ TAPPING SLEEVE & GATE VALVE ASSEMBLY WITH PLUG VALVE - WASTEWATER	DATE: 5/2023 DETAIL NO: C-26



NOTES:

1. INSTALL MANUFACTURED BLOW OFF BOXES AS APPROVED IN APPENDIX D.
2. FOR USE AT PERMANENT WATER AND RECLAIMED WATER DEAD-ENDS, SUCH AS CUL-DE-SACS.
3. LOCATING WIRE SHALL BE CONTINUOUS INSIDE THE VALVE BOX AND SHALL EXTEND 12-IN ABOVE TOP OF COLLAR. WIRE SHALL BE COLOR CODED TO MATCH THE UTILITY INSTALLED.
4. DRILL HOLE IN ID TAG AND INSTALL ON TRACING WIRE.
5. SHALL NOT BE INSTALLED IN THE PAVEMENT, SIDEWALK, OR CURB.
6. ALL PIPE AND FITTINGS SHALL BE SCH 40 BRASS OR 316 SST.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL PERMANENT BLOW OFF VALVE - RECLAIMED WATER MAINS	DATE: 5/2023 DETAIL NO: C-27



NOTES:

1. FOR USE AT PHASE LINES OR TEMPORARY TERMINATION POINTS.
2. LOCATING WIRE SHALL BE CONTINUOUS INSIDE THE VALVE BOX AND SHALL EXTEND 12-IN ABOVE TOP OF COLLAR. WIRE SHALL BE COLOR CODED TO MATCH THE UTILITY INSTALLED.
3. DRILL HOLE IN ID TAG AND INSTALL ON TRACING WIRE.
4. ALL PIPE AND FITTINGS SHALL BE SCH 40 BRASS OR 316 SST.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL TEMPORARY BLOW OFF VALVE - RECLAIMED WATER MAINS	DATE: 5/2023 DETAIL NO: C-28

SEWER CONSTRUCTION GENERAL NOTES:

1. REFER TO THE OVERALL CONSTRUCTION GENERAL NOTES AND UTILITIES STANDARDS HANDBOOK RELATED TO PIPE, MANHOLES, VALVES, FITTINGS, TRENCHING, TESTING AND OTHER REQUIREMENTS RELATED TO SEWER SYSTEM CONSTRUCTION.

2. PVC SEWER PIPE SHALL BE GREEN PVC SDR 26, ASTM D-3034. IN PLACES WHERE A MINIMUM COVER OF 3.0' CANNOT BE MAINTAINED, AWWA C900 GREEN PVC DR-25, CLASS 100 OR CONCRETE ENCASEMENT SHALL BE USED. SEWER LINES CONSTRUCTED BETWEEN MANHOLES SHALL FOLLOW A STRAIGHT ALIGNMENT. BENDING OF SEWER PIPE IN ANY DIRECTION IS PROHIBITED.

3. GRAVITY SANITARY SEWER LINE CONSTRUCTION SHALL BE ACCOMPLISHED BY THE USE OF A LASER INSTRUMENT UNLESS ANOTHER METHOD IS PREVIOUSLY APPROVED BY THE CITY.

4. MANHOLE RIMS SHALL MATCH FLUSH WITH THE FINISH GRADE ELEVATION IN PAVED AREAS AND A MINIMUM OF 0.2 FEET AND MAXIMUM OF 0.5 FEET ABOVE GRADE GENERALLY IN UNPAVED AREAS.

5. THE CONTRACTOR SHALL CONSTRUCT SANITARY SEWER MANHOLES IN SUCH A WAY THAT SEWER LINES DO NOT INTERSECT SEALED JOINTS BETWEEN SECTIONS OF THE MANHOLE.

6. RUBBER BOOTS AND 316 STAINLESS STEEL BANDS SHALL BE UTILIZED IN THE CONNECTION OF THE SEWER MAIN TO THE MANHOLES PER THE STANDARD CONSTRUCTION DETAIL.

7. NEW SEWER MANHOLES SHALL BE COATED INSIDE AND OUT WITH TWO (2) COATS OF WATER BASED POLYAMINE EPOXY COATING, MIN. 8 MILS THICK PER COAT. EXISTING AND NEW MANHOLES THAT RECEIVE NEWLY CONSTRUCTED FORCE MAIN DISCHARGE SHALL BE COATED OR LINED PER THE UTILITIES STANDARDS HANDBOOK.

8. THE CONTRACTOR SHALL TAKE ALL MEASURES NECESSARY TO PREVENT FLOATATION OF MANHOLES AND PIPE DUE TO HIGH GROUND WATER TABLE.

9. INDIVIDUAL SANITARY SERVICE ON NEW CONSTRUCTION SHALL NOT BE CONNECTED DIRECTLY INTO MANHOLES, AND MUST BE CONNECTED TO SEWER MAIN LINES BY USE OF WYE CONNECTIONS, UNLESS OTHERWISE APPROVED BY THE CITY.

10. FOR SINGLE FAMILY HOMES, SINGLE FOUR INCH SEWER SERVICES LATERALS SHALL BE CONSTRUCTED AT EACH LOT OR UNIT AND LOCATED ON THE DOWNSTREAM SIDE OF THE LOT CENTERLINE. THESE SERVICES SHALL BE EXTENDED 4 FEET ABOVE GROUND AT THE PROPERTY LINE WITH A PVC RISER AND PLUS BEING EASILY VISIBLE FROM THE ROAD. RUBBER SEAL FITTINGS SHALL BE USED ON ALL LINES. NO GLUED JOINTS ARE PERMITTED ON LATERALS.

11. ALL GRAVITY SEWER LINES WHICH ARE CONSTRUCTED OUTSIDE OF PUBLIC RIGHTS-OF-WAY WITHIN EASEMENTS IN SIDE YARDS, BACKYARDS, AND OTHER POORLY ACCESSIBLE AREAS SHALL BE CONSTRUCTED USING PRESSURE RATED C900 DR21 PVC PIPE. IN THE EVENT FITTINGS ARE REQUIRED THEY SHALL BE D.I. PER THE UTILITIES STANDARDS MANUAL.

12. SEWER LATERAL LOCATIONS SHALL BE MARKED ALONG THE OUTSIDE OF THE CURB WITH A SAW CUT "S", OR BY A METAL TAB SET INTO THE PAVEMENT.

13. AS A GENERAL RULE, THE NUMBER OF JOINTS BETWEEN MANHOLES SHALL BE LIMITED WHENEVER POSSIBLE. IN SPECIAL CASES WHERE A POINT REPAIR TO AN 8" TO 12" PVC GRAVITY SEWER LINE IS REQUIRED, THE PROPER RIGID WRAP AROUND SLEEVE SUCH AS A JCM-210 OVERSIZED DUCTILE IRON COUPLING OR AN APPROVED EQUAL MAY BE ALLOWED BY SPECIAL APPROVAL BY THE CITY.

14. ALL CORING OF EXISTING MANHOLES SHALL BE PERFORMED BY THE CONTRACTOR AND WITNESSED BY THE CITY AND REQUIRES A MINIMUM 2 BUSINESS DAYS NOTIFICATION TO THE CITY. THE CONNECTION SHALL BE SCHEDULED TO COMMENCE BETWEEN 8:00 AM AND NOON ON THE SCHEDULED DAY, WITH RESPECT TO TIE-IN CONNECTIONS AND CORING OPERATIONS. THE CITY RESERVES THE RIGHT TO REQUIRE CONNECTIONS TO BE PERFORMED DURING PERIODS OF LOW FLOW (MIDNIGHT TO 6:00 AM) IN ORDER TO MINIMIZE SERVICE DISRUPTION TO EXISTING CUSTOMERS.

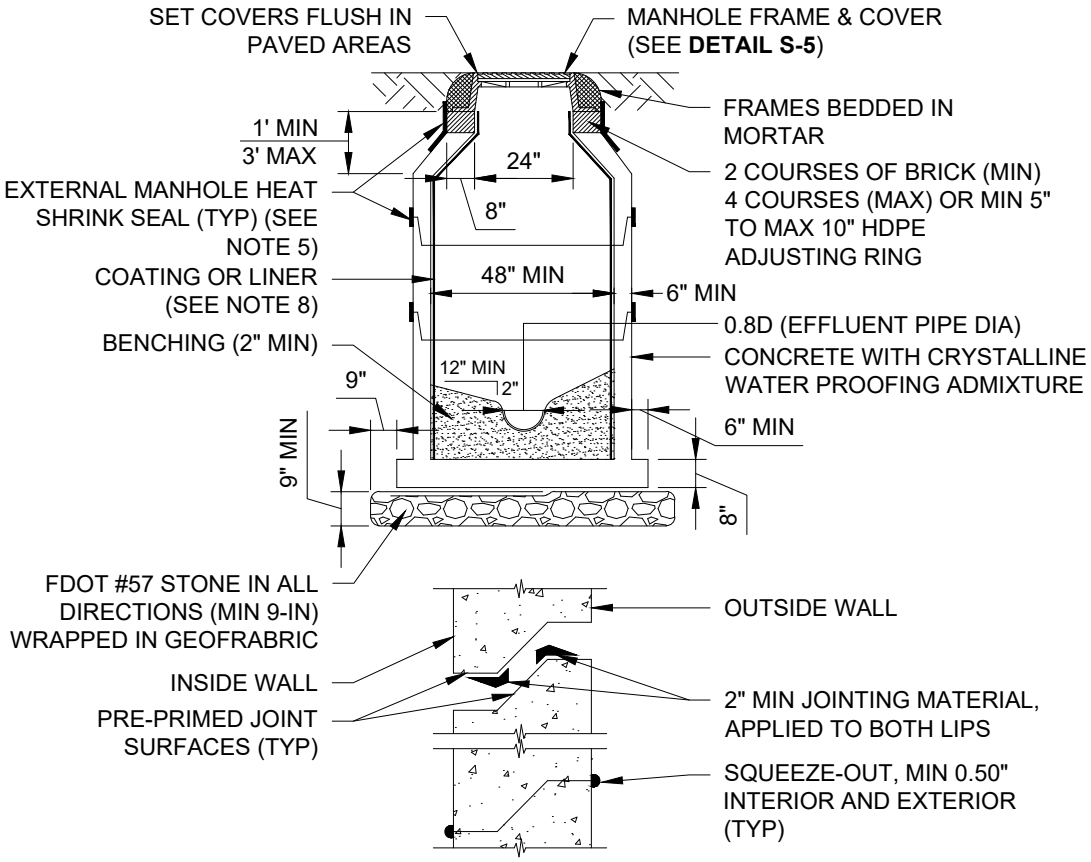
15. THE CONTRACTOR SHALL PROVIDE AND PAY FOR BYPASSING OR HAULING OF WASTEWATER DURING APPROVED INTERRUPTIONS OF WASTEWATER FLOWS AND CONNECTIONS. SUBMIT THE BYPASS PLAN FOR APPROVAL. AS A MINIMUM, THE BYPASS PLAN SHALL INCLUDE PROPOSED DISCHARGE LOCATIONS AND PROPOSED PUMPS. REFER TO THE UTILITIES STANDARDS HANDBOOK FOR ADDITIONAL REQUIREMENTS OF THE BYPASS PUMPING.

16. THE CITY MAY REQUIRE ALL NEW SANITARY SEWER GRAVITY SYSTEMS TO BE SMOKE TESTED PRIOR TO FINAL ACCEPTANCE. ALL TESTING MUST BE DONE IN THE PRESENCE OF THE CITY'S DESIGNATED SITE INSPECTOR, AND SHALL BE AT THE CONTRACTOR'S EXPENSE.

17. THE CITY RESERVES THE RIGHT TO REQUIRE THE CONTRACTOR TO PERFORM VACUUM TESTING OF ALL SANITARY MANHOLES, AIR TEST SEWER MAINS, AND REQUIRES THAT ALL SANITARY SEWER MAIN LINES BE TELEVISED PRIOR TO FINAL ACCEPTANCE. LATERALS SHALL BE TELEVISED UPON DEMAND BY THE CITY PRIOR TO FINAL ACCEPTANCE WHEN IT IS SUSPECTED THAT A PROBLEM EXISTS. ALL TESTING SHALL BE AT THE CONTRACTOR'S EXPENSE.

18. ALL GRAVITY SEWER LINES, PRIOR TO FINAL ACCEPTANCE BY THE CITY AND PRIOR TO ANY FINAL PAVING OPERATIONS, SHALL BE TELEVISED AT THE CONTRACTOR'S EXPENSE AND SUBMITTED TO THE CITY USING A "PAN AND TILT CAMERA" WITH DEPTH GAUGE IN FRONT OF THE CAMERA BY A CITY APPROVED CONTRACTOR. THE CAMERA SHALL RUN FROM THE DOWNSTREAM MANHOLE TO THE UPSTREAM MANHOLE. CITY INSPECTOR SHALL BE NOTIFIED IN ADVANCE AND BE PRESENT DURING THE TELEVISING OF THE SEWER SYSTEM. THE VIDEO SHALL BE NON-STOP WITH AUDIO DESCRIBING WHAT IS BEING REVIEWED. WRITTEN VIDEO LOGS DESCRIBING THE CONDITION OF THE LINES SHALL ACCOMPANY THE VIDEO SUBMISSION TO THE CITY PRIOR TO COMMENCING ANY INSTALLATION OF ASPHALT OR CONCRETE PAVEMENT. THE CITY MAY REQUIRE ADDITIONAL VIDEO TAPING OF THE MAIN OR LATERALS, AND/OR INFILTRATION/EXFILTRATION TESTS IF DEFECTS ARE APPARENT OR WORKMANSHIP IS QUESTIONABLE.

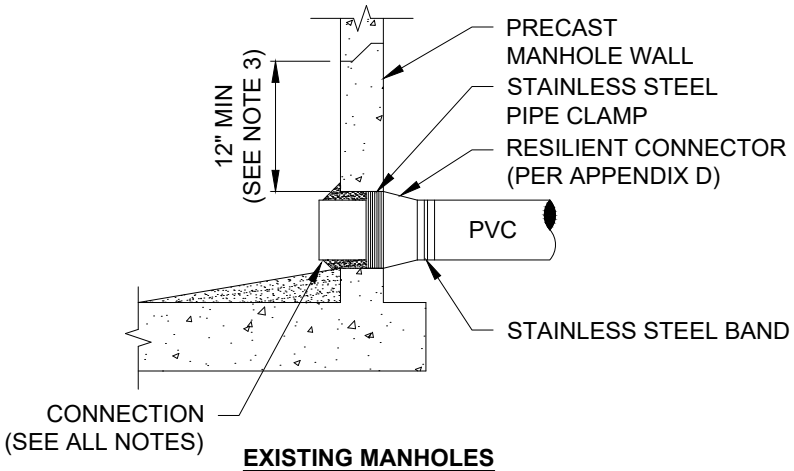
19. THE CONTRACTOR SHALL, AT ITS EXPENSE, CONDUCT DEFLECTION TESTING OF GRAVITY SEWER PIPELINE AFTER THE FINAL BACKFILL HAS BEEN IN PLACE AT LEAST 30 DAYS. MAXIMUM ALLOWABLE PIPE DEFLECTION IS 5%. THE CITY INSPECTOR SHALL BE NOTIFIED IN ADVANCE AND BE PRESENT DURING THE DEFLECTION TESTING. MEASURE DEFLECTION BY MANUALLY PULLING A MANDREL THROUGH THE PIPE. THE MINIMUM MANDREL OUTER DIAMETER SHALL BE IN ACCORDANCE WITH THE FOLLOWING: 6" SEWER = 5.45" MANDREL; 8" SEWER = 7.28" MANDREL; 10" SEWER = 9.08" MANDREL; 12" SEWER = 10.79" MANDREL.
20. ALL FORCE MAIN VALVES SHALL BE ADJUSTED TO FINISHED GRADE AND THE VALVE BOX LIDS PAINTED GREEN PER THE UTILITIES STANDARDS HANDBOOK.
21. ALL FORCE MAIN VALVES SHALL BE CAST IRON SUITABLE FOR WASTEWATER SERVICE WITH PRESSURES UP TO 250 PSIG, AND SHALL BE QUARTER-TURN, NON-LUBRICATED, ECCENTRIC TYPE WITH RESILIENT FACED PLUG, MANUFACTURED AND TESTED IN ACCORDANCE WITH AWWA C517. PORT AREAS OF NOT LESS THAT 100% OF PIPE AREA SHALL BE SUPPLIED ON ALL VALVES.
22. ALL PLUG VALVES SHALL BE MARKED WITH AN "X" SAW CUT INTO THE CURB OR BY METAL TABS SET INTO THE PAVEMENT. TAPPING VALVES SHALL BE MARKED WITH AN "X" SAW CUT INTO THE CURB OR PAVEMENT WITH THE ARROW POINTING TO THE DIRECTION OF THE PRESSURE MAIN RUN.



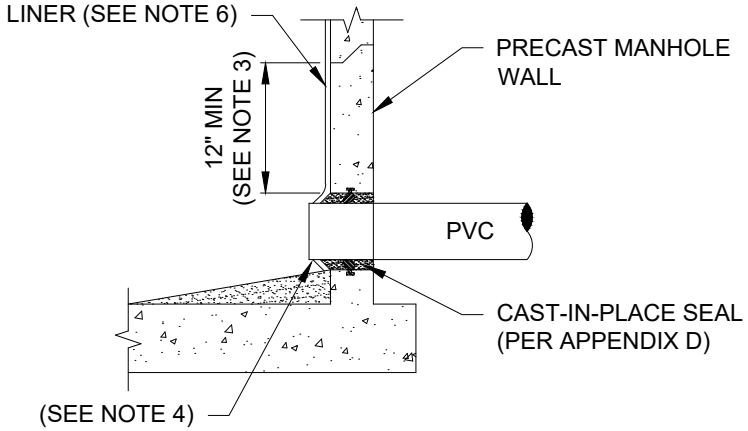
NOTES:

1. DROP CONNECTIONS ARE REQUIRED WHENEVER INVERT OF INFLUENT SEWER IS 24-IN OR MORE ABOVE THE INVERT OF THE MANHOLE. SEE MANHOLE **DETAIL S-3**.
2. ECCENTRIC CONE DESIGN MAY BE USED FOR CONFLICT RESOLUTION WITH CITY APPROVAL.
3. A FLOW CHANNEL SHALL BE CONSTRUCTED INSIDE MANHOLE TO DIRECT INFLUENT INTO FLOW STREAM IN ACCORDANCE WITH **DETAIL S-4**.
4. LIFT HOLES THROUGH STRUCTURE ARE NOT PERMITTED.
5. HEAT SHRINK WRAP FOR ALL BARREL SECTION JOINTS SHALL BE A MIN 9-IN WIDTH AND A MIN 17-IN WIDTH WRAP ON THE CORBEL SECTION, RISER RINGS AND RING AND COVER.
6. HDPE ADJUSTING RINGS MAY BE SUBSTITUTED FOR BRICK RISERS.
7. SECTION HEIGHTS VARY AS REQUIRED, AND AS AVAILABLE, FROM APPROVED MANUFACTURERS LISTED IN APPENDIX D AND IN COMPLIANCE WITH ASTM C478.
8. MANHOLE SHALL BE COATED OR LINED IN ACCORDANCE WITH THE UTILITIES STANDARDS HANDBOOK.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL PRECAST CONCRETE MANHOLE	DATE: 5/2023 DETAIL NO: S-2



EXISTING MANHOLES

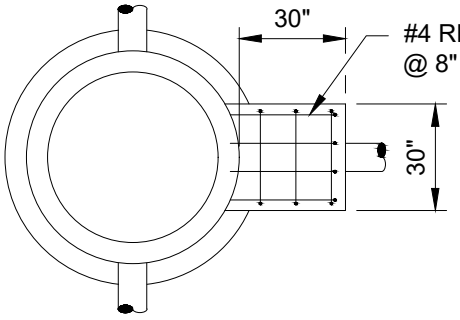


NEW MANHOLE ONLY

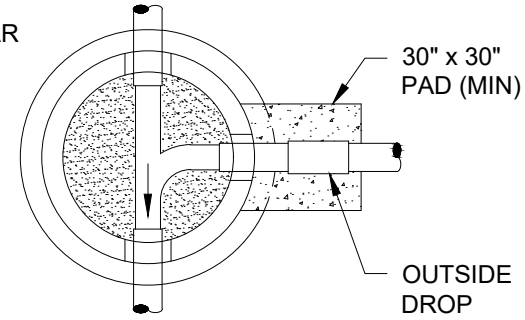
NOTES:

1. AN OUTSIDE DROP CONNECTION SHALL BE REQUIRED FOR ALL INFLUENT LINES WHICH HAVE AN INVERT 2-FT OR MORE ABOVE THE MANHOLE INVERT. SEE **DETAIL S-3 (PAGE 2 OF 2)**.
2. CONTRACTOR SHALL COORDINATE THE PRESENCE OF UTILITIES INSPECTOR DURING EXCAVATION, CORING AND CONNECTIONS TO EXISTING MANHOLES.
3. ALL PIPE CONNECTIONS SHALL HAVE A MINIMUM OF 12-IN SEPARATION FROM ALL JOINTS AND CORES.
4. PIPE SHALL PROTRUDE INTO MANHOLE 2-IN TO 4-IN. THE CONTRACTOR SHALL BEVEL MUD FROM EDGE OF PIPE TO WALL.
5. CONNECTIONS ON EXISTING MANHOLES, REFER TO THE UTILITIES STANDARDS HANDBOOK FOR EXCAVATIONS FOR STRUCTURES.
6. MANHOLE SHALL BE COATED OR LINED IN ACCORDANCE WITH THE UTILTIES STANDARDS HANDBOOK.

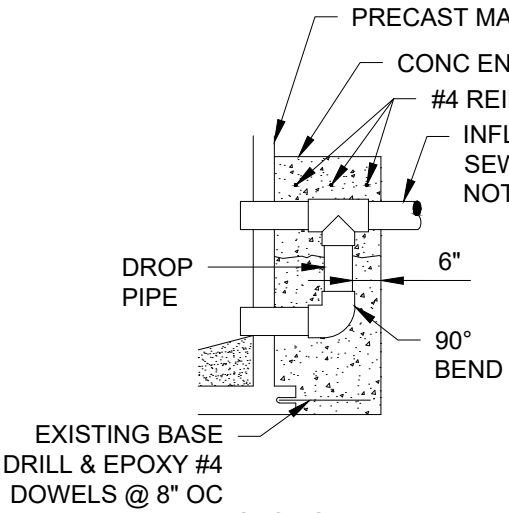
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL GRAVITY MANHOLE CONNECTION	DATE: 5/2023 DETAIL NO: S-3 (PAGE 1 OF 2)



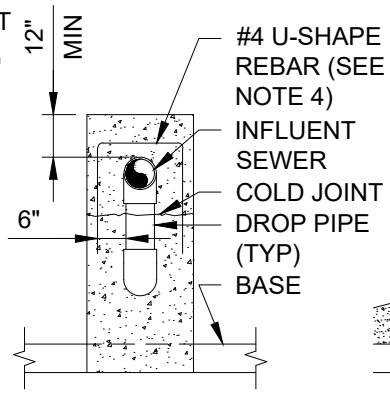
TOP PLAN



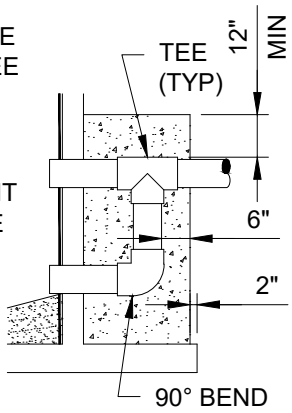
FOUNDATION PLAN



SECTION
(EXISTING MANHOLE)



SECTION
(EXISTING MANHOLE)

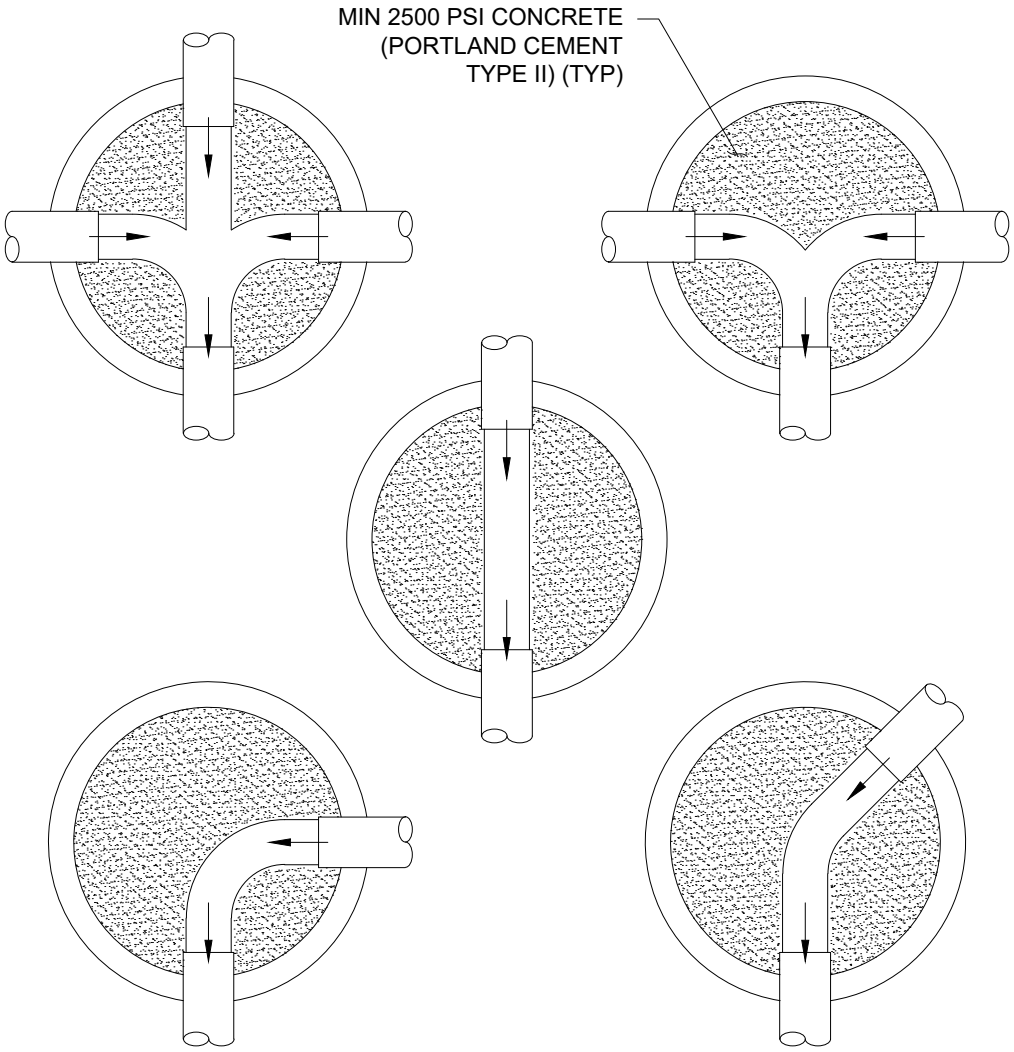


SECTION
(NEW MANHOLE)

NOTES:

1. DROP PIPE AND FITTINGS SHALL BE OF EQUAL SIZE AND MATERIAL AS THE INFLUENT SEWER.
2. AN OUTSIDE DROP CONNECTION SHALL BE REQUIRED FOR ALL INFLUENT LINES WHICH HAVE AN INVERT 2-FT OR MORE ABOVE THE MANHOLE INVERT.
3. CONTRACTOR SHALL COORDINATE THE PRESENCE OF UTILITIES INSPECTOR DURING EXCAVATION, CORING AND CONNECTIONS TO EXISTING MANHOLES.
4. FORM AND POUR CONCRETE TO BOTTOM OF TEE. INSTALL A MINIMUM OF TWO (2) U-SHAPE REBAR MIN 8-IN BELOW TEE. INSTALL GRAVITY MAIN, FORM & CAP OFF W/ CONCRETE MIN 12-IN ABOVE INFLUENT PIPE.
5. ALL PIPE CONNECTIONS SHALL HAVE A MINIMUM OF 12-IN SEPARATION FROM ALL JOINTS AND CORES.

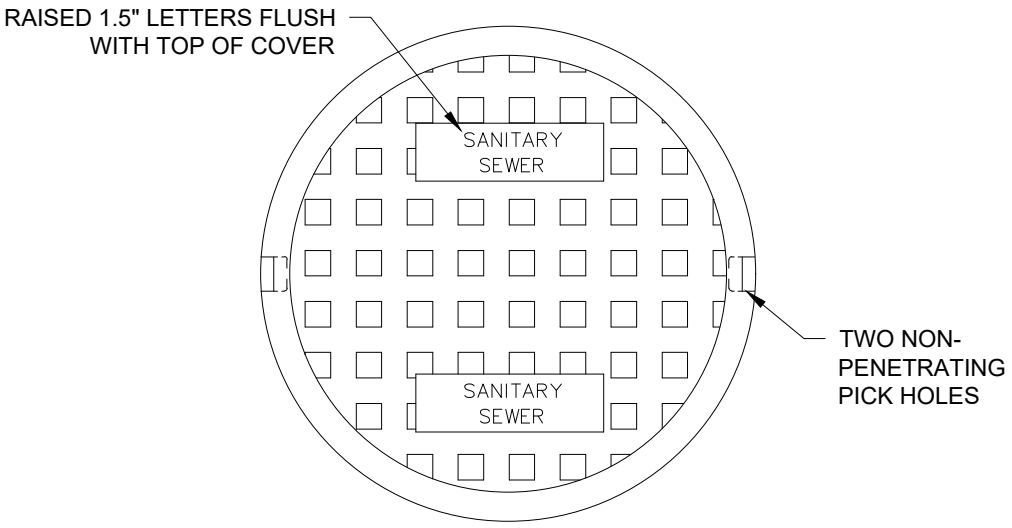
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL GRAVITY MANHOLE CONNECTION - OUTSIDE DROP	DATE: 5/2023 DETAIL NO: S-3 (PAGE 2 OF 2)



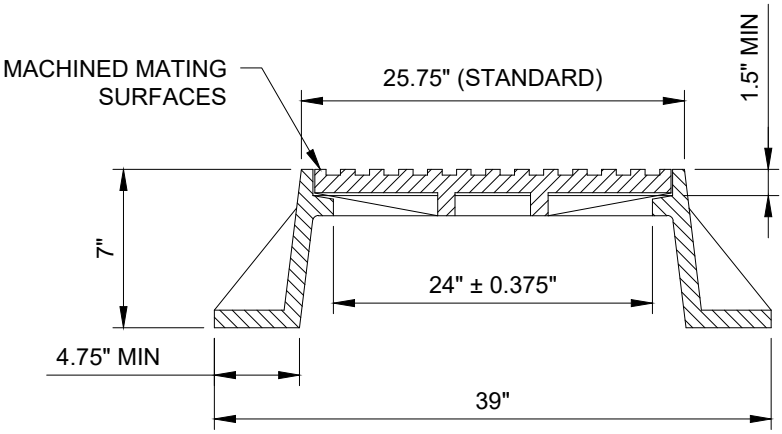
NOTES:

1. ALL PIPE CONNECTIONS SHALL BE IN ACCORDANCE WITH **DETAIL S-3**, GRAVITY MANHOLE CONNECTIONS
2. ALL BENCH WORK SHALL SLOPE TOWARDS THE INVERT AND BE A MIN 2-IN PER FOOT SLOPE.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL GRAVITY MANHOLE FLOW CHANNELS	DATE: 5/2023 DETAIL NO: S-4



PLAN

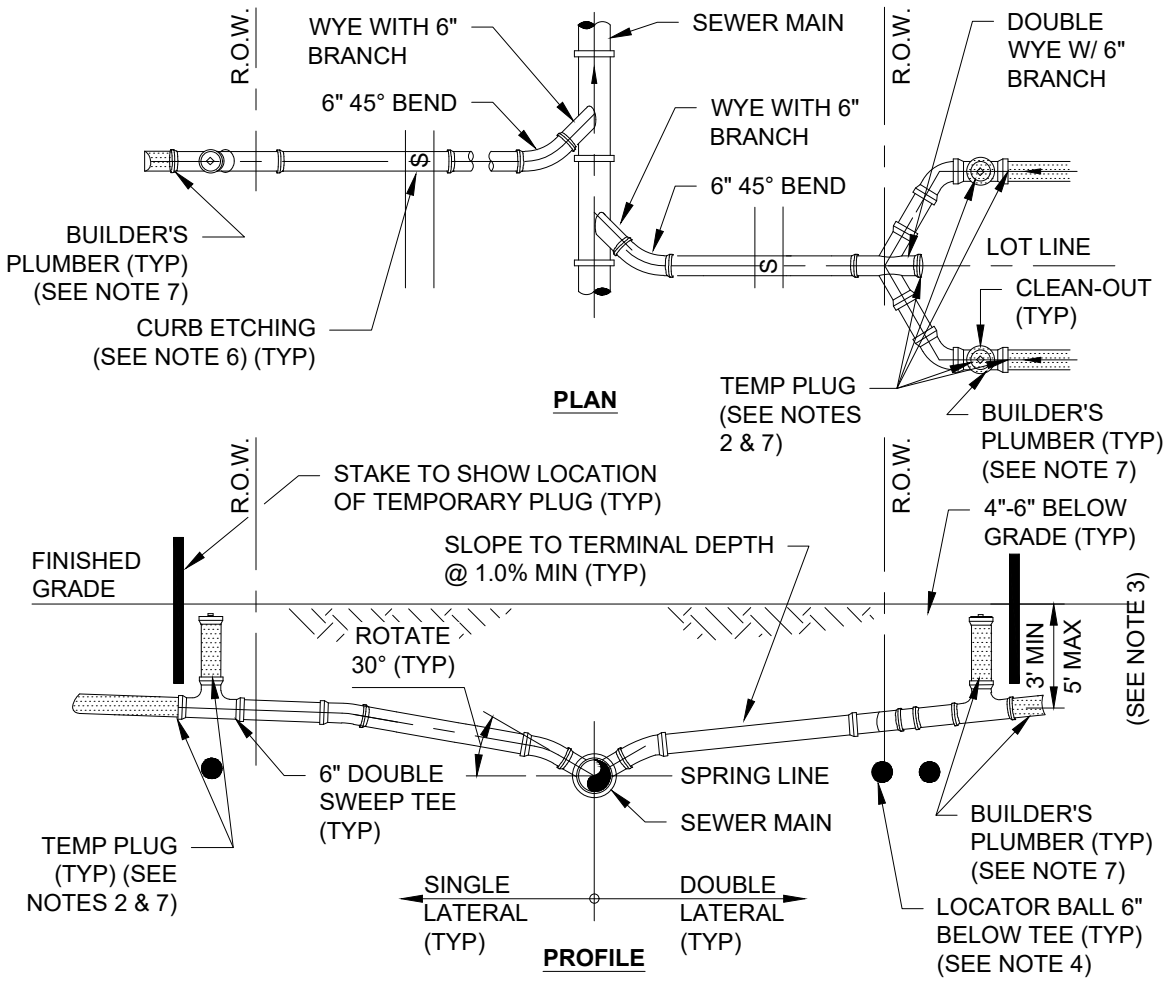


ELEVATION

NOTES:

1. ONLY APPLIES TO UTILITIES OWNED AND MAINTAINED MANHOLES.

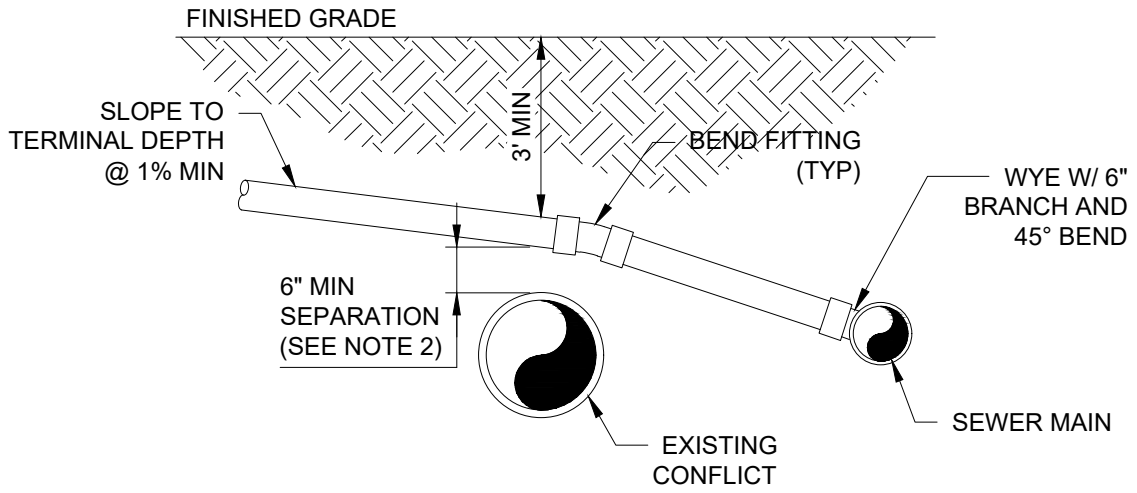
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL STANDARD MANHOLE FRAME & COVER	DATE: 5/2023 DETAIL NO: S-5

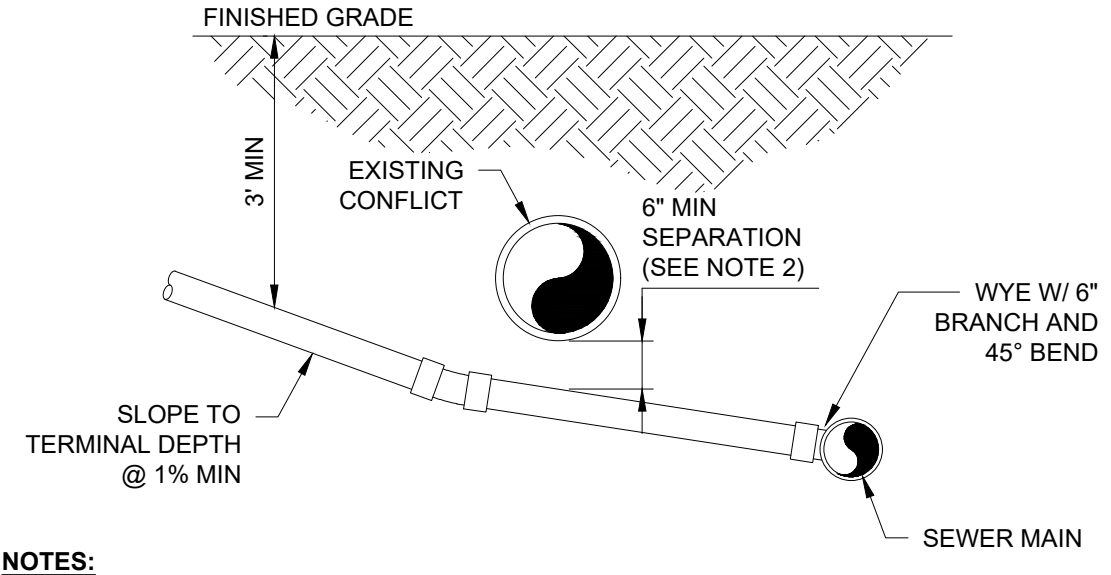


NOTES:

1. INVERT OF SERVICE LATERAL SHALL NOT ENTER SEWER MAIN BELOW SPRING LINE.
2. SERVICE LATERAL AND DOUBLE SWEEP TEES SHALL BE CAPPED BY DEVELOPER'S SITE-WORK CONTRACTOR.
3. TEE & WYE SHALL BE NO SHALLOWER THAN 3-FT AND NO DEEPER THAN 5-FT.
4. LOCATOR BALLS TO BE INSTALLED BY DEVELOPER'S SITE-WORK CONTRACTOR, TWO PER DOUBLE SERVICE AND ONE PER SINGLE SERVICE AT MINIMUM.
5. ALL FITTINGS SHOWN ARE TO BE INSTALLED.
6. SERVICE CONNECTIONS SHALL BE PERMANENTLY MARKED BY CUTTING AN "S" IN THE CURB DIRECTLY OVER THE LATERAL.
7. BUILDER'S PLUMBER WILL REMOVE PLUG(S), INSTALL CLEANOUT ON DOUBLE SWEEP TEE, AND CONNECT SERVICE LATERAL TO HOUSE. NO DIRT OR DEBRIS SHALL ENTER THE SERVICE LATERAL THROUGHOUT CONSTRUCTION.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL SEWER LATERAL	DATE: 5/2023 DETAIL NO: S-6 (PAGE 1 OF 2)

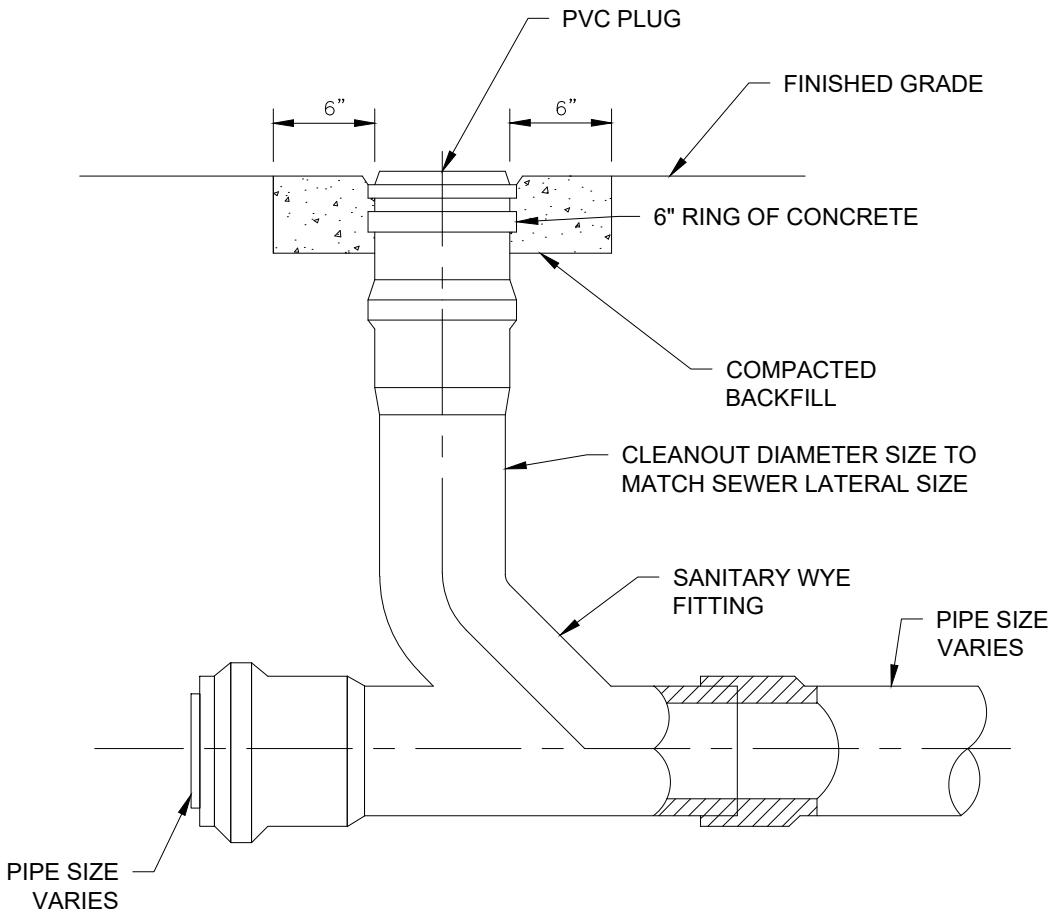




NOTES:

1. GRADE MAX CHANGE TO INSTALL SEWER LATERAL OVER OR UNDER AN EXISTING CONFLICT.
2. ALL CONFLICT SEPARATIONS LESS THAN THE MINIMUM SHALL NOT BE PERMITTED UNLESS APPROVED BY THE UTILITIES INSPECTOR.
3. MINIMUM SLOPE SHALL NOT BE LESS THAN 1%.
4. BEND FITTINGS SHALL BE USED TO ENSURE PROPER SEPARATION FROM ALL HORIZONTAL CONFLICTS.
5. IF A CONFLICT AT THE PROPERTY LINE EXISTS, TWO SINGLE SEWER SERVICES SHALL BE INSTALLED IN AN APPROVED LOCATION BY UTILITIES.

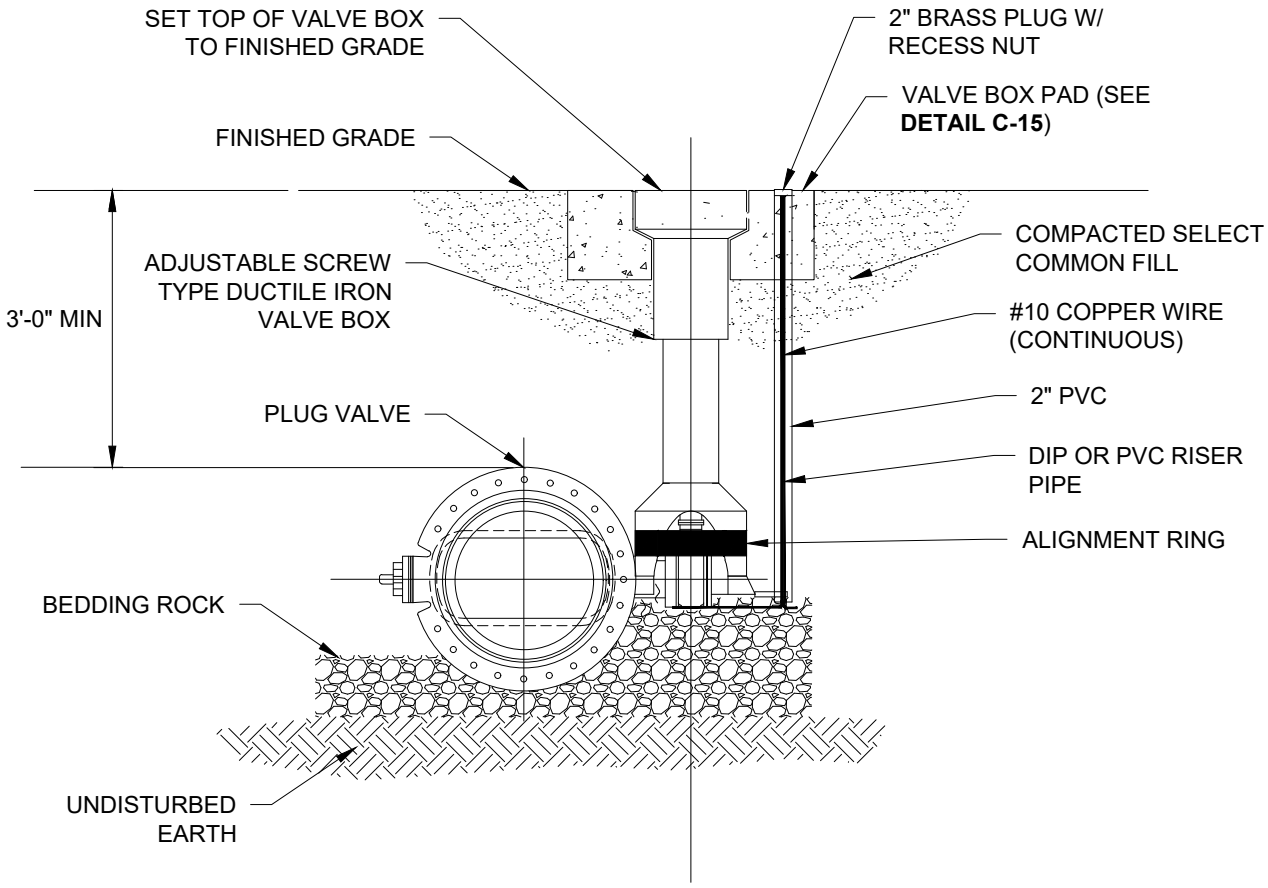
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL SEWER LATERAL - PIPE CONFLICT	DATE: 5/2023 DETAIL NO: S-6 (PAGE 2 OF 2)



NOTES:

1. CLEANOUT SIZE SHOULD ALWAYS MATCH MAIN LINE SIZE TO ALLOW FOR PROPER CLEANING.

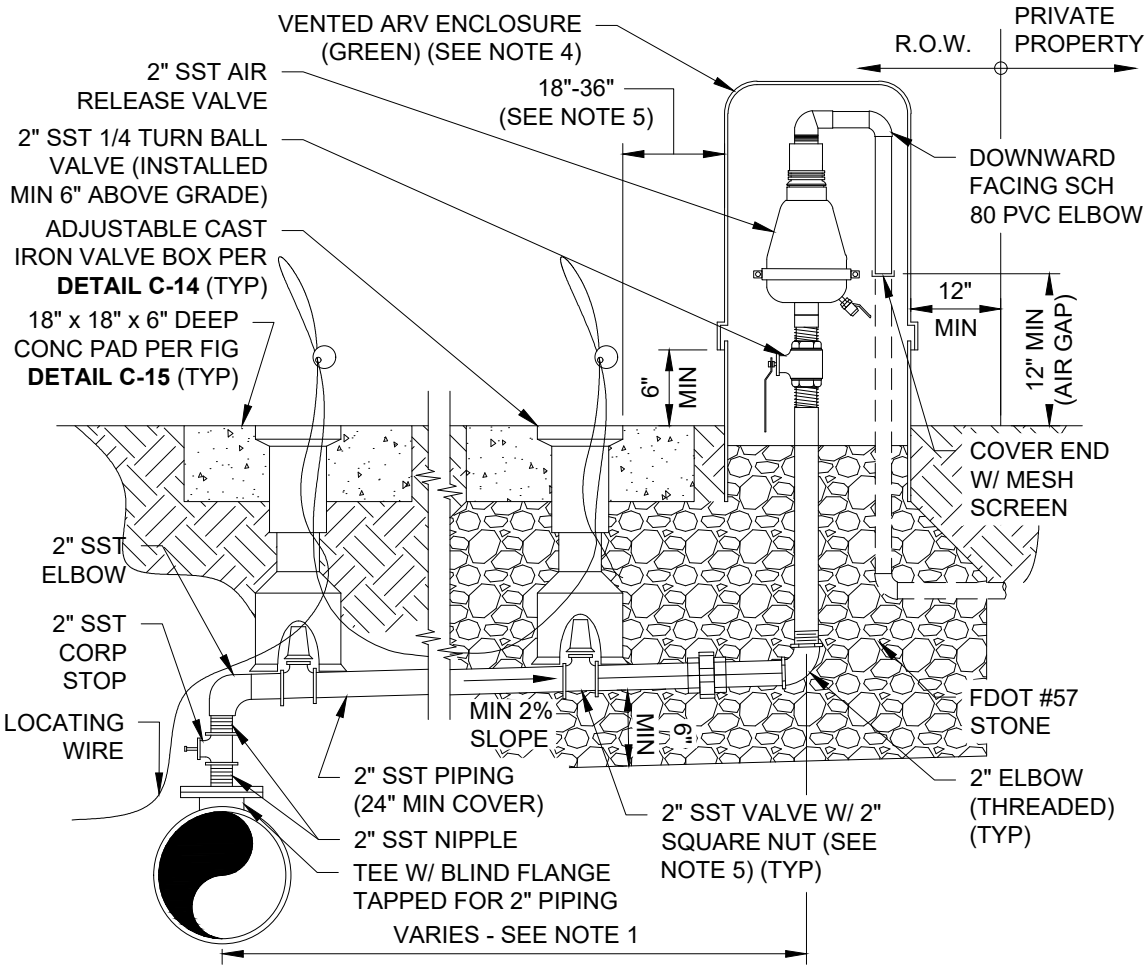
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL SEWER CLEANOUT	DATE: 5/2023 DETAIL NO: S-7



NOTES:

1. THE VALVE ACTUATING NUT SHALL BE EXTENDED TO BE WITHIN 3' OF FINISHED GRADE.
2. LOCATING WIRE SHALL BE CONTINUOUS WITH NO SPLICES AND SHALL EXTEND 12" ABOVE TOP OF COLLAR. WIRE SHALL BE COLOR CODED TO MATCH THE UTILITY INSTALLED.

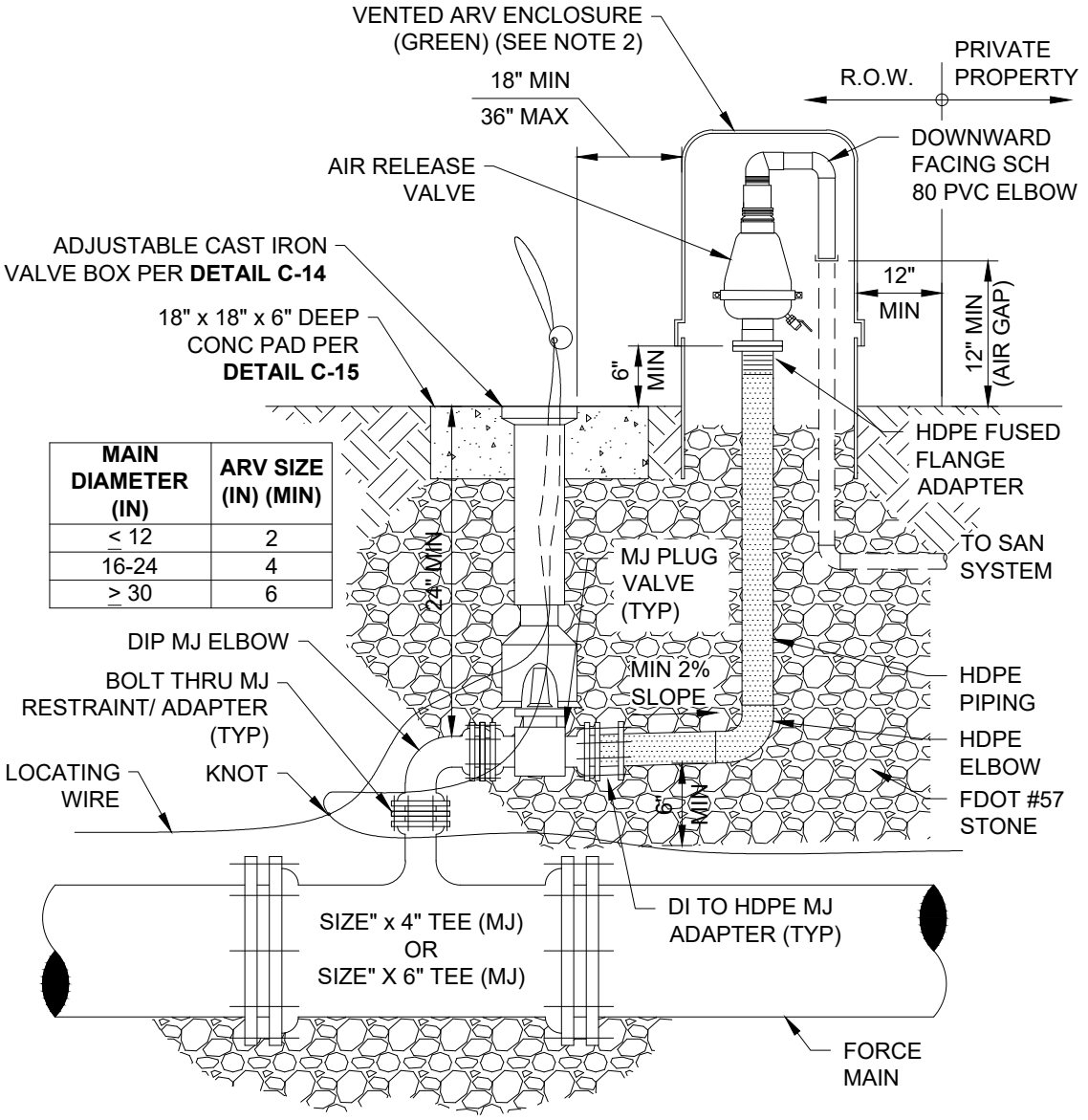
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL PLUG VALVE	DATE: 5/2023 DETAIL NO: S-8



NOTES:

1. OFFSET DISTANCE TO BE FIELD DETERMINED AND AS CLOSE TO THE RIGHT OF WAY AS POSSIBLE AND CLEAR OF PEDESTRIAN WALKWAYS. IF PIPE IS AT RIGHT OF WAY LINE, NO OFFSET IS REQUIRED.
2. ABOVE DETAIL APPLIES TO A 2-IN ARV. FOR LARGER ARVS, PIPE DIAMETER AND VALVES SHALL BE EQUAL TO THE SIZE OF THE ARV. FOR LARGER DIAMETER REFER TO **DETAIL S-11**.
3. ALL PIPING, VALVES AND APPURTENANCES TO BE 316 SST EXCEPT WHERE SPECIFIED OTHERWISE.
4. THE ENCLOSURE VENTS MUST BE CAPABLE OF ALLOWING AT LEAST THE SAME AMOUNT OF AIRFLOW AS THE VALVE.
5. VALVES SHALL BE INSTALLED WITHIN 18-IN FROM 90° AT MAIN. AN ADDITIONAL VALVE IS REQUIRED IF THE VALVE IS IN THE ROAD OR IF THE ARV IS FURTHER THAN 10-FT FROM VALVE.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL COMBINATION AIR RELEASE VALVE FOR WASTEWATER - 2" DIA	DATE: 5/2023 DETAIL NO: S-9 (PAGE 1 OF 2)



MAIN DIAMETER (IN)	ARV SIZE (IN) (MIN)
≤ 12	2
16-24	4
≥ 30	6

NOTES:

1. ALL PIPING, VALVES AND APPURTENANCES TO BE AS SPECIFIED.
2. THE ENCLOSURE VENTS MUST BE CAPABLE OF ALLOWING AT LEAST THE SAME AMOUNT OF AIRFLOW AS THE VALVE.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL COMBINATION AIR RELEASE VALVE FOR WASTEWATER - 4" DIA	DATE: 5/2023 DETAIL NO: S-9 (PAGE 2 OF 2)

LIFT STATION CONSTRUCTION GENERAL NOTES:

1. REFER TO THE OVERALL CONSTRUCTION GENERAL NOTES AND UTILITIES STANDARDS HANDBOOK RELATED TO LIFT STATIONS, INCLUDING PUMPS, VALVES, FITTINGS, PIPE, FENCING, TRENCHING, TESTING AND OTHER REQUIREMENTS RELATED TO LIFT STATION CONSTRUCTION.

2. ALL STANDARD PERIMETER FENCING AT LIFT STATIONS SHALL BE 6' HIGH CHAIN LINK FENCE VINYL COATED BLACK. UPGRADED FENCING IF REQUIRED AND AS APPROVED BY THE CITY IN COMPLIANCE WITH THE ARCHITECTURAL AND LANDSCAPE REQUIREMENTS OF THE LDC SHALL BE INSTALLED BY THE CONTRACTOR AS DETAILED ON THE CONSTRUCTION PLANS. REGARDLESS OF FENCE TYPE, A MINIMUM OF 3-FT CLEARANCE FROM ALL ABOVE GRADE STRUCTURES OR EQUIPMENT SHALL BE PROVIDED.

3. ALL EXPOSED ABOVE GRADE PIPE, VALVES, AND FITTINGS SHALL BE PAINTED PER THE UTILITIES STANDARDS HANDBOOK.

4. PRESSURE GAUGES SHALL BE STAINLESS STEEL WITH A STAINLESS STEEL DIAPHRAGM; 4-1/2" DIAL AND HAVE SUFFICIENT RANGE TO READ 20% ABOVE THE DESIGN HEAD CONDITION (0-50 PSI).

5. THE INTERIOR OF THE WET WELL SHALL BE LINED WITH HDPE, MINIMUM OF 5.0 MM THICKNESS, AS PER APPROVED MANUFACTURERS LIST. THE OUTSIDE OF THE WET WELL SHALL BE COATED WITH TWO (2) COATS OF WATER BASED POLYAMINE EPOXY COATING, MIN. 8 MILS THICK PER COAT.

6. WET WELL ACCESS HATCHES SHALL BE ALUMINUM AND SHALL BE NO LESS THAN 36"X48". A LARGER WET WELL HATCH SIZE MAY BE REQUIRED PER THE PUMP MANUFACTURER. ALL HATCHES SHALL BE NO LESS THAN H20 LOAD RATED. DOORS SHALL HAVE FLUSH ALUMINUM DROP HANDLE WITH A LOCKSET AND AN AUTOMATIC HOLD OPEN ARM WITH RELEASE HANDLE. ALL FASTENERS AND ACCESSORIES SHALL BE 316 STAINLESS STEEL. HATCH FRAMES TO BE INTEGRALLY CAST INTO CONCRETE TOPS. THE HATCHES SHALL BE FLOOD TIGHT.

7. THE UNDERSIDE OF ALUMINUM ACCESS COVERS AND ALL ALUMINUM SURFACES IN CONTACT WITH CONCRETE SHALL BE COATED WITH A SUITABLE BITUMINOUS PAINT. ALL NUTS, BOLTS, WASHERS AND MISCELLANEOUS HARDWARE ARE TO BE 316 STAINLESS STEEL.

8. THE CONTRACTOR SHALL COORDINATE WITH POWER COMPANY FOR ELECTRICAL SERVICE TO THE LIFT STATION SITE, AND SHALL MEET ALL POWER COMPANY REQUIREMENTS AND SHALL PAY ALL FEES ASSESSED BY THE POWER COMPANY.

9. THE CONTRACTOR SHALL TAKE ALL MEASURES NECESSARY TO PREVENT FLOTATION OF THE WET WELL DUE TO HIGH GROUND WATER TABLE.

10. ALL WET WELL CONSTRUCTION JOINTS TO BE SEALED WITH "'RAM-NECK" TAPE AND ANHYDROUS CEMENT TO A LEAK FREE STATE.

11. ALL EXPOSED AND EMBEDDED CONDUITS TO BE PVC.

12. TESTING OF THE FORCE MAIN AND LIFT STATION IS REQUIRED. THE LIFT STATION SHALL BE TESTED WITH FIRST PUMP ON, SECOND PUMP ON, AND BOTH PUMPS ON. GENERATOR TESTING SHALL BE IN ACCORDANCE WITH THE UTILITIES STANDARDS HANDBOOK.

LIFT STATION CONSTRUCTION GENERAL NOTES (CONT.):

13. TESTING OF THE FORCE MAIN AND LIFT STATION IS REQUIRED. THE LIFT STATION SHALL BE TESTED WITH FIRST PUMP ON, SECOND PUMP ON, AND BOTH PUMPS ON. GENERATOR TESTING SHALL BE IN ACCORDANCE WITH THE UTILITIES STANDARDS HANDBOOK.

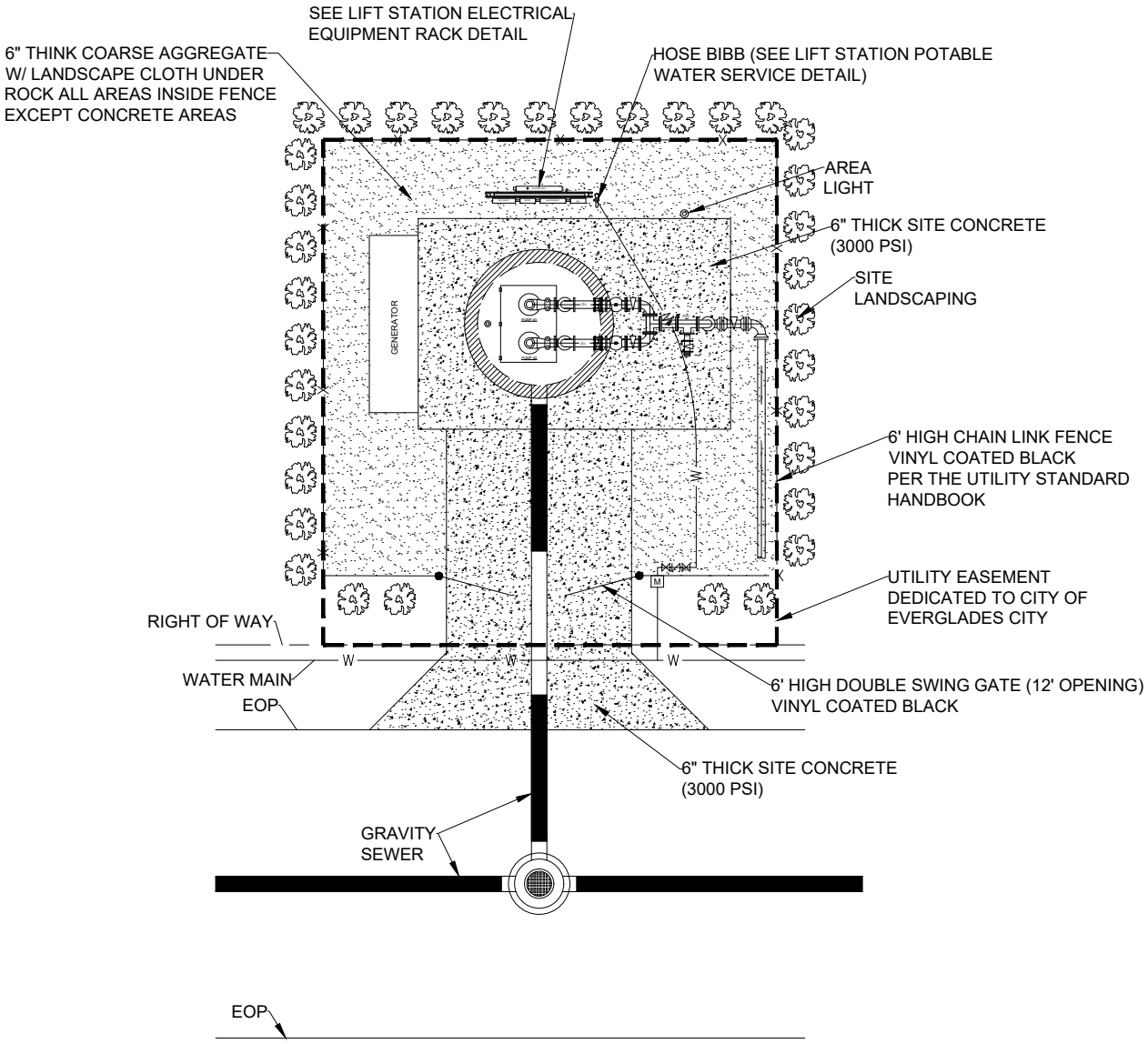
14. ALL SUPPORTS AND HARDWARE FOR ELECTRICAL EQUIPMENT SHALL BE ALUMINUM OR STAINLESS STEEL.

15. THE ENTIRE AREA WITHIN THE PERIMETER FENCE SHALL HAVE A MINIMUM OF 6" STONE OVER LAYER OF LANDSCAPE CLOTH.

16. NO PENETRATIONS THROUGH THE TOP OF THE CONTROL CABINET FOR LIGHTS OR HORNS SHALL BE PERMITTED.

17. ALL LIFT STATIONS THAT ARE TO BE CITY OWNED AND MAINTAINED SHALL HAVE A PERMANENT GENERATOR INSTALLED BY THE CONTRACTOR AT THE CONTRACTOR'S EXPENSE OF THE DEVELOPER SHALL PAY FOR THE CITY TO PURCHASE A TRAILER MOUNTED GENERATOR.

18. THE LIFT STATION SHALL BE EQUIPPED WITH A PROGRAMMABLE LOGIC CONTROLLER (PLC) / RTU WITH CONFIGURABLE I/0 TO ALLOW MONITORING AND CONTROL OF THE PUMP STATION. INTERFACE TO THE PLC WILL BE BY 2 LINE DISPLAY AND KEYPAD. SAMPLE SCREENS SHALL BE PROVIDED TO THE CITY OF EVERGLADES CITY FOR APPROVAL. THE PLC SHALL INCLUDE AN INTEGRATED CELLULAR TEXT MODEM SYSTEM THAT COMPLIES WITH ALL APPLICABLE FCC REQUIREMENTS. TEXT MESSAGING WILL BE THE PRIMARY MEANS OF COMMUNICATION. THE CELLULAR ANTENNA SHALL BE A MULTI-BAND EXTERNAL ANTENNA, FREQUENCY RANGE: 824-960/1710-1990 MHZ, 2 DBI GAIN. REFER TO THE UTILITIES STANDARDS HANDBOOK FOR ADDITIONAL REQUIREMENTS.



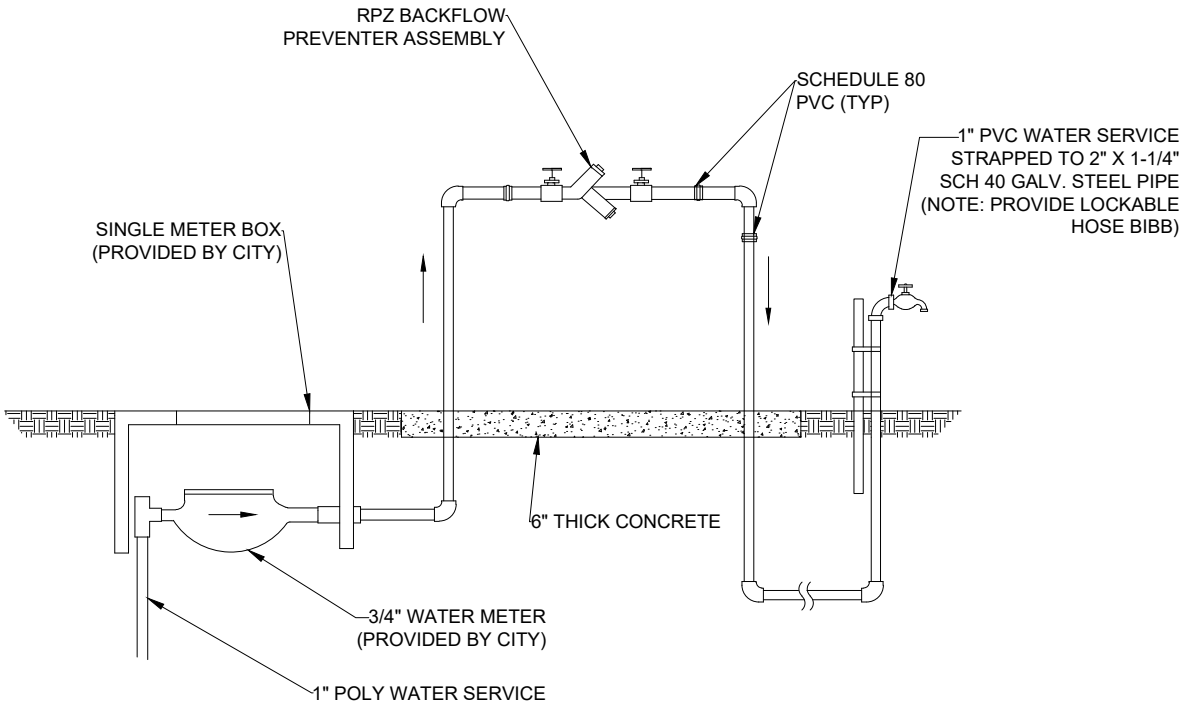
NOTES:

1. THIS DETAIL APPLIES TO LIFT STATIONS THAT ARE TO BE DEDICATED TO THE CITY AND LIFT STATIONS THAT ARE TO BE OWNED AND MAINTAINED BY THE CITY.

2. PERIMETER LANDSCAPING SHALL BE IN ACCORDANCE WITH THE LAND DEVELOPMENT CODE. LANDSCAPING SHALL BE OUTSIDE THE FENCE, IN A LANDSCAPE EASEMENT. ALL LANDSCAPING SHALL BE MAINTAINED BY THE DEVELOPER AND SUBSEQUENT HOA.

3. THE LIFT STATION SITE TO BE DEDICATED TO THE CITY SHALL BE TO THE LIMITS OF THE SITE FENCING AND SHALL EXTEND TO THE RIGHT-OF-WAY.

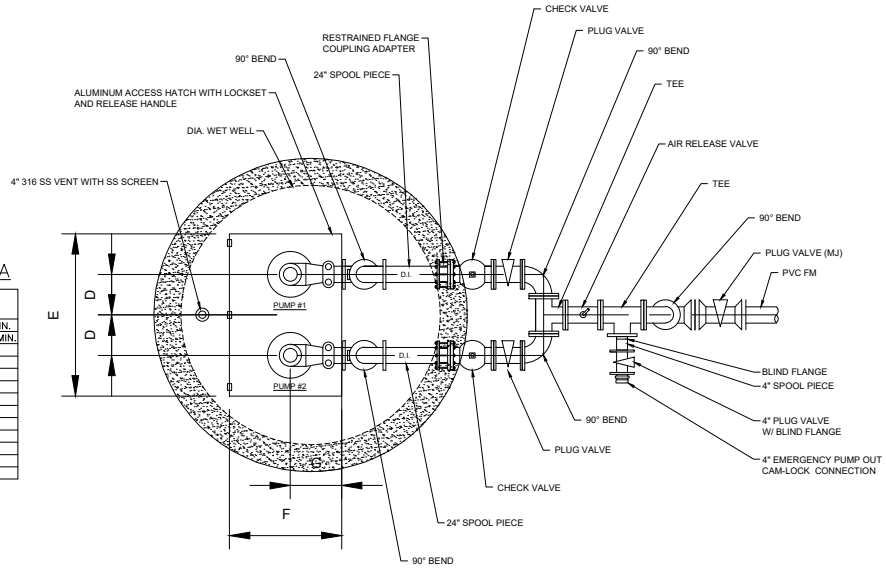
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL TYPICAL LIFT STATION SITE PLAN	DATE: 5/2023 DETAIL NO: S-11



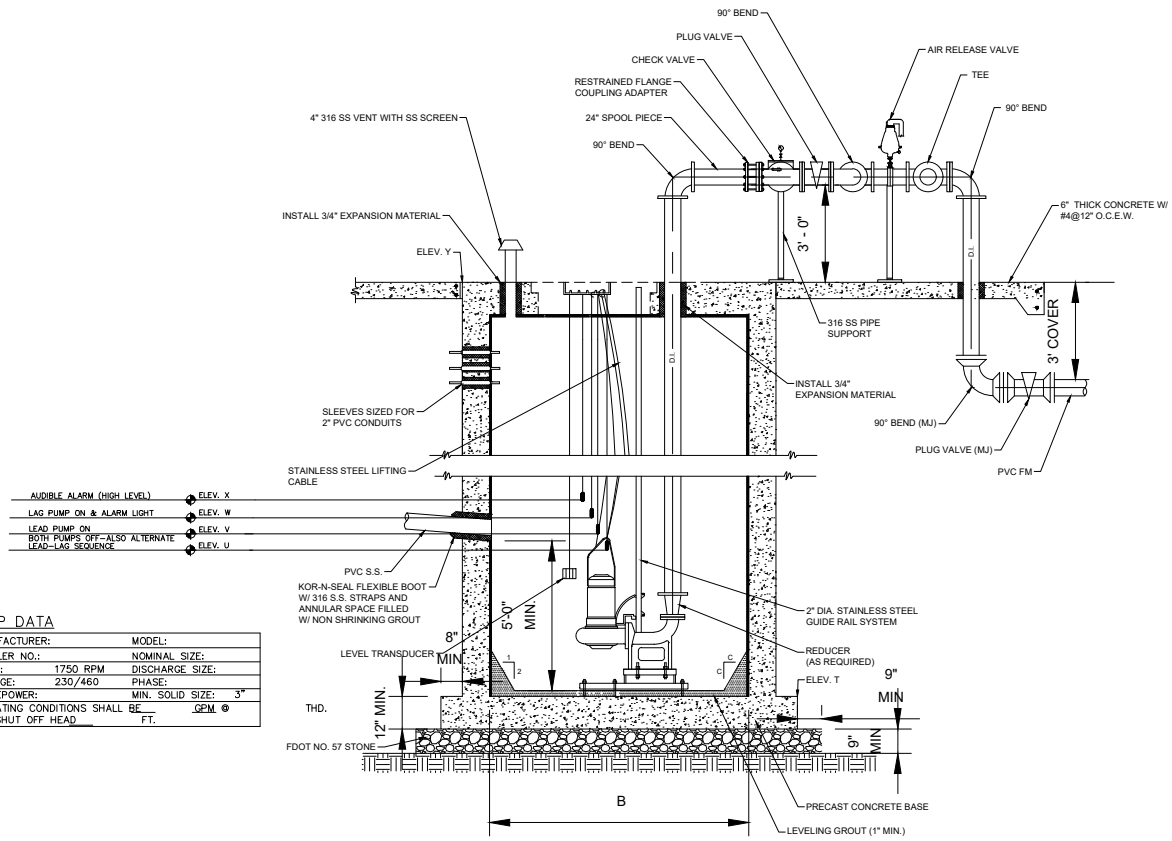
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL LIFT STATION POTABLE WATER SERVICE (WHERE NO RECLAIMED WATER SERVICE IS AVAILABLE)	DATE: 5/2023 DETAIL NO: S-12

LIFT STATION DATA

PUMPING STATIONS	DIMENSION	ELEV. AT CONST.	
DIM A			8" MIN.
DIM B			6 FT. MIN.
DIM C			
DIM D			
DIM E			
DIM F			
DIM G			
ELEV. T			
ELEV. U			
ELEV. V			
ELEV. W			
ELEV. X			
ELEV. Y			



PLAN VIEW
N.T.S.



SECTION
NTS

PUMP DATA

MANUFACTURER:		MODEL:	
IMPELLER NO.:		NOMINAL SIZE:	
SPEED:	1750 RPM	DISCHARGE SIZE:	
VOLTAGE:	230/460	PHASE:	
HORSEPOWER:		MIN. SOLID SIZE:	3"
OPERATING CONDITIONS SHALL BE			GPM @
MIN. SHUT OFF HEAD		FT.	

CITY OF EVERGLADES CITY

STANDARD CONSTRUCTION DETAIL

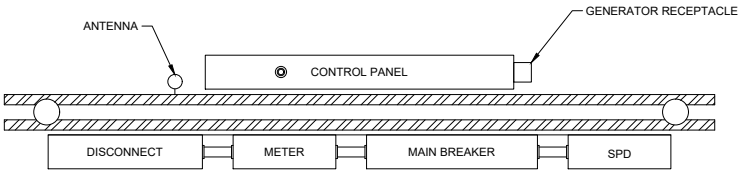
LIFT STATION DETAILS

DATE:

5/2023

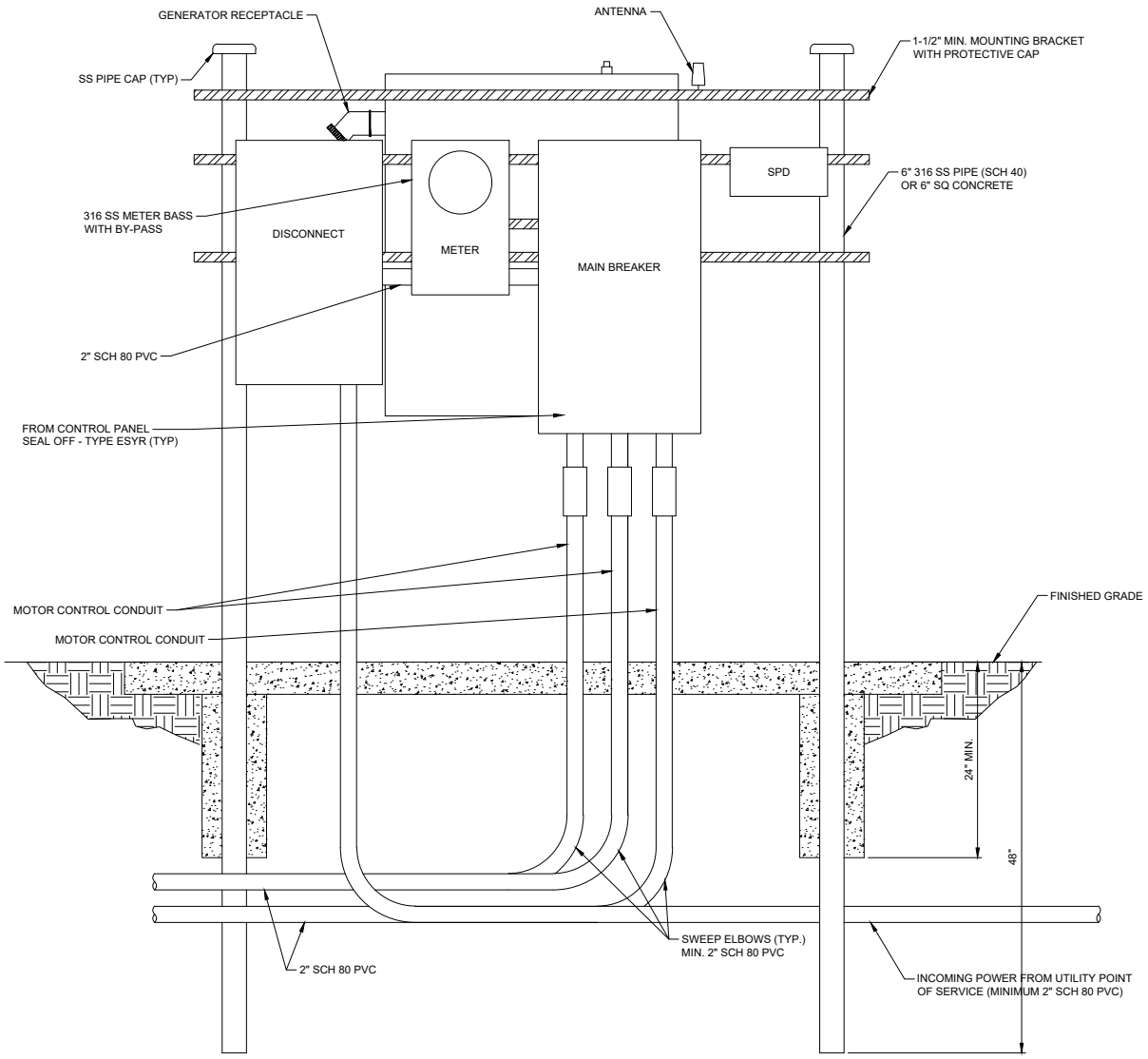
DETAIL NO:

S-13



PLAN VIEW

N.T.S.



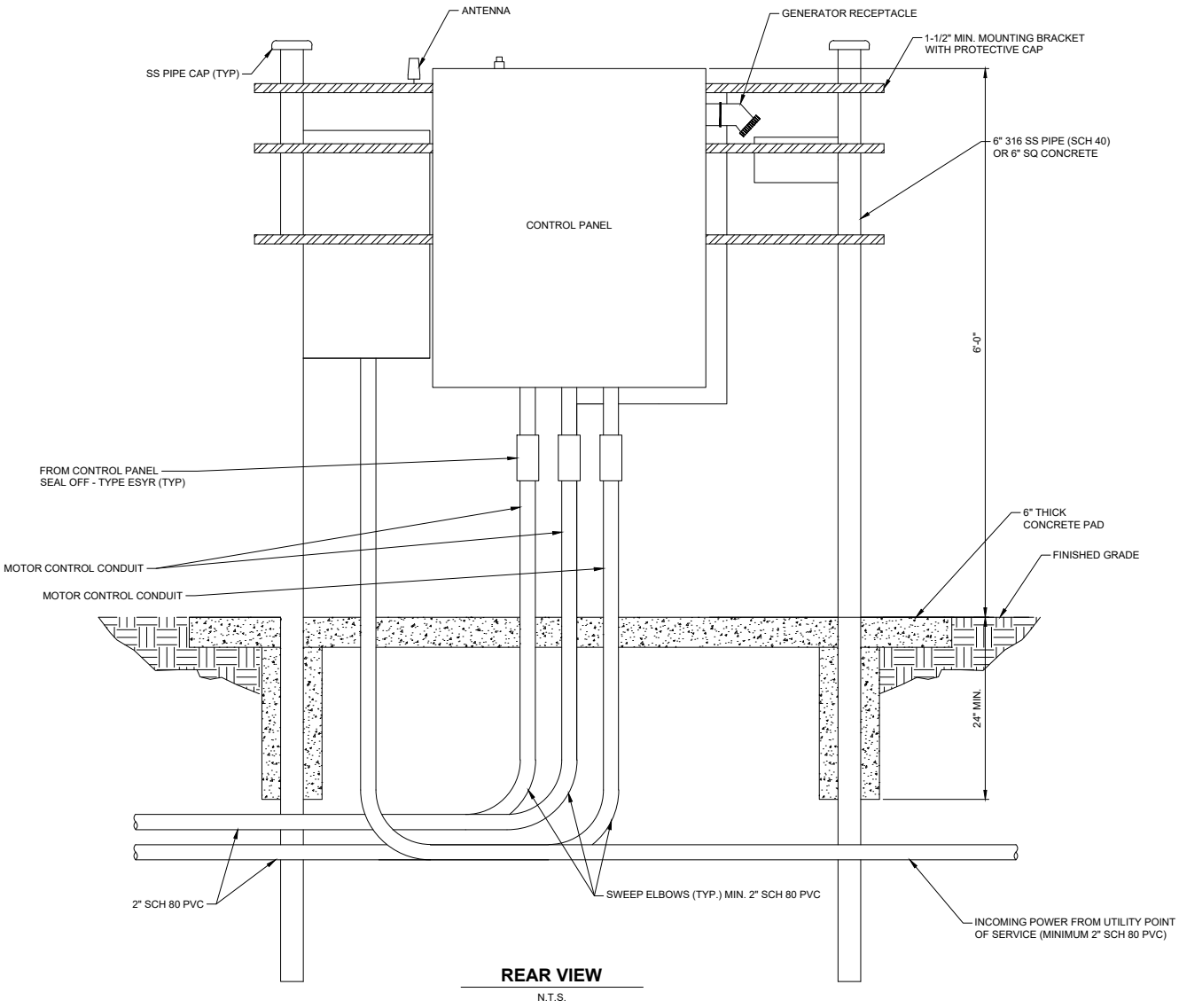
FRONT VIEW

N.T.S.

NOTES:

1. SEE PAGE 2 OF 2 FOR EQUIPMENT RACK NOTES.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL	DATE: 5/2023
		DETAIL NO: S-14 (PAGE 1 OF 2)



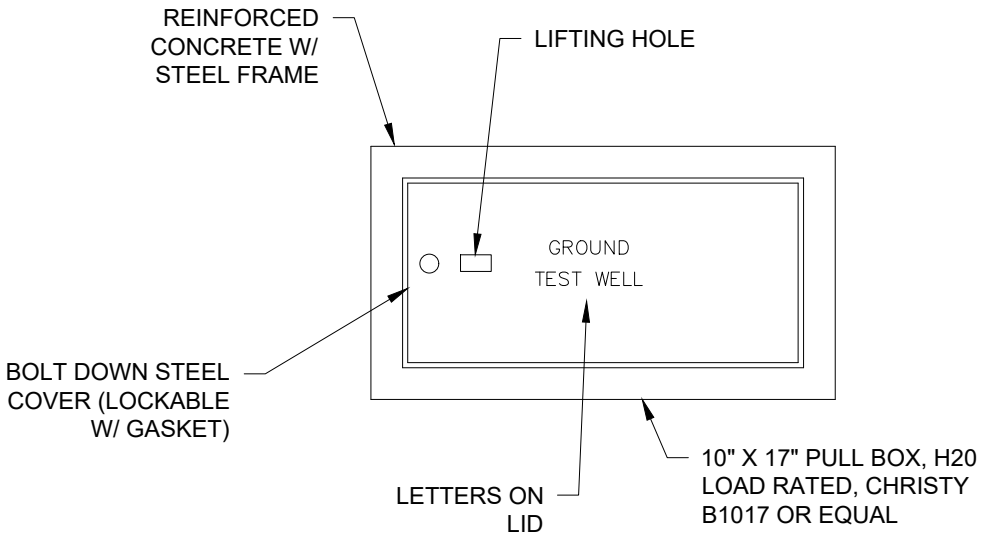
REAR VIEW

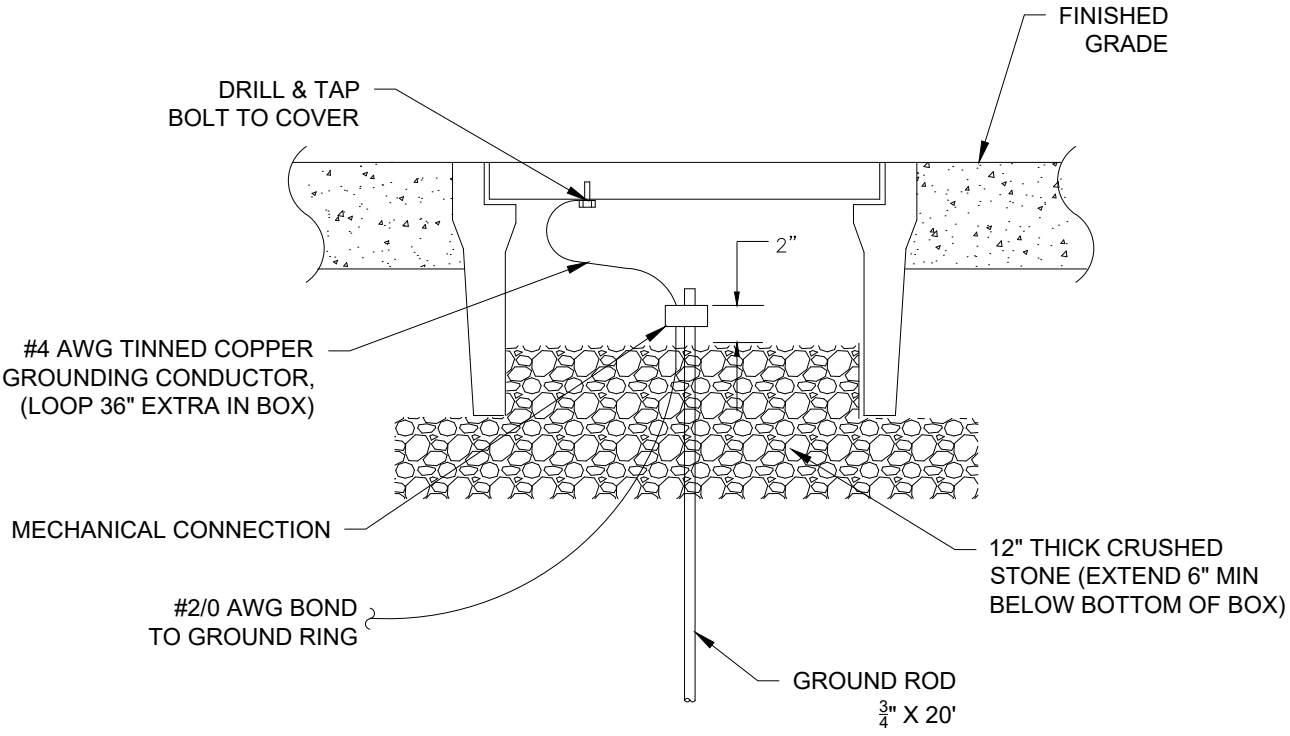
N.T.S.

NOTES:

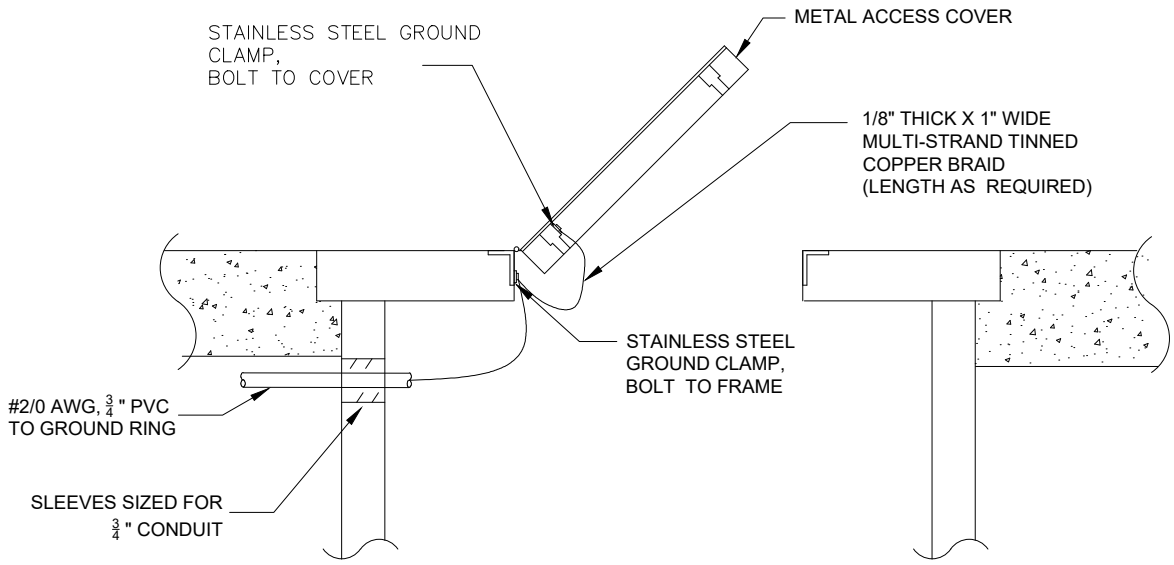
1. MOTOR CONDUCTOR CONDUIT AND CONTROL CONDUIT TO BE 2" MINIMUM. ALL ABOVE GRADE CONDUIT SHALL BE RIGID ALUMINUM, AND ALL BELOW GRADE CONDUIT SHALL BE SCH.80 PVC.
2. THE POWER SUPPLY SHALL BE UNDERGROUND ON THE LIFT STATION SITE.
3. PROVIDE AN ELECTRICAL GROUNDING SYSTEM AS REQUIRED PER THE NATIONAL ELECTRIC CODE, LOCAL CODES, AND ORDINANCES. AS A MINIMUM, PROVIDE AN UNDERGROUND PERIMETER SYSTEM WITH CONNECTIONS TO THE WET WELL COVER, CONTROL PANEL, DISCONNECT, AND METAL FENCE (PROVIDE ADDITIONAL CONNECTIONS AS REQUIRED).
4. ALL MOUNTING HARDWARE, BRACKETS, AND ENCLOSURES SHALL BE 316 STAINLESS STEEL.
5. SUBMIT WIND LOAD CALCULTIONS SIGNED AND SEALED BY A FLORIDA LICENSED ENGINEER TO THE CITY (RISK CATEGORY II, 135 MPH WIND SPEED).

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL LIFT STATION ELECTRICAL EQUIPMENT RACK	DATE: 5/2023 DETAIL NO: S-14 (PAGE 2 OF 2)





CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL GROUND TEST WELL	DATE: 5/2023 DETAIL NO: S-15

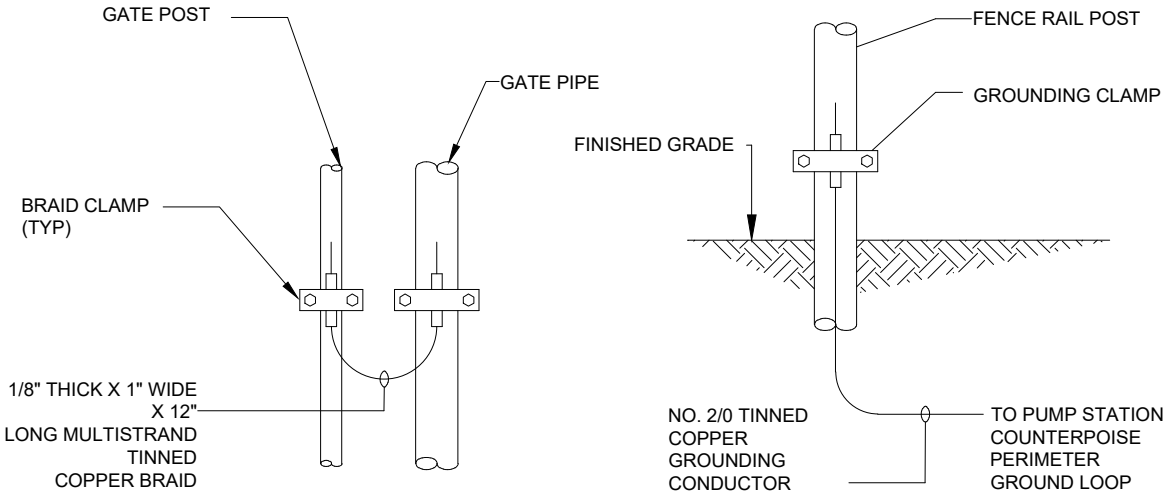


WET WELL GROUNDING

NOTES:

1. INSTALL SCH.80 PVC CONDUIT EXTENDING FROM HATCH TO GROUND RING. INSTALL GAS TIGHT SEAL AT WET WALL.

2. INSTALL GROUND WIRE IN WET WELL AT THE EDGE NEAR THE FRAME AWAY FROM THE HATCH OPENING SO IT DOES NOT INTERFERE WITH PUMP REMOVAL AND MAINTENANCE ACTIVITIES.



CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL WET WELL AND FENCE POST GROUNDING	DATE: 5/2023 DETAIL NO: S-16

RECLAIMED WATER CONSTRUCTION GENERAL NOTES

1. REFER TO THE OVERALL CONSTRUCTION GENERAL NOTES AND UTILITIES STANDARDS HANDBOOK RELATED TO PIPE, VALVES, FITTINGS, TRENCHING, TESTING AND OTHER REQUIREMENTS RELATED TO THE RECLAIMED WATER SYSTEM CONSTRUCTION.

2. UPON FINAL ACCEPTANCE OF NEW RECLAIMED WATER SYSTEMS, VALVES SHALL BE COMPLETELY OPENED BY CITY UTILITIES PERSONNEL ONLY. AT NO TIME SHALL THE CONTRACTOR OPERATE ANY EXISTING VALVES.

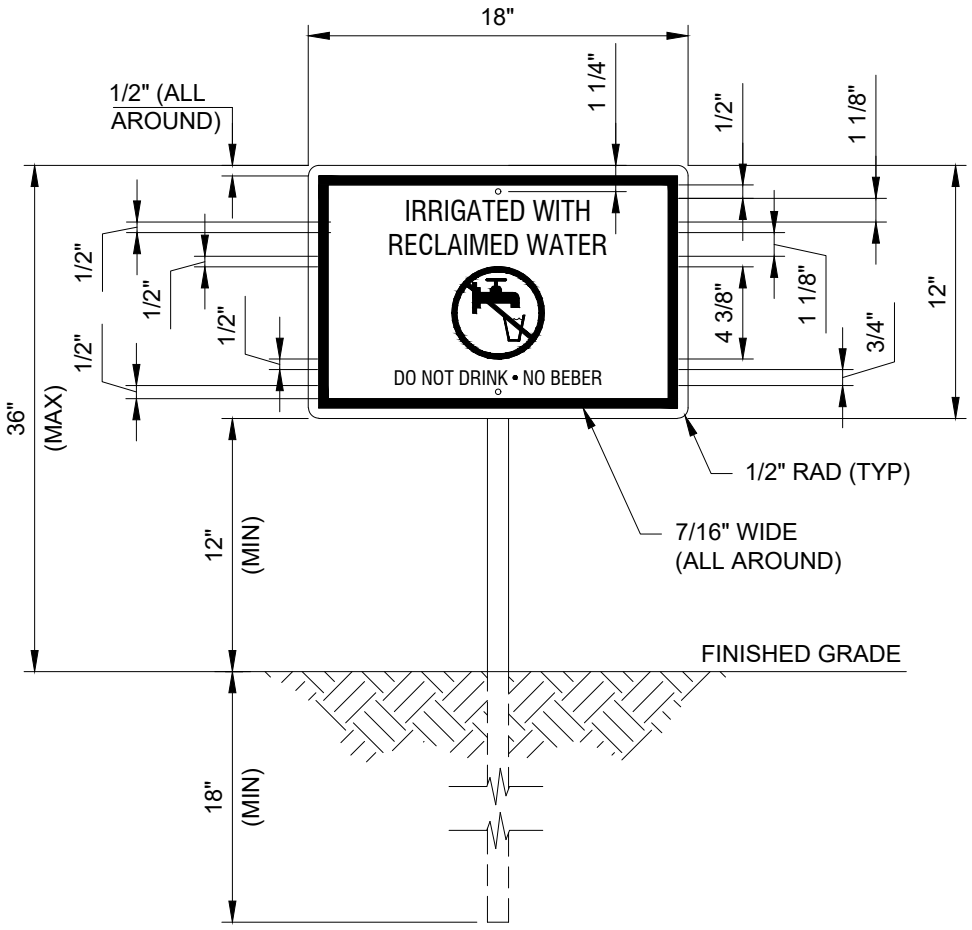
3. ALL RECLAIMED WATER VALVES SHALL BE ADJUSTED TO FINISHED GRADE AND THE VALVE BOX LIDS PAINTED PURPLE PER THE UTILITIES STANDARDS HANDBOOK.

4. ALL RECLAIMED WATER VALVES SHALL BE MARKED WITH AN "X" SAW CUT INTO THE CURB OR BY METAL TABS SET INTO THE PAVEMENT. BLOW-OFFS SHALL BE MARKED SIMILARLY. TAPPING VALVES SHALL BE MARKED WITH AN "X" SAW CUT INTO THE CURB OR PAVEMENT WITH THE ARROW POINTING TO THE DIRECTION OF THE PRESSURE MAIN RUN.

5. ALL RECLAIMED WATER SERVICE ENDINGS SHALL BE MARKED WITH A 2"X4" LUMBER (PRESSURE TREATED) EXTENDING 4 FEET ABOVE GRADE, WITH RECLAIMED WATER SERVICES SECURED 12" MAXIMUM ABOVE THE GROUND. ALL SERVICES SHALL BE LOCKED AT THE TIME OF FINAL INSPECTION BY THE CONTRACTOR IN THE PRESENCE OF THE CITY, AFTER THEY HAVE BEEN INSPECTED AND VERIFIED TO OPERATE PROPERLY. ALL RECLAIMED WATER SERVICES SHALL BE MARKED WITH A "R" SAW CUT INTO THE CURB OR BY METAL TABS SET INTO THE PAVEMENT.

6. LARGE COMMERCIAL RECLAIMED WATER METERS GREATER THAN 3" TAKE A MINIMUM OF 6 WEEKS FOR DELIVERY AFTER FEES ARE PAID TO THE CITY. IN ADDITION ALL METERS AND VAULTS 3" AND GREATER SHALL BE INSTALLED BY THE CONTRACTOR. THE FEE COLLECTED BY THE CITY IS FOR MATERIALS ONLY. ALL METERS, 2" AND LESS, SHALL BE INSTALLED BY THE CITY.

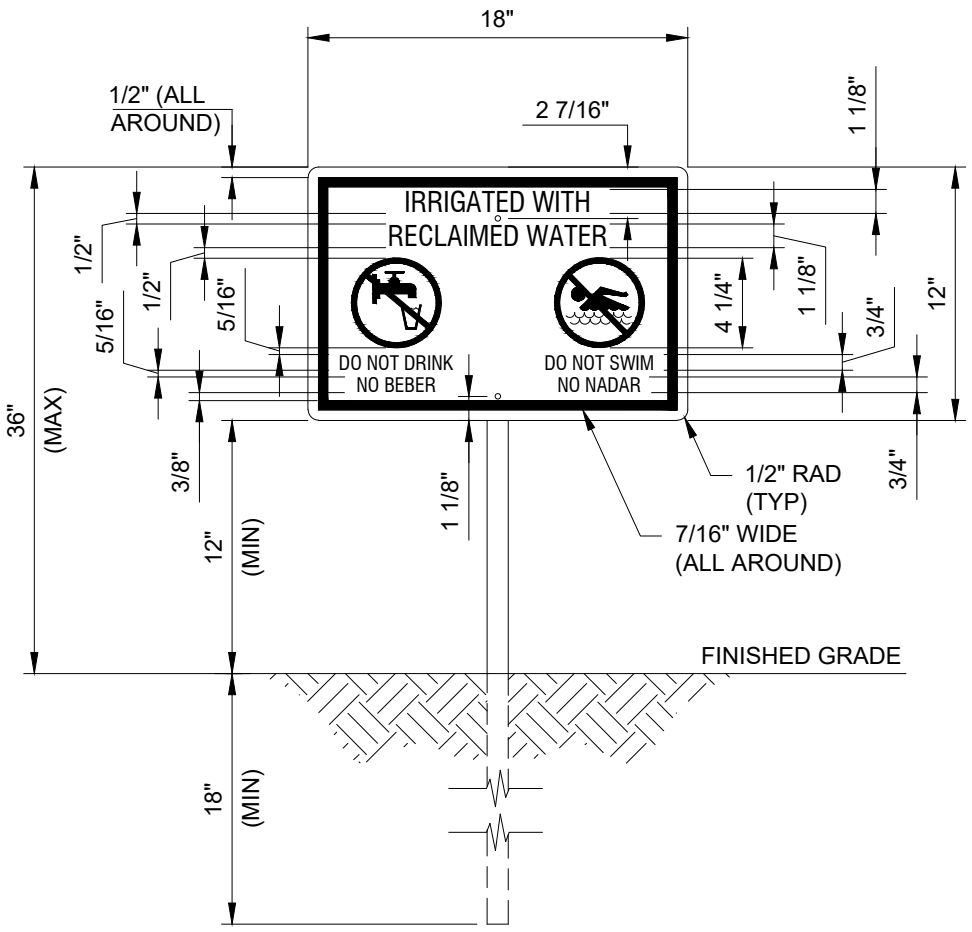
7. NEWLY CONSTRUCTED RECLAIMED WATER SYSTEM EXTENSIONS MAY NOT BE USED PRIOR TO FINAL TESTING AND ACCEPTANCE BY THE CITY. THIS INCLUDES CONSTRUCTION WATER REQUIRED FOR SEWER LINE CLEANING OR OTHER RELATED USES.



NOTES:

1. SIGN TO BE PROVIDED BY OCU.
2. HEIGHT OF SIGN WILL DEPEND ON LOCATION AND SURROUNDING LANDSCAPE PLANT TYPES. IN ALL CASES, THE SIGN SHALL BE VISIBLE TO THE PUBLIC.
3. BACKGROUND SHALL BE WHITE, LETTERS SHALL BE BLACK (HELVETICA, SWISS 721 COREL OR ACCEPTABLE EQUAL) AND BORDER SHALL BE PANTONE PURPLE 522C.
4. ENGINEERING GRADE REFLECTIVE MATERIALS SHALL BE USED.
5. SIGN MATERIAL SHALL BE 0.040 GAUGE METAL.
6. POST SHALL BE 2.375-IN OD ALUMINUM PIPE, HOT DIP GALVANIZED PER ASTM A-123. POST TO BE PROVIDED BY CUSTOMER.
7. MOUNTING HARDWARE SHALL BE STAINLESS STEEL.
8. SIGNS SHALL BE PLACED BY THE CONTRACTOR IN ACCORDANCE WITH CHAPTER 62-610 "ACCESS CONTROL AND ADVISORY SIGNS", FAC, THE COUNTY APPROVED ENGINEERING PLANS AND / OR AS APPROVED BY THE UTILITIES.

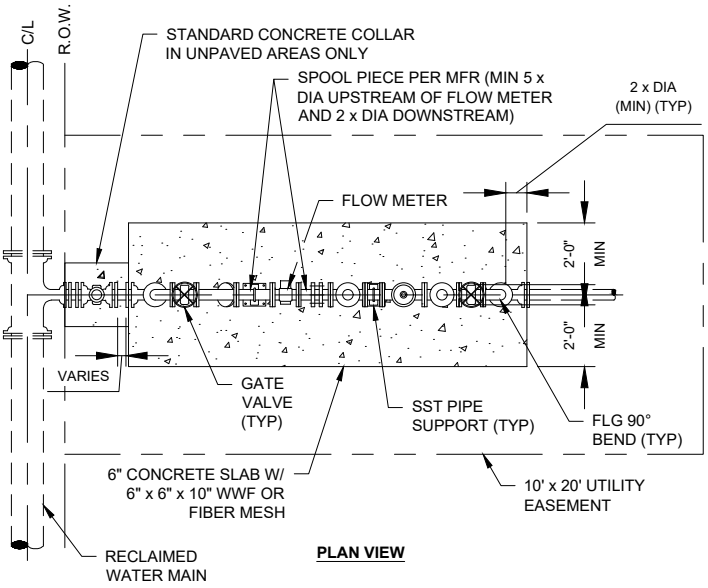
CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL RECLAIMED WATER SIGN - "DO NOT DRINK WATER"	DATE: 5/2023 DETAIL NO: R-2



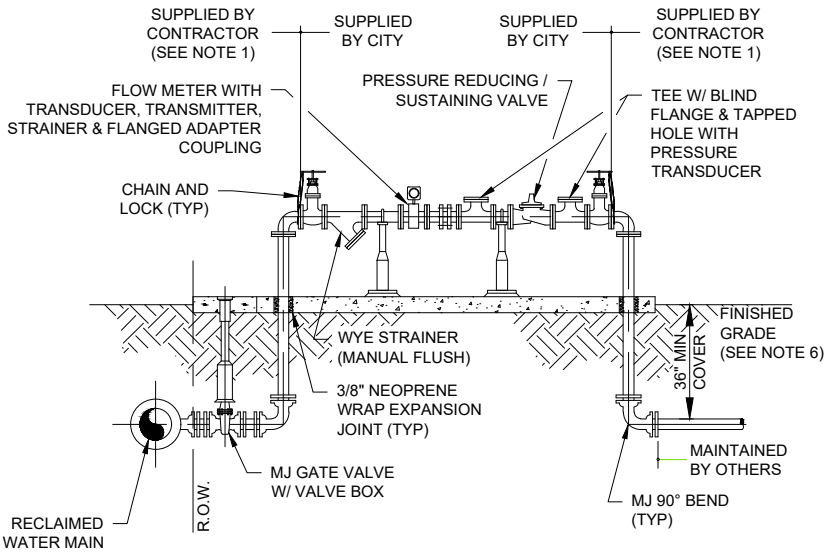
NOTES:

1. SIGN TO BE PROVIDED BY OCU.
2. HEIGHT OF SIGN WILL DEPEND ON LOCATION AND SURROUNDING LANDSCAPE PLANT TYPES. IN ALL CASES, THE SIGN SHALL BE VISIBLE TO THE PUBLIC.
3. BACKGROUND SHALL BE WHITE, LETTERS SHALL BE BLACK (HELVETICA, SWISS 721 COREL OR ACCEPTABLE EQUAL) AND BORDER SHALL BE PANTONE PURPLE 522C.
4. ENGINEERING GRADE REFLECTIVE MATERIALS SHALL BE USED.
5. SIGN MATERIAL SHALL BE 0.040 GAUGE METAL.
6. POST SHALL BE 2.375-IN OD ALUMINUM PIPE, HOT DIP GALVANIZED PER ASTM A-123. POST TO BE PROVIDED BY CUSTOMER.
7. MOUNTING HARDWARE SHALL BE STAINLESS STEEL.
8. SIGNS SHALL BE PLACED BY THE CONTRACTOR IN ACCORDANCE WITH CHAPTER 62-610 "ACCESS CONTROL AND ADVISORY SIGNS", FAC, THE COUNTY APPROVED ENGINEERING PLANS AND / OR AS APPROVED BY THE UTILITIES.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL RECLAIMED WATER SIGN - "DO NOT SWIM"	DATE: 5/2023 DETAIL NO: R-3



PLAN VIEW

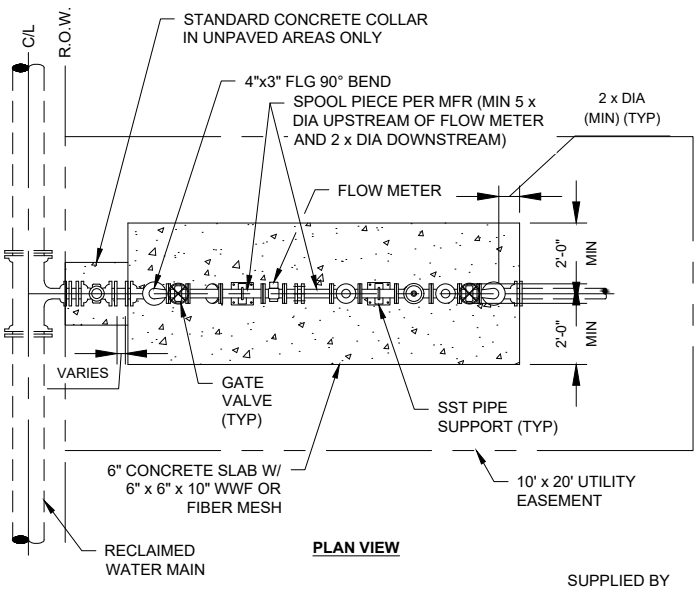


SECTION VIEW

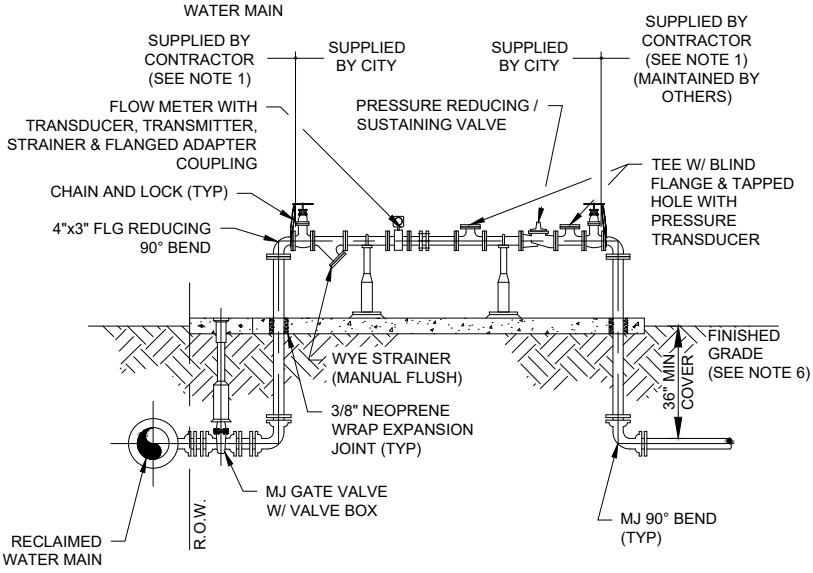
NOTES:

1. CONTRACTOR TO CONSTRUCT RISER AFTER ASSEMBLY IS RECEIVED FROM CITY.
2. INSTALLATION SHALL COMPLY WITH ALL REQUIREMENTS OF CHAPTER 62-610 FAC.
3. PIPING AND APPURTENANCES SHALL BE PAINTED PANTONE PURPLE 522C. PVC PIPE SHALL BE COLORED FROM THE FACTORY WITH PANTONE PURPLE 522C USING LIGHT STABLE COLORANTS. PIPE SHALL BE MARKED TO UTILITIES SPECIFICATIONS.
4. METER SHALL BE CAPABLE OF ACCURATELY MEASURING THE ENTIRE RANGE OF EXPECTED FLOWS AND THE TYPE AND MANUFACTURER SHALL BE APPROVED BY UTILITIES.
5. SERVICES 4-IN AND LARGER SHALL BE DIP FROM THE POINT OF CONNECTION AT THE MAIN TO THE METER ASSEMBLY IF THE MAINS IS ON THE SAME SIDE OF THE STREET AS THE ASSEMBLY. IF THE MAIN IS ON THE OPPOSITE SIDE OF THE STREET AS THE ASSEMBLY, A MINIMUM OF ONE SEGMENT OF PIPE IMMEDIATELY UPSTREAM FROM THE METER ASSEMBLY SHALL BE DIP.
6. FINISH GRADE AROUND METER ASSEMBLY SLAB SHALL ENSURE A SAFE WORK ENVIRONMENT. GRADING SLOPE DROP OFF SHALL NOT EXCEED 6-IN WITHIN 5-FT OF SLAB.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL RECLAIMED WATER MASTER METER ASSEMBLY (4" & LARGER)	DATE: 5/2023 DETAIL NO: R-4



PLAN VIEW

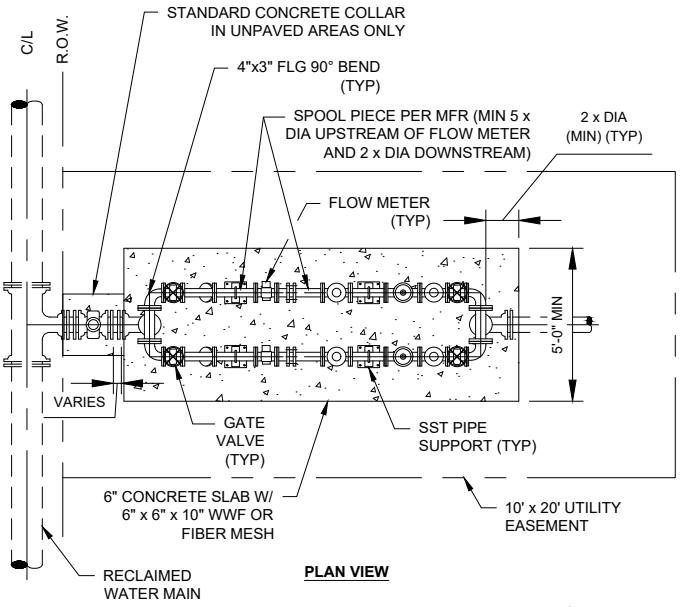


SECTION VIEW

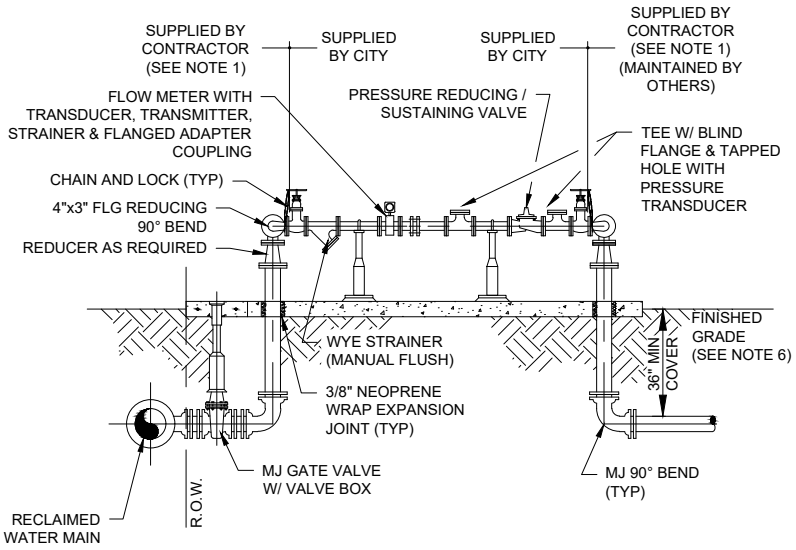
NOTES:

1. CONTRACTOR TO CONSTRUCT RISER AFTER ASSEMBLY IS RECEIVED FROM CITY.
2. INSTALLATION SHALL COMPLY WITH ALL REQUIREMENTS OF CHAPTER 62-610 FAC.
3. PIPING AND APPURTENANCES SHALL BE PAINTED PANTONE PURPLE 522C. PVC PIPE SHALL BE COLORED FROM THE FACTORY WITH PANTONE PURPLE 522C USING LIGHT STABLE COLORANTS. PIPE SHALL BE MARKED TO UTILITIES SPECIFICATIONS.
4. METER SHALL BE CAPABLE OF ACCURATELY MEASURING THE ENTIRE RANGE OF EXPECTED FLOWS AND THE TYPE AND MANUFACTURER SHALL BE APPROVED BY UTILITIES.
5. SERVICES 4-IN AND LARGER SHALL BE DIP FROM THE POINT OF CONNECTION AT THE MAIN TO THE METER ASSEMBLY IF THE MAINS IS ON THE SAME SIDE OF THE STREET AS THE ASSEMBLY. IF THE MAIN IS ON THE OPPOSITE SIDE OF THE STREET AS THE ASSEMBLY, A MINIMUM OF ONE SEGMENT OF PIPE IMMEDIATELY UPSTREAM FROM THE METER ASSEMBLY SHALL BE DIP.
6. FINISH GRADE AROUND METER ASSEMBLY SLAB SHALL ENSURE A SAFE WORK ENVIRONMENT. GRADING SLOPE DROP OFF SHALL NOT EXCEED 6-IN WITHIN 5-FT OF SLAB.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL SINGLE RECLAIMED WATER MASTER METER ASSEMBLY (3" METER)	DATE: 5/2023 DETAIL NO: R-5



PLAN VIEW



SECTION VIEW

NOTES:

1. CONTRACTOR TO CONSTRUCT RISER AFTER ASSEMBLY IS RECEIVED FROM CITY.
2. INSTALLATION SHALL COMPLY WITH ALL REQUIREMENTS OF CHAPTER 62-610 FAC.
3. PIPING AND APPURTENANCES SHALL BE PAINTED PANTONE PURPLE 522C. PVC PIPE SHALL BE COLORED FROM THE FACTORY WITH PANTONE PURPLE 522C USING LIGHT STABLE COLORANTS. PIPE SHALL BE MARKED TO UTILITIES SPECIFICATIONS.
4. METER SHALL BE CAPABLE OF ACCURATELY MEASURING THE ENTIRE RANGE OF EXPECTED FLOWS AND THE TYPE AND MANUFACTURER SHALL BE APPROVED BY UTILITIES.
5. SERVICES 4-IN AND LARGER SHALL BE DIP FROM THE POINT OF CONNECTION AT THE MAIN TO THE METER ASSEMBLY IF THE MAINS IS ON THE SAME SIDE OF THE STREET AS THE ASSEMBLY. IF THE MAIN IS ON THE OPPOSITE SIDE OF THE STREET AS THE ASSEMBLY, A MINIMUM OF ONE SEGMENT OF PIPE IMMEDIATELY UPSTREAM FROM THE METER ASSEMBLY SHALL BE DIP.
6. FINISH GRADE AROUND METER ASSEMBLY SLAB SHALL ENSURE A SAFE WORK ENVIRONMENT. GRADING SLOPE DROP OFF SHALL NOT EXCEED 6-IN WITHIN 5-FT OF SLAB.

CITY OF EVERGLADES CITY	STANDARD CONSTRUCTION DETAIL DOUBLE RECLAIMED WATER MASTER METER ASSEMBLY (3" METER)	DATE: 5/2023 DETAIL NO: R-6

	WASTEWATER SYSTEM		RECLAIMED WATER SYSTEM	
Product	**Manufacturer**	**Model No.**	**Manufacturer**	**Model No.**
Gate Valves	N/A	N/A	American Flow Control	Series 2500, DI
	N/A	N/A	Clow	Model 2638, 2639, 2640
	N/A	N/A	Mueller	Series A-2361, A-2362
	N/A	N/A	Kennedy	Model KS_FW, KS_RW, Rotating Disc Gate Valve
Butterfly Valves	N/A	N/A	Clow	Style #1450, MJ and Flanged
	N/A	N/A	Dezurik	BAW
	N/A	N/A	Mueller	Linseal III
	N/A	N/A	Kennedy	Series 1450, 4500
Plug Valves	Clow	F-5412, F-5413	N/A	N/A
	Kennedy	Full Port Retangular	N/A	N/A
	Dezurik	PEC Eccentric, PEF 100% Port Ecentric	N/A	N/A
	Val-Matic	Series 5600 or 5800, Series 5700 or 5900	N/A	N/A
Tapping Sleeves (SS)	Ford	FTSS-xxxx-MJ-Q style	Ford	FTSS-xxxx-MJ-Q style
	JCM	JCM 6439, 6459	JCM	JCM 6439, 6459
	PowerSeal	3490AS, 3490 MJ-SST316	PowerSeal	3490AS, 3490 MJ-SST316
	Total Piping Solutions	Extended Range 316 SS Tapping Sleeve	Total Piping Solutions	Extended Range 316 SS Tapping Sleeve

	WASTEWATER SYSTEM		RECLAIMED WATER SYSTEM	
Product	**Manufacturer**	**Model No.**	**Manufacturer**	**Model No.**
Tapping Sleeves (DI)	American Flow Control	Series 2800	American Flow Control	Series 2800
	Tyler Union	25U Compact DI MJ	Tyler Union	25U Compact DI MJ
Tapping Valves	American Flow Control	Series 2500	American Flow Control	Series 2500
	Clow	Series F-6114	Clow	Series F-6114
	Mueller	Series T2360, T2361	Mueller	Series T2360, T2361
Air Release Valves	Bermad	Model C50	Bermad	Model C50
	Crispin-Multiplex	PL20/V5, X-Series (316SS)	Crispin-Multiplex	PL20/V5, X-Series (316SS)
	H-TEC	986 (316 SS)	H-TEC	986 (316 SS)
	Valmatic	48-A, VM-48ABW, VM-48A-S	Valmatic	45VC
Swing Check Valves	American Flow Control / American - Darling	Series 600 or 50 line	N/A	N/A
	Clow / M&H / Kennedy	59, 106, 159, 259	N/A	N/A
	APCO/DeZURIK	Series 6000	N/A	N/A
	Mueller	Series 2600	N/A	N/A
Air Release Valve Enclosure	Water Plus Corporation	131632 (With Vents) (Color: Green)	Water Plus Corporation	131632 (Color: Purple)
Fire Hydrants	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A

	WASTEWATER SYSTEM		RECLAIMED WATER SYSTEM	
Product	**Manufacturer**	**Model No.**	**Manufacturer**	**Model No.**
Valve Boxes	Star Pipe Products	VBM7615W, VBM76130W, VBM7605S, VBM7635S	Star Pipe Products	VBM7615W, VBM76130W, VBM7605S, VBM7635S
	U.S.F.	7615 Ring FC Cover, 7630 Ring & FD Cover, 7605 Ring & FB Cover	U.S.F.	7615 Ring FC Cover, 7630 Ring & FD Cover, 7605 Ring & FB Cover
	East Jordan Iron Works	1552Z, 1552A 1553Z, 1553A 1551Z, 1551A 1556Z, 1556A	East Jordan Iron Works	1552Z, 1552A 1553Z, 1553A 1551Z, 1551A 1556Z, 1556A
Saddles	Romac Industries, INC.	Style “CB” Sewer Saddle	Romac Industries, INC.	202S/202N
	N/A	N/A	Smith-Blair	317 Service Saddles
	N/A	N/A	JCM	JCM 406, 408
	N/A	N/A	Ford	202B, FC202-xxx-xxx style, Style F101, FS101, FC101, F202, FS202, FC202, FSD202, FCD202
	N/A	N/A	A.Y. McDonald	3801, 3802, 3805, 3806
Curb Stops	N/A	N/A	Ford	B11-xxx-NL B11-xxxW-NL B41-xxx-NL B41-xxxW-G-NL B44-xxx-NL B77-xxx-NL B21-xxxW-NL

	WASTEWATER SYSTEM		RECLAIMED WATER SYSTEM	
Product	**Manufacturer**	**Model No.**	**Manufacturer**	**Model No.**
	N/A	N/A	Mueller	B20200N
	N/A	N/A	A.Y. McDonald	74606B-44 76101 76101W 76102-22 76102WG 76100-22 76100-44 76102W
Corporation Stops	N/A	N/A	Ford	FB800-x-NL FB1000-xx-NL FB1000-xx-G-NL FB1100-x-G-NL FB1100-X-NL FB1600-x-NL FB1700-x-NL
	N/A	N/A	Mueller	300 Ball Style Corp Stop
	N/A	N/A	A.Y. McDonald	73121B 74701B-22 74701BG 74704BG 74704B 73148B 73149B
PVC Pipe (C900/C905) DR18	JM Eagle	C-900 (Green) C-905 (Green)	JM Eagle	C-900 (Pantone Purple) C-905 (Pantone Purple)

	WASTEWATER SYSTEM		RECLAIMED WATER SYSTEM	
Product	**Manufacturer**	**Model No.**	**Manufacturer**	**Model No.**
	National Pipe & Plastics Inc	C-900 (Green) C-905 (Green)	National Pipe & Plastics Inc	C-900 (Pantone Purple) C-905 (Pantone Purple)
	North American Pipe Corp (NAPCO)	C-900 (Green) C-950 (Green)	North American Pipe Corp (NAPCO)	C-900 (Pantone Purple) C-950 (Pantone Purple)
	Diamond Plastics Corp	C-900 (Green)	Diamond Plastics Corp	C-900 (Pantone Purple)
PVC Pipe SDR 26	JM Eagle	Gravity Sewer	N/A	N/A
	National Pipe & Plastics Inc	Ever-Green Sewer Pipe	N/A	N/A
	North American Pipe Corp (NAPCO)	Gravity Sewer	N/A	N/A
	Diamond Plastics Corp	Diamond Gravity Sewer Pipe	N/A	N/A
DI Pipe	American Ductile Iron Pipe	Protecto 401 Liner	American	Cement Lined
	McWane Inc. DI Pipe Group	Protecto 401 Liner	McWane Inc. DI Pipe Group	Cement Lined
	US Pipe	Protecto 401 Liner	US Pipe	Cement Lined
HDPE Pipe C906 DR 11	JM Eagle	DR11 Green	JM Eagle	DR11 Pantone Purple
	Performance Pipe	Driscoplex 4300, DR11 Green	Performance Pipe	Driscoplex 4000, DR11 Pantone Purple

	WASTEWATER SYSTEM		RECLAIMED WATER SYSTEM	
Product	**Manufacturer**	**Model No.**	**Manufacturer**	**Model No.**
PE Tubing (Service Lines)	N/A	N/A	Endot Industries, Inc.	HDPE EndoPure PE-4710 Endopoly/Endopure Endotrace (Color Purple)
	N/A	N/A	Cerro Flow Products, Inc.	Cerro Tube (Color Purple)
D.I. Fittings	American	Flexible Ring and Lok Ring Fittings	American	Flexible Ring and Lok Ring Fittings
	Sigma Corporation	C110 MJ DI Fittings C153 MJ Compact C110 Flanged	Sigma Corporation	C110 MJ DI Fittings C153 MJ Compact C110 Flanged
	Star Pipe	DI Compact MJ DI Full Body MJ DI Compact Push-On DI Flanged	Star Pipe	DI Compact MJ DI Full Body MJ DI Compact Push-On DI Flanged
	Tyler Union	DI C110 Full Body MJ DI C153 Compact MJ DI C110 Flanged	Tyler Union	DI C110 Full Body MJ DI C153 Compact MJ DI C110 Flanged
PVC Pipe Fittings	HARCO	SDR 26 PVC Gasketed	HARCO	PVC C-900 Gasketed
	IPEX	PVC Trench Tough	IPEX	PVC Trench Tough
	Royal Plastic Trends	G-Series	Royal Plastic Trends	G-Series

	WASTEWATER SYSTEM		RECLAIMED WATER SYSTEM	
Product	**Manufacturer**	**Model No.**	**Manufacturer**	**Model No.**
PVC Pipe MJ Restraints	EBAA Iron Inc.	Series 1600, 2100, 2000PV, 2200, 1600TD, 2000SV, 2800, Tru-Dual Series 1500TD, Megaflange 2100	EBAA Iron Inc.	Series 1600, 2100, 2000PV, 2200, 1600TD, 2000SV, 2800, Tru-Dual Series 1500TD, Megaflange 2100
	Sigma Corporation	SIGMA ONE-LOK PV-LOK	Sigma Corporation	SIGMA ONE-LOK PV-LOK
	Smith Blair	Bell-Lock Series 165 Cam Lok Series 120	Smith Blair	Bell-Lock Series 165 Cam Lok Series 120
	Star Pipe	Series 1100, 4000, 7200, 4000G2, 100	Star Pipe	Series 1100, 4000, 7200, 4000G2, 100
DI Pipe MJ Restraints	EBAA Iron Inc.	Series 1700, 2100, 1100, 1600TD, 1100HD, Tru-Dual 1500 TD, Megaflange 2100	EBAA Iron Inc.	Series 1700, 2100, 1100, 1600TD, 1100HD, Tru-Dual 1500 TD, Megaflange 2100
	Sigma Corporation	SIGMA ONE-LOK PV-LOK Series SSLDH ONE-LOK	Sigma Corporation	SIGMA ONE-LOK PV-LOK Series SSLDH ONE-LOK
	Smith Blair	Cam Lok Series 111 Bell-Lock Series 165 911 Flange Cam Lok Series 120	Smith Blair	Cam Lok Series 111 Bell-Lock Series 165 911 Flange Cam Lok Series 120
	Star Pipe	Series 1100C, 100 Stargrip 3100P, 3000, 3100S Super Flange 7200	Star Pipe	Series 1100C, 100 Stargrip 3100P, 3000, 3100S Super Flange 7200
Flange Coupling Adapter	EBAA Iron Inc.	Series 3800	N/A	N/A
	JCM Industries	JCM 241-242	N/A	N/A

	WASTEWATER SYSTEM		RECLAIMED WATER SYSTEM	
Product	**Manufacturer**	**Model No.**	**Manufacturer**	**Model No.**
(Restrained)	Romac	MarcoHS, SS, CL Alpha Wide Range	N/A	N/A
Casing Spacers	Advance Products	SSI8 / SSI12 Model AC, AW	Advance Products	SSI8 / SSI12 Model AC, AW
	Cascade Water Works	Series CCS, CCES	Cascade Water Works	Series CCS, CCES
	CCI Pipeline	CCS8 / CSS12 Model ESW, ESC	CCI Pipeline	CCS8 / CSS12 Model ESW, ESC
	Pipeline Seal & Insulator, Inc (PSI)	Series S8G-2 / S12G-2 Model C and W	Pipeline Seal & Insulator, Inc (PSI)	Series S8G-2 / S12G-2 Model C and W
Submersible Pumps	Xylem Flygt		N/A	N/A
	ABS		N/A	N/A
Wet Well Access Hatch (H20 Load Rated)	Halliday Products		N/A	N/A
	US Foundry Fabrication, Inc.		N/A	N/A
Liners	Expoxytec	Uroflex, with CPP, Ceramico or Tnemic 219 (Wet Wells and Manholes)	N/A	N/A
	Polymorphic Polymers Corp	PPC Coating System WW-200-1a/Damp Concrete (Wet Wells and Manholes)	N/A	N/A
	Raven Lining System	Raven 405 Epoxy with Raven 755 Epoxy (Manholes)		

	WASTEWATER SYSTEM		RECLAIMED WATER SYSTEM	
Product	**Manufacturer**	**Model No.**	**Manufacturer**	**Model No.**
Control Panels	ABS / Hydra Service, Inc.		N/A	N/A
	Flygt		N/A	N/A
Generator Receptacle	Russelstoll	JRS 104yFR	N/A	N/A
	Russelstoll	JAAB10 (Adapter)	N/A	N/A
RTU / SCADA System	Sanders SciText Plus			
Generator	Generac		N/A	N/A