CITY OF TAMPA

WASTEWATER DEPARTMENT



TECHNICAL STANDARDS GUIDELINE FOR CONSTRUCTION OF WASTEWATER FACILITIES July 2014 Version 6

2545 Guy N Verger Boulevard, Tampa, FL 33605



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CITY OF TAMPA WASTEWATER DEPARTMENT TECHNICAL STANDARDS GUIDELINE

PREFACE

Chapter 62-604 of the Florida Administration Code (FAC) outlines the standards, criteria, and requirements for the design, construction, modification, and operation of wastewater collection/transmission systems in the State of Florida. The Florida Department of Environment Protection (FDEP) is responsible for implementing and enforcing the rules in this chapter. However, for facilities located within Hillsborough County, the Environment Protection Commission of Hillsborough County (EPC) has been delegated the authority by the FDEP to permit, review, and inspect the installation of these facilities to ensure compliance with the various FAC requirements.

Additionally, City code requires that all extensions or improvements provided by the applicant be designed, constructed, and inspected in accordance with all applicable federal, state, or other local laws, rules, and regulations as well as sound engineering practices and industry standards.

Purpose

The intent of the guideline is to provide the information needed to assist the applicants and their engineer so that the design documents and the installation of the wastewater facilities are consistent with the various requirements established in the FAC and typical conditions outlined in the City of Tampa Wastewater Department's (Department or Wastewater Department) letter of commitment for service. This guideline provides: the general requirements for the preparation of construction drawings; requirements for the design of the wastewater facilities; requirements for the submittal of as-built drawings; post installation testing; material specifications; and standard details.

General

All developments constructed within the City's wastewater service area that connect to the City's wastewater system must comply with the following requirements:

- Developments that connect to the City's Wastewater system shall meet all conditions outlined in the Wastewater Department's letter of commitment to provide wastewater service. The commitment for service will establish: the conditions for connecting to the Citys wastewater system; the conditions for release of building permits and the certificate of occupancy for the project; and requirements that must be met prior to constructing the new wastewater facilities and placing the wastewater facilities in use.
- Developments that connect to the City's wastewater system shall comply with all sections of City Code that establish the requirements for the use of the City's wastewater system.

CITY OF TAMPA WASTEWATER DEPARTMENT TECHNICAL STANDARDS GUIDELINE

PREFACE

- All wastewater facilities required to connect a development to the City's wastewater system are subject to the review and approval by the Wastewater Department.
- Wastewater facilities constructed within public rights of way or within easements that will be dedicated to the City shall be conveyed to the City for ownership and maintenance. These facilities shall be designed and constructed in accordance with the standards and requirements established in this guideline.
- Wastewater facilities constructed on private property shall be owned and maintained by the property owner. These facilities do not need to meet all the standards established in this guideline. However, the facilities shall comply with all local building and plumbing codes and ordinances and all other applicable rules and regulations.
- All conditions and requirements in permits granted by the City, County, State or Federal agencies shall be satisfied prior to placing any new wastewater facilities in service.

NOTE: The information provided in this guideline does not relieve the designer, developers, or the owner of the responsibility to follow applicable permitting and design standards from other local, state and/or federal government agencies. Any design criteria or standard not addressed in this guideline will be subject to review and approval by the Wastewater Department.

1.1 General

This section lists the general requirements and standards for preparing and showing information on construction plans that require review and approval by the City of Tampa's Wastewater Department (Department or Wastewater Department).

1.1.1 Professional Engineer Responsibilities

All construction plans (all sheets) submitted to this Department for review and approval shall be signed, sealed, and dated by a professional engineer licensed in the State of Florida in accordance with Chapter 471 of the Florida Statutes. It is the Engineer of Record's responsibility to comply with all regulations and requirements specified in Chapter 471 of the Florida Statutes.

1.2 Drafting Standards

1.2.1 Plan Sheet Sizes

All plans submitted for review shall be prepared on 11" x 17" or 24" x 36" size sheets. Plans submitted on oversized sheets (30" x 42", etc.) will not be accepted.

1.2.2 Scales

- A. All plan views shall be prepared using standard engineering scales (i.e. 1"=10', 1"=20', 1"=30', 1"=40', 1"=50', or 1"=60').
- B. All profile views shall be prepared using standard engineering scales (i.e. 1"=1', 1"=2', 1"=3', 1"=4', 1"=5', or 1"=6').
- C. The use of architectural scales for plan and profile views is prohibited. Architectural scales may be used for details that may be required for the project.
- D. Standard details or proposed details do not have to be drawn to scale however; these details should be proportional so that the information is clearly shown.

1.2.3 Title Blocks

Each sheet of the construction plan set shall have a title block that includes the project name, location, content of the plan sheet, sheet number, the date the sheet was prepared, the name of the Engineer of Record, Professional Engineering (P.E.) license number, and the name, address, and telephone number of the consulting firm. The title block should also include a block for notes describing the latest revisions and the dates the revisions were made. The title block shall be located along the bottom or right edge of the sheet.

1.2.4 Displaying Drawing Notes and Data

- A. Drawing notes, call outs, dimensions, elevations, and other drawing information shall be displayed in a manner that is easily read. Pointers and arrows shall be used as needed to reference the feature associated with the note or data. Notes and data must not overlap other notes or data. In general, notes and data shall be displayed using the following guidelines:
 - 1. <u>Information displayed horizontally</u>: Read left to right
 - 2. <u>Information displayed vertically</u>: Read bottom to top
 - 3. <u>Information displayed diagonally</u>: Read left to right
- B. Pipe inverts, rim elevations, and other elevations shall be displayed in feet accurate to 2 digits right of the decimal point. The compass direction corresponding to each pipe invert shall be indicated.
- C. Pipe slopes shall be labeled in percent accuracy to 2 digits right of the decimal point.
- D. Dimensions for pipeline locations shall be displayed in feet accurate to 1 digit right of the decimal point.
- E. Dimensions for the width of roadways, right of ways, sidewalks, and other related features shall be shown in feet accurate to the nearest foot.

1.2.5 Abbreviations

Abbreviations may be used to save space and time preparing the drawing. However, they must be clear, concise, and consistant throughout the plan set. A list of abbreviations used throughout the construction plans should be included in the beginning of the plan set.

1.2.6 Legend

A legend that shows and labels the symbols used for elements of the various items and features of the plans shall be included.

1.2.7 Elevation Datum

The elevation datum used for all plan sets shall be North America Vertical Datum (NAVD) 88. The datum shall be specified on all sheets that include elevation information.

1.2.8 Displaying Features and Utilities

Features and utilities shall be shown consistently and shall be defined in the beginning of the plan set. Standards for existing and proposed utilities shall be used as described in section 1.2.8.2 below.

1.2.8.1 Features

Drawing features such as right of way lines, property lines, edge of pavement, sidewalks, etc. shall be displayed using a unique line type or symbol for each feature.

1.2.8.2 Utilities

- A. The various utilities along the alignment of the proposed wastewater facilities or adjacent to the site shall be shown using a unique line type or symbol for each utility
- B. Existing utilities shall be shown with a dashed or light line weight. Proposed utilities shall be shown with a solid line or a line weight heavier than the line weight used for existing utilities.

Please note that it is the Engineer of Record's responsibility to obtain all information available on the location of existing utilities from the various utility agencies.

1.3 Construction Plan Requirements and Items to be Included in the Plan Set

1.3.1 General

All construction plans for the development of the project site and for the proposed and existing wastewater facilities located outside the development shall be based on recent field survey data obtained from a licensed surveyor registered in the State of Florida.

All plan sets shall include the following:

- Cover sheet
- General notes
- Site plan/master utility plan
- Plan and profile views for the proposed wastewater facilities
- Standard details
- Details specific to the design of the proposed wastewater facilities

Listed below is a description of the requirements for these plan set items.

1.3.2 Cover Sheet Requirements

The construction plan set shall include a cover sheet. The cover sheet shall list the project name, address, and any associated folio number(s). The cover sheet should also include the name, address, contact information of the owner/developer of the project, and an index of all drawings within the plans. All consulting firms associated with the project must also be listed. A vicinity map that illustrates the location of the project site as it relates geographically to the surrounding

area and any major intersections should also be included on the cover sheet. The vicinity map should indicate the following information: section, township, and range of the project, north arrow, and scale (if applicable).

1.3.3 General Notes

The construction plan set shall include a general notes page(s) that describe the requirements and guidelines for the project. The following Wastewater Department general notes shall be included with these notes:

- 1. At least 3 weeks prior to any construction, the Developer's representative shall contact the Planning Division's Field Inspector, 306 East Jackson Street., Tampa, Florida 33602 (phone 813-274-8070), and supply the field inspector with further construction information. This information should include all required shop drawings, the contractor's name, starting date, projected schedule, and other information required by the Planning Division. It is imperative that the contractor be fully informed of the notification and submittal requirements outlined in the approval for construction letter issued by the Department. Failure to comply with all Department requirements could delay processing of the Certificate of Occupancy for the project. Also, the Planning Division office should be contacted by telephone five days prior to the actual start of field operations in order to ensure availability of inspection personnel. Failure to contact the Planning Division at the specified times could invalidate Department approval.
- 2. The Contractor shall perform an infiltration/exfiltration test on all gravity sewers and a pressure test on all force mains (as applicable) in accordance with City of Tampa regulations. Said tests are to be certified by the Engineer of Record and submitted to the City of Tampa Wastewater Department for approval.
- 3. One or more of the following certificates/shop drawings, depending on the type of connections, will be required:
 - Ductile iron pipe (DIP) or Poly-vinyl Chloride (PVC) certificate of manufacture
 - Manhole shop drawings and concrete strength report
 - Frame and cover shop drawings
 - Flexible coupling shop drawings
 - Casing pipe certificate
 - Jacking pit detail
 - Crushed stone submittal
 - Valve shop drawing
 - Manhole drop connection detail

These items must be submitted, reviewed, and approved prior to starting construction.

- 4. The Certificate of Occupancy will not be issued until the following has been completed:
 - Final inspection in conjunction with Department personnel
 - As-builts have been submitted and accepted
 - All necessary testing completed and certified
 - Payment of all capacity fees
 - Issuance of the Florida Department of Environmental Protection (F.D.E.P.) certification of completion approval (if applicable)

Other standard Department notes specific to the installation of gravity sewers or force mains shall also be included. These notes are listed in the sections provided below that describe the plan requirements for gravity sewers and force mains.

1.3.4 Requirements for Site Plan/ Master Wastewater Utility Plan

This section describes requirements for provision of a site plan or master water utility plan for construction plans.

1.3.4.1 General

All construction plan sets shall include a site plan or a master wastewater utility plan that shows the entire site or development and the wastewater facilities needed to provide wastewater service to the development. Specific requirements for the site plan/master wastewater utility plan are described in the sections below.

For the purposes of describing the requirements for the site plan/master utility plan, the Department uses two categories of projects:

- Single Developments
- Subdivisions and Multi-lot Developments

1.3.4.1.1 Single Developments

Single development projects typically consist of the construction of a new building(s) on one or more lots, or additions to existing buildings.

1.3.4.1.2 Subdivisions or Multi-lot Developments

These types of projects consist of multiple separate lots where future homes or buildings will be constructed. The construction plan sets for these projects are typically submitted with only the proposed infrastructure needed to provide service to the lots. The submittal of separate service applications and plans for the development of each of lot is required when each lot is developed.

The requirements for a site plan/master utility plan for each of these project types are described below.

1.3.4.2 Site Plan Requirements for Single Developments

The site plan for a single development shall show the entire site and the on-site and off-site wastewater facilities needed to provide service to the site. If the project requires off-site facilities that cannot be completely shown on the typical project site plan, an overall plan view shall also be provided that shows the site and the entire length of the off-site facilities. This plan view shall be drawn to scale and include the following: existing lots, roadways and names, right of ways, north arrow, drawing scale, and other features needed to illustrate the location of the project and the required wastewater facilities.

The requirements for the project site plan are listed below:

- A. The site plan shall be based on the existing lots or proposed lot configuration for the development. All lot/property lines shall be clearly shown and the corresponding folio number(s), addresses, and lot numbers shall be indicated. The bearing and distance of the property lines for the site shall be specified and property corner monuments shall be shown.
- B. The site plan shall be based on recent surveyed information obtained from a licensed surveyor. Survey bench marks used for the project shall be shown and labeled. City of Tampa Bench Mark ID or Hillsborough County Bench Mark ID shall be labeled, if used.
- C. The site plan shall be drawn to scale. The scale shall be indicated both numerically and graphically.
- D. A north arrow shall be clearly shown. The City of Tampa atlas sheet number and the section, township, and range where the project is located shall be indicated adjacent to the north arrow.
- E. All existing or proposed right of ways and edge of pavement of streets shall be shown, labeled, and the street names indicated.
- F. All proposed and existing driveways and entrances shall be shown and labeled.
- G. All proposed buildings, existing buildings, and additions to existing buildings on the site shall be shown and the square footage, number of units, and number of floors indicated.
- H. The alignment of all proposed wastewater facilities needed to provide wastewater service to the proposed buildings or building additions on the site shall be shown and the size, types of pipes, and flow directions indicated. The existing wastewater facilities on the site and in the right of ways adjacent to the site shall also be shown and the size, type of pipe, and flow directions indicated.

- I. All existing and proposed wastewater manholes on the site and in the rights of way adjacent to the site shall be shown. All pipes connecting to the manholes shall be shown and the size and type of pipe indicated. The rim elevation of the manhole and the invert of each pipe connecting to the manhole shall be indicated. The compass direction (i.e. N, SW, etc.) corresponding to each connecting pipe shall be included with the invert.
- J. All existing laterals that extend to the site shall be shown and labeled.
- K. All existing or proposed utilities located on the site and in the right of ways adjacent to the site shall be shown and clearly labeled. Sizes and types of pipe shall be indicated for each utility. All existing and proposed utility structures (power poles, inlets, manholes, etc.) shall also be shown and labeled.
- L. All existing or proposed easements shall be shown and the width indicated. The type of easement (i.e. utility easement, drainage easement, private, etc.) shall be labeled.
- M. Rights of way located on the site that have been vacated or will be vacated shall be shown and labeled.

1.3.4.3 Master Plan Requirements for Subdivisions or Multi-Lot Developments

Plan sets for subdivisions or multi-lot developments shall include a master utility plan that shows the entire development and the on-site and off-site facilities needed to provide wastewater service to the development:

- A. The master plan shall be based on the existing or proposed plat or lots for the development. All existing and proposed lots shall be clearly shown and labeled.
- B. The master utility plan shall be drawn to scale. The scale shall be indicated both numerically and graphically.
- C. The master utility plan shall be based on recent surveyed information obtained from a licensed surveyor.
- D. A north arrow shall be clearly shown. The City of Tampa atlas sheet number and the section, township, and range where the project is located shall be indicated adjacent to the north arrow.
- E. All existing or proposed right of ways and streets shall be shown and labeled. The type of right of ways and streets, public or private, shall be labeled. Street names shall be indicated, if available. If street names have not been determined at the time of the plan submittal, street names such as "street A" can be used, however as-built drawing must indicate final street name.
- F. The master plan shall show all existing or proposed buildings (if known).

- G. The master plan shall indicate the size and/or type of development for each lot so that potential wastewater flow rates from the development can be determined. The following criteria shall be used:
 - 1. <u>Commercial/office/retail developments</u>: indicate square footage of all proposed and existing buildings
 - 2. <u>Motels/hotels</u>: indicate the number of rooms within each existing and proposed buildings
 - 3. <u>Apartments/condos/townhomes</u>: indicate the number of units within each of the existing or proposed buildings.
 - 4. <u>Restaurants</u>: indicate the number of seats within restaurant.
 - 5. <u>Single family home developments</u>: indicate each lot with a single family home
- H. The alignment, size, and flow direction of all proposed wastewater facilities needed to provide wastewater service to the proposed lots shall be shown. The existing wastewater facilities at the point of connection for the development, or adjacent to the development, shall also be shown and size of pipes and flow directions indicated.
- I. Existing and proposed utilities within the development or adjacent to the development shall be shown and labeled
- J. All existing or proposed easements shall be shown. The type of easement (i.e. utility easement, drainage easement, etc.) shall be labeled.
- K. Right of ways located within the development that have been vacated or will be vacated shall be shown and labeled

1.3.5 Standard Requirements for Plan and Profile Views

This section provides requirements for plan and profile views for construction plans.

1.3.5.1 General

- A. **Plan view** The plan set shall include a detailed plan view(s) along the entire length of all proposed wastewater facilities needed to connect the project to the City's wastewater collection system.
 - 1. For single developments, an additional plan view of the proposed wastewater facilities is not required if the entire length of the proposed wastewater facilities can be shown on the site plan
 - 2. For subdivisions or multi-lot developments, plan views of the existing and proposed facilities along each of the proposed streets, right of ways, or easements shall be provided

B. **Profile view** - A profile view shall be provided for all proposed wastewater facilities located within the right of way.

The specific requirements for the plan and profile views are described in the sections below.

1.3.5.2 Standard Plan View Requirements

- A. The construction plans shall include a plan view(s) along the entire length of the proposed wastewater facilities needed to provide wastewater service to the project/development
- B. The plan view(s) of the proposed wastewater facilities shall be drawn to scale. The scale shall be clearly labeled both numerically and graphically on each sheet.
- C. A north arrow shall be included on all plan view sheets. The City of Tampa atlas sheet number and the section, township, and range where the project is located shall be indicated adjacent to the north arrow.
- D. The size, type of pipe, and flow directions of the proposed wastewater facilities shall be indicated
- E. Existing wastewater facilities adjacent to and along the alignment of the proposed wastewater facilities shall be shown and the size, type of pipe, and flow directions indicated
- F. All proposed wastewater facilities located in the right of way that are parallel to the right of way shall be dimensioned to the right of way and edge of payment at regular intervals and at all changes in horizontal direction
- G. The existing wastewater facilities at the point of connection shall be dimensioned to the edge of pavement and the right of way
- H. All existing and proposed wastewater manholes shall be shown. All pipes connecting to the manholes shall also be shown and the size and type of pipe indicated. The rim elevation of the manhole and the invert of each pipe connecting to the manhole shall be indicated. The compass direction (i.e. N, SW, etc.) corresponding to each connecting pipe shall be included with the invert.
- I. The items listed below that are adjacent to and along the alignment of the proposed wastewater facilities shall be shown in the plan view(s):
 - 1. All existing and proposed utilities adjacent to and along the alignment of the proposed wastewater facilities shall be shown and labeled. The size and type of pipe shall also be indicated
 - 2. All existing and proposed utility structures (power poles, inlets, manholes, etc.) shall be shown and labeled

- 3. All existing and proposed swales and ditches shall be shown, labeled, and top of banks indicated
- 4. All existing and proposed sidewalks shall be shown, labeled, and the width of the sidewalk indicated
- 5. The property lines of all proposed or existing lots shall be shown. Lot numbers, property addresses, or folio numbers shall be indicated to identify each lot.
- 6. All right of way lines shall be shown, labeled, and the width of the right of way indicated. If the proposed wastewater facilities cross an intersection, the right of way lines of the crossing roadway shall be shown, labeled, and the width of the right of way indicated.
- 7. The edges of pavement of roadways shall be shown and labeled. The width of the pavement shall also be indicated. If the proposed wastewater facilities cross an intersection, the edges of pavement of the crossing roadway must be labeled and the width of the pavement indicated.
- J. The roadway names along the alignment of the proposed wastewater facilities and the names of roadways crossing the proposed wastewater facilities shall be labeled
- K. If the proposed wastewater pipeline will cross existing pavement, the method of installing the pipe at the crossing shall be indicated (i.e. open-cut, directional drill, or jack and bore)
- L. To establish the location of key features along the alignment of the proposed wastewater facilities located in the right of way, one of the following methods shall be used:
 - 1. The proposed wastewater pipeline shall be stationed in 100-ft increments along the alignment of the pipeline. Station 0+00 shall be located at the point of connection to the City's wastewater system.
 - 2. A survey baseline stationed in 100-ft increments shall be shown in the plan view that is either parallel to the right of way or parallel to the proposed wastewater facilities

In cases where the plan view of the proposed wastewater pipeline must be displayed on multiple sheets or views, match lines shall be used to designate the point along the pipeline where the particular plan view stops. The match lines shall be labeled and the corresponding station indicated along the pipeline where the match line is shown. The sheet number where the continuation of the pipeline is shown must also be indicated. The match line, the corresponding station, and the sheet number from the previous sheet or view shall be labeled on the next sheet or view so that the match lines can be abutted to assemble an entire view of the pipeline.

1.3.5.3 Standard Profile View Requirements

- A. Profile views along the entire length of all proposed wastewater pipelines located in the right of way shall be provided.
- B. The plans shall be arranged so that the profile view is located directly below the plan view.
- C. Profile view shall be drawn to scale both horizontally and vertically. The horizontal scale shall match the scale of the plan view.
- D. The horizontal and vertical scale of the profile view shall be clearly labeled both numerically and graphically on the profile view.
- E. The profile view shall be displayed on a grid. The horizontal axis of the grid shall show stations in 100-ft increments with a vertical line displayed across the grid at each increment. The vertical axis of the grid shall be labeled with standard increments of elevations based on the scale used for the profile view. A horizontal line shall be displayed across the grid at each increment.
- F. The profile view shall show the existing or proposed grade directly over the proposed pipeline.
- G. All utilities that the proposed pipeline will cross shall be shown in the profile view. The size, type of utility, type of pipe, and invert or top of pipe at the crossing shall be labeled.
- H. All parallel utilities within 10-ft of the proposed pipeline shall also be shown in the profile view.

In cases where the plan view of the proposed pipeline is displayed on multiple sheets or views and match lines are used (see match line requirements above), a profile view corresponding to the plan view between the match lines shall be provided. The match lines used in the plan view shall be labeled in the profile view and station of the match line indicated. The sheet number where the continuation of the pipeline is shown must also be indicated.

1.4 Construction Plan Requirements for Force Mains

1.4.1 Plan View Requirements for Force Mains

- A. The size and type of pipe of the proposed force main shall be labeled and the flow direction indicated.
- B. All horizontal bends, fittings, valves, changes in horizontal alignment, and points of connection to other wastewater facilities shall be labeled and the station, or station and offset from the baseline (if a baseline system is used), indicated.
- C. The proposed force main shall be dimensioned to the right of way and edge of pavement at regular intervals and/or at all locations where the proposed force main changes

horizontal direction. The location of all isolation valves shall be dimensioned to the edge of pavement and to the right of way.

- D. If the force main connects to an existing or a proposed manhole, all pipes that connect to the manhole shall be shown and the sizes, types of pipes, flow directions, and inverts of all existing and proposed pipes that connect to the manhole shall be labeled. The compass direction (i.e. N, SW, etc.) corresponding to each connecting pipe shall be included with the invert. The gravity sewer at the point of connection shall also be dimensioned to the right of way and edge of pavement.
- E. If the force main connects to an existing or another proposed force main, the size, type of pipe, and flow direction shall be labeled. The existing force main shall be dimensioned to the right of way and edge of pavement. The location of the connection shall also be dimensioned to the nearest roadway intersection.
- F. All proposed air release valves shall be labeled and the station, or station and off-set, indicated. The location of the air release valve shall be dimensioned to the edge of pavement and right of way line.

1.4.2 Profile View Requirements for Force Mains

- A. The size and type of pipe of the proposed force main shall be labeled.
- B. All vertical and horizontal bends, fittings, valves, changes in horizontal and/or vertical alignment, and points of connection to other wastewater facilities shall be labeled and the station or station and offset from the baseline indicated. The invert of the pipe at all vertical bends, fittings, valves, changes in vertical alignment, and points of connection to other wastewater facilities shall be indicated. If the project includes a force main located on both private property and the right of way, the invert of the force main at the property line shall be indicated.
- C. Since the Department requires that the vertical alignment of the force main be designed and constructed with specified points of vertical deflection, references to minimum cover requirements shall not be indicated on the plans.
- D. If the force main connects to an existing or a proposed manhole, the manhole shall be shown and the sizes, types of pipes, and inverts of all the existing and proposed pipes that connect to the manhole shall be labeled. The slope of the gravity sewer downstream of the point of connection shall also be indicated.
- E. If the force main connects to an existing or another proposed force main, the size and type of pipe shall be labeled. The invert of both the existing and proposed force main at the point of connection shall also be indicated.
- F. All proposed air release valves shall be labeled and the station and invert indicated.

1.4.3 Other Plan Requirements for Force Mains

- A. If the force main connects to an existing force main, the method of connection shall be indicated in both the plan view and the profile view.
- B. If the connection will be made by removing a section of the existing force main and installing a tee or other fitting, a detail for completing the connection must be included in the plan set. The detail shall show all necessary fittings needed to complete the connection. Notes regarding the requirements for maintaining flow, dewatering the force main, and disposing the sewage shall also be included. Please note that the Wastewater Department does not typically allow these types of connection and they are reviewed on a case by case basis. If the Department approves this type of connection, the Department will provide assistance with preparing the necessary notes, details, and the requirements for completing the connection.
- C. If the connection will be made by "hot-tapping" the existing force main, the connection shall be labeled accordingly and standard notes listed under Force Main Plan Note Requirements, below, shall be included.
- D. If the force main will connect to an existing manhole, a detail of the connection shall be included in the plan set.

1.4.4 Plan Note Requirements for Force Mains

All projects that involve the construction of a force main located in the right of way shall include the following City of Tampa standard notes:

- A. All force mains located in the right of way shall be constructed of C-900, DR 18, green PVC for force mains less than 14-inches in diameter. For force mains with diameter 14-inches or greater, the force main shall be constructed of C-905, DR18, green PVC.
- B. The force main shall be installed with a metallic locating wire in accordance with the City's PVC Pipe Locating Wire Detail (See Appendix B: Standard Details)
- C. All force main bends, fittings, and valves shall have restrained mechanical joints as manufactured by "Mega-lug", or approved equal. Additional pipe joints upstream and downstream of each fitting, bend, or valve shall also be restrained in accordance with the City's standard pipe joint restraint table included in the plan set.
- D. The force main shall be constructed in a straight alignment between the specified points of horizontal and vertical deflection. There shall be no intermediate high or low points between the vertical points of deflection. Air release valves shall v installed at all high points specified on the plans. Final location of the air release valve shall be adjusted so that it is located at the actual high point of the completed installation.
- E. The force main shall be installed using "Class C" bedding unless otherwise specified

If the force main connects to an existing force main by "hot-tapping" the existing force main, the following note shall be included on the plans:

A. Hot-tap connection to the existing force main shall be performed by the Contractor and shall be witnessed by a City inspector. The Contractor shall contact the Wastewater Department's Planning Section at (813) 274-8070 a minimum of 48-hours prior to completing the hot-tap to arrange inspection.

If the force main will connect to a manhole, the following notes shall be included on the plans:

- A. The flow channel in the existing manhole shall be reconstructed to accommodate the new connection
- B. All interior surfaces of the manhole shall be coated with either a polymorphic resin coating or an epoxy coating system that is completely resistant to corrosion caused by hydrogen sulfide gas. The coating shall have a minimum thickness of 175 mil DFT. Approved coating manufacturers include Raven Lining Systems, Broken Arrow, OK and Integrated Environmental Technologies, Santa Barbara, CA. Other coatings meeting the specifications of these coatings may be submitted for approval.

1.4.5 Detail Requirements for Force Mains

All projects that involve the construction of a force main located in the right of way shall include the following City of Tampa standard details (See Appendix B: Standard Details):

- Valve Box Detail
- Pipe Bedding Details
- Air Release Detail
- Force Main Restraint Table
- Locating wire detail
- Connection Detail (if required)
- Any other details that are specific to the project

<u>1.5 Construction Plan Requirements for Gravity Sewers</u>

1.5.1 Plan View Requirements for Gravity Sewers

- A. The size and type of pipe of the proposed gravity sewer(s) and all existing gravity sewers shall be labeled and the flow directions indicated.
- B. All proposed manholes and all existing manholes shall be shown and labeled. If the connection to the existing gravity sewer will be made by constructing a "dog-house" manhole over the existing gravity sewer, the proposed manhole shall be labeled as a "dog-house" manhole.

- C. The station, or station and offset from the baseline, (if a baseline system is used) of all proposed manholes and the manhole at the point of connection shall be indicated
- D. The angles between all existing and proposed pipes that connect to proposed manholes shall be indicated. If the proposed gravity sewer will connect to an existing manhole, the angle between the proposed pipe and the existing pipes that connect to the manhole shall be indicated.
- E. The rim elevation of each manhole and the inverts of all proposed and existing pipes that connect to each manhole shall also be indicated. The compass direction (i.e. N, SW, etc.) corresponding to each connection shall be included with the invert.
- F. All proposed manholes with a drop connection shall be labeled as drop manholes. Connections to existing manholes that require a drop connection shall be labeled as drop connections.
- G. The proposed gravity sewer shall be dimensioned to the right of way and edge of pavement at regular intervals and/or at all locations where the proposed gravity sewer changes horizontal direction
- H. Each proposed lateral connection shall be shown. The station and invert (or depth) of the connection at the property line shall be indicated.
- I. Proposed laterals that will connect to an existing gravity pipe by the installation of a wye shall be dimensioned to the nearest manhole

1.5.2 Profile View Requirements For Gravity Sewers

- A. The size and type of pipe of the proposed gravity sewers and the existing gravity sewer at the point of connection shall be labeled
- B. The slope of all proposed gravity sewers and the existing gravity sewer downstream of the point of connection shall be indicated
- C. All proposed manholes and all existing manholes shall be shown and labeled
- D. The station, or station and offset from the baseline, (if a baseline system is used) of all proposed manholes and the manhole at the point of connection shall be indicated
- E. The size and type of pipe of all pipes that connect to the proposed manholes and to existing manholes shall be indicated. The rim elevation of each manhole and the inverts of all proposed and existing pipes that connect to each manhole shall also be indicated. The compass direction (i.e. N, SW, etc.) corresponding to each connection shall be included with the invert.
- F. All proposed manholes with a drop connection shall be labeled as drop manholes. Connections to existing manholes that require a drop connection shall be labeled as drop connections.

G. In order to determine clearances of the proposed laterals, all utilities that are parallel to the proposed main gravity sewer that the lateral crosses shall be shown in the profile view. The size and type of pipe of the utility shall also be indicated.

1.5.3 Other Plan Requirements For Gravity Sewers

Details for connecting the proposed gravity sewer or lateral to an existing manhole, or a proposed lateral to an existing gravity pipe, shall be included in the plan set. The detail shall show all necessary fittings needed to complete the connection. Notes regarding the requirements for maintaining flow, dewatering the pipeline, and disposing the sewage shall also be included. Guidelines for completing the connections are provided in the Design Standards of this guideline.

1.5.4 Plan Note Requirements for Gravity Sewers

All projects that involve the construction of a gravity sewer located in the right of way shall include the following City of Tampa standard notes:

- A. Proposed gravity sewer shall be constructed of green, SDR-35 (unless otherwise specified), PVC meeting the requirements of ASTM D-3034
- B. The gravity sewer shall be installed using "Class C" bedding unless otherwise specified

If the proposed gravity sewer or lateral will connect to a manhole, the following note shall be included on the plans:

A. The flow channel in the existing manhole shall be reconstructed to accommodate the new connection

1.5.5 Detail Requirements For Gravity Sewers

All projects that involve the construction of a gravity sewer located in the right of way shall include the following City of Tampa standard details (See Appendix B: Standard Details):

- Manhole Details
- Manhole Frame and Cover Detail
- Pipe Bedding Details
- Lateral Connection Details
- Clean-out Cover Details
- Manhole connection detail
- Any other details that are specific to the project

1.6 Construction Plan Requirements for Private Pumping Stations

A. The location of the pumping station shall be clearly shown and labeled on the site plan.

- B. All pipes connecting to the pumping station shall be shown and the sizes and types of pipes indicated
- C. The plan set shall include a pumping station detail sheet that includes the following information:
 - 1. A plan and sectional view showing the wet well, valve vault, connecting gravity pipes, discharge piping, valves, bends, fittings and all other appurtenances
 - 2. The size and type of all valves, fittings, and bends labeled in both the plan and sectional view
 - 3. The invert elevation of the influent gravity main, bottom of wet well, discharge force main, and finished grade elevations labeled in the sectional view
 - 4. The sectional view of the wet well shall show all operating elevations of the station, i.e. pump off, lead pump on, lag pump on, and high water alarm
 - 5. Information on the proposed pumps, including the following: pump manufacturer, model number, pump size, impeller size or number, horse power, and motor speed. A copy of the manufacturer's pump curve shall also be shown.
 - 6. Information on the control panel, electrical, and instrumentation requirements

<u>1.7 Construction Plan Requirements for Jack and Bore Crossing</u>

- A. Installations of gravity sewers and force mains by jack and bore shall be labeled in both the plan view and profile
- B. The entire length of the casing pipe shall be shown to scale in both the plan and profile views
- C. The size, type of pipe, pipe wall thickness, and length of the casing pipe shall be indicated in both the plan and profile views
- D. The station, or station and off-set, of the ends of the casing pipe shall be indicated in both the plan and profile views. The invert of each end of the casing pipe and the carrier pipe shall be indicated in the profile view. The slope of the casing pipe shall also be indicated in the profile view.
- E. The jacking pit and receiving pit shall be shown in the plan view
- F. The Wastewater Department's Jack and Bore detail (See Appendix B: Standard Details) shall be included with the plan set

1.8 Construction Plan Requirements for Directional Bore Crossings

- A. Installation of force mains by directional drill shall be labeled in both the plan view and profile view
- B. The beginning and end of the section of the pipeline installed by directional drill shall be labeled and stationed in both the plan and profile view. The inverts at the beginning and end shall be provided in the profile view.
- C. The entrance angle and exit angle of the directional drilled pipe shall be labeled in the plan and profile views
- D. The station, or station and off-set, at the beginning and end of changes in horizontal direction shall be indicated in both the plan and profile views. The invert at the beginning and end of changes in horizontal direction shall be indicated in the profile view. The horizontal bending radius shall be indicated in the plan view.
- E. The station, or station and off-set, and the invert at the beginning and end of changes in vertical direction shall be indicated in the profile views. The vertical bending radius of the pipe shall also be indicated in the profile view.
- F. The type of pipe installed by directional drill shall be indicated in both the plan and profile views
- G. If HPDE pipe is used for the installation, the Wastewater Department's HDPE Transition detail (See Appendix B: Standard Details) shall be included in the plan set
- H. The following notes shall be included on the plans:
 - 1. All force mains installed by directional drill shall be constructed of high density polyethylene (HDPE) pipe meeting the requirements of AWWA C-906 or C900/C905, DR18, green PVC pipe with "certa-lok" joints. PVC pipe with fusible joints will not be allowed. HDPE pipe shall have ductile iron pipe outside diameter ("DIPS") and shall have a minimum of two (2) longitudinal stripes impregnated into the pipe wall. The minimum working pressure rating of the pipe shall be 160 psi and shall have a minimum wall thickness of SDR-11.
 - 2. The Contractor shall verify the depth and location of all crossing utilities prior to starting installation by directional drill

1.9 Construction Plan Requirements for Discharge Meters

Projects requiring the installation of discharge meters shall include the following:

- A. Plan view showing the location of the meter and the location of the meter's display
- B. Details of the meter installation that shows all pipes and fittings required for the installation. The detail shall indicate meter size, pipe sizes, size and type of fitting, and lengths of pipe upstream and downstream of the meter.

2.1 General

This section provides information on the design standards and requirements for the construction and installation of proposed wastewater facilities located within public rights of way. Since the Wastewater Department will not own or maintain wastewater facilities located on private property, the Wastewater Department does not set specific design standards or requirements for these facilities. Regardless of the location of the facilities, the Engineer of Record is responsible to design all proposed wastewater facilities to meet the specific requirements of project and to comply with all local, state, and federal regulations.

2.2 Design Standards for Force Mains

2.2.1 Pipe Sizes

All force mains constructed in the right of way shall have a minimum diameter of 4 inches. Larger diameter force mains shall be used to meet the flow rates of the proposed pumping station or when the Wastewater Department specifies the installation of larger pipelines to provide additional capacity for future growth.

2.2.2 Horizontal Alignment/Clearances

- A. Force mains within the right of way shall be located a minimum of 5-feet from the right of way line (property line)
- B. The horizontal alignment of the force main shall be designed with specified points of deflection. The alignment between these points shall be straight. Deflection at standard pipe joints or at bends shall not exceed the standards specified in the pipe material section provided in this guideline.
- C. As specified in Chapter 62-604 of the Florida Administration Code, force mains shall be laid at least ten (10) feet (outside to outside) horizontally from water mains
- D. Force mains shall be located a minimum of 5 feet from the outside wall of any parallel utility or structure such as a utility pole, stormwater manhole or inlet. In no case shall a force main be located directly under a utility structure regardless of vertical clearance.
- E. Force mains 12 inches or smaller installed at a depth less than 7 feet shall be located a minimum of 5 feet from the outside edge of any tree with a trunk diameter of 24 inches or less (measured at the base). Greater horizontal distances are required between trees with a trunk diameter larger than 24 inches, force mains with diameters greater than 12 inches, and force mains installed with depth greater than 7 feet. The required distance will be determined on a case by case basis and shall comply with the City of Tampa Tree and Landscape Code Technical Manual.

2.2.3 Vertical Alignment/Clearances

- A. All force mains located in the right of way shall have a minimum cover of 3 feet
- B. The vertical alignment of the force main shall be designed with specified points of deflection. The alignment between these points shall be straight. Deflection at standard pipe joints or at bends shall not exceed the standards specified in the pipe material section provided in this guideline.
- C. As specified in Chapter 62-604 of the Florida Administration Code, force mains shall cross under water mains unless there is no alternative. Force mains crossing water mains or reclaimed water lines permitted under Part III of Chapter 62-610, F.A.C. shall be laid to provide a minimum vertical distance of 18-inches between the invert of the upper pipe and the crown of the lower pipe. The minimum vertical separation shall be maintained whether the water main is above or below the force main.
- D. A minimum vertical clearance of 6 inches shall be provided when crossing above all other utilities. A minimum of 6 inches of vertical clearance shall be provided when crossing below a utility with a diameter 6 inches or less. A minimum of 12 inches of clearance shall be provided when crossing below a utility with a diameter greater than 6 inches up to a diameter of 18 inches. A minimum of 18 inches of vertical clearance will be required when crossing under utilities with diameters greater than 18 inches.

2.2.4 Force Main Connections

- A. Force main connections to existing force mains are typically completed by "hot-tapping" the existing force main. The hot-tap shall be performed by the Contractor and shall be witnessed by a City inspector. Connections to existing force mains made by removing a section of the existing force main and installing a tee or other fitting are reviewed on case by case basis and require specific approval by the Wastewater Department. A detail showing all required fittings needed to complete the connection shall be provided in the plan set. The Wastewater Department will provide guidelines and the requirements for completing the connection. The plans must also provide the specific requirements for bypassing the flow in the existing pipeline and for disposing any wastewater that is discharged from the existing pipelines during the installation.
- B. Force main connections to existing gravity sewers require the installation of a manhole over the existing gravity sewer. The manhole shall be lined with a protective coating that prevents corrosion from hydrogen sulfide gas. If the force main connects to an existing manhole, a fiberglass liner shall be installed inside the manhole or all interior surfaces of the manhole shall be lined with a protective coating (See Appendix C: Workmanship and Material Specifications W-52 Manhole Protective Coatings and Rehabilitation). For connections of force mains greater than 4-inches or force mains longer than 500-ft, additional manholes downstream of the force main connection may also require lining. The lining requirements will be determined on a case by case basis.

- C. To minimize turbulence and the release of odorous gases, the force main shall connect to the manhole at an elevation so that the water surfaces within the force main and the downstream gravity pipe are equal when the pipes are 80% full. Inside or outside drop connections shall not be used to meet the required elevation of the force main connection. Force mains shall connect to the manhole at angle that is no less than 90-degrees from the downstream pipe.
- D. Flow channels shall be provided in the manhole that directs the flow from the force main to the downstream a pipe. When a force main connects to an existing manhole, the flow channel within the manhole shall be reconstructed to accommodate the flow direction from new force main.

2.2.5 Use of Valves

- A. A plug valve shall be installed on the force main at the property line. The valve shall be located on the right of way side of the property line. A valve shall also be installed on each connection to an existing force main or connection to another proposed force main. If the valve at the property line is within 50-ft to the point of connection, an additional valve at the point of connection is not required.
- B. Air release valves shall be provided at the downstream end of all high points along the vertical alignment of the force main

2.2.6 Requirements for Restraining Pipe Joints

- A. All bends, fittings, and valves installed on the force main shall have restrained mechanical joints
- B. Additional pipe joints upstream and downstream of all bends, fittings, and valves shall also be restrained. The required lengths of the restrained pipe shall meet the lengths specified in the Restrained Pipe Table shown in the force main details provided in Appendix B: Standard Details.
- C. Thrust blocks are not permitted on force mains

2.2.7 Material Requirements

2.2.7.1 Pipes

- A. Force mains located in the right of way with diameters of 14 inches or less shall be constructed with green, ASTM C900 DR 18, PVC pipe
- B. Force mains located in the right of way with diameters greater than 14 inches shall be constructed with green, ASTM C905, DR 18, PVC pipe.

C. Deflections at standard pipe joints shall not exceed 1-degree. Deflections up to a maximum of 3-degrees may be accomplished at a pipe joint utilizing twin gasket high deflection coupling instead of a standard bell and spigot joint. Standard bends shall be used for deflections greater than 3-degrees.

2.2.7.2 Bends and Fittings

- A. Factory fabricated bends shall be used to accomplish bends greater than 3-degrees.
- B. Pipe bends and fittings shall be factory molded PVC bends meeting the requirements of AWWA C900 / C905 or DIP bends and fittings meeting the requirements of AWWA C 110. Pipe deflections at these bends shall not exceed 3-degrees. All bends and fittings shall have restrained mechanical joints.

2.2.7.3 Restraining Devices

Restraining devices shall accommodate the full working pressure rating of the pipe plus surge allowance. Restrainers shall be EBAA Iron "Megalug" or approved equal.

2.2.7.4 Pipe Bedding

All pipes shall be installed using Class C bedding, unless otherwise instructed or advised by the Department. Backfill shall be clean soil free of debris, organics, rocks, and deleterious material.

2.2.7.5 Valves

- A. All valves used for the isolation of branches and sections along the force main line shall be plug valves. Gate valves shall only be used for completing "hot-taps" on existing force mains.
- B. Plug valves shall be eccentric design and shall meet the requirements of AWWA C517 and C550. Valves shall be rated for a working pressure of 150 psi. Plug valves shall have a rectangular port with an area that is equal to 100% of the standard pipe area. The valve body shall be constructed of Cast Iron ASTM A126 Class B and shall be equipped with mechanical joints. The valve plug shall be Ductile Iron ASTM A536 and shall be resilient faced. Valve seats shall be constructed of nickel. Valves shall have an interior and exterior epoxy coating. The valve shall close when turning the valve operator clockwise referenced by looking down on the valve nut.
- C. Gate valves used for tapping force mains shall be resilient type with bodies and bonnets made of ductile iron. Valves shall be rated for a working pressure of 250 psi. The valve shall be furnished with a flange at one end and a mechanical joint on the other end. The flange shall be furnished with an alignment ring to ensure true alignment of the valve and tapping sleeve. The valve wedge shall be fully encapsulated with EPDM rubber.

2.3 Design Standards for Gravity Sewers

2.3.1 Pipe Sizes and Slopes

- A. All main line gravity sewers located in the right of way shall have a minimum diameter of 8 inches. All service lateral pipes located in the right of way shall have a minimum diameter of 6 inches.
- B. A pipe diameter larger than 8 inches for mainline gravity sewer may be required when the flow rates from the project require additional capacity to accommodate the peak flow rates. These pipes shall be sized based on the slope and diameter required to provide a minimum velocity of 2 feet per second when flowing half full. Using larger diameter pipes to allow the pipeline to be installed with flatter slopes is strictly prohibited. In no case shall larger diameter pipe be installed upstream of a smaller diameter pipe.
- C. The minimum slope requirements for the various pipe sizes shall be as listed in the following chart:

Pipe Diameter (in)	Minimum Slope (%)
6 (laterals)	1.00
8	0.40
10	0.28
12	0.22
15	0.15
18	0.11
21	0.09
24	0.08

Large diameter pipes that are not shown on this chart shall be designed to have mean velocities of 2 feet per second when flowing full. A Manning's roughness coefficient of 0.013 shall be used to determine the required slope.

2.3.2 Horizontal Alignment/Clearances

- A. All gravity sewers within the right of way shall be located a minimum of 5 feet from the right of way line (property line) or distance equal to the depth of the pipeline, whichever is greater.
- B. If the gravity sewer is located within a roadway, the sewer shall be aligned either along the center line of the road or along the center of a traffic lane. The gravity sewer shall not be aligned in a location where the manholes will be located under the vehicle's wheel paths.

- C. Locating gravity sewers that will be owned and maintained by the City within easements on private property shall not be permitted unless prior approval is obtained from the Wastewater Department.
- D. Gravity sewers shall not be located within ditches or swales that are parallel to the pipeline.
- E. Manholes shall be installed at the locations described in section 2.3.4 Use of Manholes.
- F. The alignment of the gravity sewer between manholes shall be straight
- G. As specified in Chapter 62-604 of the Florida Administration Code, the gravity sewer shall be laid at least ten (10) feet (outside to outside) horizontally from water mains Provided the applicant demonstrates there is no reasonable alternative, smaller horizontal separation distances for sewers will be allowed if one of the following conditions is met:
 - 1. The top of the gravity sewer is installed at least 18 inches below the bottom of the potable water line
 - 2. The gravity sewer is encased in watertight carrier pipe or concrete
 - 3. Both the gravity sewer and the water main are constructed of slip-on or mechanical joint pipe complying with public water supply design standards and pressure tested to 150 psi to assure water-tightness. For this condition, the gravity sewer shall be constructed DR-18, C-900, or C-905 PVC pipe.
 - 4. The applicant provides documentation accompanying the FDEP permit application showing that another alternative will result in an equivalent level of reliability and public health protection
 - 5. Minimum separation, regardless of additional protection, shall not be less than 5 feet
- G. Gravity sewers shall be located a minimum of 5 feet from the outside wall of any parallel utility or structure such as a utility pole, stormwater manhole or inlet. In no case shall a gravity sewer be located directly under a utility structure, regardless of vertical clearance.
- H. Gravity sewers 12 inches in diameter or smaller, installed at a depth less than 7 feet shall be located a minimum of 5 feet from the outside edge of the tree trunk for any tree with a trunk diameter of 24 inches or less (measured at the base). Greater horizontal distances are required between trees with a trunk diameter larger than 24 inches, sewers with diameters greater than 12 inches, and sewers installed with depth greater than 7 feet. The required distance will be determined on a case by case basis and shall comply with the City of Tampa Tree and Landscape Code Technical Manual.

2.3.3 Vertical Alignment/Clearances

- A. All gravity sewers located within the right of way shall have minimum cover of 3 feet.
- B. Gravity sewers shall have a constant slope between manholes.
- C. Manholes shall be installed at all changes in the vertical alignment (see additional requirements described in section 2.3.4 Use of Manholes).
- D. As specified in Chapter 62-604 of the Florida Administration Code, gravity sewers shall cross under water mains unless there is no alternative. Gravity sewers crossing water mains or reclaimed water lines permitted under Part III of Chapter 62-610, F.A.C. shall be laid to provide a minimum vertical distance of 18-inches between the invert of the upper pipe and the crown of the lower pipe. The minimum vertical separation shall be maintained whether the water main is above or below the gravity sewer. For gravity sewer crossings, the crossing shall be arranged so that the gravity sewer pipe joints are equidistant and as far as possible from the water main joints. Adequate structural support shall be provided for the gravity sewer to maintain line and grade. Provided that the applicant demonstrates there is no reasonable alternative, smaller vertical separation distances will be allowed if one of the following conditions is met:
 - 1. The gravity sewer is encased in watertight carrier pipe or concrete.
 - 2. The gravity sewer is constructed with pipe equal to water pipe and tested to 150 psi to assure water-tightness. For this condition, the gravity sewer shall be constructed of DR-18, C-900 or C-905 PVC pipe.
 - 3. The applicant provides documentation accompanying the FDEP permit application showing that another alternative will result in an equivalent level of reliability and public health protection.
 - 4. Minimum separation, regardless of additional protection, shall not be less than 12-inches.
- E. A minimum vertical clearance of 6 inches shall be provided when crossing above all other utilities. A minimum of 6 inches of vertical clearance shall be provided when crossing below a utility with a diameter 6 inches or less. A minimum of 12 inches of clearance shall be provided when crossing below a utility with a diameter greater than 6 inches up to a diameter of 18 inches. A minimum of 18 inches of vertical clearance will be required when crossing under utilities with diameters greater than 18 inches.

2.3.4 Use of Manholes

- A. Manholes shall be installed at the following locations or conditions:
 - 1. Terminal end of each pipeline
 - 2. At all changes in pipe size
 - 3. At all changes in horizontal alignment
 - 4. At all changes in vertical alignment
 - 5. At all locations where another gravity main (not a service lateral) or force main connects to the pipeline
- B. Distance between manholes shall not be greater than 350 feet
- C. Cleanouts may not be used to substitute for the required installation of a manhole
- D. Pipes shall not be connected to a manhole at an angle less than 90-degrees from the downstream pipe
- E. Pipes connecting to a manhole with a vertical distance greater than 2 feet above the downstream pipe will require the installation of an outside drop connection. Inside drop connections will not be allowed unless specifically approved by the department (See Appendix B: Standard Details: Manhole Drop Connections).
- F. All manholes shall have flow channels that directs the flow from all upstream pipes to the downstream a pipe. When a new pipe connects to an existing manhole, the flow channel within the manhole shall be reconstructed to accommodate the flow direction from new pipe.
- G. Vertical drops shall be provided between all upstream pipes connecting to the manhole and the downstream pipe to compensate for the energy losses across the manhole. For a pipe connecting to a manhole at a 90° angle from the downstream pipe, a minimum vertical drop of 1-inch shall be provided. As the angle between the pipes increases, the vertical drop shall decrease proportionally to a minimum of ¹/₄-inch for pipes connecting 180-degrees from the downstream pipe.
- H. At locations where a smaller diameter pipeline connects to a manhole with a larger diameter downstream pipeline, the smaller pipe shall connect at an elevation no less than the elevation required so that the water surfaces within the pipes match when the smaller pipe and downstream pipe are 80% full.
- I. The installation of a "dog-house" manhole should used in locations where a new pipe (ie. main line or force main) connects to an existing gravity sewer to avoid the need to bypass the flow in the existing gravity pipe. The City will allow the installation of standard manholes that require removal of a section of the existing gravity pipe when necessary.

However, these installations are reviewed on a case by case basis and the plans must include the specific requirements for bypassing the flow in the existing gravity pipe and disposing any wastewater that is discharged from the existing pipelines during the installation. Requirements for the bypass system are detailed in Appendix C: Workmanship and Material Specifications: Specification W-20 - Maintaining Existing Sanitary Sewer in Operation.

2.3.5 Service Laterals

When the peak flow rates from the project or the on-site collection system allows the use of pipes less than 8-inches, a lateral or service connection can be used to connect the project to the City's gravity main.

The guidelines below shall be used to determine the lateral requirements for the following types of developments:

- **Single developments:** for developments consisting of a single commercial building or house constructed on one or more existing lots, one independent service lateral shall be used. Connecting a single building or an addition to an existing building or house to more than one lateral will only be permitted if the on-site plumbing cannot be arranged so that the building can connect to a single lateral. Developments consisting of multiple buildings on a common platted lot may share a single lateral connection to the City's gravity main if the peak flow rates do not exceed the capacity of the lateral.
- **Subdivisions or multi-lot developments:** for new multi-lot commercial developments, a separate and independent service lateral shall be installed from the main line gravity sewer to each platted lot. For new residential subdivisions, two lots can share a single lateral extended from the mainline gravity sewer. However, a separate clean-out and connection to the lateral shall be provided on the right of side of the property line for each lot.
- A. All lateral pipes constructed within the right of way shall have a minimum diameter of 6 inches. The pipe sizes used for the on-site piping may be smaller, however the sizes selected shall meet local plumbing and building code requirements.
- B. The horizontal alignment of the section of the service lateral located in the right of way shall be straight between the connection to the mainline and the property line. No horizontal bends shall be used. At locations where the service lateral connects to the main line using a wye, the horizontal alignment of the lateral between the property line and the main line shall be at an angle that is 90-degress from the mainline. At locations where the lateral connects to a manhole, the horizontal alignment between the property line and the main line shall be no less than 90-degress from the downstream pipe.

- C. The maximum length of a lateral within the right of way shall not exceed 75 feet from the mainline
- D. All service laterals installed within the right of way shall have a minimum slope of 1.0%
- E. All service laterals located within the right of way shall have minimum cover of 3 feet. At locations where a service lateral crosses a ditch or swale, a minimum cover of 18 inches shall be provided.
- F. The depth of the service lateral at the property line shall be no greater than 5 feet and no less than 3 feet
- G. Service laterals shall be equipped with a clean-out that is installed at the right of way line or property line (See Appendix B: Standard Details: Cleanout Cover Details)
- H. The vertical alignment of the service lateral shall be designed so that no more than two(2) vertical bends are required between the connection to the gravity main and the property line
- I. A minimum vertical clearance of 12-inches shall be provided when crossing above a water main. However, a vertical clearance less than 12-inches but greater than 6-inches will be allowed if the lateral is installed using one the following criteria:
 - 1. The lateral is encased in at least 4 inches of concrete
 - 2. The lateral is installed in a casing pipe with an impact strength equal to the impact strength of pressure class 350 ductile iron
 - 3. The lateral is constructed of ductile iron pipe with a minimum pressure class of 350
- J. A minimum of 6 inches of vertical clearance shall be provided when crossing below water mains with a diameter 6 inches or less. A minimum of 12 inches of clearance shall be provided when crossing below a water main with a diameter greater than 6 inches up to a diameter of 18 inches. A minimum of 18 inches of vertical clearance will be required when crossing under a water main with diameters greater than 18 inches
- K. At all water main crossings, the joints of the lateral pipe at the crossing shall be arranged so that no joint is within 6 feet of a joint along the water main. If the joint spacing cannot be achieved, then the lateral pipe shall be constructed of C-900 PVC.
- L. A minimum vertical clearance of 6 inches shall be provided when crossing above all utilities other than a water main. A minimum of 6 inches of vertical clearance shall be provided when crossing below a utility, other than a water main, with a diameter 6 inches or less. A minimum of 12 inches of clearance shall be provided when crossing below a utility, other than a water main, with a diameter of learance shall be provided when crossing below a utility, other than a water main, with a diameter greater than 6 inches up to a diameter of 18 inches. A minimum of 18 inches of vertical clearance will be required when crossing under utilities with diameters greater than 18 inches.

- M. Lateral connections to an existing gravity main pipe shall be made by removing a section of the pipe and installing a PVC wye. If the existing pipeline is constructed of VCP (vitrified clay pipe) or DIP (ductile iron pipe), the wye shall be connected to the main line pipe by providing a PVC spool piece at each end of the wye and connecting the spool pieces to the existing pipe using flexible adapters. If the existing mainline sewer is constructed of PVC, one end of the wye can be connected directly to the existing pipe. The other end shall be connected by providing a spool piece and connecting the spool piece to the existing pipe using a flexible or rigid adapter. The plans must provide the specific requirements for bypassing the flow in the existing pipeline and for disposing any wastewater that is discharged from the existing pipelines during the installation. Requirements for the bypass system are detailed in Appendix C: Workmanship and Material Specifications: W-20 Maintaining Existing Sanitary Sewer In Operation.
- N. Lateral connections to existing gravity sewers with high flow rates should be made by the installation of a "dog-house" manhole over the existing pipe to avoid the need to bypass the flow. The Department will provide guidance for locations where the connection should be made by installing a "dog-house manhole".
- O. Service laterals shall be located a minimum of 5 feet from the outside edge of any tree with a trunk diameter of 24 inches or less (measured at the base). Greater horizontal distances are required between trees with a trunk diameter larger than 24 inches. The required distance will be determined on a case by case basis and shall comply with the City of Tampa Tree and Landscape Code Technical Manual.

2.3.6 Materials Requirements for Gravity Sewers

2.3.6.1 Pipes

All new gravity sewers shall be constructed with solid wall green polyvinyl chloride (PVC) meeting the requirements of ASTM D-3034.

Standard Specifications Reference 6-inch Through 15-inch Diameter Pipe Based on Depth of Burial				
Depth of cover from finished Grade	Material	Specifications		
0'-18'	Green PVC	ASTM D3034 SDR 35		
18' or greater	Green PVC	ASTM D3034 SDR 26		

- A. Sewer pipes 18-inch through 36-inch shall comply with ASTM F679 and all other applicable requirements specified in Section No. 2 of ASTM F679.
- B. All pipe wyes used to connect service laterals to main line sewers shall be constructed of PVC.
- C. All gravity sewers shall be installed with Class C bedding (Appendix B: Standard Details: Misc. Gravity Details) unless the field conditions or the structural requirements of the pipeline require the use of other bedding types.

For further details see, Appendix C: Workmanship and Material Specifications, Specification W-11-PVC Gravity Pipe of this Technical Standards Guideline.

2.3.6.2 Pipe Joints, Fittings and Transitions

- A. Fittings shall be made of PVC having a cell classification as outlined in Section No. 4 "Materials" of ASTM F679 and as defined in ASTM D1784
- B. Joints for solid wall PVC pipe and fittings shall be gasket, bell and spigot, push-on type. Joints shall be a molded integral part of the pipe section. Separate joints or couplings furnished loose shall not be allowed.
- C. Fittings shall be factory molded. No fabricated fittings or saddles shall be permitted
- D. Fittings for solid wall PVC pipe shall comply with ASTM D3034 SDR-35
- E. SDR-35 fittings are permitted for use on SDR-26 piping
- F. Transitions between PVC and CIP, or DIP pipes shall be made using rigid adapters
- G. Transitions between VCP and other pipes shall use flexible adapters

For further details see standard specification in Appendix C: Workmanship and Materials, Specification W-11 PVC Gravity Pipe, of this Technical Standards Guideline.

2.3.6.3 Manholes

- A. Only pre-cast concrete manholes are allowed
- B. Manholes for gravity sewers 8-inches to 24-inches shall have a minimum internal diameter of 4-ft and a minimum access opening of 24-inches. The minimum wall thickness shall be 8-inches. However, the Wastewater Department will allow the use of manholes with a 5-inch wall thickness in locations where there is no flow from a force main discharge upstream of the manhole.
- C. Manholes for gravity sewers 27-inches and 30-inches shall have a base section with a minimum internal diameter of 5-ft. Manholes for gravity sewers 36-inches to 42-inches shall have a base section with a minimum internal diameter of 6-ft. The barrel section for
both of these manholes shall have minimum diameter of 4-ft and a minimum access opening of 32-inches. The minimum wall thickness for the base section shall be 6-inches and the minimum wall thickness for the barrel section shall be 5-inches. All interior surfaces within the manhole shall be lined with a corrosion resistant lining or protective coating.

- D. At locations where a force main will discharge into a manhole, the manhole shall be lined with a corrosion resistant lining or protective coating. A list of approved protective coatings for manholes is provided in Appendix C: Workmanship and Material Specifications, Specification W-52 - Manhole Protective Coatings of this Technical Standards Guideline.
- E. Materials of construction and installation shall be in accordance with Appendix B: Standard Details, and Appendix C: Workmanship and Material Specifications, Specification W-12 - Precast Concrete Manholes, both in this Technical Standards Guideline.

2.3.6.4 Frame and Cover

Manhole frames and covers, for both structures and manholes, shall be heavy duty frames and covers designed to withstand an HS20-44 loading defined in the AASHTO Specifications. Only Manholes located within the right-of-way shall have the City logo on the cover. Frame and covers with City logo shall not be used for manholes located on private property. For further details see standard specification in Appendix B: Standard Details under Miscellaneous Gravity Details in this Technical Standards Guideline.

2.3.6.5 Laterals

All service laterals shall be constructed with ASTM D-3034, SDR 35, green PVC unless the installation requirements for laterals specified in Section 2.3.5 Service Laterals specify the use of ductile iron pipe or other pipe. Ductile iron pipe (DIP) used for laterals shall meet the requirements of ASTM standards and shall have a pressure class of 350. DIP used for laterals shall be lined with a corrosion resistant lining such as Protecto 401, manufactured by Induron Coatings, Birmingham, Alabama, or equal.

2.3.6.6 Pipe Bedding

All pipes shall be installed using Class C bedding, unless otherwise instructed or advised by the Department. Backfill shall be clean soil free of debris, organics, rocks, and deleterious material.

2.4 Design Standards for Installations by Directional Drill

2.4.1 General

This section provides the general standards and requirements for installing wastewater pipelines using horizontal directional drilling (HDD).

- A. The City does not permit gravity sewers or service laterals to be installed by directional drilling methods. Only force mains may be installed by directional drill and are only allowed in locations where the installation of the pipeline by direct burial cannot be completed due to the following conditions:
 - 1. High traffic volume roadways
 - 2. Crossing under large utilities
 - 3. Aquatic crossings
 - 4. Sensitive environmental lands
- B. Installations by directional drill shall meet the requirements listed below and the requirements specified by any other governmental agency having jurisdiction over the rights of way where the pipeline is installed (i.e. Hillsborough County, FDOT, etc). If these requirements conflict, the requirements specified by the agency having jurisdiction over the right of way shall prevail.

2.4.2 Horizontal Alignment

- A. The horizontal alignment of the pipeline installed by directional drill shall be straight between the entry and exit points of the installation.
- B. The horizontal alignment shall be designed to provide the same alignment and clearances as specified in Section 2.2.2 Horizontal Alignment/Clearances.

2.4.3 Vertical Alignment

- A. Pipelines installed by directional drill shall be designed to provide a minimum cover of 36-inches above the crown of the borehole. The maximum depth of the installation shall not exceed 6-ft unless specifically required by another agency having jurisdiction over the rights of way where the pipeline is installed (i.e. FDOT, Hillsborough County, etc.).
- B. The entry angle and exit angle shall not exceed the allowable bending radius of the pipe.
- C. The vertical alignment between the bottom of the entry angle and the beginning of the exit angle shall be straight. There shall be not intermediate high points between these points.

D. The vertical alignment shall be designed to provide the same clearances as specified in 2.2.3 Vertical Alignment/Clearances

2.4.4 Materials

- A. Pipe used for directional drilling shall be High Density Polyethylene (HDPE) pipe meeting the requirements of AWWA C-906, C900, or C905 green PVC with "certa-lok" joints. PVC pipe with fusible-joints is not permitted. HDPE pipe shall have ductile iron pipe outside diameter ("DIPS") and shall have a minimum of two (2) longitudinal green stripes impregnated into the pipe wall. The minimum working pressure rating of the pipe shall be 160 psi and shall have a minimum wall thickness of SDR-11.
- B. The HDPE resin shall be PE3408 resin characterized by ASTM D3350. Butt fusion of joints shall comply with ASTM D2657.
- C. The fittings for HDPE shall be HDPE fittings with ductile iron outside diameter that meet the requirements of ANSI/AWWA C-906, latest revision, with a minimum working pressure rating of 160 psi and minimum wall thickness of SDR-11. Ductile iron fittings may be used provided that butt fused HDPE MJ adapters are used to transition from the pipe to the fitting. HDPE transition fittings, adapters, and service fittings shall be heat (butt) fused.
- D. A minimum of two separate conductive tracking wires or coated conductive tape shall be attached to the pipe, either externally or integrated with the pipe. Conductors must be located on opposite sides of the pipe when installed externally. Locating wires shall terminate 4 or more inches above the concrete valve pad and fold back inside a 3-inch PVC access pipe.
- E. The pipes shall be marked in accordance with AWWA requirements.
- F. Leakage testing shall be performed in accordance with the City's specifications (Appendix C: Workmanship and Material Specifications, Specification W-18 - Leakage Test in this Technical Standards Guideline).

2.5 Design Standards for Installations by Jack and Bore

2.5.1 General

A. This section lists the general standards and requirements for installing underground wastewater utilities using the Jack and Bore method of installation consisting of a casing pipe to install a carrier pipe. This method of installation requires specific approval by the City and is only allowed in locations where the installation of the pipeline by direct burial cannot be completed due to the following conditions:

- 1. High traffic volume roadways
- 2. Railroad crossings
- 3. Crossing under large utilities
- 4. Aquatic crossings
- 5. Sensitive environmental lands
- B. Installations by Jack and Bore method shall meet the requirements listed below and the requirements specified by any other governmental agency having jurisdiction over the rights of way where the pipeline is installed (i.e. CSX Railroad Co., Hillsborough County or FDOT). If these requirements conflict, the requirements specified by the agency having jurisdiction over the right of way shall prevail.

2.5.2 Horizontal Alignment

- A. The casing pipe shall extend a minimum of 5-feet beyond the curb or edge of pavement when crossing roadways unless additional distances are required by another governmental agency having jurisdiction over the rights of way where the pipeline is installed. For crossing under railways, the casing pipe shall extend the minimum distance required by CSX Railroad. For crossing under large utilities, the casing pipe shall extend the minimum distance needed to complete the installation without damaging the utility. The Engineer of Record will be responsible for determining the required distance.
- B. The horizontal alignment shall be designed so the same alignment and clearances from water lines, structures, and other utilities as specified in Section 2.2.2 Horizontal Alignment/Clearances for Force Mains and Section 2.3.2 Horizontal Alignment/Clearances for Gravity Sewers are provided for the portions of pipeline that extend beyond the casing pipe.

2.5.3 Vertical Alignment

- A. Pipelines installed by Jack and Bore shall be designed to provide a minimum cover of 36inches over the casing pipe. Additional cover shall be provided as needed to meet the requirements of other governmental agencies having jurisdiction over the rights of way where the pipeline is installed (i.e. FDOT, Hillsborough County, CSX Railroad).
- B. For Jack and Bore installations under large utilities, the vertical alignment of the casing pipe shall be designed to provide a minimum of 12-inches of clearance between the outside of the casing pipe and the outside of the utility.
- C. The casing pipe shall have the same slope or vertical alignment as carrier pipe so that carrier pipe can be centered in the casing pipe

D. The vertical alignment shall be designed so the same alignment and clearances from water lines, structures, and other utilities as specified in Section 2.2.3, Vertical Alignment/Clearances for Force Mains and 2.3.3, Vertical Alignment/Clearances for Gravity Sewers are provided for the portions of pipeline that extend beyond the casing pipe.

2.5.4 Installation of Carrier Pipe

The carrier pipe shall be installed inside the casing pipe so that it is near the center of the casing pipe. Pipe spacers shall be provided so that the carrier pipe is completely supported on all sides and cannot move within the casing pipe. Distance between spacers shall not exceed 6-ft.

2.5.5 Materials

2.5.5.1 Casing Pipe Material

Steel pipe casings shall conform to the requirements of AWWA C-200 and ASTMA-139, grade B. The minimum thickness of the casing pipe shall be 3/8-inch. Additional thickness shall be provided for large diameter casing pipes and for installations under railroads.

2.5.5.2 Carrier Pipe Spacers

Carrier pipe spacers shall be pre-manufactured pipe spacers as produced by Cascade Waterworks MFG. Inc., Advance Products and System Corporation, or approved equal. The spacers shall be constructed of stainless steel and other corrosion resistant materials.

2.5.5.3 Carrier Pipe

The carrier pipe shall meet the same material requirements specified in Section 2.2 Design Standards for Force Mains and 2.3 Design Standards for Gravity Sewers.

2.6 Design of City Pumping Stations

The design standards and requirements for pumping stations that will be owned and maintained by the Wastewater Department are not addressed in the Technical Standards Guideline since the design is site specific. For projects that involve the construction of a City pumping station, the Wastewater Department will provide assistance with the selection of the required pumps and information needed to complete the design in accordance with the City's current mechanical, electrical, and instrumentation requirements. Regardless of the information provided by the City, the Engineer of Record shall be responsible for designing the station in accordance with all local, county, and state regulations and standards.

2.7 Design of Private Pumping Stations

- A. The Wastewater Department will not own, operate, or maintain pumping stations located on private property or stations that will not be dedicated for City ownership. As a result, the Wastewater Department does not set specific requirements or standards for the design of these stations. The Engineer of record shall design the station in accordance with all local, county, and state regulations and standards. The Wastewater Department will only analyze the pump selection to confirm that the pump will operate under the operating conditions specified in the commitment letter.
- B. The Engineer shall be responsible for sizing the pump and the on-site piping so that pump's flow rate does not exceed the flow rate limitations specified in the commitment letter. If the pumping station will connect to a force main that is owned and operated by the City of Tampa, the City will provide the minimum and maximum head conditions at the point of connection in the commitment letter. Maximum head conditions occur when all other pumping stations that connect to the force main are "on." Minimum head conditions occur when all pumping stations that connect to the force main are "off." The pumps selected may exceed the flow limitations during minimum head conditions.
- C. The maximum and minimum head conditions provided by the City in the commitment letter are specified as the hydraulic grade line (HGL) at the point of connection which includes the pressure in the pipe and the pipeline elevation. Head conditions at the pump are calculated by subtracting the pump operating elevation from the HGL and adding the frictional pipeline losses between the pump and the point of connection.
- D. If the proposed pumping station will connect to a new force main (constructed as part of the project) that will connect to a manhole, the Engineer is responsible for calculating the operating conditions for the pump.
- E. Each pump station must post a name plate containing 24-hour emergency contact information.

2.8 Design Requirements for Discharge Meters

- A. A discharge meter is required in cases where wastewater disposal charges cannot be based on the water meter readings. The discharge meter shall be installed at the Developer's/property owner's expense and shall be maintained by the property owner.
- B. The discharge meter shall be a magnetic flow meter suitable for measuring wastewater flow rates. The meter shall include a remote digital display located in an area that can be accessed by City personnel to record monthly readings.
- C. Details on the installation and discharge meter must be submitted for review and approval. The details should show pipe sizes, fittings, bends, meter size, and any other information needed to determine that the meter will be installed in accordance with the manufacturer's recommendations.

- D. The Manufacturer's data sheet on the meter must be submitted for review and approval. This information shall include specific information on the type, model number, meter size, installation requirements, and other details needed to determine suitability of the meter and the requirements for installation.
- E. Information on the meter's display shall be submitted, including the exact units used for total volume and units used for instant flow rate. Volumetric units must be large enough so that the total measured flow does not roll over to zero between meter readings. Confirmation must be provided that the meter will be programmed so that the totalizer cannot be reset to zero.
- F. The installation of the meter shall be inspected by City personnel prior to being placed into operation.
- G. Once the installation of the meter has been approved by City personnel and the meter has been placed into operation, wastewater disposal charges shall be based on the readings from the new meter.
- H. The approved discharge meter shall be calibrated at least semi-annually by the owner. Copies of the calibration documentation shall be transmitted to the Wastewater Department.

3.1 General

This section lists the general requirements and standards for preparing record drawings. When required in the approval of constuction letter, Record Drawings (also known as as-built drawings) shall be submitted for review and approval by the Wastewater Department prior to placing any new wastewater facility into service. These drawings shall reflect the final field locations and changes to the original design that were made during the completion of the installation. All changes and deviations from the original approved design must be clearly reflected on the Record Drawing/As-builts. These drawings shall be prepared using the original approved construction plans and shall be based on surveyed information obtained after the completion of the installation. Any deviation and/or change from the original approved plans shall be indicated with a strike through the original design information and the changed information legibly shown adjacent to the original design information. These drawings shall be marked as "Record Drawings" or "As-builts" and shall be signed and dated by a Professional Engineer registered in the State of Florida. Listed below are the general types of information that should be included in the record drawings:

- A. Record drawings shall be on 24" x 36" sheets of paper. Each sheet shall be dated and signed by the engineer of record as being "Record Drawing" or "As-built." In total, 5 sets of prints shall be submitted to the Department. AutoCAD drawing files (Rel. 2000 or later) of the asbuilts shall also be furnished. In addition, a PDF version of the signed and sealed as built drawings shall accompany the submittal. The PDF version of the as builts shall be marked as "Record Drawing" or "As-built".
- B. The elevation datum used for record drawings shall be NAVD 88. The datum shall be specified on all sheets that include elevation information.
- C. Record drawings shall include the final names for all new roadway and streets.
- D. Record drawings shall include the final address of the project site. For multi-lot or multiunit developments, the final addresses of each lot or unit shall be provided.
- E. Record drawings shall show the final location and dimensions of all new wastewater easements that were required for the project. Right of ways that were vacated shall also be shown.
- F. All existing wastewater pipelines or facilities that were abandoned or removed during the construction shall be clearly labeled.

3.2 Force Main Record Drawing Requirements

- A. Final size and type of pipe used for the force main shall be labeled and the flow direction indicated in both the plan and profile views.
- B. The as-built location of all horizontal bends, fittings, valves, changes in horizontal alignment, and points of connection to other wastewater facilities shall be labeled in both

the plan and profile views and shall include the as-built station, or station and offset from the baseline (if a baseline system is used). The as-built location, station, and invert of the pipe at all vertical bends and changes in vertical alignment shall be indicated in the profile view. The as-built invert at point of connection to other wastewater facilities shall also be indicated in the profile view. If the project includes a force main located on both private property and the right of way, the as-built invert of the force main at the property line shall be indicated.

- C. The as-built location of the new force main shall be dimensioned in the plan view to the right of way, easement lines, and edges of pavement at regular intervals and/or at all locations where the proposed force main changes horizontal direction. The as-built location of all new valves shall be dimensioned to the edge of pavement and to the right of way in the plan view.
- D. If the new force main connects to an existing or a new manhole, the as-built location of the manhole and all pipes that connect to the manhole shall be shown in the plan and profile views. The as-built sizes and the types of pipes of all existing and new pipes that connect to the manhole shall also be indicated in the plan and profile views. The as-built inverts of each of these pipes shall be indicated in the profile view. The compass direction (i.e. N, SW, etc.) corresponding to each connecting pipe shall be included in the plan view and reflect the as-built location. The as-built location of the gravity sewer at the point of connection shall be dimensioned to the right of way and edge of pavement in the plan view.
- E. If the new force main connects to an existing or another new force main, the as-built size, type of pipe, and flow direction of the other force main shall be labeled in both the plan and profile views. The as-built location of the other force main shall be dimensioned to the right of way and edge of pavement in the plan view. The as-built location of the connection shall also be dimensioned to the nearest roadway intersection.
- F. The as-built location of all new air release valves shall be labeled and the station, or station and off-set, indicated in both the plan and profile views. The as-built location of the new air release valves shall be dimensioned to the edge of pavement and right of way line in the plan view.
- G. The Record Drawings shall include all details for connecting to existing manholes or force mains that were provided in the approved construction drawings. These details shall be revised to reflect the as-built conditions.

3.3 Gravity Sewer Record Drawing Requirements

- A. The final size and type of pipe of the new gravity sewer(s) and all existing gravity sewers shall be labeled in both the plan and profile views
- B. The as-built location of all new manholes and all existing manholes shall be shown and labeled in both the plan and profile views

- C. The as-built station, or station and offset from the baseline, (if a baseline system is used) of all new manholes and the manhole at the point of connection shall be indicated in both the plan and profile views
- D. The as-built angles between all pipes that connect to the new manholes shall be indicated in the plan view. If the new gravity sewer connects to an existing manhole, the as-built angle between the new pipe and the existing pipes that connect to the manhole shall also be indicated in the plan view.
- E. The as-built rim elevation of each new manhole and the inverts of all new and existing pipes that connect to the manhole shall also be indicated in both the plan and profile. The compass direction (i.e. N, SW, etc.) corresponding to each connection shall be included with the invert. The final size and type of pipe of each pipe that connects to the manhole shall also be indicated.
- F. The as-built slope of all new gravity sewers and the existing gravity sewer downstream of the point of connection shall be labeled in the profile view
- G. The as-built location of the new gravity sewer shall be dimensioned in the plan view to the right of way, easement lines, and edges of pavement at regular intervals and/or at all locations where the proposed gravity sewer changes horizontal direction
- H. Each new lateral connection shall be shown. The as-built station and invert (or depth) of the connection at the property line shall be indicated in the plan view
- I. The as-built location of new laterals that connect to an existing gravity pipe by the installation of a wye shall be dimensioned to the nearest manhole in the plan view
- J. The Record Drawings shall include all details for connecting to existing manholes or a new lateral to an existing gravity pipe that were provided in the approved construction drawings. These details shall be revised to reflect the as-built conditions.

3.4 Record Drawing Requirements for Jack and Bore Crossings

- A. The as-built location of installations of gravity sewers and force mains by jack and bore shall be labeled in both the plan view and profile
- B. The as-built size, type of pipe, pipe wall thickness, and length of the casing pipe shall be indicated in both the plan and profile views
- C. The as-built station, or station and off-set, of the ends of the casing pipe shall be indicated in both the plan and profile views. The as-built invert of each end of the casing pipe and the carrier pipe shall be indicated in the profile view. The as-built slope of the casing pipe and the carrier pipe shall also be indicated in the profile view.

3.5 Record Drawing Requirements for Directional Bore Crossings

- A. The as-built locations of installation of force mains by directional drill shall be labeled in both the plan view and profile view
- B. The as-built size, type of pipe, pipe wall thickness, and length of the pipe installed by direction drill shall be indicated in both the plan and profile views
- C. The as-built location of the beginning and end of the section of the pipeline installed by directional drill shall be labeled and stationed in both the plan and profile view. The asbuilt inverts at the beginning and end of the section of the pipeline installed by directional drill shall be provided in the profile view.
- D. The as-built station, or station and off-set, at the beginning and end of changes in horizontal direction shall be indicated in both the plan and profile views. The as-built invert at the beginning and end of changes in horizontal direction shall be indicated in the profile view. The as-built horizontal bending radius shall be indicated in the plan view.
- E. The as-built station, or station and off-set, and the as-built invert at the beginning and end of changes in vertical direction shall be indicated in the profile views. The as-built vertical bending radius of the pipe shall also be indicated in the profile view.

3.6 Record Drawing Requirements for Private Pumping Stations

- A. The final location of the pumping station shall be clearly shown and labeled on the site plan
- B. The final the sizes and types of pipes of all pipes connecting to the pumping station shall be shown
- C. The Record Drawings shall include a pumping station detail sheet that includes the following information:
 - 1. A plan and sectional view showing the wet well, valve vault, connecting gravity pipes, discharge piping, valves, bends, fittings and all other appurtenances.
 - 2. The final size and type of all valves, fittings, and bends labeled in both the plan and sectional view.
 - 3. The as-built invert elevations of the influent gravity main, bottom of wet well, discharge force main, and finished grade elevations labeled in the sectional view.
 - 4. The sectional view of the wet well shall show the as-built operating elevations of the station (i.e. pump off, lead pump on, lag pump on, and high water alarm).
 - 5. Information on the pumps that were installed shall be provided. This information shall include the following: pump manufacturer, model number, pump size, impeller size or number, horse power, and motor speed. A copy of the manufacturer's pump curve shall also be shown on the Record Drawings.
 - 6. As-built information on the control panel, electrical, and instrumentation requirements.

SECTION 4 – POST INSTALLATION TESTING AND INSPECTION

4.1 General

This section provides the general requirements for testing and post installation inspection for new wastewater facilities located in the right of way that are installed by Developers. The facilities must pass these tests before the Wastewater Department will accept the new facilities and allow the facilities to be placed into operation. In addition, the Developer shall warranty these facilities for a period of 12-months after acceptance. Any deficiency found during the warranty period shall be repaired at the expense of the Developer. The specific testing and inspection requirements are detailed in the various workmanship and materials sections provided in Appendix C: Workmanship and Material Specifications. All tests and inspections shall be completed at the expense of the Developer. The Contractor shall notify the Engineer of the date and time of the test a minimum of 5 days prior to the test.

4.2 Test and Inspection Requirements for Gravity Sewer Sewers

Prior to final acceptance of a completed gravity sewer, the pipelines must pass a leakage test, a deflection test, and T.V. inspection. The leakage test shall be performed by the Contractor or a Wastewater Department approved test lab after the base has been compacted and sealed. The deflection test shall be performed a minimum of 7-days after the base has been compacted and sealed. The Contractor or a Wastewater Department approved test lab shall perform the deflection testing. The T.V. inspection shall be performed **AFTER** the pipelines have passed both the leakage and deflection tests (See W-11 PVC Pipe Gravity & W-18 Leakage Tests of Appendix C: Workmanship and Materials Specifications).

A. LEAKAGE TESTING

All new gravity sewers shall be tested for either infiltration or leakage after completion of backfilling. If the groundwater level is two (2) feet or more above the crown of the pipe, an infiltration test must be performed to measure the amount of water that may be leaking into the pipeline. If the groundwater level is less than two (2) feet above the crown of the pipe, a leakage test must be performed to measure that amount of water or air (if air testing is used) that may be leaking out of the pipeline. The test procedures and allowable leakage for either test is specified in Appendix C: Workmanship and Material Specification: Section W-11 PVC Pipe – Gravity.

B. <u>DEFLECTION TESTING</u>

A deflection test shall be performed on all new gravity sewers to ensure that the pipe is not out of round, contains deflected or off-sets joints, or other defects. The Contractor shall have the option of testing for 5% deflection after the base has been compacted and sealed for a minimum of 7 days; or for $7\frac{1}{2}$ % deflection after the base has been compacted and sealed for a minimum of 30 days.

SECTION 4 – POST INSTALLATION TESTING AND INSPECTION

C. <u>T.V. INSPECTION</u>

The Department requires two TV inspections of the completed gravity sewers. The first TV inspection shall be performed after the new gravity sewer has passed both the leakage test and the deflection test. An additional TV inspection shall be performed ten (10) months from the date the City has accepted ownership of the wastewater facilities. Any deficiencies identified by the inspections shall be repaired by the Developer at no cost to the City.

The TV inspections shall be completed by the Contractor or a private company that specializes in TV inspection. The inspection shall be completed in accordance with the requirements specified in W-11 PVC Pipe – Gravity and Section W-72 TV Inspections of Appendix C: Workmanship and Materials Specifications.

4.3 Test Requirements for Force Mains

All new force mains shall be pressure tested upon completion of the pipeline. The test shall be performed at an average pressure of not less than 100 psig. The test shall include the testing of new valves installed with the force main to ensure that there is no leakage through the valve. The pressure test shall be completed in accordance with the requirements specified in Appendix C: Workmanship and Material Specification, W-18 Leakage Test.

4.4 Test Requirements for Force Mains Installed by Directional Drill

Force mains installed by directional drill shall be subject to two tests. The first test shall be performed after pipe joining, but prior to installation. A second test shall be performed after the pipe has been installed. Both tests shall be performed at a test pressure not less 100 psig. The pressure test shall be completed in accordance with the requirements specified in Appendix C: Workmanship and Material Specification, Section W-13 Directional Drilling with HDPE Pipe.

APPENDIX A - CONSTRUCTION DRAWING CHECKLIST

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A.	General Plan Set Requirements	CL-1
B.	Site Plan Requirements	CL-1
C.	Master Utilities Plan Requirements	CL-2
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E.	General Profile View Requirements for Wastewater Facilities in R/W	CL-3
F.	Specific Plan Requirements for Force Mains	CL-4
G.	Specific Plan Requirements for Gravity Sewers	CL-5
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I.	Plan Requirements for Jack and Bore Crossings	CL-5
J.	Plan Requirements for Directional Bore Crossings	CL-5

CHECKLIST

A. General Plan Set Requirements

- 1. Cover sheet requirements
 - \Box Project name indicated
 - \Box Address of project indicated
 - □ Folio numbers associated with project indicated
 - □ Name, mailing address, and contact information of owner/developer
 - \Box Index of all drawings
 - \Box Name, mailing address, and phone number of each consulting firm associated with the project
 - $\hfill\square$ Vicinity map showing location of the project
- 2. General Notes
 - □ Wastewater Department general notes included
- **B.** <u>Site Plan Requirements</u> For further details, see subsections 1.2 and 1.3 of Section 1 Construction Plan Requirements
 - $\hfill\square$ Site plan drawn to scale
 - \Box Scale indicated
 - $\hfill\square$ North arrow and section, township, and range provided
 - \Box Right of way and property lines shown and labeled
 - □ Streets adjacent to the site shown with names indicated and edge of pavement labeled

- □ Folio number(s) and property address (if known) labeled
- □ Existing and proposed buildings and additions to existing buildings shown, indicating square footage, number of floors, number of units, and square footage
- □ Driveways and entrances shown and labeled
- □ Proposed wastewater facilities shown; sizes and types of pipe labeled;
- □ Existing wastewater facilities shown; sizes and types of pipe labeled
- □ Existing laterals shown (if applicable)
- □ Wastewater manholes shown (if applicable); inverts of all pipes connecting to each manhole indicated
- □ Location of lift station shown (if applicable)
- □ Existing and proposed utilities shown with sizes and types of pipe labeled
- □ Existing or proposed easements shown and labeled
- \Box Vacated rights of way shown
- C. <u>Master Utility Plan Requirements</u> For further details, see subsection "1.3.4 Requirements for Site Plan/Master Wastewater Utility Plan" of Section 1 Construction Plan Requirements

Note: Master utility plan only required for subdivisions or multi-lot developments

- \Box Master plan drawn to scale
- \Box Scale indicated
- \Box North arrow and section, township, and range provided
- \Box Existing and proposed rights of way shown and labeled
- □ Existing and proposed streets shown and labeled; names of streets indicated (if available)
- □ Existing and proposed lots shown and labeled
- □ Existing and proposed buildings shown (if known)
- □ Size and type of development for each lot indicated
- □ Proposed wastewater facilities shown; size of pipes indicated
- □ Existing wastewater facilities shown; size of pipes indicated
- □ Existing and proposed utilities shown and labeled
- \Box Existing and proposed easements shown and labeled
- \Box Vacated rights of way shown

D. Standard Plan View Requirements for Wastewater Facilities located in the right of way

For further details, see subsection "1.3.5.2 Standard Plan View Requirements" of Section 1 – Construction Plan Requirements

- \Box Plan view(s) along the entire length of the proposed wastewater facilities provided
- \Box Plan view(s) drawn to scale
- $\hfill\square$ Scale indicated

- □ North arrow, section, township, and range, and city atlas sheet number provided
- \Box Right of way and property lines shown, labeled, and width indicated
- \Box Edge of pavement lines shown, labeled, and width indicated
- \Box Roadway names indicated
- □ Property lines of proposed and existing lots along the alignment of the proposed pipeline shown; lot numbers, addresses, or folio numbers indicated to identify each lot
- □ Existing and proposed swales and ditches shown, labeled, and top of bank indicated
- □ Existing and proposed sidewalks shown, labeled, and width indicated
- □ Size, type of pipe, and flow direction of proposed wastewater facilities indicated
- □ Proposed wastewater facilities parallel to the right of way dimensioned to the right of way and edge of pavement
- □ Proposed wastewater facilities stationed along center of the pipeline or survey baseline shown
- □ Existing wastewater facilities shown and size, type of pipe, and flow directions indicated
- □ Existing wastewater facility at the point of connection dimensioned to right of way and edge of pavement
- □ Existing wastewater manholes and all pipes connecting to the manhole shown; size, type of pipe, and compass direction of each pipe connecting to the manhole indicated; rim elevation and invert of each pipe indicated
- □ All existing and proposed utilities shown, labeled, and size and type of pipe indicated
- \Box All existing and proposed utility structures shown and labeled
- E. <u>Standard Profile View Requirements for Wastewater Facilities located in the right of</u> <u>way</u> For further details, see subsection "1.3.5.3 Standard Profile View Requirements" of Section 1 – Construction Plan Requirements
 - □ Profile view(s) provided along the entire length of the proposed wastewater pipeline(s) located in the right of way
 - $\hfill\square$ Profile view located below plan view
 - □ Profile view drawn to scale, horizontally and vertically
 - □ Horizontal and vertical scale indicated
 - $\hfill\square$ Profile view displayed on a grid with stations in 100-ft increments and elevations provided
 - □ Existing or proposed grade directly above proposed pipelines shown
 - □ All Existing and proposed utilities that cross the proposed wastewater pipeline shown, labeled, type of pipe and invert or top of pipe indicated

- F. <u>Construction Plan Requirements for Force Mains</u> For further details, see subsection "1.4 Construction Plan Requirements for Force Mains" of Section 1 Construction Plan Requirements of this TSM
 - 1. Plan View Requirements
 - □ Size and type of pipe of the proposed force main labeled and flow direction indicated
 - □ Horizontal bends, fittings, changes in horizontal direction, changes in pipe size, valves, and points of connection labeled and station and invert indicated
 - $\hfill\square$ Proposed force main dimensioned to right of way and edge of pavement
 - $\hfill\square$ If the force main will connect to an existing or proposed manhole:
 - □ Sizes, types of pipe, compass direction, and inverts of pipes that connect to manhole indicated
 - □ Gravity sewer at point of connection dimensioned to right of way and edge of pavement
 - \Box If the force main will connect to an existing force main:
 - □ Size, type of pipe, flow direction of existing force main indicated
 - $\hfill\square$ Existing force main dimensioned to right of way and edge of pavement
 - □ Point of connection dimensioned to center line of nearest intersection
 - □ Method of connection indicated (ie. "hot tap" or by installing tee)
 - $\hfill\square$ Air release values shown, labeled, stationed, and dimensioned to edge of pavement and right of way

2. Profile View Requirements

- □ Size and type of pipe of the proposed force main labeled and flow direction indicated
- □ Horizontal bends, vertical bends, fittings, changes in vertical direction, changes in pipe size, valves, and points of connection labeled and station indicated
- \Box If the force main will connect to an existing or proposed manhole:
 - □ Sizes, types of pipe, and inverts of pipes that connect to manhole indicated
 - □ Slope of the gravity sewer downstream of the point of connection indicated
- $\hfill\square$ If the force main will connect to an existing force main:
 - □ Size, type of pipe, flow direction of existing force main indicated
 - \Box Method of connection indicated
 - $\hfill\square$ Invert of proposed and existing force main indicated
- \Box Air release valves shown, labeled, invert indicated, and stationed
- 3. Other Force Main Plan Requirements
 - $\hfill\square$ Details and notes for completing force main connection included
 - \Box Force main notes provided
 - \Box Force main details included in plan set

- G. <u>Specific Plan Requirements for Gravity Sewers</u> For further details, see subsection "1.5 Construction Plan Requirements for Gravity Sewers" of Section 1 Construction Plan Requirements
 - 1. Plan View Requirements
 - $\hfill\square$ Size and type of pipe of the proposed gravity sewer labeled and flow direction indicated
 - \Box Proposed and existing manholes shown, labeled, and stationed
 - □ Angles between existing and proposed pipes at the connection to manholes indicated
 - □ Rim elevation and inverts of proposed and existing pipes at each manhole indicated
 - □ Manhole drop connections labeled
 - □ Proposed gravity sewer dimensioned to right of way and edge of pavement
 - □ Proposed laterals shown, stationed, and invert at the property line indicated

2. Profile View Requirements

- □ Size, type of pipe, slope of the proposed gravity sewer and existing gravity sewer at the point of connection labeled
- □ All proposed and existing manholes shown, labeled, and stationed
- $\hfill\square$ Size and type of pipe of all pipes that connect to proposed and existing manholes indicated
- \Box Rim elevation and inverts of proposed and existing pipes at each manhole indicated
- \Box Manhole drop connections labeled
- □ Utilities parallel to main gravity sewer that will be crossed by a proposed lateral shown with size and type of pipe indicated
- 3. Other Plan Requirements for Gravity Sewers
 - □ Details and notes for completing gravity sewer connections included
 - \Box Gravity sewer notes provided
 - \Box Gravity sewer details included in plan set
- **H.** <u>Plan Requirements for Private Pumping Stations</u> See subsection 1.6 of Section 1 Construction Plan Requirements of this TSM
 - $\hfill\square$ Location of pumping station shown on site plan
 - \Box Pipes connecting to pumping station shown with size and type of pipe indicated
 - □ Pumping station detail sheet included in plan set
- I. <u>Plan Requirements for Jack and Bore Crossings</u> See subsection 1.7 of Section 1-Construction Plan Requirements
- J. <u>Plan Requirements for Directional Bore Crossings</u> See subsection 1.8 of Section 1-Construction Plan Requirements



WASTEWATER DEPARTMENT

STANDARD DESIGN DETAILS

FORCE MAINS

<u>GRAVITY</u>

- AND COVER)
- 6 NEW LATERAL CONNECTIONS
- CONFLICTS)
- 8 CLEANOUT COVER DETAILS

- 11 DOGHOUSE MANHOLE DETAILS
- 12 FIBERGLASS MANHOLE DETAILS
- 13 MANHOLE INSIDE DROP CONNECTION

MISCELLANEOUS

- 14 JACK & BORE DETAILS
- 15 CONNECTION TO EX. "T-LOCK" MH

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WASTEWATER DEPARTMENT	1				DATE:	WASTEWATEN DEI ANTMENT	

INDEX:

MISCELLANEOUS FORCE MAIN DETAILS 1 OF 2 (AIR RELEASE VALVE, VALVE BOX, LOCATING WIRE, VALVE OPERATION DISK)

2 MISCELLANEOUS FORCE MAIN DETAILS 2 OF 2 (JOINT RESTRAINT TABLE, CLASS "C" BEDDING, HDPE TRANSITIONS)

3 SINGLE FAMILY HOME FORCE MAIN - REQUIRED VALVES

FORCE MAIN CONNECTION TO EXISTING MANHOLE

5 MISCELLANEOUS GRAVITY DETAILS (PIPE BEDDING, MANHOLE FRAME

7 EXISTING LATERAL CONNECTIONS (REPLACEMENT FOR UTILITY

9 STANDARD MANHOLE DETAILS (FOR PIPES 8" TO 24" IN DIAMETER)

10 STANDARD MANHOLE DETAILS (FOR PIPES 27" TO 42" IN DIAMETER)

STANDARD DETAILS COVER

W.O. ---



PW9

/ FINISHE	D GRADE	
<u>1" Max</u>		
Ι		

METALLIC LOCATING WIRE

^LWRAP WIRE AROUND BELL

TOPERABLE VALVE: TAG ANCHORED TO THE CONCRETE METER AND 1/8-INCH THICK. H "SEWER", SIZE OF VALVE, TYPE MBER OF TURNS TO OPEN. E ON A EQUIRES LOCKWISE) E THE H TAG: SEWER 4" P.V. 1/4 T.O.L.	
E ON A EQUIRES LOCKWISE) E THE TAG: SEWER 4" P.V. 1/4 T.O.L.	I OPERABLE VALVE: TAG ANCHORED TO THE CONCRETE METER AND 1/8-INCH THICK. I "SEWER", SIZE OF VALVE, TYPE MBER OF TURNS TO OPEN.
	E ON A EQUIRES LOCKWISE) E THE 17AG: SEWER 4" P.V. 1/4 T.O.L.

STANDARD DETAILS MISC. FM DETAILS 1 OF 2

W.O. --SHEET **OF** 15



(ONLY ALLOWED WITH CITY INSPECTOR APPROVAL)



A = MINIMUM FOOTAGE OF PIPE TO BE RESTRAINED

* MINIMUM ONE PIPE JOINT UPSTREAM AND DOWNSTREAM OF EACH FITTING SHALL BE RESTRAINED

VERTICAL OFFSET:

			RESTR	AIN "A	۱" (LF,)^			
TITTING TYPE	4"	6"	8"	10"	12"	16"	18"	20"	24"
11-1/4*	3*	4*	5*	6*	7*	9*	10*	11*	12*
22-1/2*	5*	8*	10*	12*	14*	17*	19*	21	24
45°	11*	15*	20	23	28	35	39	43	50

A = MINIMUM FOOTAGE OF PIPE TO BE RESTRAINED

* MINIMUM ONE PIPE JOINT UPSTREAM AND DOWNSTREAM OF EACH FITTING SHALL BE RESTRAINED

FITTING RESTRAINT DETAIL

² MJ FITTING OR MJ VALVE HDPE MJ ADAPTER -

HDPE TRANSITION DETAIL

Not To Scale

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TANDARD DETAILS C. FM DETAILS 2 OF 2

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NOTE: Schematic shown for standard MJ fitting and plug valves.



GLAND RING







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1. The locations of house laterals by symbols on plans are approximate only and the actual location and slopes will be determined in the field by the contractor with the approval of the engineer.

2. The minimum diameter of all house laterals shall be 6 inches.

3. The vertical alignment of the service lateral shall be designed so that no more than two (2) vertical bends are required between the connection to the gravity main and the property line.

4. House laterals which pass under drainage ditches with less than 18" of cover or which have less than 30" of cover under pavement shall be Pressure Class 350 with 40 mils (MDFT) of Protecto 401 interior coating

5. A minimum vertical clearance of 12-inches shall be provided when crossing above a water main. However, a vertical clearance less than 12-inches but greater than 6-inches will be allowed if the lateral is installed using one the following criteria:

• The lateral is constructed of ductile iron pipe with a minimum pressure class of 350 with 40 mils (MDFT) of Protecto 401 interior coating. • The lateral is encased in at least 4-inches of concrete. • The lateral is installed in a casing pipe with an impact strength equal to the impact strength of pressure class 350 ductile iron.

A minimum of 6-inches of vertical clearance shall be provided when crossing below water mains with a diameter 6-inches or less. A minimum of 12-inches of clearance shall be provided when crossing below a water main with a diameter greater than 6-inches up to a diameter of 18-inches. A minimum of 18-inches of vertical clearance will be required when crossing under a water main with diameters greater than 18-inches.

At all water main crossings, joints of the lateral pipe at the crossing shall be arranged so that no joint is within 6-ft of a joint along the water main. If the joint spacing can not be achieved, then the gravity sewer at the crossing shall be constructed of C-900 PVC.

A minimum vertical clearance of 6-inches shall be provided when crossing above all utilities other than a water main. A minimum of 6-inches of vertical clearance shall be provided when crossing below a utility with a diameter 6-inches or less. A minimum of 12-inches of clearance shall be provided when crossing below a utility with a diameter greater than 6-inches up to a diameter of 18-inches. A minimum of 18-inches of vertical clearance will be required when crossing under utilities with

6. Transitions from SDR 35 PVC to either C900 or ductile iron pipes shall be made with PVC rigid adaptors. Transitions from SDR 35 PVC to either existing clay or concrete pipes shall be made with a Fernco 1000 series flexible coupling with stainless steel shear ring or approved equal.

7. In sub-divisions where the Developer has provided a recorded utility easement (typically 10') beyond the property line, the clean out shall be installed within the easement away from the sidewalk.

8. At the direction of the City's inspector, the contractor shall temporarily stake the cap of all laterals at the property line with a 2"x4" treated

9. Double laterals are only allowed for single family homes on single lots.

STANDARD DETAILS NEW LATERAL CONNECTIONS

W.O. ---SHEET



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HOUSE	LATERAL	REPLACEMENT	DETAIL
	NI - F		

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	No.	DATE	REVISIONS	DES: DR	TY of The	STANDARD DETAILS
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DVER	
- FLANGE - FINISH GRADE	
6" (150mm) PVC GASKETED CLEAN-OUT W/ THREADED CAP	
" (150mm) PVC PIPE	
PAVED AREAS	
REVERSIBLE CAST-IRON RING W/ 8" (200mm) OPENING. U.S. FOUNDRY 7621 OR EQUAL (INSTALL FLANGE UP)	
150mm) PVC PIPE	
N/VEHICULAR TRAFFIC	
e four (4 sf) square part of the clean or clean—out with	
own on this sheet.	
STANDARD DETAILS	W.O Shfft
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OF 15





PW9



PRECAST CONCRETE MANHOLE (SEE STANDARD MANHOLE DETAILS)	
IVE TOP SECTION IPE	
PVC LINER DOWN TO 8" /E MANHOLE FLOOR	
LITHIC POUR OF INVERT & H W/CLASS "D" CONCRETE	
* TYPICAL WIDTH OF OPENING IS 24" FOR AN EX. 8" PIPE	
NCH TO MATCH	
BENCH OVE TOP SECTION OF PIPE	
157 STONE	
SEE STANDARD PRECAST IANHOLE DETAILS)	
STANDARD DETAILS	W.O
DOGHOUSE MANHOLE	0F 15



PW9

	SCHEDULE FOR	DROP MANHOLE			
ſ	INLET PIPE DIAMETER "D"	DROP PIPE DIAMETER "d"			
ſ	8" 8"				
	10*	8"			
	12"	10"			
	15"	12"			
	18*	15*			
	21"	18"			
	24"	18"			
	27"	18"			

OF 15



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EX. CONCRETE MH WALL \triangleleft 6" (MIN) ·Δ PROPOSED SANDED M.H. ADAPTOR \triangleleft 316 STAINLESS STEEL STRAP & CLAMP FOLD EXCESS T-LOCK OVER CLAMP Δ FOR PROTECTION 4 .ie i 4 <u>Drowing Name</u>: K:\Drafting\Standord\Details\CURRENT DETAILS\DETAILS ALL STANDARDS FOR TECH MANUAL no index.dwg Ex. T-Lock MH <u>Plotted</u>: 12/26/2013 11:06:32 AM <u>CTB</u>: WW-T0SHIBA_PIPE-RS.CTB <u>Default LW</u>: 25mm \sim FLOW DIRECTION 4 . 4 PROPOSED PIPE -PROP. "T-LOCK" LINER AND ۰Z WELD STRIP (TYP) \triangleleft SEAL WITH Δ NON-SHRINK GROUT EX. "T-LOCK" LINER <1 PIPE TO LINED STRUCTURE N.T.S. DATE REVISIONS No. DES: DR CITY of TAMPA : ss1s <u>ut:</u> Con 3 DRN: BL JACINTO CARLOS FERRAS, P.E. #49454 DESIGN DIVISION HEAD WASTEWATER DEPARTMENT 2 CKD: CONNE WASTEWATER DEPARTMENT <u>User:</u> Lavou DATE: 1

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NECTION EX. "T-LOCK" MH	SHEET 15 0F 15

SECTION W-11 – PVC GRAVITY MAIN

W-11.01 General

All pipe and fittings, 6"-27" nominal diameter, shall be solid wall Polyvinyl Chloride (PVC) Pipe MANUFACTURED to standards as outlined in the following sections.

All references to ASTM Designations shall include Manufacturing (PVC Cell Classification) and Performance (Inspection, Sampling and Testing) Specifications and the most recent shall govern. Pipe and fittings meeting ONLY the Performance Test Specification will not be acceptable. The minimum nominal diameter for mainline pipe is 8 inches and for laterals is 6 inches. The maximum laying length shall be 13.0 feet.

W-11.02 Standards (6"-15" Diameter)

Solid wall PVC pipe shall comply with ASTM D 3034 and all applicable ASTM documents as covered in Section No. 2 of ASTM D 3034. All pipe and fittings shall be made of PVC plastic having cell classifications as outlined in Section No. 5 "Materials" of ASTM D 3034 and as defined in ASTM D 1784. For depths of cut through 18 feet, a minimum wall thickness of SDR-35 is required. For depths of cut greater than 18 feet, a minimum wall thickness of SDR-26 is required. Fittings shall be either integrally cast (factory molded) or factory solvent welded and a separate section from the mainline pipe. SDR-26 fittings shall be used with SDR-26 pipe.

W-11.03 Standards (18"-27" Diameter)

Solid wall PVC pipe and fittings shall comply with ASTM F 679 and all applicable ASTM documents as covered in Section No. 2 of ASTM F 679. All pipe and fittings shall be made of PVC plastic having cell classifications as outlined in Section No. 4 "Materials" of ASTM F 679 and as defined in ASTM D1784. All pipe and fittings shall meet the wall thickness and cell classification requirements of either T-1 or T-2 of Table 1 "Pipe Dimensions and Minimum Pipe Stiffness" of ASTM F 679. Fittings shall be either integrally cast (factory molded) or factory solvent welded and a separate section from the mainline pipe.

W-11.04 Joints (6"-27" Diameter)

Joints for solid wall PVC pipe and fittings shall be gasket, bell and spigot, push-on type. Joints shall be a molded integral part of the pipe section. Joints or couplings furnished loose shall not be permitted. Solvent cemented joints shall not be permitted. Lubricant shall be as recommended by the pipe manufacturer. (Assembly of gasketed joints is outlined in the Section "Joining of PVC Pipe").

SECTION W-11 – PVC GRAVITY PIPE

Joints for pipe and for fittings shall comply with ASTM D 3212 "Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals." Elastomeric gaskets shall meet the requirements of ASTM F 477. Joints for pipe and fittings shall comply with ASTM D 3034 for 6"-15" diameter, ASTM F 679 for 18"-27" diameter, and ASTM F 1336 for 6"- 27" diameter.

W-11.05 Pre-installation Tests, Reports, Markings and Submittals

All 6"-15" pipe and fittings shall be marked per Section No. 12 "Marking" of ASTM D 3034. All 18"-27" pipe and fittings shall be marked per Section 11 "Marking" of ASTM F 679. All required information shall be marked on the pipe. If in code, the markings shall be decoded in writing by letter to the City in advance.

<u>PRIOR TO SHIPMENT</u> of the pipe and fittings to the project site, the Contractor shall submit to the Engineer certifications as described below duly certified by the manufacturer's testing facility or an independent certified testing laboratory demonstrating full compliance with the applicable ASTM specifications described above. Certification from the supplier is not acceptable.

An original plus four (4) copies of the following shall be submitted to the Engineer.

- 1. The name, address, and phone number of the pipe and fittings manufacturer and the location of the plant at which they will be manufactured.
- 2. A letter of certification stating that each lot of pipe used on this project has been manufactured, sampled, tested, and conforms to Section 8 "Test Methods" of ASTM D 3034 for 6"-15" diameter and Section 7 "Test Methods" of ASTM F 679 for 18"-27" diameter pipe. A letter of certification from the fittings manufacturer shall be provided stating that all fittings conform with ASTM D 3034 for 6"-15" diameter, ASTM F 679 for 18"-27" diameter, and ASTM F 1336 for 6"-27" diameter.

W-11.06 Bedding Requirements

Unless otherwise indicated on the Plans, solid wall PVC pipe shall be installed with Class "C" bedding as described in Section W-2 - Backfilling." If soil conforming to subsection W-2.04 "Select Fill Material-Sand" is not excavated at the project site, it shall be imported. Compaction requirements are described in subsection W-2.07 "Bedding Placement for Pipelines." In no case shall a concrete cradle be used. In the event the Plans call for or the Contractor opts to install crushed stone, it shall be NO GREATER THAN a #57 stone.
W-11.07 Post-installation Tests

SCOPE:

Prior to final acceptance of the project all PVC pipelines shall be leakage tested, deflection tested, and T.V inspected, all at the expense of the Contractor. The leakage test shall be performed by the Contractor or a Wastewater Department approved test lab after the subbase has been compacted. The Contractor or a Wastewater Department approved test lab shall perform the deflection testing. The deflection test shall be performed a minimum of 7 days after the base has been compacted and sealed. The Contractor shall perform the T.V. inspection only AFTER the pipelines have passed both the leakage and deflection tests.

DEFLECTION TESTING:

A deflection test shall be performed on all new gravity sewers to ensure that the pipe is not out of round, contains deflected or off-sets joints, or other defects. The Contractor shall have the option of testing for 5% deflection after the base has been compacted and sealed for a minimum of 7 days; or for $7\frac{1}{2}\%$ deflection after the base has been compacted and sealed for a minimum of 30 days. The maximum installed deflection shall not exceed 5% or 7-1/2% of the base inside diameter of the pipe as listed in the following tables:

MAXIMUM ALLOWABLE INSTALLED PIPE DEFLECTION BY NOMINAL SIZE & TYPE Units: Inches							
<u>SDR-35</u>							
Nominal <u>Size</u>	Base Inside <u>Diameter</u>	5% Deflection after 7 days <u>Mandre</u> l	7-1/2% Deflection after 30 days <u>Mandre</u> l				
8	7.665	7.28	7.09				
10	9.563	9.08	8.85				
12	11.361	10.79	10.51				
15	13.898	13.20	12.86				
<u>TYPE T-1</u>							
18	16.976	16.13	15.70				
21	20.004	19.01	18.50				
24	22.480	21.36	20.79				
27	25.327	24.06	23.43				

MAXIMUM ALLOWABLE INSTALLED PIPE DEFLECTION BY NOMINAL SIZE & TYPE Units: Inches							
<u>SDR-26</u>							
Nominal <u>Size</u> 8 10 12	Base Inside <u>Diameter</u> 7.488 9.342 11.102	5% Deflection after 7 days <u>Mandre</u> l 7.11 8.87 10.55	7-1/2% Deflection after 30 days <u>Mandrel</u> 6.93 8.64 10.27				
15	13.575	12.90	12.56				
	<u>T</u>	<u>YPE T-2</u>					
18	17.054	16.20	15.77				
21	20.098	19.09	18.59				
24	22.586	21.46	20.89				
27	25.446	24.17	23.54				

If the pipe fails the 7 day, 5% deflection test, the Contractor shall immediately conduct a 7-1/2% deflection test. If the pipe passes the 7-1/2% deflection test, the Contractor has the option of repairing that section at that time or waiting until a minimum of 30 days after the base has been compacted and sealed and then re-testing for a maximum of 7-1/2% deflection.

If the pipe fails the 7-1/2% deflection test after 7 days or at 30 days, the Contractor shall repair that section immediately.

If the Contractor performs the deflection testing rather than employing an approved test lab, the following shall apply:

The Contractor shall furnish the mandrel, labor, materials, and equipment necessary to perform the tests as approved by the Engineer. The mandrel shall be pulled through by HAND or a HAND operated reel in the presence of the Engineer. Prior to performing the deflection tests, the Contractor shall submit to the Engineer certification that the 9- arm mandrels are preset as stated above. Each mandrel shall be engraved with the following:

Serial Number Nominal pipe diameter Either "ASTM D 3034," year and either "SDR-35" or "SDR26" or "ASTM F 679," year and either "Type T-1" or "Type T-2" Percent (%) deflection as stated above.

If the mandrel fails to pass any section of pipe, the Contractor shall excavate and make all

repairs necessary to correct the excessive deflection. The Contractor shall then backfill, recompact, and reseal the permanent pavement base, and retest the line. If the mandrel fails to pass a second time, the section shall be replaced. Re-rounding is NOT permitted.

LEAKAGE TESTING

The Contractor or a reputable test lab shall perform either an infiltration, exfiltration or an air leakage test as authorized by the Engineer. If the groundwater level is two (2) feet or more above the crown of the pipe, an infiltration test must be performed. The Contractor shall notify the Engineer of the date and time of the test a minimum of 5 days prior to the test.

The infiltration/exfiltration tests shall be performed as described in Section W-18 – Leakage Tests.

AIR TESTING - The minimum time duration permitted for pressure drops of 1.0 psi and 0.5 psi are shown in Tables I and II on the following page and are based on a maximum allowable exfiltration rate of 0.0015 cu. ft./min./sq. ft. of internal pipe surface. Derivations may be found in the Uni-Bell PVC Pipe Association publication: "Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe," UNI-B-6-85. (Available from Uni-Bell, 2655 Villa Creek Drive, Suite 155, Dallas, Texas 75234)

The test shall commence after the plugged line has reached a stabilized gauge pressure of $4.0\pm 1/2$ psi. Air testing equipment shall be arranged so that it is located at the ground surface and shall have an approved air relief arrangement to prevent the sewer from being pressurized to greater than 9.0 psig.

If the pressure drops 1.0 psig (or 0.5 psig) before the appropriate time shown in Table I (Page W11-8) or Table II (Page W11-9) has elapsed, the line has failed. In such case, the Contractor shall structurally repair or replace all defective materials and/or workmanship to the satisfaction of the Engineer.

Sealants are NOT permitted. The completed pipe installation shall then be retested.

The lengths of lateral sewers may be ignored for computing required test times. In the event a test section (mainline and laterals), having a combined total internal surface area less than 625 square feet, fails to pass the air test when laterals have been ignored; the test time may be reduced per Section 9.4 of UNI-B-6-85. If the reduced test time is short enough to allow the section to pass, the computations shall be included with the test results

TV INSPECTION

All completed gravity sewers shall be subject to two TV inspections. The first TV inspection shall be performed after the new gravity sewer has passed both the leakage test and the deflection test. An additional TV inspection shall be performed eleven (11) months from the date the City has accepted the wastewater facilities. The inspection shall be used to identify deficiencies such as cracked pipe, leaking joints, damaged connections, and depressions or dip in the pipe alignment (see below for allowable dips). Any deficiencies identified by the inspections shall be repaired by the Contractor at no cost to the City.

The TV inspections shall be completed by the Contractor or a private company that specializes in TV inspection. The TV inspected shall be completed by means of a closed-circuit color television. Prior to the inspection of newly constructed collection systems, water shall be run through the pipeline so that depressions or dips can be identified during the inspection. TV inspections shall be completed in accordance with Section W-72 TV Inspection.

If the TV inspection identifies standing water in the pipe revealing a depression or dip in the pipe alignment, the magnitude of the depression shall be approximated by a means approved by the City. Approved methods include attaching a cylinder, disc, or ball of distinct size in front of the camera during the inspection. For example, if a 1" diameter disc is utilized and is totally submerged during the inspection, the depression is approximated to be greater than 1-inch. Listed below is the allowable depth of depression for the various pipe sizes. Depressions exceeded the allowable limits shall be repaired by the Contractor at no cost to the City.

ALLOWABLE DEPTH OF DEPRESSION (DIP) IN PIPE ALIGNMENT					
Pipe Diameter (inches)	Minimum Dip for Failure (inches)				
8''-10''	1.0"				
12" – 16"	1.5"				
18" – 24"	2.0"				

W-11.08 Joining of PVC Pipe

The assembly of gasketed joints shall be performed as recommended by the pipe manufacturer. In all cases, clean the gasket and bell, especially the groove area and the spigot area with a rag, brush, or paper towel to remove any dirt or foreign material before the assembly. Lubricant shall be applied as specified by the pipe manufacturer.

Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Apply firm steady pressure either by hand or by bar and block assembly until the spigot easily slips through the gasket.

If undue resistance to insertion of the pipe end is encountered or the reference mark does not position properly, disassemble the joint and check the position of the gasket. If it is twisted or pushed out of its seat ("fish- mounted"), inspect components, repair or replace damaged items, clean the components, and repeat the assembly steps. Be sure both pipe lengths are in concentric alignment. If the gasket was not out of position, verify proper location of the reference mark.

To join field-cut pipe, first square-cut the pipe end. Use a factory-finished beveled end as a guide for proper bevel angle and depth of bevel plus the distance to the insertion reference mark. Bevel the end using a pipe beveling tool or a wood rasp which will cut the correct taper. Round off any sharp edges on the leading edge of the bevel.

W-11.10 Joining PVC Pipe to Clay Pipe

The joining of PVC to clay pipe shall be accomplished with flexible compression couplings. Such couplings shall meet the requirements of ASTM Des: C 425 and shall be Series No. 1002 flexible polyvinyl chloride couplings with stainless steel compression bands as manufactured by Fernco Joint Sealer Co., Ferndale, Michigan; Band-Seal couplings as manufactured by Mission Clay Products Corp., Whittier, California; or equal. Installation of flexible couplings shall be done in accordance with the manufacturer's instructions.

After the joint has been completed, any voids in the excavation beneath the coupling shall be thoroughly tamped full of granular fill material to provide a full bearing for the pipe and prevent excessive pressure on the bottom of the joint.

W-11.11 Joining PVC Pipe to Ductile Iron Pipe

The joining of PVC pipe to ductile iron pipe shall be accomplished with rigid PVC C900 x SDR-35 adapter couplings. Such couplings shall be molded of PVC material meeting ASTM D-1784 specifications. Joints shall meet ASTM D-3213 requirements with gaskets conforming to ASTM F-477. The adapter couplings shall be manufactured by Harco, Lynchburg, Virginia, or equal. Installation of rigid couplings shall be done in accordance with the manufacturer's instructions.

After the joint has been completed, any voids in the excavation beneath the coupling shall be thoroughly tamped full of granular fill material to provide a full bearing for the pipe and prevent excessive pressure on the bottom of the joint.

W-11.12 Connection to Manholes

The Contractor will be required to submit a shop drawing, detailing the method of connecting the proposed pipe to the manhole and making it watertight. For connecting PVC pipe, the Contractor shall use a flexible rubber boot, precast into the manhole. The boot shall have stainless steel bands to compress and seal to the proposed pipe or shall be a compression type, such as A-Lock.

Should the flexible rubber boot need to be relocated when connecting to an existing manhole, the Contractor shall perform the connection by one of two methods. The preferred method is to core the manhole and install a rubber boot. The rubber boot shall be manufactured by Kor-n-Seal, or equal. The boot shall be installed and the PVC pipe connection shall be in accordance with the manufacturer's instructions. If the manhole cannot be cored or if the manhole is constructed of brick, the connection shall be made with a PVC manhole adapter with an exterior impregnated with a silica surface layer. The adapter shall be installed and grouted into the manhole wall in accordance with the manufacturer's instructions with non-shrink grout. The PVC pipe shall be inserted through the adapter.

W-11.13 Storage of PVC Pipe

Pipe shall be stored at the job site in unit packages provided by the manufacturer. Caution shall be exercised to avoid compression, damage, or deformation to bell ends of the pipe. When unit packages of PVC pipe are stacked, ensure that the weight of upper units does not cause deformation to pipe in lower units.

PVC pipe unit packages shall be supported by racks or dunnage to prevent damage to the bottom during storage. Supports shall be spaced to prevent pipe bending.

PVC pipe shall not be stored close to heat sources or hot objects such as heaters, boilers, steam line, engine exhaust, etc.

When unit packages of PVC pipe are stacked, ensure that the height of the stack does not result in instability which could cause stack collapse, pipe damage, bodily injury, and property damage.

The interior as well as all sealing surfaces or pipe, fittings, and other accessories shall be kept free from dirt and foreign matter.

Gaskets shall be protected from excessive exposure to heat, direct sunlight, ozone, oil and grease.

W-11.14 Handling of PVC Pipe - Standard Procedures

When using forklifts or other handling equipment, prevent damage to PVC pipe.

When handling PVC pipe, avoid severe impact blows, abrasion damage and gouging or cutting by metal surfaces or rocks.

Avoid stressing bell joints and damage of bevel ends.

Pipe shall be lowered, not dropped, from trucks and into trenches.

In preparation for pipe installation, placement (stringing) of pipe shall be as close to the trench as practical and on the opposite side from excavated earth. Bell ends shall point in the direction of work progress.

The Engineer may reject any pipe that shows visible signs of damage resulting from poor storage and handling practices.

TABLE I

SPECIFICATION TIME REQUIRED FOR A <u>1.0 PSIG PRESSURE DROP</u> FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

Pipe Diameter	Minimum Time	Length for Minimum	Time for Longer	Specification Time for Length (L) Shown (min:sec)							
(in)	(min:sec)	Time (ft)	Length (sec)	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

TABLE II

SPECIFICATION TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

Pipe	Minimum	Length for Minimum Time	Time for Longer Length	Specification Time for Length (L) Shown (min:sec)							
(in)	(min:sec)	(ft)	(sec)	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	0.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	46:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.483 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

W-12.01 General

Manholes shall be constructed of precast reinforced concrete sections. Each manhole shall have a base section or tee section, barrel section, and an eccentric or concentric cone top, all as required. Manholes shall be built without steps. Except as otherwise specified or shown, precast concrete manholes shall comply with ASTM Des: C 478.

Manholes are classified as Standard Deep Type Manholes, Standard Shallow Type Manholes, or Standard Drop Manholes. The maximum depths permitted for Standard Shallow Type Manholes and the locations where Standard Drop Manholes are to be used shall be as shown on the Plans.

Manhole barrel sections shall be constructed with preformed openings properly located for making sewer line connections. The diameter of such openings shall be not more than 4 inches larger than the outside diameter of the pipe or pipe bell to be connected. The distance between the nearest edge of such openings and the shoulder of the barrel joint shall be 6 inches minimum.

W-12.02 Materials

Cement, sand, and water shall meet the requirements of the Workmanship and Materials section headed "Concrete Materials."

Brick shall meet the requirements of ASTM Des: C 32 Grade SM and shall have minimum dimensions of 2-1/4 inches by 3-1/2 inches by 7-1/2 inches. Brick shall be new, solid, sound, hardburned throughout, and uniform in size and quality.

Manhole frames and covers shall be of gray iron, shall meet the requirements of the Workmanship and Materials section headed "Metal Castings" and shall conform to the details shown on the Plans.

W-12.03.1 Manholes on Sewers 24 Inches or Less in Diameter

Base sections for Standard Deep Type and Shallow Type Manholes shall consist of a circular slab base with a minimum thickness of 8 inches, and shall be reinforced as shown on the Plans. The base slab may extend beyond the outside diameter of the barrel section a maximum of 6 inches, providing the extension is equal at all points on the circumference of the slab. The manhole shall be set on not less than 6 inches of thoroughly compacted #57 stone.

Barrel sections for Standard Deep Type Manholes shall have an inside diameter of 48 inches plus or minus 1/2 inch and a minimum wall thickness of 8 inches plus or minus 2/5 inch. The minimum cover from the inside face of the wall to the reinforcement shall be 4-1/4 inches, and the minimum cover from the outside face of the wall to the reinforcement shall be 1-1/4 inches. The bottom section of manhole barrel shall be integrally precast with the manhole base section.

Top sections for Standard Deep Type Manholes shall be eccentric cones as shown on the Plans, with a minimum wall thickness of 8 inches plus or minus 2/5 inch. The minimum cover from the inside face of the cone to the reinforcement shall be 4-1/4 inches, and the minimum cover from the outside face of the cone to the reinforcement shall be 1-1/4 inches.

Standard Drop Manholes shall comply with all applicable sections of the specifications for Standard Deep Type manholes and shall conform to the details as shown on the Plans.

W-12.03.2 Manholes on Sewers 27 to 42 Inches in Diameter

Base sections for Standard Deep Type and Shallow Type Manholes shall consist of a circular slab base, 5 feet or 6 feet in diameter as shown on the Plans, with a minimum thickness of 8 inches, and shall be T-Lok lined and reinforced as shown on the Plans. The base slab may extend beyond the outside diameter of the barrel section a maximum of 6 inches, providing the extension is equal at all points on the circumference of the slab. The manhole shall be set on not less than 8 inches of thoroughly compacted #57 stone.

Barrel sections for Standard Deep Type Manholes shall have an inside diameter of 48 inches plus or minus 1/2 inch, be T-Lok lined and a minimum wall thickness of 5 inches plus or minus 1/4 inch, and the minimum cover from the outside face of the wall to the reinforcement shall be 1-1/4 inches.

Top sections for Standard Deep and Shallow Type Manholes shall be a flat slab as shown on the Plans, with a minimum thickness of 10.5 inches and shall be T-Lok lined.

Standard Drop Manholes shall comply with all applicable sections of the specifications for Standard Deep Type manholes and shall conform to the details as shown on the Plans.

W-12.03.3 Manholes on Sewers 48 Inches or Greater in Diameter

Base sections for Standard Deep Type and Shallow Type Manholes shall be precast reinforced concrete pipe tees in the sewer lines as shown on the Plans. The run of each tee shall have the same diameter as the sewer and shall have the same joints. The run section shall conform to the requirements for Class V pipe, ASTM Des: C 76.

Barrel sections for Standard Deep Type Manholes shall have an inside diameter of 48 inches plus or minus 1/2 inch, T-Lok lined and a minimum wall thickness of 5 inches plus or minus 1/4 inch.

The minimum cover from the inside face of the wall to the reinforcement shall be 1-1/4 inches, and the minimum cover from the outside face of the wall to the reinforcement shall be 1-1/4 inches. The bottom section of the manhole barrel shall be integrally precast with the manhole base section.

Top sections for Standard Deep Type Manholes shall be a flat slab, T-Lok lined as shown on the Plans, with a minimum wall thickness of 10.5 inches.

Standard Drop Manholes shall comply with all applicable sections of the specifications for Standard Deep Type Manholes and shall conform to the details as shown on the plans.

W-12.04 Workmanship

Mortar shall be composed of one part cement to two parts sand.

Concrete for the base invert shall be Class D. The invert shall be constructed as shown in detail on the Plans and shall have a smooth channel with a circular shaped bottom with a radius equal to the inside radius of the sewer section.

Connections to pipes shall be without projections or voids. Connections to pipes shall be made with flexible type boot, cast integrally into the wall of the manhole and stainless steel bands, as detailed on the Plans, or equal.

Manhole sections shall be joined with rubber gaskets as specified for reinforced concrete pipe sewers, except that a preformed joint sealing compound, Waterstop-RX Cold Joint Water Stop, Volclay Waterproofing Systems as manufactured by American Collord Co.; Ram-Nek, manufactured by Hamilton-Kent, Kent, Ohio; or equal, be applied in accordance with the manufacturer's instructions. This may be substituted for the rubber gasket in manholes on sewers 42 inches or less in diameter. Sufficient preformed joint sealing compound shall be installed so as to completely fill the joint and show a "squeeze-out" on the inside and outside of the joint. Annular spaces on the inside and outside of joints with rubber gaskets shall be filled with mortar.

The elevation of the top rim of manhole frames shall be set to conform with grades and transverse slopes furnished by the Engineer. Precast concrete manhole components shall not be ordered until such elevations are issued by the Engineer. Manhole frames shall be firmly embedded in mortar. Wedges of shims shall be provided to ensure accurate placing of the frame.

W-12.05 Curing

All precast concrete manhole sections shall be cured in accordance with any one of the methods specified in ASTM Des: C 478. The facilities for curing shall, however, be subject to review and prior approval of the Engineer. No precast concrete manhole sections shall be delivered to the job site until the specified minimum compressive strength of 4,000 psi (6,000 psi in the case of manhole base sections on sewers 48 inches or larger in diameter), as determined by crushing tests on cured concrete cylinders, has been obtained.

W-12.06 Inspection and Testing of Precast Concrete Manholes

All precast concrete manholes shall be inspected by an independent, certified testing laboratory, approved by the Engineer, to establish the strength of the concrete and the adequacy of curing, to certify the date that the manhole were cast and to confirm that the steel has been properly placed, all in accordance with the Plans and Specifications. The cost of these tests shall be included in the various unit price Contract Items, and no special payment will be made there for. This testing shall be performed by the laboratory at the Contractor's manufacturing plan, prior to shipment.

All concrete cylinders must be cured in a natural environment. At least three (3) cylinders shall be taken each day that manholes are cast, with batch samples to be designated by the laboratory representative. At least one set of cylinders shall be taken for each 9 cubic yards of concrete used in the construction of the manhole sections. These samples shall be tested for strength. If the samples fail to meet minimum concrete strength requirements set forth in the Specifications, all manhole sections manufactured from the concrete from which the cylinders were made will be considered rejected.

In addition, the City reserves the right to core manholes either at the site or point of delivery to validate strength of concrete and placement of steel. If cores fail to demonstrate the required strength or indicate incorrect placement of reinforcing steel, all sections not previously tested will be considered rejected until sufficient additional cores are tested, at the Contractor's expense, to substantiate conformance to these requirements.

W-12.07 Transportation and Delivery

Every precaution shall be taken to prevent injury to the precast manhole sections during the transportations and unloading of the sections. The precast sections shall be unloaded using skids, pipe hooks, rope slings, or suitable power equipment, if necessary, and the sections shall be under perfect control at all times. Under no conditions shall the precast sections be dropped, dumped, or dragged.

If any precast section is damaged in the process of transportation, or handling, such section shall be rejected and immediately removed from the site and replaced at the Contractor's expense.

W-12.08 Test Reports

Each manhole delivered to the construction site must have a concrete test report indicating a minimum of 4,000 psi strength. If the manhole sections are produced from different pours, each section must have a concrete test report. Test reports must be submitted to the Engineer prior to shipment of the manholes.

* * *

PART 1 – GENERAL

1.01 WORK INCLUDED

A. The work specified in this section consists of furnishing and installing underground utilities using the horizontal directional drilling (HDD) method of installation, also commonly referred to as directional boring or guided horizontal boring utilizing high density polyethylene (HDPE) pipe. This work shall include all services, equipment, materials, and labor for the complete and proper installation testing, restoration of underground utilities and environmental protection and restoration.

1.02 QUALITY ASSURANCE

- A. Design Requirements
 - 1. Horizontal alignment shall be as shown on the Drawings. The pipe shall have a minimum 48-inch cover. The maximum depth shall be determined based on 36-inch minimum clearance under water or gas lines and 24-inch minimum clearance under all other existing or proposed utilities to be crossed. Compound curvatures may be used, but shall not exceed the maximum deflections as set forth by the HDPE pipe manufacturer or AWWA Standards, whichever is stricter.
 - 2. Entry angle shall be 12° 14° ideal (not to exceed 15°). Exit angle shall be 6°-12°to facilitate "pull-back."
 - 3. Entry and exist angles are defined as angles from the horizontal.
- B. Qualifications: Directional drilling contractor (or subcontractor) shall have a minimum of four years experience with similar construction including pipelines of the same or larger diameter and the same or greater lengths. The Contractor shall also have successfully completed a minimum of five (5) similar projects of the same or larger diameter and of equal or greater lengths. All pipe and appurtenances of similar type and material shall be furnished by a single manufacturer.

1.03 SUBMITTALS

A. <u>Work Plan</u>: Prior to beginning work, the Contractor must submit to the Engineer a work plan (Plan) detailing the procedure and schedule to be used to execute the project. The work plan should include a description of all equipment to be used, down-hole tools, a list and resume of key personnel and their qualifications and experience, list of subcontractors, a schedule of work activity, a safety plan, traffic control plan, an environmental protection plan and contingency plans for possible problems. Work plan should be comprehensive, realistic, and based on actual working conditions for this particular project. The Plan should document the thoughtful planning required to successfully complete the project.

- B. Equipment: Contractor will submit specifications on directional drilling equipment to be used to ensure that the equipment will be adequate to complete the project. Equipment shall include but not be limited to: drilling rig, mud system, mud motors (if applicable), down-hole tools, guidance system, and rig safety systems. Calibration records for guidance equipment shall be included and evidence of calibration within the last 6 months must be provided. Specifications for any drilling fluid additives that Contractor intends to use or might use will be submitted.
- C. <u>Material</u>: Specifications on material to be used shall be submitted to Engineer. Material shall include the pipe, fittings, and any other item which will be an installed component of the project.

PART 2 - EQUIPMENT AND PRODUCTS

2.01 GENERAL

A. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pull-back the pipe, a drilling fluid mixing, delivery, and recovery system of sufficient capacity to successfully complete the crossing, a drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be reused, a magnetic guidance system to accurately guide boring operations and record data for as-built purposes, a vacuum truck of sufficient capacity to handle the drilling fluid volume, trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project

2.02 DRILLING SYSTEM

A. 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. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations. The rig shall be grounded during drilling and pull-back operations. There shall be a system to detect electrical current from the drilling string and an audible alarm, which automatically sounds when an electrical current is detected.

2.03 PIPE

- A. Pipe shall be AWWA C-906 HDPE and have a ductile iron pipe outside diameter ("DIPS"). The pipe shall contain a minimum of 2 impregnated, longitudinal green stripes. The dimension ratio shall be verified by the Contractor based on the pipe pull strength required for the directional drilling. The minimum working pressure rating of the pipe supplied shall be 160 psi.
- B. HDPE resin shall be PE3408 resin characterized by ASTM D3350
- C. HDPE pipe shall have a minimum thickness as that of SDR-11. HDPE pipe shall be in minimum nominal lengths of 20 feet
- D. Fittings shall be HDPE with ductile iron outside diameter meeting ANSI/AWWA C906, latest revision, with a minimum working pressure rating of 160 psi. Ductile iron fittings may be used only where specified on the plans and provided butt fused HDPE MJ adapters are used to transition from the pipe to the fitting. HDPE transition fittings, adapters, and service fittings shall be heat (butt) fused unless otherwise approved by the engineer.
- E. Pipes shall be marked in accordance with AWWA requirements

2.04 DRILLING FLUIDS

A. Drilling fluids shall consist of a mixture of potable water and gel-forming colloidal material such as bentonite, or a polymer surfactant mixture producing slurry of custard-like consistency.

PART 3 - EXECUTION

3.01 PERSONNEL REQUIREMENTS

- A. Responsible representatives of the Contractor and Subcontractor(s) shall be present at all times during the actual crossing operations. A responsible representative as specified herein is defined as a person experienced in the type of work being performed and who has the authority to represent the Contractor in a routine decision making capacity concerning the manner and method of carrying out the work specified herein.
- B. The Contractor and Subcontractor(s) shall have sufficient number of competent workers on the project at all times to ensure the utility placement is made in a timely, satisfactory manner. Adequate personnel for carrying out all phases of the actual crossing operation (where applicable: tunneling system operators, operator for removing spoil material, and laborers as necessary for various related tasks) must be on the job site at the beginning of work. A competent and experienced supervisor representing the Contractor or Subcontractor that is thoroughly familiar with the equipment and type of work to be performed, must be in direct charge and control of the operation at all times. In all cases,

the supervisor must be continually present at the project site during the actual crossing operation.

3.02 COORDINATION OF THE WORK

- A. The Contractor shall notify the Engineer at least 24 hours in advance of starting work. In addition, the actual crossing operation shall not begin until the Engineer or his representative is present at the project site and agrees that proper preparations for the crossing have been made. The Engineer's approval for beginning the crossing shall in no way relieve the Contractor from the ultimate responsibility for the satisfactory completion of the work.
- B. The Contractor and the Engineer shall select a mutually convenient time for crossing operation to begin in order to avoid schedule conflicts.

3.03 MAINTENANCE OF TRAFFIC

A. Erection or installation of appropriate safety and warning devices in accordance with the Florida Department of Transportation (FDOT) Manual on Traffic Control and Safe Practices shall be completed prior to beginning work.

3.04 JOINING AND CUTTING

- A. Joining and Connections: Before joining, and before any special surface preparation, surfaces must be clean and dry. General dust and light soil may be removed by wiping the surfaces with clean, dry, lint-free cloths. Heavier soil may be washed or scrubbed off with soap and water solutions, followed by thorough rinsing with clean water, and drying with dry, clean, lint-free cloths.
- B. Cutting Pipe: Joining methods for plain end pipe require square-cut ends. Pipe cutting is accomplished with guillotine shears, run around cutters, and saws.
- C. Cutting Branch Outlet Holes: Except for self-tapping saddle tees, hole cutting is required for field installed side outlet fittings. Polyethylene pipe hole saws shall be used.
- D. Conventional heat fusion joining: is the process where mating surfaces are prepared for joining, heated until molten, joined together, and cooled under pressure. All fusion procedures require appropriate surface preparation tools, alignment tools, and temperature controlled heating irons with properly shaped, non-stick heater faces. An open flame cannot be used for heating because it oxidizes the surface and prevents bonding. During joining, all heat fusion procedures require the mating components to be moved several inches apart to accommodate surface preparation and surface heating tools. All fusions shall be constructed in strict accordance with pipe and fitting manufacturers' recommendations. The following methods of conventional heat fusion, with restrictions, may be used:

- 1. Socket fusion shall be used with ¹/₂ inch through 4-inch pipe and fittings
- 2. Saddle fusion outlets may be used on 8 inch and smaller outlets applied to 12 inch and smaller mains. Larger outlets and pipe sizes shall be factory fabricated.
- 3. Butt fusion joints shall be field constructed between pipe and fittings. Fusion may occur in the trench
- E. Electrofusion: This is an acceptable heat fusion process where a socket or saddle fitting contains an integral heating source. After surface preparation, the fitting is installed on the pipe, and the heating source is energized. During heating, the fitting and pipe materials melt, expand, and fuse together. Heating and cooling cycles are automatically controlled.
- F. All heat fusion techniques and methods shall be in STRICT ACCORDANCE with the manufacturer's recommendations.

3.05 INSTALLATION

- A. Erosion and sedimentation control measures and on-site containers shall be installed to prevent drilling mud from spilling out of entry and/or exit pits. Drilling mud will be disposed of off-site in accordance with local, state and federal requirements and/or permit conditions
 - 1. No other chemicals or polymer surfactant shall be used in the drilling fluid without written consent of the Engineer, and after a determination is made that the chemicals to be added are not harmful or corrosive to the facility and are environmentally safe
- B. Pilot hole: Pilot hole shall be drilled on bore path with no deviations greater than 2 percent of depth over a length of 100 feet. In the event that pilot does deviate from bore path more than 2 percent of depth in 100 feet, Contractor will notify Engineer and Engineer may require Contractor to pull-back and re- drill from the location along bore path before the deviation
- C. Reaming: Upon successful completion of pilot hole, Contractor will ream bore hole to a minimum of 25 percent greater than outside diameter of pipe using the appropriate tools. Contractor will not attempt to ream at one time more than the drilling equipment and mud system are designed to safely handle. The Contractor shall take all precautions required to avoid inadvertent mud returns (frac outs).
- D. Pull-back: After successfully reaming bore hole to the required diameter, Contractor will put the pipe through the bore hole. In front of the pipe will be a swivel and barrel reamer to compact bore hole walls. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations, Contractor will not apply more than the maximum safe pipe pull

pressure at any time. Contractor shall protect the pipe from damage or gouging at all times and at no time overstress the pipe during pull back or any other operation. Above ground rollers shall be used to prevent gouging or damage during fusing and pullback operations.

- E. The system must be remotely steerable and permit electronic monitoring of tunnel depth and locations. The system must be able to control the depth and direction of the pipe and must be accurate to a window of ± 2 ".
- F. Equipment shall be fitted with a permanent alarm system capable of detecting an electrical current. The system shall have an audible alarm to warn the operator if the drill head contacts electrified cables.
- G. Two strands of #8 gauge green insulated copper or #10 gauge green insulated copper clad steel tracing wire shall be attached to the pipe in a manner that assures the wires will be affixed near the top of the pipe. See Section W-24 "PVC Pipe Force Main" requirements for direct bury pipe. Wire insulation must be suitable for buried service such as HDPE or HMWPE. Nylon insulation is not acceptable. Wires must be spliced together with wire connectors suitable for buried service such as DBR Kit by 3M, Snakebite by Copperhead Industries or approved equal. Twisting wires together and sealing with electrical tape is not acceptable. No payment will be made for pipe that does not pass a continuity test through the wires after installation. See standard details for additional requirements

The locating wire shall terminate at the top of each valve box, air release valve box and manhole and must be capable of extending 24" above the top of the box (or manhole) in such a manner so as not to interfere with the valve operation

- H. The Contractor shall field locate all utilities and plan his work to avoid conflict with all sewer laterals and all other utilities. SP-31 details the Contractor's responsibilities for locating utilities.
- I. Depth and horizontal location of the pipe shall be shown on the As-built Drawings at intervals of 10 feet. Horizontal location shall be referenced to edge of pavement, rightof-way line or as directed by the Engineer. Horizontal location shall be accurate to within 2 feet. All valves, fittings, points of connection, depth and horizontal changes from the plans shall be shown on the As-built Drawings at all locations.
- J. The pipe entry area shall be graded to provide support for the pipe to allow free movement into the bore hole. The pipe shall be guided in the bore hole to avoid deformation of, or damage to, the pipe.
- K. If unexpected subsurface conditions are encountered during the bore, the procedure shall be stopped. The installation shall not continue until the Engineer has been consulted.

- L. The pipe shall be pulled back through the bore hole using the wet insertion construction technique. The pipe may be installed full of water.
- M. The pipe shall be installed in a manner that does not cause upheaval, settlement, cracking, movement or distortion of surface features.
- N. Prior to construction, the Contractor shall submit for approval by the Engineer, a plan that establishes a means to determine if other utilities have been damaged by directional drilling operations. For gravity sewers, sewer laterals, storm sewer and other non-pressure conduits this may involve checking manholes, inlets or other structures for evidence of drilling fluids or drilled soil materials.

3.06 FIELD TESTING

A. Testing shall be in accordance with Section W-18 "Leakage Tests" as described below:

All newly joined and laid pipe, including fittings, valves and service lines shall be pressure tested in accordance with AWWA standard C-600. Allowable leakage shall be as defined by the equation in Section 4.1.6. of AWWA C-600

Two tests shall be performed. The first test shall be after pipe joining but prior to installation (pulling). This test shall be per AWWA C-600 and allowable leakage used as the pass/fail criteria. A second pressure test per AWWA C-600 shall be performed after pipe installation.

The Contractor shall provide all necessary equipment and instrumentation required for flushing and testing of the piping systems. If requested by the City, the Contractor shall furnish to the City certified test data for the pressure gauges and recorders used on hydrostatic equipment. The cost to purchase water for test purposes will be paid by the City. Testing shall be conducted in the presence of and to the satisfaction of the City as a condition precedent to the approval and acceptance of the system. Not less than 3 days notice shall be given prior to start of such tests, and such testing shall not be scheduled until preliminary testing by the Contractor has indicated that the test section is ready for testing. The schedule and procedures for testing shall be determined by the Contractor and reviewed with the City prior to testing.

The duration of each pressure test shall be at least 2 hours with a test pressure of 100 psi. At no time shall the test or line pressure exceed 110 psi. If required by the City, pump test equipment will be equipped with pressure relief valves pre-set to 110 psi. Each valved section of pipe shall be slowly filled with water and a pump shall be connected to the low point of the section being tested.

Before conducting the test, the Contractor shall backfill all pipe and reaction blocking unless the City directs certain joints or connections to be left uncovered. When reaction blocking is provided, the pressure test shall not be made until adequate curing time for the blocking has been allowed.

Before application of the test pressure, all air shall be expelled from the pipe.

At the end of the 2-hour test period, the Contractor will be required to pump the lines back up to the highest pressure obtained during the duration of the test period.

Pressure tests shall be made to demonstrate the ability of the valve to sustain pressure. All piping systems shall be tested in accordance with these test methods in addition to any other tests required by local plumbing codes or building authorities. At the option of the City, flow meters and/or pressure gauges used on hydrostatic testing equipment with approved strip or round chart recorders shall be supplied by the Contractor. Tests shall be made in sections not to exceed ¹/₂ mile.

Throughout the duration of the test, the Contractor is required to maintain a minimum pressure in excess of 100 psi. The Contractor is advised that, should the test pressure fall to or below 100 psi any time during the 2- hour test, the test will be considered invalid and a retest will be required. Therefore, it is advised that the Contractor should pump water into the line as the test pressure approaches 100 psi.

The Contractor is warned that pressure testing against existing values is done at his own risk. Failure of these values to hold test pressure will not relieve the Contractor of the pressure testing.

All exposed pipe, fittings, valves and joints shall be carefully examined for leaks. Any cracked or defective pipe, fittings, valves or other appurtenances discovered as a consequence of the pressure test shall be removed and replaced with acceptable material. All leaking or defective joints shall be repaired, corrected or replaced. After all necessary replacements and corrections have been made; the test shall be repeated to the satisfaction of the City.

If the pipeline fails the pressure test twice, then the Contractor shall be required to retest the pipeline and provide to the certification by a Professional Engineer registered in the State of Florida, that the pipeline has passed the test in accordance with these standards before the department will witness another test.

* * *

W-15.01 General

The installation, delivery, transportation, unloading, and stringing of pipes, fittings, and accessories for force mains and sewers shall be done in accordance with AWWA C600 for ductile iron pipe and ASTM Des: C 12 for clay and concrete pipe and ASTM D 2321 and pipe manufacturer's recommendations for PVC pipe, as modified or supplemented by the specifications of this section and by the details shown on the Plans.

Proper and suitable tools and appliances for the safe and convenient cutting, handling, and laying of the pipe and fittings shall be used.

Suitable fittings shall be used where shown and at connections where grade or alignment changes require offsets greater than those recommended by the pipe manufacturer.

Pipes and fittings shall be thoroughly cleaned before they are laid and shall be kept clean until they are accepted in the completed work.

All lines shall be closed off with bulkheads when pipe laying is not in progress.

Before being laid, all pipe and specials shall be thoroughly examined for defects, and no piece shall be installed which is known to be defective. If any defective piece should be discovered after having being installed, it shall be removed and replaced with a sound one in a satisfactory manner by the Contractor at his own expense.

Pipe shall be thoroughly cleaned before it is laid and shall be kept clean until it is accepted in the completed work. Special care shall be exercised to avoid leaving bits of wood, dirt, and other foreign particles in the pipe. If any such particles are discovered before the final acceptance of the work, they shall be removed and the pipe cleaned at the Contractor's expense.

Pipe laying for sewers shall begin at the low end of a run and proceed upgrade. Generally, all such pipe shall be laid with bells or grooves pointing uphill. Each pipe shall be carefully placed and checked for line and grade.

Adjustments to bring pipe to line and grade shall be made by scraping away or filling in granular material under the body of the pipe, but in no case by wedging or blocking up the barrel. The faces of the spigot ends and the bells shall be brought into fair contact, and the pipe shall be firmly and completely shoved home. As the work progresses, the interior of the pipelines shall be cleaned of all dirt and superfluous materials of every description. All lines shall be kept absolutely clean during construction. Pipelines shall be laid accurately to line and grade.

Gaskets for pipe joints shall be stored in a cool place and protected from light, sunlight, heat, oil, or grease until installed. Any gaskets showing signs of checking, weathering, or other deterioration will be rejected.

Pipe shall be of the types, sizes, and classes shown on the Plans or as listed in the contract items.

Each piece of pipe shall be inspected and cleaned before it is lowered in the trench and any lumps or projections on the face of the spigot or tongue end or the shoulder shall be cut away. No cracked, broken, or defective pieces shall be used in the work.

Concrete pipe manufactured with a plastic sheet liner shall be laid so that the liner is on the crown of the pipe and placed symmetrically about the vertical centerline of the pipe.

Pipe laying will be permitted only in dry trenches having a stable bottom. Where groundwater is encountered, the Contractor shall make every effort to secure an absolutely dry trench bottom.

If, in the opinion of the Engineer, the Contractor has failed to obtain an absolutely dry trench bottom by improper or insufficient use of all known methods of trench dewatering, the Engineer may then order the Contractor to excavate below grade and place sufficient selected fill material, crushed stone, or Class D concrete over the trench bottom at the Contractor's own expense.

If all efforts fail to obtain this condition and the Engineer determines that the trench bottom is unsuitable for pipe foundation, he will order in writing the kind of stabilization to be constructed.

W-15.02 Transportation and Delivery

Every precaution shall be taken to prevent injury to the pipe during transportation and delivery to the site. Extreme care must be taken in loading and unloading the pipe and fittings. Such work must be done slowly with skids or suitable power equipment, and the pipe shall be under perfect control at all times. Under no condition shall the pipe be dropped, bumped, dragged, pushed, or moved in any way which will cause damage to the pipe or coating. When handling the pipe with a crane, a suitable pipe hook or sling around the pipe shall be used. Under no condition shall the sling be allowed to pass through the pipe unless adequate measures are taken to prevent damage to the pipe ends.

If in the process of transportation, handling, or laying, any pipe or special is damaged, such pipe or pipes shall be replaced or repaired by the Contractor at his own expense.

The Contractor shall furnish and install suitable blocking and stakes so as to prevent the pipe from rolling. The type of blocking and stakes, and the method of installation, shall be approved by the Engineer.

W-15.03 Pipe Laying - Trenches

Pipelines shall be laid in trench excavation on bedding material as specified under the Workmanship and Materials section headed "Backfilling," Class D concrete cradle or other foundations as shown on the Plans, specified, or ordered in writing by the Engineer. The pipe shall be properly secured against movement and pipe joints shall be made in the excavation as required. The pipe bedding shall be carefully graded, compacted, and formed to fit the bottom quadrant of the pipe. Bell holes shall be cut out for each joint as required to permit the joint to be properly made and allow the barrel of the pipe to have full bearing throughout its length.

Where pipelines are laid in Class D concrete cradle or encasement, the installation shall conform to the requirements of the Workmanship and Materials section headed "Pipe Cradles and Encasements."

Pipelines laid on other type foundations shall be installed as specified for such other foundations or as directed in writing by the Engineer.

W-15.04 Lateral Detection Tape

Detectable underground marking tape shall be installed over all laterals from the edge of pavement to the property line. The tape shall be Lineguard encased aluminum foil, or equal. The

2-inch wide tape shall be APWA green and reverse printed bearing the identification of the sewer line below it and a warning such as "CAUTION."

The tape shall be buried 4-6 inches. After trench backfilling, the tape shall be placed in the backfill and allowed to settle into place with the backfill.

W-15.05 Mechanical Joints for Ductile Iron Pipe

In making up mechanical joints, the spigot shall be centered in the bell. The surface with which the rubber gasket comes in contact shall be cleaned thoroughly and the gasket shall be washed thoroughly with soapy water just prior to assembly of the joint. The gasket and gland shall be placed in position, the bolts inserted, and the nuts tightened fingertight. The nuts then shall be tightened by means of a torque wrench in such a manner that the gland shall be brought up evenly into the joint. The following range of bolt torques shall be applied:

RANGE OF BOLT TORQUES					
Bolt Size (Inches)	Range of Torque (Foot-Pounds)				
5/8	45-60				
3/4	75-90				
1	80 - 100				
1-1/4	105 - 120				

If effective sealing is not obtained at the maximum torque listed above, the joint shall be disassembled and reassembled after a thorough cleaning.

All bolts and nuts shall be field coated with a bituminous coating after assembly of the joint. See <u>W-15.06 Push-on Joints for Ductile Iron Pipe</u>

In making up push-on joints, the gasket seat in the socket shall be cleaned thoroughly and the rubber gasket shall be wiped clean with a cloth. The gasket shall be placed in the socket and a thin film of lubricant shall then be applied to the inside surface of the gasket that will come in contact with the entering pipe. The plain end of the pipe to be entered shall be cleaned thoroughly and placed in alignment with the bell of the pipe to which it is to be joined. The joint shall be made up by exerting sufficient force on the entering pipe so that its plain end is moved past the gasket until it makes contact with the base of the socket.

W-15.07 Joining Clay Pipe

The joining of clay pipe with flexible plastic joints shall be done in accordance with the manufacturer's instructions. The joint surface on both the bell and spigot ends shall be wiped clean and coated with a lubricant furnished by the manufacturer to facilitate assembly. The spigot end shall be inserted in the bell and pressure applied sufficient to seat the pipe properly. After the joint has been completed, any voids in the excavation beneath the spigot shall be thoroughly tamped full of granular fill material to provide a full bearing for the pipe and prevent excessive pressure on the bottom of the joint.

W-15.08 Joining of PVC Pipe-Gravity

The assembly of gasketed joints shall be performed as recommended by the pipe manufacturer. In all cases clean the gasket and bell, especially the groove area and the spigot area, with a rag, brush or paper towel to remove any dirt or foreign material before the assembly. Lubricant shall be applied as specified by the pipe manufacturer.

Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Apply firm steady pressure either by hand or by bar and block assembly until the spigot easily slips through the gasket.

If undue resistance to insertion of the pipe end is encountered or the reference mark does not position properly, disassemble the joint and check the position of the gasket. If it is twisted or pushed out of its seat ("rolled"), inspect components, repair or replace damaged items, clean the components, and repeat the assembly steps. Be sure both pipe lengths are in concentric alignment. If the gasket was not out of position, verify proper location of the reference mark.

To join field-cut pipe, first square cut the pipe end. Use a factory-finished beveled end as a guide for proper bevel angle and depth of bevel plus the distance to the insertion reference mark. Bevel the end using a pipe beveling tool or a wood rasp which will cut the correct taper. Round off any sharp edges on the leading edge of the bevel.

W-15.09 Joining Concrete Pipe

Before joining concrete pipe using flexible rubber gaskets, the joint surfaces of both the bell and spigot (tongue and groove) ends shall be wiped clean. Any lumps, projections, burrs, or chips which would interfere with the proper compression of the gasket shall be repaired. The spigot or tongue end with the gasket in place and with all surfaces lubricated as recommended by the manufacturer, shall be inserted into the bell or groove. Pressure shall be applied to seat the pipe properly in the bell or groove. Voids under the pipe shall be tamped full of granular material to provide full bearing for the pipe.

Curves for reinforced concrete pipe sewers shall be constructed with standard pipe where the opening of the joint on the outside of the curve is less than 1/2 inch. Where greater opening of the joint would be required, the curves shall be constructed using beveled or radius pipe with standard joints.

Curves for reinforced concrete pressure pipe or prestressed concrete pipe shall be constructed with standard pipe sections, where the opening of the joint on the outside of the curve is less than 1/2 inch, or with beveled pipe, precast elbows or combination of these methods.

W-15.10 Concrete Pipe Rubber Gasket Joints

Rubber gaskets shall be of the O-ring type or equivalent cross section approved by the Engineer. The composition and properties of the gaskets for gravity flow sewers shall meet the requirements of ASTM Des: C 443.

Composition and properties for concrete pressure pipe gaskets shall meet the requirements of the specifications for the concrete pressure pipe with which the gasket will be used.

In making O-ring rubber gasketed joints, the gasket and the pipe socket shall be lubricated with an approved rubber gasket lubricant, and the gasket shall be stretched over the spigot and placed accurately in position. The tongue or spigot end shall be carefully centered in the socket of the preceding pipe so as to avoid displacement of the gasket, and the pipe shall be drawn home fully compressing the gasket. Adjustments to line and grade shall be made in such a manner that the compressed rubber gasket will not be disturbed. Before proceeding with backfilling, the joint shall be felt completely around to determine whether the gasket is in its proper position. If the gasket can be felt out of place, the pipe shall be withdrawn and the gasket examined for cuts or breaks. If the gasket has been damaged, it shall be replaced with a new one before the pipe is replaced.

Rubber gaskets shall be stored in a cool place and protected from light, sunlight, heat, oil, or grease until installed. Any gaskets showing signs of checking, weathering, or other deterioration will be rejected.

W-15.11 Temporary Bulkheads

At the ends of contract sections, where adjoining pipelines have not been completed, and in connections built into pipelines where adjoining pipelines or structures have not been completed and are not ready to be connected, temporary bulkheads, approved by the Engineer, shall be built. Such bulkheads encountered in connecting sewers or structures included in the Contract, or pipelines or structures previously built, shall be removed by the Contractor when the need for them has passed or when ordered by the Engineer.

W-15.12 Testing

The testing of pipelines shall be done in accordance with the requirements of the Workmanship and Materials section headed "Leakage Tests."

W-15.13 Joining Different Types (Clay, PVC, or Ductile Iron) of Pipe

The joining of clay pipe to ductile iron pipe or clay pipe to PVC pipe, shall be accomplished with flexible compression couplings. Such couplings shall meet the requirements of ASTM DES: C 425 and shall be Series No. 1002 flexible polyvinyl chloride couplings with stainless steel compression bands as manufactured by Fernco Joint Sealer Co., Ferndale, Michigan; Band-Seal couplings as manufactured by Mission Clay Products Corp., Whittier, California; or approved equal. Installation of flexible couplings shall be done in accordance with the manufacturer's instructions. After the joint has been completed, any voids in the excavation beneath the coupling shall be thoroughly tamped full of granular fill material to provide a full bearing for the pipe and prevent excessive pressure on the bottom of the joint.

The joining of SDR-35 or SDR-26 PVC pipe to ductile iron or C-900 PVC pipe, shall be accomplished with rigid PVC C900 x SDR-35 adapter couplings. Such couplings shall be molded of PVC material meeting ASTM D-1784 specifications. Joints shall meet ASTM D-3213 requirements with gaskets conforming to ASTM F-477. The adapter couplings shall be manufactured by Harco, Lynchburg, VA, or equal. Installation of rigid couplings shall be done in accordance with the manufacturer's instructions. After the joint has been completed, any voids in the excavation beneath the coupling shall be thoroughly tamped full of granular fill material to provide a full bearing for the pipe and prevent excessive pressure on the bottom of the joint.

W-15.14 Connection to Manholes

The Contractor will be required to submit a shop drawing, detailing the method of connecting the proposed pipe to the manhole and making it watertight:

- 1. For connecting vitrified clay or ductile iron pipe, the Contractor shall use nonshrink grout to seal the opening between the pipe O.D. and manufactured opening in the manhole or flexible rubber boot, precast into the manhole. The boot shall have stainless steel bands to compress and seal to the proposed pipe or shall be a compression type, such as A-Lock.
- 2. For connecting PVC pipe, the Contractor shall use a flexible rubber boot, precast into the manhole. The boot shall have stainless steel bands to compress and seal to the proposed pipe or shall be a compression type, such as A-Lock. Should the flexible rubber boot need to be relocated or when connecting to an existing manhole,

the Contractor shall perform the connection by one of two methods. The preferred method is to core the manhole and install a rubber boot. The rubber boot shall be manufactured by Kor-n-Seal, or equal. The boot shall be installed and the PVCP connection shall be in accordance with the manufacturer's instructions. If the manhole cannot be cored or if the manhole is constructed of brick, the connection shall be made with a PVC manhole adapter which has an exterior impregnated silica surface layer. The adapter shall be installed and grouted into the manhole wall in accordance with the manufacturer's instructions. The PVCP shall be installed and grouted through the adapter.

W-15.15 Joint Grouting

Joints for concrete pipelines using rubber gaskets and steel end rings shall be grouted on the outside with cement mortar composed of one part Type IA portland cement to one part sand by volume. The materials shall be thoroughly mixed to produce a uniform mortar with all aggregate particles well coated.

The joint grouting shall not advance closer than two pipe lengths to the laying operations. In grouting the joint, a cloth diaper shall be used to encase the outside diameter of the bell of the pipe and adequately straddle the joint recess so as to keep out dirt and to serve as a form for grouting. The joint space shall be filled with cement mortar, just thin enough to run around the joint. The diaper is to be left in place permanently. Before the mortar has taken its initial set, the diaper shall be examined, and if not completely filled, additional mortar shall be forced into the joint.

W-18.01 General

All pipelines will be tested and inspected for infiltration or leakage by the Engineer with the assistance of the Contractor prior to final acceptance of the work. All tests and inspections will be conducted in a manner to minimize as much as possible any interference with the Contractor's work or progress.

The Contractor shall notify the Engineer when the work is ready for testing and inspecting, and tests and inspections shall be made as soon thereafter as practicable under the direction of the Engineer. Personnel for reading meters, gauges, or other measuring devices will be furnished by the Engineer. The Contractor shall furnish all other labor, materials, services, and equipment, including power, fuel, meters and gauges, pumps, bulkheads, backflow preventers, water, and other items and apparatus necessary for making leakage tests, preparing pipelines for testing, assembling, placing, and removing testing equipment, and placing pipelines in service, all to the satisfaction of the Engineer. Only City water shall be used for testing unless otherwise approved by the Engineer. The water shall be disposed of by the Contractor into storm sewers or drainage courses approved by the Engineer.

W-18.02 Tests of Sewer - General

All sewers shall be tested for infiltration or leakage after completion of backfilling. All wyes, house connections, and stubs shall be suitably plugged or bulkheaded to the satisfaction of the Engineer prior to testing. All sewers shall be cleaned and pumped out as necessary prior to testing.

Sewer shall be tested for infiltration, unless otherwise ordered by the Engineer. If the Engineer determines that groundwater conditions are not suitable for infiltration testing, sewers shall be tested for leakage. Sewers may be tested for leakage by measuring leakage out of the sewer or by air testing. The length of sewer to be tested shall be subject to prior approval of the Engineer.

The length of house connections, if any, will be included in the total length of sewer under test when computing infiltration or leakage.

All testing equipment and the arrangement of such equipment shall be subject to the prior approval of the Engineer. Sections of sewers under test shall be arranged to prevent the internal pressure on any joint from exceeding 10 psi.

Refer to Section 11 - PVC Pipe Gravity for specific requirements for infiltration and leakage testing for PVC gravity pipe.

W-18.03 Infiltration Test of Sewers

Infiltration tests shall be performed when the groundwater level is a minimum of 2 feet above the crown of the sewer at the highest point in the test section. No such tests shall be started until the infiltration conditions are established in the work to be tested. The Contractor shall provide suitable observation wells along the line of the work or other approved means to determine the groundwater level.

Infiltration tests will be made by measuring the infiltrated flow of water over a measuring weir set up in the invert of the sewer a distance, as approved by the Engineer, from a temporary bulkhead or other limiting point of infiltration. Testing shall be for a minimum period of 4 hours. The quantity of infiltration for any section of the sewer shall not exceed 50 gallons/mile/day/inch of pipe diameter.

W-18.04 Leakage Test of Sewers

Leakage tests shall be performed by bulkheading the section of sewer under test at the manhole, at the lower end, and filling the sewer with clear water until the water level is up a minimum of 2 feet above the crown of the sewer or a minimum of 2 feet above the groundwater level, whichever is greater, in the manhole at the highest point in the section. Leakage will be the measured amount of water added to maintain the level in the higher end manhole. Tests shall be carried on a minimum of 4 hours with readings at 30-minute intervals. The quantity of leakage for any section of the sewer shall not exceed the limits specified for infiltration in the subsection headed "Infiltration Test of Sewers."

W-18.05 Air Leakage Test of Sewers

Air pressure leakage tests shall be limited to sewers 30 inches in diameter and smaller. The maximum allowable air leakage is based on prewetted pipe walls. The contractor may, therefore, fill the pipe with clear water and then empty the pipe prior to air testing. When pipe walls are prewetted, air leakage tests shall be completed within 24 hours after filling the sewer section to be tested.

Air pressure tests shall be made by placing the sewer under 3.0 psig air pressure and measuring the volume of air required to maintain this pressure. The rate of air leakage shall be determined when the system reaches an equilibrium state and air flow shall be read by means of an approved rotameter.

The maximum rate of air loss shall be 0.003 cfm per square foot of interior pipe surface, and the maximum air flow shall not exceed 2.0 cfm when the total pressure on the sewer is maintained at 3.0 psig. When the groundwater level is above the invert of the sewer, but below a level adequate for infiltration testing, the maximum air loss shall be reduced 6 percent for each foot of groundwater above the sewer invert.

Air testing equipment shall be arranged so that compressors, valving, gauges, and other test devices are located at the ground surface. Air testing equipment shall have an approved air relief arrangement to prevent the sewer from being pressurized to greater than 10.0 psig.

W-18.06 Leakage Tests of Force Mains

For Directional drilled pipe, see Section W-13 for additional testing requirements.

Force mains shall be tested as a whole or in sections valved or bulkheaded at the ends. The mains shall be tested under an average hydrostatic pressure of not less than 100 pounds per square inch, unless otherwise indicated in the Specific Provisions. The pressure shall be applied to the pipeline through a tap in the pipe by means of a hand pump or other method and shall be maintained for a minimum of 2 hours. Air shall not be used for testing force mains.

The leakage for all force mains, as determined by the above test, shall not exceed the allowable leakage for iron water mains as given by the following formula in Section 7.3 of AWWA Specification C606-05:

$$\mathbf{L} = \frac{\mathbf{SD} \vee \mathbf{P}}{\mathbf{148,000}}$$

in which L is the allowable leakage, in gallons per hour, S is the length of force main tested in feet, D is the nominal diameter of the pipe in inches, and P is the average test pressure in psi gauge.

During the test, each valve shall be operated through several complete cycles of closing and opening. In addition, each valve, when in the closed position, shall have the test pressure applied to one end of the valve only. Each end of the valve shall be tested in this manner. There shall be no visible leakage through the valves, and the valves shall not show any evidence of structural distress.

All harnessed sections of the buried force main shall be completely backfilled before such sections are tested.

W-18.07 Repairing Leaks

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

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SECTION W-19 - JACKING AND AUGERING

W-19.01 General

Pipelines shall be installed in casing pipes beneath railroads, highways, or other structures, as shown on the Plans, specified, or ordered by the Engineer. Casing pipes may be installed by augering or by jacking. All operations and materials involved in augering or jacking operations shall conform to the regulations of the Florida Department of Transportation, City of Tampa, Hillsborough County, Railroad Company, or any other agency having jurisdiction over the crossing. Approval of all materials and methods shall be obtained from the agency having jurisdiction over the crossing prior to construction. The crossing permits, required by the agencies, will be obtained by the City prior to the beginning of the work. Upon the satisfactory completion of the crossing, the Contractor shall obtain and deliver to the Engineer a written release from the agency.

W-19.02 Methods of Construction

The entire crossing operations shall be performed by a qualified contractor regularly engaged in this type of work. Extreme care shall be taken to ensure that the casings are installed to accurate line and grade.

Timber or steel rails or skids shall be placed inside the casing pipe and set to uniformly support the carrier pipe barrel in accordance with the accepted practice or as directed by the Engineer. After the carrier pipe has been placed, the ends of the carrier pipe shall be plugged and the ends of the casing pipe shall be sealed with brick masonry bulkheads unless otherwise shown, specified, or directed.

W-19.03 Augering

Augering shall be carried out with the proper equipment and procedure such that the carrier pipe and the casing pipe can be installed to the grades specified without disturbance to the adjacent earth. All equipment and procedure shall be subject to prior approval by the Engineer.

W-19.04 Jacking

Prior to ordering equipment and materials, the Contractor shall get an approval from the Engineer of his jacking equipment and procedures.

The jacking pit shall be of adequate length to provide room for the jacking frame, the jacking head, the reaction blocks, the jacks, auger rig, and the jacking pipe. The pit shall be sufficiently wide to allow ample working space on each side of the jacking frame. The depth of the pit shall be such that the invert of the pipe, when placed on the guide frame, will be at the elevation desired for the completed line. The pit shall be tightly sheeted and kept dry at all times.

SECTION W-19 - JACKING AND AUGERING

The jacking frame shall be designed so that it applies a uniform pressure over the entire pipe wall area of the pipe to be jacked.

The reaction blocks shall be adequately designed to carry the thrust of the jacks to the soil without excessive soil deflection and in such a manner as to avoid any disturbance of adjacent structures or utilities. Adequate protective railings shall be provided at the top of the pit at all times.

Hydraulic jacks shall be used in the jacking operation, and extreme care shall be taken to hold the pipe to exact line and grade. Excavation at the heading shall be advanced not more than 1 foot ahead of the casing pipe, and may be done manually or with an auger.

W-19.05 Casing Pipe

All casing pipes shall be welded steel pipe conforming to ASTM Des: A 139, Grade B, or ASTM Des: A 53, Grade B, having a minimum inside diameter as designated on the plans. The minimum wall thickness shall be 3/8 inch, or thicker if so indicated on the plan and profile drawings.

SECTION W-20 - MAINTAINING EXISTING SANITARY SEWER IN OPERATION

W-20.01 General

It shall be the Contractor's responsibility to preserve all existing sanitary sewer services without interruption while performing the work included in this project. The Contractor shall furnish all labor, materials, and equipment required to bypass wastewater flow around the working area to an acceptable point of discharge. Also, if deemed necessary by the engineer, the contractor will be responsible to provide necessary noise suppression devices to minimize bypass pump noise.

The Contractor shall not be permitted to pump or otherwise direct the flow of sanitary sewage into storm sewers, streams, or other open channels or onto streets or alleys at any time during the course of the work.

W-20.02 Bypass Pumping

The Contractor shall submit the proposed plan to the Engineer for approval prior to proceeding with the work. All required agency approvals and permits shall be the responsibility of the Contractor. The hydraulic design of the bypass pumping arrangement shall be the sole responsibility of the Contractor.

Pumping equipment shall be of a type suitable for pumping raw unscreened sewage over an indefinite period without clogging or requiring shutdown for routine maintenance. Bypass pumping shall be continuous during the entire length of time each portion of the work is being accomplished. The Contractor shall submit drawings and equipment specifications, detailing the proposed pumping equipment and the method of installation, to the Engineer for approval.

The Contractor shall possess at least one (1) backup pump, no smaller than the largest pump in use, on site for every 1 to 3 bypass pumps in operation. An additional backup pump shall be required on site for each increment of 3 pumps in operation as illustrated on the following table:

Operating Bypass Pumps	Required Backup Pumps On Site
1 - 3	1
4 - 6	2
7 - 9	3

SECTION W-20 - MAINTAINING EXISTING SANITARY SEWER IN OPERATION

W-20.03 Connections

All house laterals and connections to lateral sewers shall be maintained in operation without leakage or backup during the work.

W-20.04 Street Closures

The Contractor shall be responsible for coordination of maintenance of traffic and all street closures with the City of Tampa, Department of Public Works; Hillsborough County, Superintendent of Maintenance; and the State of Florida, Department of Transportation.

W-20.05 Cleanup

When the repair or reconstruction has been completed, all temporary connections and bulkheads shall be removed. Sewers shall be cleaned of all settled solids.

* * *

W-24.01 General

All pipe and fittings, 4"-48" nominal diameter, shall be solid wall polyvinyl chloride (PVC) pipe manufactured to standards as outlined in the following sections.

W-24.02 Pipe standards

For PVC force mains, 4" through 12", the pipe shall be AWWA C900, DR-18 (class 150). For PVC force mains 14" through 48", the pipe shall conform to AWWA C905, DR-25. The outside diameter dimensions shall be identical to ductile iron pipe dimensions. The pipe shall have integral bell push on type joints conforming to ASTM D3139. Bell ends shall be equipped with elastomeric gaskets meeting the requirements of ASTM F477. The color shall be green and the nominal laying length per pipe section shall be 20 ft.

W-24.03 Pre-Installation Tests, Reports, Markings and Submittals

All pipe and fittings shall be marked per Section 2.6 "Marking Requirements" of AWWA C900.

PRIOR TO SHIPMENT of the pipe and fittings to the project site, the Contractor shall submit to the Engineer test reports and certifications as described below, duly certified by the manufacturer's testing facility or an independent certified testing laboratory demonstrating full compliance with AWWA C900 or C905. Certification from the supplier is not acceptable.

An original, plus four (4) copies of the following, shall be submitted to the Engineer.

- 1. The name, address, and phone number of the pipe and fittings manufacturer and the location of the plant at which they will be manufactured
- 2. CERTIFICATION AND CERTIFIED TEST REPORTS that each LOT of pipe and fittings has been manufactured, sampled, and tested per AWWA C900 or C-905. The City shall be provided in writing with the means to cross-reference the markings with the certification and test reports (i.e. date of manufacturer, lot number and shift number etc.). If this information is marked on the pipe in a code, the markings shall be decoded in writing.

W-24.04 Bedding Requirements

Unless otherwise indicated on the Plans, the PVCP force main shall be installed with Class "C" bedding as shown on the plans. If suitable fill material is not excavated at the project site, it shall be imported. Compaction requirements are described in subsection W-24.12 "Bedding Placement for Pipelines". In no cases shall a concrete cradle be used. In the event the Contractor opts to install crushed stone, it shall be **NO GREATER THAN A #57 STONE**.

W-24.05 Fittings

Both PVC and ductile iron fittings are acceptable unless the plans specifically call for PVC fittings. For standard angles, in sizes 4" through 12", fittings shall be injection molded in accordance with AWWA C907 and CSA B137.2. For larger sizes (10" and greater) and for non-standard angles, fittings shall conform to the requirements of CSA B137.3 and shall be fabricated in a factory from AWWA C900/905 pipe.

Injection molded fittings shall have a dimensional ratio of 18 (DR18) and fabricated fittings shall have a dimensional ratio equal to that of the pipe they are being installed on. All injection molded fittings shall conform to AWWA C907, CSA B137.2 and fabricated fittings shall conform to CSA B137.3

All PVC fittings shall incorporate integral elastomeric gasket bell joints push on type. Materials used in the manufacture of PVC fittings shall equal or exceed cell class 12454 (ASTM 1784) with a hydrostatic design basis of 27.58 Mpa at 23°C as outlined in AWWA C900 and C905, and CSA B137.3.

Fabricated fittings shall be manufactured from segments of PVC pipe to the requirements of AWWA C900 and C905, and CSA B137.3. Segments shall be bonded together and over wrapped with fiberglass-reinforced polyester. All bends, up to and including 45°, shall be constructed from a single section of PVC pipe, without joints, bonding or fiberglass-reinforced polyester wrapping.

The pressure rating of the fittings shall be equal to the pressure rating of the pipe they are being installed on.

The manufacturer shall meet all the qualification test requirements as outlined in CSA B137.3:

- All fittings shall be marked with the following identifications:
- Nominal size, CIOD
- Manufacturers name or trademark
- AWWA pressure rating/pressure class and standard number to which the fitting is made
- CSA Standard number
- Proper handling label

W-24.06 Harnessing

Joint restraint devices for all pipes and fittings shall meet requirements as specified under the "RESTRAINING DEVICES" specification. Thrust blocks shall not be allowed.

All wedge devices assemblies and related parts shall be processed through a phosphate wash, rinse and drying operation prior to coating application. The coating shall consist of a minimum of two coats of liquid Xylan fluoropolymer coating with heat cure to follow each coat.

All casting bodies shall be surface pretreated with a phosphate wash, rinse and sealer before drying. The coating shall be electrostatically applied and heat cured. The coating shall be a polyester based powder to provide corrosion, impact and UV resistance.

The coating system shall be Mega-Bond as manufactured by EBAA Iron, Inc., Eastland, Texas, or approved equal.

W-24.07 Marking and Locating

Two strands of #12 gauge green insulated copper tracing wires shall be attached to the pipe with duct tape at regular intervals in the 10 and 2 o' clock position. The wires shall be looped around each bell. See Section W-13 "Directional Drilling HDPE Pipe" requirements for directional drilled pipe. Wire insulation must be suitable for buried service such as HDPE or HMWPE. Nylon insulation is not acceptable. Wires must be spliced together with wire connectors suitable for buried service such as DBR Kit by 3M, Snakebite by Copperhead Industries or equal. Twisting wires together and sealing with electrical tape is not acceptable. No payment will be made for pipe that does not pass a continuity test through the wires after installation. See standard details for additional requirements.

The locating wire shall terminate at the top of each valve box, air release valve box and manhole and must be capable of extending 24" above the top of the box (or manhole) in such a manner so as not to interfere with the valve operation.

W-24.08 Installation

Installation of PVCP force mains shall comply with the requirements of AWWA Standard C605 "Underground Installation Of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings For Water".

Pipe bending shall not be allowed.

Joint deflections up to a maximum of 1 degree will be permitted at integral bell and spigot joints. Joint deflections up to a maximum of 3 degrees will be permitted by utilizing twingasketed couplings instead of integral bell and spigot joints. Deflections larger than 3 degrees

may be accomplished with factory molded or fabricated standard angle fittings; or, a standard deflection shall be accomplished with a factory fabricated fitting of the proper angle. Refer to Section W-24.05.

Air release valves shall use service saddles to attach the corporation stop connection to the PVC pipe. The service saddle body shall be sized exactly to the outside diameter of the pipe, with double straps anchored with a minimum of a four bolt pattern. The service saddle body shall be ductile iron, the sealing gasket shall be BUNA- N rubber and the straps shall be corrosion resistant alloy steel.

W-24.09 Testing

Testing of PVCP force mains shall comply with the requirements of AWWA Standard C605 "Underground Installation Of Polyvinyl Chloride (PVC) Pressure Pipe And Fittings For Water" Section 7 (less references to disinfecting). The hydrostatic and leakage testing may be performed simultaneously. The average hydrostatic test pressure shall be 100 psi.

Air pressure testing of installed pressure pipe is expressly prohibited due to the catastrophic nature of failure should failure occur.

W-24.10 Storage of PVC Pipe

Pipe shall be stored at the job site in unit packages provided by the manufacturer. Caution shall be exercised to avoid compression, damage, or deformation to bell ends of the pipe. When unit packages of PVC pipe are stacked, the Contractor ensure that the weight of upper units does not cause deformation to pipe in lower units.

PVC pipe unit packages shall be supported by racks or dunnage to prevent damage to the bottom during storage. Supports shall be spaced to prevent pipe bending.

PVC pipe shall not be stored close to heat sources or hot objects such as heaters, boilers, steam line, engine exhaust, etc.

When unit packages of PVC pipe are stacked, ensure that the height of the stack does not result in instability which could cause stack collapse, pipe damage, bodily injury, and property damage.

The interior as well as all sealing surfaces of pipe, fittings, and other accessories shall be kept free from dirt and foreign matter.

Gaskets shall be protected from excessive exposure to heat, direct sunlight, ozone, oil and grease.

W-24.11 Handling of PVC Pipe - Standard Procedures

When using forklifts or other handling equipment, prevent damage to PVC pipe.

When handling PVC pipe, avoid severe impact blows, abrasion damage and gouging or cutting by metal surfaces or rocks. Avoid stressing bell joints and damage of bevel ends.

Pipe shall be lowered, not dropped, from trucks and into trenches.

In preparation for pipe installation, placement (stringing) of pipe shall be as close to the trench as practical and on the opposite side from excavated earth. Bell ends shall point in the direction of work progress.

The Engineer may reject any pipe that shows visible signs of damage resulting from poor storage and handling practices.

W-24.12 Bedding Placement for Pipelines

Select fill material, used as pipe bedding, shall be placed by hand, in uniform layers not greater than 6 inches in loose thickness and thoroughly compacted in place. Select fill material pipe bedding shall extend to one foot over the top of the pipe.

Each layer of select fill shall be thoroughly tamped and compacted in place by hand or with suitable mechanical or pneumatic tools to a dry density not less than 95 percent of the maximum dry density as determined by AASHTO Des: T-180. No stone larger than 4 inches in diameter shall be placed closer than two feet to any point on any pipe.

W-24.13 Trench Backfill

Trench backfilling work shall be done in a manner to prevent dropping of material directly on top of any conduit or pipe from a vertical distance greater than 5 feet. In no case shall backfilling material from a bucket be allowed to fall directly on a structure or pipe and in all cases, the bucket shall be lowered so that the shock of falling earth will not cause damage.

Lumps shall be broken up and if there are any stones, pieces of crushed rock or lumps which cannot be readily broken up, they shall be distributed throughout the mass so that all interstices are solidly filled with fine material.

W-24.14 Backfill for Short Tunnel

Where pipelines are placed in short tunnels, the annular space between the outside of the pipe wall and the tunnel wall shall be completely filled with select fill material or suitable excavated material. Pipelines in short tunnels shall be suitably supported, to permit placing backfill which shall be suitably tamped in place.

W-24.15 Inspection and Testing of Backfilling

All backfill shall be subject to test by the Engineer.

* * *

W-32.01 General

This section includes all valves to be used on City maintained force mains, City owned pump stations and the Howard F. Curren Advanced Wastewater Treatment Plant. Requirements of this section apply to all valves unless exceptions are shown or stated on the plans or specific provisions.

Plug valves for buried applications shall be provided with mechanical joints. Plug valves for above-ground applications shall be provided with flanged connections.

All force main valves shall be plug valves meeting the requirements of the sub-section "Eccentric Plug Valves."

Valves 2 inches in diameter and smaller shall be all brass or bronze, except the handwheel, and shall have screwed ends. Valves 2-1/2 inches in diameter and larger shall be iron body, bronze mounted with flanged ends, except that in the smaller sizes, valves may be all bronze at the Contractor's option.

All gate, globe, and angle valves shall have rising stems, unless otherwise specified, and shall open when the nut or handwheel is turned counterclockwise. Each handwheel shall be marked with an arrow and the word "Open." Each nut shall be marked with an arrow and shall not be greater than 24 inches in depth below finished grade.

All references to "stainless steel" or "SS" shall mean 316 stainless steel.

All values of the same type shall be from a single manufacturer. Parts of values of the same type and size shall be interchangeable.

All valves shall be carefully erected in their respective positions, free from all distortion and strain, and shall be packed and left in satisfactory operating condition.

W-32.02 Submittals

The Contractor shall prepare and submit for approval a complete detail drawing of all valves in accordance with the requirements of the General Provisions. At minimum the submittal shall show all proposed material types to be used as well as proposed interior and exterior coating manufacturer, coating type and proposed minimum dry film thickness.

W-32.03 Flanges

Flanges shall be cast solid and faced accurately at right angles to the axis of the casting. Flanges shall be faced and drilled and shop coated with a rust preventive compound before shipment.

Dimensions and drillings of flanges shall meet the requirements of ANSI B16.1 for working pressures of 125 pounds per square inch. Special drillings shall be provided where required.

W-32.04 Gate Valves

Except as otherwise specified, gate valves shall meet the requirements of Fed. Spec. WW-V-54, Class A, 125 pounds.

Gate valves shall have standard stuffing box seals. Bonnet bolts, studs, and nuts shall be cadmium plated. Wedging devices shall be bronze to iron or bronze to bronze as specified. Glands shall be bronze bushed; gland bolts and nuts shall be bronze.

Gate valves 2-1/2-inch diameter and larger shall be of the double disc type. Gate valves 2- inch diameter and smaller may be of the double disc or solid wedge type.

Valves with operating nuts or wheels 7 feet or more above the floor shall be provided with chains and chain wheels.

W-32.05 Globe and Angle Valves

Except as otherwise specified herein, globe and angle valves shall meet the requirements of Fed. Spec. WW-V-51, Class A, 125 pounds.

W-32.06 Hose Valves

Hose valves shall be globe or angle valves with rising stems, and rubber composition discs for cold water pressures up to 200 psi, nonshock.

Hose valves shall be all bronze or brass, except the handwheel which shall be of malleable iron. Hose threads shall conform to ANSI B2.4.

W-32.07 Check Valves

Check valves, unless otherwise specified, shall be APCO Series 100 of the horizontal, swing type designed to allow full diameter passage and to operate with a minimum loss of pressure. A Letter of Standardization has been executed for this valve. The letter states that no other valve shall be considered an "or equal" in accordance with the City's standardization program. The "or equal" clause applies to all other equipment, unless specifically excluded by a Single Source Certificate or Letter of Standardization.

Check valves shall have body and body cover of heavily constructed cast iron meeting requirements of ASTM A48, Class 30. Check valve body shall have integrally cast-on end flanges. The flapper shall be rubber and have an "O" ring seating edge and be internally reinforced with steel. The flapper shall be easily replaced while the valve remains in place.

The exterior of the check valve shall be factory coated with an approved interior and exterior corrosion resistance coating. The exterior of the check valve shall receive a field coat as indicated for "Steel Pipe and Fittings" in the Workmanship & Materials Section titled "Painting".

W-32.08 Pump-Check Eccentric Plug Valve

Pump-check valves, unless otherwise specified, shall meet the requirements of the subsection for "Eccentric Plug Valves."

The valve shall be equipped with a G-Series rotary cylinder pneumatic actuator that is properly sized for the existing compressed air system within the pump station.

Plug valves shall be Dezurik PEF Eccentric Plug Valve. A Letter of Standardization has been executed for this valve. The letter states that no other valve shall be considered an "or equal" in accordance with the City's standardization program. The "or equal" clause applies to all other equipment, unless specifically excluded by a Single Source Certificate or Letter of Standardization.

W-32.09 Eccentric Plug Valves

Plug valves shall be of the eccentric valve design and shall meet or exceed the requirements of AWWA C517 and shall be designed for 175 PSI 3'-12" and 150 PSI 14"- 36."

Manufacturer's Name shall be cast in body and Valve shall be serialized for future parts identification. Port area shall be 100% of standard pipe area. The Plug shall be Rectangular with associated Rectangular Port and shall provide dead tight shutoff when seated in the closed position. Body material shall be Cast Iron ASTM A126 Class B, Seats shall be 1/8" thick 95% Nickel and 1/2" wide for proper plug seating. Plug shall be Ductile Iron ASTM A536 and

Chloroprene Faced. Bearings shall be sintered, oil impregnated permanently lubricated type 316 stainless steel, include upper and lower grit excluders to prevent grit and foreign solids from entering the bearings. Shaft seals shall be multiple V- ring type and shall be externally adjustable via an air gap and re-packable under pressure without removing the actuator or bonnet from the valve. Valves shall have interior and exterior epoxy.

Plug valves shall be nut operated (1/4 turn) 4" to 8" and gear operated 10" and larger. Both nut and gear operated valves shall have a 2-inch square nut for operation. On pump stations where the valve is 7 feet or more above the floor level, a chain and wheel shall be provided for operation.

Plug valves shall be Dezurik PEF (100% Port) eccentric plug valve or approved equal.

W-32.10 Knife Gate Valves

Valves shall be bonnet-less wafer knife gate type with cast single-piece body construction. Lugged ends shall have threaded holes in accordance with ANSI B16.1. 25/150 pound standards. Working pressure rating shall be 150 psi in sizes 2"-24". Valve body and gate shall be stainless steel type 316 or as specified. Stem shall be type 304 stainless steel. Valve shall have a round port equal to 100% of the connecting pipe. Valves shall be chloroprene resilient seated or as specified.

The body design shall have no pockets or grooves in the flow port where media can settle and adversely affect closure. The gate shall be polished to provide low thrust requirements and long packing life. The leading edge of the gate shall be beveled to assist in closure. The stem shall be outside of the body and will not contact the flowing media. Valves shall have multi-layer square packing with adjustable packing gland bolting.

All valve bodies shall be tested with water at 150% of rated pressure with no visible leakage. Assembled valves shall be tested for seat leakage with water at 40 psi applied to the back of the gate (pressure in the normal flow direction) and allowable leakage shall be as per MSS SP-81 specifications.

Valves shall be provided with a manually operated direct-mounted handwheel as specified or shown on the construction drawings. Floor stands and extensions shall be provided if specified. Valve superstructures shall be designed to allow easy field interchangeability between manual and pneumatic actuators. New superstructures shall not be required for conversion between manual and pneumatic operators.

Metal surfaces other than stainless steel shall receive a field coat as indicated for "Steel Pipe and Fittings" in the Workmanship & Materials Section titled "Painting". Valves shall be model GKU by DeZURIK, Inc, or approved equal.

W-32.11 Multiport Valves

Three-way and four-way valves, unless otherwise specified, shall meet the requirements of the sub-section for eccentric plug valves.

W-32.12 Solenoid Valves

Solenoid valves, unless otherwise shown or specified, shall be normally closed packless type with full area ports. The body and bonnet shall be forged brass and the solenoid core shall be stainless steel. The diaphragm shall be of synthetic rubber assuring long service life. The coils shall be designed for 115-volt, 60-hertz operation and shall be embedded in molded plastic in NEMA Type I general purpose enclosure.

W-32.13 Ball Valves for CPVC Piping

Manually operated ball valves for CPVC piping shall be CPVC ball valves having renewable Teflon ball seats and EPDM seals. Ball valves shall block in both seating directions, leaving full pressure on the opposite end of the valve. The CPVC ball valves shall be rated at not less than 150 psi working pressure at 75 degrees F, self-lubricating, and shall have socket end connectors. The ball valves shall be of true union design to allow for inspection or removal. CPVC ball valves shall be as manufactured by Hayward Industrial Products, Inc., or equal.

W-32.14 Ball Check Valves for CPVC Piping

Ball check valves for CPVC piping shall be constructed of solid CPVC and shall have a CPVC ball. The check valve shall have EPDM O-rings and shall be capable of operating either horizontally or vertically. The check valve shall have a full flow design that provides a free open area that is equivalent to the connecting pipe size. The check valves shall have socket end connectors and shall be of the true union design to allow for inspection and removal of the valve. Ball valves for CPVC piping shall be as manufactured by Hayward Industrial Products, or equal.

W-32.15 Testing

All valves shall be given hydrostatic shop pressure tests at twice the working pressure specified. The valves shall be tested, first by applying the hydrostatic pressure with the valve open and then with the valve closed. The valves shall be tight and secure under the test pressure.

Valves shall be tested in place by the Contractor, as far as practicable, and any defects in valves or connections shall be corrected to the satisfaction of the Engineer.

W-32.16 Painting and Coating

Plug valves shall receive a factory interior and exterior coating of Tnemec Series 141 (4 mils thick).

All other valves shall receive a factory interior and exterior coating of an approved system. Metal surfaces other than stainless steel shall receive a field coat as indicated for "Machinery and Equipment" in the Workmanship & Materials Section titled "Painting".

Chain wheels shall be coated by galvanizing or electroplating with zinc or cadmium. The chain shall be coated by electroplating with zinc or cadmium. Zinc electroplating shall meet the requirements of Fed. Spec. QQ-Z-325, Type II, Class 2; and cadmium electroplating shall meet the requirements of Fed. Spec. QQ-P-416, Type II, Class 2.

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SECTION W-52 – MANHOLE PROTECTIVE COATINGS & REHABILITATION

W-52.01 General

This specification provides technical information for the installation of protective coatings on existing or proposed brick and concrete manholes, junction chambers and structures. The specification also provides information on requirements for rehabilitating deteriorated brick and concrete manholes and structures to restore the structural integrity and to provide a suitable surface for the installation of the protective coating. Protective coatings shall consist of a 100% solids epoxy system, or polymorphic resin rehabilitation system as specified herein. All aspects of the installation and required rehabilitation shall be done in strict accordance to the manufacturer's instructions.

It is the Contractor's responsibility to comply with OSHA standards and all regulations pertaining to work in confined space entry.

W-52.02 Submittals

Prior to the commencement of any coating or rehabilitation work, the Contractor shall submit the following to the Engineer for approval:

- A. A plan detailing the methods, materials and procedures proposed for the coating and/or rehabilitation of the structures.
- B. Details of methods for the containment of debris.
- C. Description of all the equipment to be used for the coating and/or rehabilitation.
- D. Safety plan describing all safety and ventilation equipment to be utilized in compliance with OSHA standards pertaining to work in confined space entry.
- E. Written certification by the protective coating manufacturer stating that the proposed concrete repair material is compatible and acceptable as a substrate for the protective coating to be applied.

W-52.03 Surface Preparation

The Contractor shall remove all corroded materials from the existing manholes or structures and complete all surface preparation in strict accordance with both the approved concrete repair material and the protective coating manufacturers' written instructions. All surfaces to be rehabilitated shall be cleaned with a high pressure water spray (10,000 psi) or other method as required by the approved material's manufacturer. Surfaces shall be cleaned and abraded to produce a sound and uncontaminated surface with adequate profile and porosity to provide a strong bond between the proposed material and the substrate. Mechanical methods such as chipping, brushing or other methods approved by the engineer may be necessary to

SECTION W-52 – MANHOLE PROTECTIVE COATINGS & REHABILITATION

expose sound concrete. If sand blasting is utilized to achieve the necessary substrate, 100% of the material shall be contained and disposed of as approved by the Engineer. All sand blasting shall be followed by water blasting in order to remove sand and dust from the concrete substrate. The use of acid for cleaning purposes will not be allowed. All corroded materials that are removed shall be disposed of at an off-site location in accordance with all Federal, State, and local regulations

Concrete repair materials shall be applied in strict accordance with the manufacturer's instructions and shall be finished as recommended by the protective coating manufacturer. At minimum, the repair material shall be troweled or brushed to provide a smooth surface with an average profile equivalent to coarse sandpaper to optimally receive the protective coating.

Prior to the project's initial application of either the approved concrete repair material or protective coating, the applicable manufacturer's representative must inspect and approve the completed surface preparation in the presence of the Engineer and Inspection personnel. The approved surface should be a guideline for additional surface preparation for the remainder of the project. It is the manufacturer's discretion whether additional site inspections of the finished surface preparation is necessary before application of the rehabilitation material.

The moisture content of the substrate shall be measured using an on-site concrete moisture meter to record the percent moisture levels in at least one location per every 300 square feet of surface to be rehabilitated or as recommended by the manufacturer. The moisture content shall be at a level acceptable to the manufacturer before applying concrete repair or protective coating materials. If moisture content levels are unacceptable, additional curing time or other means as approved by the engineer will need to be implemented to achieve the proper moisture content.

W-52.04 Concrete Repair Materials

- A. The following products manufactured by the Sika Corporation have been determined to be suitable for the necessary repairs. Products of other manufacturers may be acceptable, providing they meet or exceed the mechanical properties, service records and warranties of the following products:
 - 1. <u>SikaTop 123 Plus</u> a two-component, polymer-modified, non-sag cementitious mortar intended for vertical and overhead surfaces. This product also contains FerroGard 901 penetrating corrosion inhibitor
 - <u>SikaRepair 224</u> a one component, cementitious mortar intended for repair of vertical and overhead surfaces. Formulated for application by trowel or low-pressure spray.

SECTION W-52 – MANHOLE PROTECTIVE COATINGS & REHABILITATION

- 3. <u>Sika Armatec 110 EpoCem</u> a three component, solvent-free, moisture tolerant, epoxy-modified, cementitious product specifically formulated as a bonding agent and an anti-corrosion coating. This product shall be applied on existing steel reinforcement.
- B. All surface preparation, storage and application of these products shall strictly conform to the manufacturer's instructions and recommendations. These products shall be manufactured to ISO 9001 and 9002 standards.

W-52.05 Epoxy Coating System

- A. The sprayed applied epoxy coating system shall be as manufactured by Raven Lining Systems, Broken Arrow, Oklahoma, Sherwin Williams Cor Cote SC, Cleveland, Ohio or equal
- B. The product shall be a 100% solids, solvent-free ultra high-build epoxy
- C. The finished epoxy shall be resistant to sulfuric acid attack associated with domestic sewage
- D. The epoxy shall be manually sprayed onto the structure to provide a uniform smooth and even surface
- E. The minimum finished thickness shall be as specified on the plans
- F. The coating system shall be capable of being applied over wet surfaces without degrading the final product.
- G. The cured epoxy system shall conform to the minimum physical standards, as listed below:

CURED EPOXY	STANDARD	LONG-TERM DATA
TENSILE STRENGTH	ASTM D-638	7,500 psi
FLEXURAL MODULUS	ASTM D-790	600,000 psi
FLEXURAL STRESS	ASTM D-790	13,000 psi
COMPRESSIVE STRENGTH	ASTM D-695	18,000 psi

- H. The Contractor shall provide certified independent, third party test results verifying the minimum physical properties listed above. The tests shall be in conformance with the ASTM specifications listed.
- I. The finished liner shall be cured in strict accordance with the manufacturer's instructions.
- J. Composite systems containing layers of different materials or cured-in-place resin systems will not be considered as equal.

SECTION W-52 – MANHOLE PROTECTIVE COATINGS & REHABILITATION

W-52.06 Polymorphic Resin Systems

- A. The sprayed applied Polymorphic Resin system shall be as manufactured by Integrated Environmental Technologies, Santa Barbara, California or equal.
- B. The Polymorphic Resin shall be a 100% solids, two component, highly modified isothalic polyester resin material.
- C. The finished resin shall be resistant to sulfuric acid attack associated with domestic sewage. The minimum finished thickness shall be as specified on the plans.
- D. The cured resin system shall conform to the minimum physical standards, as listed below:

CURED RESIN	STANDARD	LONG-TERM DATA
TENSILE STRENGTH	ASTM D-638	4,900 psi
FLEXURAL STRESS	ASTM D-790	8,630 psi
FLEXURAL MODULUS	ASTM D-790	15,120 psi

- E. The Contractor shall provide certified independent, third party test results verifying the minimum physical properties listed above. The tests shall be in conformance with the ASTM specifications listed.
- F. The finished liner shall be cured in strict accordance with the manufacturer's instructions. Composite systems containing layers of different materials or cured-in-place resin systems will not be considered as equal.

W-52.07 Fiber-Reinforced Modified Polyamine Epoxy System

- A. The spray-applied polyamine resin system shall be Cor Cote FRE as manufactured by the Sherwin Williams Co, Cleveland, Ohio, Perma-Shield FR, Series 436 as manufactured by Tnemec Company, Inc, Kansas City, Missouri, or equal.
- B. The finished polyamine epoxy shall be resistant to sulfuric acid attack associated with domestic sewage.
- C. The epoxy shall be manually sprayed onto the structures to provide a uniform smooth surface.
- D. The minimum finished thickness shall be as specified on the plans.
- E. The coating system shall be capable of being applied over wet surfaces without degrading the final product.

SECTION W-52 – MANHOLE PROTECTIVE COATINGS & REHABILITATION

- F. Concrete surfaces shall be prepared for the application of the fiber reinforced modified polyamine system by cleaning and stoppage of infiltration as specified above. Prior to applying the modified polyamine liner, concrete surfaces shall be repaired to the extent needed to provide a smooth and even surface to which the liner will adhere.
- G. The cured fiber-reinforced modified polyamine system shall conform to the minimum physical standards, as listed below:

CURED RESIN	STANDARD	LONG-TERM DATA
TENSILE STRENGTH	ASTM D-638	2,507 psi
FLEXURAL STRESS	ASTM D-790	8,148 psi
FLEXURAL MODULUS	ASTM D-790	540,000 psi

- H. The Contractor shall provide certified independent, third party test results verifying the minimum physical properties listed above. The tests shall be in conformance with the ASTM specifications listed.
- I. The finished liner shall be cured in strict accordance with the manufacturer's instructions.

W-52.08 Contractor Qualifications

- A. The manufacturer and the Contractor's installer of the rehabilitation system shall have been specialized in the design and installation of the rehabilitation system for at least 5 years
- B. The installer, which must be a person in responsible charge, as approved by the Engineer, shall be approved and certified in writing by the manufacturer and shall be completely trained in leak repair, surface preparation, and installation of the rehabilitation system
- C. References shall be provided upon request to demonstrate that the installer has successfully used the rehabilitation system in Florida on a minimum of 5 projects, one of which must be at least 5 years old

W-52.09 Thickness Verification and Inspection

A. The Contractor shall provide a method of verifying the actual coating thickness installed to ensure it meets or exceeds the minimum values specified. The proposed liner thickness verification method shall be submitted to the Engineer for approval. Dry film thickness readings can be taken on concrete by the use of ultrasonic thickness gauges in strict accordance with SSPC PA 9.

SECTION W-52 – MANHOLE PROTECTIVE COATINGS & REHABILITATION

- B. Contractor may utilize a wet film thickness gage meeting ASTM D4414 to ensure monolithic coating and uniform thickness during application. A minimum of three readings per 200 square foot area shall be recorded. Documentation on thickness readings shall be conveyed to the Inspector on a daily basis when the coating application occurs.
- C. All phases of the structure rehabilitation such as surface preparation, liner application, curing, testing, etc., will be inspected by the City's Field Engineering personnel for conformance to the specifications, construction drawings, and manufacturer's instructions. The Contractor shall coordinate all rehabilitation work with the City and with due regard for site and weather conditions prevailing at the time.

W-52.10 Spark Testing

- A. The coating system shall be spark tested prior to acceptance
- B. The holiday testing shall be in strict accordance with NACE SPO188
- C. After the coating system has set hard to touch the coating shall be inspected with high-voltage holiday detection equipment.
- D. The spark tester shall be initially set at 100 volts per 1 mil (25 microns) of minimum specified (not average) film thickness applied but may be increased if it is insufficient to detect the induced holiday.
- E. All detected holidays shall be marked and repaired per the manufacturer's recommendations
- F. All costs associated with the testing shall be born by the Contractor
- G. Testing equipment shall be in good working condition and evidence of certified calibration within the last year shall be provided before the detection test equipment shall be used

W-52.11 Warranty

- A. The Contractor shall furnish the City of Tampa with an unconditional 5-year warranty for materials and workmanship. This warranty shall be a guarantee against failure for the warranty period. Failure shall be defined to occur if the rehabilitation system fails to:
 - 1. Prevent the internal damage or corrosion of the structure
 - 2. Adhere to existing structure surface.
- B. If any failures occur within the specified warranty period after final acceptance, the Contractor shall repair or restore the structure to its previously accepted state including all materials, labor, and at no additional cost to the City
- C. Repair shall be completed within 30 days of written notification of the failure.

SECTION W-72 - TELEVISION INSPECTION

W-72.01 General

TV inspections of gravity sewers shall be performed by means of a radial view closedcircuit color television camera. The inspection will be done one manhole section at a time. Flow in existing gravity sewers sections requiring inspection shall be maintained and controlled as required to allow passage of the camera and to allow a visual inspection of the entire circumference of the pipe along the length of the pipeline. Contractor will be required to submit methods for controlling flow and maintaining service during these inspections. Prior to the inspection of newly constructed gravity sewers, water shall be run through the pipeline so that depressions or dips in the alignment can be identified during the inspection.

W-72.02 Camera

The television camera used for the inspection shall be specifically designed and constructed for inspections of pipelines. The camera shall be capable of providing a radial view for inspection of the top, bottom, and sides of pipe and for looking up lateral connections. The camera shall be mounted on adjustable skids, or self propelled, to keep it in the center of the pipe. Lighting of the camera shall be supplied by a lamp on the camera, capable of being dimmed or brightened remotely from the control panel. The lighting system shall be capable of lighting the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions and shall have a minimum of 650 lines of resolution. The camera, television monitor, recording devices, and other components of the video system shall be capable of producing a picture quality satisfactory to the Engineer.

The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire manhole section, the Contractor shall set up his equipment so that the inspection can be performed from the opposite manhole. If, again, the camera fails to pass through the entire sewer section, the Contractor shall immediately report this information to the City. For post- construction inspections of Developer installed projects, the owner shall be notified of the problem and shall repair the deficiency to the City's satisfaction.

When manually operated winches are used to pull the television camera through the line telephones or other suitable means of communication shall be set up between the two manholes of the section being inspected to ensure good communications between members of the crew.

SECTION W-72 - TELEVISION INSPECTION

W-72.03 Measurements

The importance of accurate distance measurements is emphasized. A distance meter shall be used for accurately recording the location of defects and key features along the pipeline. The distance meter shall be a direct reading, above ground, friction clamp device or other suitable equipment. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. The meter shall be capable of reducing readings for reverse movement of the camera and shall be capable of being manually re-zeroed for each new setup. The importance of accurate distance measurements is vital. Accuracy of the measurement meter shall be checked daily by use of a walking meter, roll-a-tape, or other suitable device. Footage measurements shall begin at the centerline of the starting manhole and end at the centerline of the ending manhole. Footage shall be shown on the video view and recorded at all times.

W-72.04 Documentation of Inspection

Written television inspection reports shall be provided for each line segment inspected to document defects and key features along the pipeline. The National Association of Sewer Service Companies (NASSCO) coding system shall be used. Information that should be included in the inspection logs is indicated below. One (1) copy of these records shall be supplied to the City.

Video recordings shall also be supplied to provide a visual and audio record of the TV inspection. Video playback shall be at the same speed that it was recorded. A complete recording shall be made of each line televised. A voice recording shall be included that provides brief and informative comments on the sewer conditions. All television inspection videos shall be in DVD format. Video tapes in VHS format will not be accepted. The video file shall be an MPEG4 viewing format and compatible with viewing in Microsoft Windows Media Player.

Inspection reports shall use NASSCO standard coding system and shall include, but not be limited to, the following information:

- Date, time, city, street, name of operator, inspector, and weather conditions
- Pipe diameter, pipe material, section length, depth of pipe, length between joints, and corresponding video recording identification
- Location of each point of leakage
- Location of each service connection
- Location of any damaged sections, nature of damage, and location with respect to pipe axis.
- Deflection in alignment of grade of pipe.

SECTION W-72 - TELEVISION INSPECTION

Video recordings shall include written information on the screen and an audio recording describing the inspection and findings. The DVD shall be labeled with information on the location of the inspection, description of the sewer lines, date, inspection company, and other information to identify the inspections included on the DVD. The following information shall be included in video:

Visual (on screen in corner):

- Report number.
- Date of television inspection.
- Sewer section and number.
- Pipe size and material
- Distance along reach (tape counter footage).

Audio:

- Date and time of television inspection, operator name, name of overlying or adjacent street, and manhole numbers.
- Verbal confirmation of sewer section and television direction in relation to direction of flow.
- Verbal description of pipe size, type, and pipe joint length.
- Verbal description and location of each service connection and pipe defect.
