



## **UTILITY STANDARDS**

**VOLUME 1 OF 4: DESIGN PROCEDURES MANUAL**

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**CITY OF CAPE CORAL  
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## SECTION 1 - GENERAL REQUIREMENTS

### 1.1 GENERAL INFORMATION

**The Design Procedures express general information and standards for the installation of all utility infrastructure within the boundaries of the City of Cape Coral.**

The City of Cape Coral enacts the following three documents for utility infrastructure design and construction: Utility Design Procedures, Technical Specifications, and Standard Utility Drawings & Details.

The Design Procedures consist of nine Sections: (1) General Requirements, (2) General Piping Criteria, (3) Potable Water Systems, (4) Irrigation Water Systems, (5) Sanitary Sewer Gravity Systems, (6) Sanitary Sewer Force Mains, (7) Lift Stations, (8) Service Connections, and (9) Storm Water Systems. General sections of the Design Procedures contain General Requirements that govern the Work for each type of utility system.

The Technical Specifications consist of Divisions 02 – 17. General specifications contain General Requirements that govern the Work associated with each type of utility system.

The Standard Utility Drawings & Details consist of the following five groups of Details and Descriptions; (1) General; Sitework, Roads, Drainage and Flood Control. (2) Sewer Utilities; General Yard/Field Installation, Piping and Valves, Manholes, Lift Stations and Master Pump Stations. (3) Water Utilities; General Yard/Field Installation, Piping and Valves, Manholes. (4) Irrigation Utilities; General Yard/Field Installation, Piping and Valves, Manholes. (5) Fiber Optics; General Field Installation. These standard drawings & details contain General Requirements that may or may not be applicable to the Work for a given Project.

**The use of the City's Utility Standards will be required for all water, wastewater, irrigation, and fiber optic utility projects within the City of Cape Coral unless authorized by the City's Utility Department.** The City of Cape Coral has established a comprehensive set of Utility Standards that consist of the Design Procedures Manual, Front End Documents, Technical Specifications, and Standard Utility Drawings & Details, to provide for the planning and design of utility infrastructure within the City. Review all documents relevant to the project and contact the City's Utility Department with any questions, concerns, or clarifications, of the Utility Standards. Additional City guidelines; Qualified Products List (QPL), Engineering Design Standards. Project documents may be required to be submitted under a City selected Project Management Information System (PMIS).

Any work or materials that do not conform to the City of Cape Coral's Utility Standards and/or Qualified Products List (QPL), or any work performed without the knowledge of the City of Cape Coral Utilities Inspectors or Representatives is subject to removal and

replacement at the contractor's expense.

The contractor is responsible for following the Scheduled Shutdown Procedures (1.2) regarding notification of the City's Utilities Departments, for all utility system shutdowns.

The contractor is prohibited from operating any existing main line valves. These valves will be operated by a representative of the City of Cape Coral's Utilities Department.

The contractor or owner's representative will be responsible for obtaining an appropriately sized temporary jumper assembly with meter from the City of Cape Coral's Utility Collection and Distribution Division at 239-574-0852 prior to receiving City water for construction and/or tying into any existing potable water main lines. A billing account must be set up through the City's Customer Billing Department prior to installation. A representative from the City of Cape Coral's Site Development and Review Division at 239-573-3167 or 239-573-3184 must be notified 48 hours in advance of installation and be present to witness and record the installation process. Account documentation must be submitted to the Site Development and Review inspector at the time of meter installation. After construction is complete and before the temporary jumper and meter is removed all potable water mains shall be flushed and pressure tested per AWWA section C600 and disinfected per AWWA C-651.

The contractor is responsible for notifying the City of Cape Coral's Utilities Department (239-574-0852) a minimum of 48 hours prior to any pressure test on the water, irrigation, or sewer main.

Installation or replacement of all backflow prevention devices must be in accordance with the approved Utilities Collection/Distribution Backflow Replacement Procedures. Testing shall be performed by a certified cross connection control technician. Results must be emailed to [ucdinsp@capecoral.gov](mailto:ucdinsp@capecoral.gov).

The contractor or owner's representative shall order any Protectus III meter(s) and pre-pay for them in advance through the City of Cape Coral's Utilities Collections and Distribution Division at 239-574-0860. A billing account must be set up through the City's Customer Billing Department prior to installation. Upon installation a representative from the City of Cape Coral Site Development and Review Division at 239-573-3167 or 239-573-3184 must be notified 48 hours in advance and be present to witness and record the installation process. Account documentation must be submitted to the Site Development and Review inspector at the time of meter installation. After construction is complete and before the temporary jumper and meter is removed all new potable water mains shall be flushed and pressure tested per AWWA section C600 and disinfected per AWWA C-651.

The existing utility service connections that will not be utilized for this project shall be abandoned at the main or point agreed upon by the Utilities Inspector, in accordance with City of Cape Coral Specifications.

The contractor shall provide all labor, materials, and equipment necessary to dewater trench

and secure excavations. The contractor shall secure all necessary permits associated with the City of Cape Coral Utilities Standards, Technical Specifications section 02140. All dewatering shall comply with the regulations of the South Florida Water Management District and any agency with jurisdiction.

All service laterals 2" and above shall require the installation of a resilient-seated gate valve and cast-iron valve box. Please refer to the City of Cape Corals Utilities Standards, Technical Specifications Sections 2.1 and 2.2 pages 15001-1 and 15001-2.

All potable water and irrigation meters for domestic and fire protection shall be ordered and paid for through the City of Cape Coral's Customer Billing Department at 239-574-7722. Please reference the City of Cape Coral's Code of Ordinances Section 19-23 "All water meters shall be furnished and remain properties of the city and shall be accessible and subject to its control". Meters are to be Neptune Radio Read and shall be furnished and installed when the subject utility main(s) are properly pressure tested, bacteriological tested and formally accepted by an authorized representative of the City of Cape Coral.

After the Utilities Department issues site plan approval for the subject project the engineer of record may submit the required HRS and/or DEP permit applications to the Utilities Department for proper execution. Please contact the Utility Department at 239-574-0710 for further information and or assistance.

The engineer of record shall provide utility turn-over/project close out documentation to the City of Cape Coral for any utility and/or right-of-way infrastructure constructed and conveyed to the City of Cape Coral for ownership and maintenance prior to C.O. The formal utility/right-of-way acceptance documentation shall include the following: *(signed and sealed record drawings (minimum 4 copies) and GIS shapefiles, an engineer's certification letter stating that the project was built in accordance with the plans and specifications, HRS and/or DEP permits to place in service, backflow certifications, operations and maintenance manuals (lift stations), list of contributory assets all signed and sealed by a professional engineer registered in the state of Florida, a release of lien by the contractor, one year warranty for materials and labor and bill of sale, all Utility Agreements, and other any other ownership documents)*. Electronic copies of the (list of contributory assets, release of lien by contractor, one-year warranty for materials and labor and bill of sale) which can be obtained by contacting Site Development and Review at 239-573-3167. Once the documentation has been finalized and properly executed by the engineer of record the City of Cape Coral requires 2 sets of final close out documentation. One set shall be distributed to City of Cape Coral Utilities Department at 239-574-0710; the second set shall be distributed to the Site Development and Review Division at 239-574-0583.

The City requires the Contractor to obtain a Right-of-Way Permit prior to performing any work in the City R.O.W. The Contractor has been provided an application with their approved set of plans. The application should be submitted with a MOT (maintenance of traffic) design/plan/drawing. The MOT Plan can be from the FDOT Design Standards Index 600 series, which is available thru [www.myflorida.com](http://www.myflorida.com) or [www.fdot.com](http://www.fdot.com) or the contractor can

have a local traffic control company supply them with the MOT Plan. If you have any questions on the ROW/MOT permit please contact the City of Cape Coral Public Works Department.

For all meter changes (i.e. irrigation or domestic) the Engineer of record (not the contractor) must submit either a minor revision to the approved utility plan and/or a revision letter delineating the subject change.

For all items installed during construction, including but not limited to, valves, pumps, generators, electrical panels, air valves, antennas, etc. contractor shall submit at a minimum one (1) copy of all manufacturer's documentation (ex. operation and maintenance manuals) to the City for each type of unit installed.

## **1.2 SCHEDULED SHUTDOWN PROCEDURES**

Contractors must submit a Scheduled Shutdown Request to the assigned City of Cape Coral Utilities Project Manager listed below, a minimum of 10 business days prior to the proposed work schedule. This request must include the type of utility to be isolated, actual address of the proposed work, proposed date, proposed time, and a summary of the work performed. Please note\* Potable Water Main Shutdowns will be typically scheduled between 9AM and 3PM on a Monday or Tuesday to avoid existing customers under a boil water notice on weekends. All other types will be typically scheduled from Monday thru Friday during regular business hours.

### **Utilities Project Manager Groups**

- For Utilities Extension Projects (UEP), send to UEP Project Managers and/or Engineers
- For Utilities CIP Projects, send to Utilities Admin Project Managers and/or Engineers.
- For Private Development Projects, send to UCD Chief Inspector and/or UCD Inspectors

The assigned City of Cape Coral Utilities Project Manager will review the initial request and forward it via email to the Utilities Divisions listed below, a minimum of 7 business days prior to the proposed work schedule for approval to proceed on the requested date and time. The request must include a GIS image marking the exact location to expedite the confirmation from the responsible Utilities Division.

**Email Subject Line:** Scheduled Shutdown Request @ "Actual address of work site".

### **Potable Water and Irrigation (Reuse) Water Mains:**

TO: [ucdinfo@capecoral.gov](mailto:ucdinfo@capecoral.gov) Utilities Collection and Distribution Division (UCD)

**Raw Water Transmission Mains:**

TO: [roinfo@capecoral.gov](mailto:roinfo@capecoral.gov) Water Production Division. (The Chief Operator and Maintenance Supervisor will coordinate with Utilities Collection and Distribution Division (UCD))

CC: [ucdinfo@capecoral.gov](mailto:ucdinfo@capecoral.gov) Utilities Collection and Distribution Division (UCD)

**Sewer Force Mains:**

TO: [waterrec@capecoral.gov](mailto:waterrec@capecoral.gov) Utilities Water Reclamation. The Maintenance Supervisor for Lift Stations will coordinate with Utilities Collection and Distribution Division (UCD)

CC: [ucdinfo@capecoral.gov](mailto:ucdinfo@capecoral.gov) Utilities Collection and Distribution Division (UCD)

A designated representative from each Utilities Division listed above, will examine the proposed Scheduled Shutdown Request for modifications that may be needed to minimize disruptions for affected customers or for necessary repairs to the existing utility infrastructure during the proposed shutdown. The designated Utilities Division will review the request and coordinate any changes to the shutdown plan with the “requesting” project manager to mutually agree on the plan, date, and time. Please note\* upon activation of automated customer notifications, date and times cannot be changed or rescinded, as they can only be cancelled. Please ensure the date and time is accurate to prevent re-occurring customer notifications for a single event. After final approval has been confirmed, an “Advanced Notice” email will be issued by the designated Utilities Division to the assigned project manager, designated City staff, and the current health department representatives. Please note\* This email will serve as approval to proceed with the scheduled shutdown on the assigned date and time, thus providing adequate time for additional customer notifications if needed. This email will also include an outlined area of the proposed shutdown and a meeting request to ensure the scheduled shutdown is added to the Outlook calendars of all responsible City representatives.

**For more detailed information pertaining to each scheduled shutdown type, please refer to the following pages of this document.**

### **1.2.1 SCHEDULED SHUTDOWNS OF EXISTING POTABLE WATER MAINS**

- 1) Potable Water Main Shutdowns will be typically scheduled on a Monday or Tuesday to avoid placing existing customers under a boil water notice on weekends. Potable Water shutdowns performed during regular business hours shall be performed between 9AM and 3PM with customer notification to ensure adequate time for unexpected circumstances.
- 2) Upon agreement of the designated date and time, a UCD/GIS staff will complete the following approximately 5 days prior to the scheduled shutdown:

- a) Issue a Scheduled Shutdown Notice using the Automated Utility Notification System. The outlined area can be viewed from the following link:  
<http://egov.capecoral.gov/mr/mr.aspx?ID=0>
  - b) Send an “Advanced Notice” email to the assigned project manager, designated city staff, and the current health department representatives. Please note\* This email will serve as approval to proceed with the scheduled shutdown on the assigned date and time, thus providing adequate time for additional customer notifications if needed. This email will also include an outlined area of the proposed shutdown and a meeting request to ensure the scheduled shutdown is added to the outlook calendars.
- 3) Advanced Customer Notifications:
- a) **for UEP and Utilities CIP Projects (if included in the current contract)**, the Utility Contractor will be responsible for delivering scheduled shut down notices to all affected residents no later than 3 business days (72 hours) prior to the scheduled shutdown time. All Bacteriological testing should be scheduled in advance to limit the time of inconvenience to the residents. The Utility Contractor must pre-schedule and conduct all testing per City of Cape Coral Technical Specifications under Section 02666 – Pressure Pipeline Testing and Disinfection at the contractor’s expense.
  - b) **For all other projects**, a water sampling fee of \$325 will be added to the project for UCD/GIS staff to conduct advanced customer notifications (per step 2 above) and for water sampling to be conducted by a UCD field staff (step 9 below).
- 4) Prior to a scheduled shut down, UCD field staff will verify the location and operation of all isolation valves for the proposed shutdown area. Residents in the vicinity may experience fluctuations in water pressure while crews exercise isolation valves. This is needed to ensure the area can be isolated by determining if the valves are operating normal or broken. Residents may also notice a discoloration of water and multiple hydrants running water. Unfortunately, this inconvenience is necessary to restore our customer’s water service to this area as quickly as possible on the day of the shutdown.
- 5) On the scheduled date, UCD field staff will open all hydrants or flushing points needed to exercise the valves for the affected area. Utility contractors are prohibited from operation of City owned utility valves, hydrants, and flushing points without the supervision of a City of Cape Coral representative. In the event of a valve malfunction, it will be up to the discretion of the UCD Field Staff on site to determine if a larger area could be isolated, or to abort the proposed shut down. Once the utility main is shut down, UCD field staff must notify UCD/GIS staff immediately to inform the area has been isolated.
- 6) Upon receiving notice from UCD Field staff, the UCD/GIS Tech will:
- a) Issue a “Boil Water” advisory using the Automated Utility Notification System.
  - b) Send a “water off” email to the assigned project manager, designated city staff, and the current health department representatives.

- c) Contact UCD Flushing Supervisor for placement of boil water signs at the entrances to the area(s).
  - d) Ensure Water Sampling is initiated per step 3 above.
- 7) The utility contractor is responsible to perform all work in accordance with the most recent City of Cape Coral Standard Details and Technical Specifications Manuals, including the installation of all applicable joint restraints. All new fittings and pipe must be disinfected with chlorine and free of debris during installation to avoid contamination of utility lines.
- 8) After completion of the utility work, UCD field staff will:
- a) Slowly charge the water main to purge air and prevent excessive “water hammer” on the system.
  - b) Ensure adequate flushing has been accomplished and the isolated area is ready for sampling.
  - c) Notify UCD/GIS staff immediately to inform the pressure has been restored to the area.
- 9) The UCD/GIS Tech will send a “Water Service Restored / Ready to Test” email to the assigned project manager, designated city staff, and the current health department representatives, to inform the water service has been restored.
- 10) Water Sampling Process:
- a) **For UEP and CIP Projects (if included in the current contract),** After adequate flushing has been accomplished, the utility contractor will test the affected area for bacteriological quality in accordance with the requirements of the Lee County Health Department (LCHD) or other regulatory agency approved by the City at the utility contractor’s expense. Should the initial disinfection fail to produce satisfactory results, the contractor must repeat the test until acceptable results have been achieved. Failure to provide immediate bacteriological testing may result in UCD staff conducting additional testing at the utility contractor’s expense.
- Please note\* The utility contractor is responsible to ensure the “contracted NELAC lab” is informed to send all bacterial analysis sheets directly to [ucdinfo@capecoral.gov](mailto:ucdinfo@capecoral.gov). This step is required to eliminate possible clearance delays for existing utility customers for the City of Cape Coral.
- b) **For all other projects, UCD field staff** will test the affected area for bacteriological quality in accordance with the requirements of the Lee County Health Department (LCHD) or other regulatory agency approved by the City at the utility contractor’s expense, per step 3 above.
- 11) Upon receiving bacterial analysis sheets showing two days of confirmed negative results with no Coliform or E. Coli detects from a NELAC lab the UCD/GIS Tech will:
- a) Issue a Rescission Notice using the Automated Utility Notification System.

- b) Send a “Rescission Notice” to the assigned project manager, designated city staff, and the current health department representatives.
- c) Contact UCD Flushing Supervisor to exchange all boil water signs with rescission signs.

## **1.2.2 SCHEDULED SHUTDOWNS OF EXISTING REUSE (IRRIGATION) MAINS**

1. Reuse Water (Irrigation) Shutdowns will be typically scheduled from Monday thru Friday.

Note\* isolation of large diameter irrigation transmission mains, or isolation of a large area, must be coordinated with the Water Reclamation Reuse Coordinator, prior to issuance of the scheduled shutdown notification.

2. Upon agreement of the designated date and time, a UCD/GIS Tech will send out the Initial Notification email of the pending (irrigation) shutdown to the assigned project manager, designated city staff to allow adequate time for proper customer notifications
3. UCD/GIS Tech will issue a Scheduled Shutdown Notice within the Automated Utility Notification System prior to the scheduled shutdown time. The outlined area of this notification showing all affected residents can be viewed from the following link: <http://egov.capecoral.gov/mr/mr.aspx?ID=0>
4. Prior to a scheduled shut down, UCD field staff will verify the location and operation of all isolation valves for the proposed shutdown area. Residents in the vicinity may experience fluctuations in water pressure while crews exercise isolation valves. This is needed to ensure the area can be isolated by determining if the valves are operating normal or broken. Residents may also notice a discoloration of water and multiple hydrants running water. Unfortunately, this inconvenience is necessary to restore our customer’s irrigation service to this area as quickly as possible on the day of the shutdown.
5. On the scheduled date, UCD Field Staff will open all hydrants or flushing points needed to exercise the valves for the affected area. Utility contractors are prohibited from operation of City owned utility valves, hydrants, and flushing points without the supervision of a City of Cape Coral Utilities representative. In the event of a valve malfunction, it will be up to the discretion of the UCD Field Staff on site to determine if a larger area could be isolated, or to abort the proposed shut down. Once the utility main is shut down, UCD field staff must notify UCD/GIS staff immediately to inform the area has been isolated.

6. Send an “irrigation water off” email to the assigned project manager and designated city staff.
7. The utility contractor is responsible to perform all work in accordance with the most recent City of Cape Coral Standard Details and Technical Specifications Manuals, including the installation of all applicable joint restraints.
8. After completion of work, UCD staff will:
  - a. Slowly charge the affected area until air has been removed from the system.
  - b. Continue flushing until all discolored water has been eliminated.
  - c. Notify UCD/GIS staff immediately to inform the pressure has been restored to the area.
9. The UCD/GIS Tech will send an “irrigation water service restored” email to the assigned project manager and designated city staff.

### **1.2.3 SCHEDULED SHUTDOWNS OF EXISTING FORCE MAINS**

1. Water Rec staff will:
  - a. Examine the proposed area to determine the appropriate date and time to minimize possible sanitary sewer overflows resulting from excessive flow demands.
  - b. Assign a designated date / time for the force main isolation.
  - c. Notify UCD staff via [ucdinfo@capecoral.gov](mailto:ucdinfo@capecoral.gov) of the proposed date and time
2. On the scheduled date, Water Rec Staff will isolate all affected lift stations and close force main valves to isolate the requested area. If requested by Water Rec, assistance from UCD staff will be provided.
3. The utility contractor is responsible to perform all work in accordance with the most recent City of Cape Coral Standard Details and Technical Specifications Manuals, including the installation of all applicable joint restraints.
4. After completion of work, Water Rec staff will restore service to the force main and notify UCD staff via [ucdinfo@capecoral.gov](mailto:ucdinfo@capecoral.gov).

### **1.2.4 SCHEDULED SHUTDOWNS OF EXISTING RAW WATER MAINS**

1. Water Production staff will:
  - a. Examine the proposed area to determine the appropriate date and time to minimize disruption to plant operations.
  - b. Assign a designated date / time for the force main isolation.
  - c. Notify UCD staff via [ucdinfo@capecoral.gov](mailto:ucdinfo@capecoral.gov) of the proposed date and time
2. On the scheduled date, Water Production Staff will isolate all affected wells and close valves to isolate the requested area. If requested, assistance from UCD staff will be

provided.

3. The utility contractor is responsible to perform all work in accordance with the most recent City of Cape Coral Standard Details and Technical Specifications Manuals, including the installation of all applicable joint restraints.
4. After completion of work, Water production staff will restore service to the raw water main and notify UCD staff via [ucdinfo@capecoral.gov](mailto:ucdinfo@capecoral.gov).

### **1.3 COMMERCIAL & MULTI-FAMILY DEVELOPMENTS**

The Design Engineer shall comply with the design and installation requirements as specified by the City of Cape Coral, and the Florida Department of Environmental Protection.

The effect of the proposed development on the hydraulic capacity of all existing City systems, must be evaluated prior to the City of Cape Coral approval for connection to the system.

Flow demands for design shall be calculated on the basis of full development as known or projected. For phased developments, the design shall be based on total build out conditions for the development, or the anticipated service area of the proposed lift station.

A hydraulic analysis shall be used to evaluate the impact to the City's pumping systems, unless otherwise directed by the City. The owner or owner's representative will be responsible for such evaluation, or cost of the evaluation. A methodology meeting with City staff and Design Engineer is recommended prior to performing the analysis.

The hydraulic analysis will be performed to demonstrate that the anticipated flow from the proposed development does not adversely affect the existing infrastructure and/or connecting lift station(s).

The proposed additional wastewater flow shall not; surcharge any existing gravity sewers, reduce the design pumping capacity of all manifolded existing lift stations, or cause the downstream lift stations to exceed their design capacity.

Flow Demands of each structure shall be provided for review by the Utilities Department to determine if the total flow demand for the entire project may exceed the operational capacities on any of the City utility systems. If the occupancies of any structure are unknown at time of submittal, then worst case flow demands should be calculated for those structures.

## **SECTION 2 - GENERAL PIPING CRITERIA**

### **2.1 GENERAL**

This document describes the general piping criteria for all utility systems. Any variances in the individual piping systems are outlined in the specific utility sections.

The standard minimum cover for a water, irrigation, or force main is 36". If the mains are placed beneath a swale, the depth of cover may be reduced to 30" below the finished grade of the swale.

### **2.2 MATERIALS**

#### **2.2.1 Pipe Materials**

The types of pipe to be used for water mains and irrigation water systems are listed in Table 2.1. Materials used in sanitary sewer systems are listed in Table 2.2. Ductile Iron Pipe and PVC pipe types are discussed and evaluated in the following sections.

**Table 2.1 -- Potable and Irrigation Water**

Pipe Size		Below Ground			Above Ground	Under Paved Roads	Inside Casings	Directional Drill
<= 2" service*	Material	HDPE			BRASS	HDPE	HDPE	HDPE
	Code	ASTM D-2737				ASTM D-2737	ASTM D-2737	ASTM D 2737
	Grade	PE 4710				PE 4710	PE 4710	PE 4710
	Coating	-				-	-	-
	Install.	-		PVC Sleeve* (as req'd)	PVC Sleeve* (as req'd)	PVC Sleeve* (as req'd)	-	-
4"-12" main**	Material	PVC	or	DI-slip joint	DI –FLxFL	DI-slip joint/PVC***	PVC	HDPE
	Code	AWWA C-900/C-909		AWWA C-151	AWWA C-151	AWWA C-151	AWWA C-900/C-909	AWWA C-906
	Grade	DR 18		Pressure Cl. 250	Pressure Cl. 250	Pressure Cl. 250	DR 18	DR 11
	Lining	-		Cement Mortar	Cement Mortar	Cement Mortar	-	-
	Coating	-		As per MFR	As per MFR	As per MFR	-	-
	Install.	-		Polyethylene Encased (as req'd)		Poly Encased (as req'd)	-	-
16"-36" main	Material	DI-slip joint			DI –FLxFL	DI-slip joint	DI-slip joint	HDPE
	Code	AWWA C-151			AWWA C-151	AWWA C-151	AWWA C-151	AWWA C-906
	Grade	Pressure Cl. 250			Pressure Cl. 250	Pressure Cl. 250	Pressure Cl. 250	DR 11
	Lining	Cement Mortar			Cement Mortar	Cement Mortar	Cement Mortar	-
	Coating	As per MFR			As per MFR	As per MFR	As per MFR	-
	Install.	Poly Encased (as req'd)				Poly Encased (as req'd)	Poly Encased (as req'd)	-

\*PVC sleeve only required on four-lane roads.

\*\*Up to 16" pipes require a certa-lock in steel sleeve.

Note: 14" main may be considered on a case-by-case basis\*

\*\*\* Ductile Iron Pipe shall be used under pavement for all collector and divided roads. The Utility Director may allow PVC AWWA C-900 DR-18 pipe to be installed under pavement for local roads on a case-by-case basis.

Pipe Size		Below Ground			Above Ground	Under Paved Roads	Inside Casings	Directional Drill
> 36" main		Project Designed			Project Designed	Project Designed	Project Designed	Project Designed
2"-8" casing	Material	-			-	PVC	-	-
	Code	-			-	AWWA C-900	-	-
	Grade	-			-	DR 25	-	-
12"-36" casing	Material	-			-	Welded Steel	-	-
	Code	-			-	FDOT Spec. Sect 730	-	-

**Table 2.2 - Sanitary Sewer**

Pipe Size		Below Ground	Above Ground	Under Paved Roads	Inside Casings	Directional Drill
4"-12" force	Material	PVC	DI -FLxFL	PVC	PVC	HDPE
	Code	AWWA C-900/C-909	AWWA C-151	AWWA C-900/C-909	AWWA C-900/C-909	AWWA C-906
	Grade	DR 18	Pressure Cl. 250 psi	DR 18	DR 18	DR 11
	Lining	-	Ceramic Epoxy Lined	-	-	-
	Coating	-	As per MFR	-	-	-
	Install.	-	Polyethylene Encased (as req'd)	-	-	-
16"-36" force	Material	PVC	DI -FLxFL	PVC	PVC	HDPE
	Code	AWWA C-900	AWWA C-151	AWWA C-900	AWWA C-900	AWWA C-906
	Grade	DR 18 (Or City Approved Equal)	Pressure Cl. 250 psi	DR 18 (Or City Approved Equal)	DR 18 (Or City Approved	DR 11
	Lining	-	Protecto 401 Epoxy Lined	-	-	-
	Coating	-	As per MFR	-	-	-
	Install.	-	Polyethylene Encased (as req'd)	-	-	-
> 36" force		Project Designed	Project Designed	Project Designed	Project Designed	Project Designed
8"-15" gravity	Material	PVC	-	PVC	PVC	Project Designed
	Code	ASTM 3034	-	ASTM 3034	ASTM 3034	-
	Grade	SDR 26	-	SDR 26	SDR 26	-
18"-24" gravity	Material	PVC	-	PVC	PVC	Project Designed
	Code	ASTM F679	-	ASTM F679	ASTM F679	-
	Grade	SDR 26	-	SDR 26	SDR 26	-

Pipe Size		Above Ground	Below Ground	Under Paved Roads	Inside Casings	Directional Drill
2"-8" casing	Material	-	-	PVC	-	-
	Code	-	-	AWWA C-900	-	-
	Grade	-	-	DR 25	-	-
12"-36" casing	Material	-	-	Welded Steel	-	-
	Code	-	-	FDOT Spec. Sect 730	-	-

### Ductile Iron Pipe

The value for the Manning's "n" formula/coefficient for Ductile Iron Pipe shall be 0.013. The design value for the Hazen-Williams Roughness Coefficient for DIP shall be 120 (proposed) and 100 (existing).

Ductile Iron Pipe shall be of the diameter shown on the drawings and shall be furnished complete with rubber gaskets as well as all specials and fittings.

All ductile iron pipe, fittings, and specials used in water lines shall be cleaned and lined in the shop with cement-mortar lining.

All ductile iron pipe and fittings for gravity sewers and pressure mains shall be coated internally with either factory applied epoxy lining or factory applied polyethylene lining.

The exterior surfaces of pipe which shall be exposed to the atmosphere inside structures or above ground shall be thoroughly cleaned and provided a shop coat of epoxy rust-inhibitive primer and protective coating.

### Polyvinyl Chloride Pipe (PVC)

The value for the Manning's "n" formula/coefficient for PVC pipes shall be 0.012. The design value for the Hazen-Williams Roughness Coefficient for PVC pipes shall be 130.

All PVC pressure pipe and fittings shall conform to the latest revisions of ASTM D1785 or D2241, the National Sanitation Foundation Testing Laboratories and the applicable Commercial Standards. The material used to produce the pipe shall be clean, virgin N.S.F. "Approved for Potable Water Service" material and shall conform to the latest revision of ASTM D1784, Class 1245B, and 200 psi design stress.

All PVC Gravity sewer pipe and fittings shall conform to the latest revision of ASTM D3034 "Type PSM (Poly Vinyl Chloride) (PVC) Sewer Pipe and Fittings," SDR 26. The pipe shall be made of PVC plastic having a cell classification of 12454B, 13454C or 13364B as defined in ASTM D1784. All fittings shall utilize rubber gasketed watertight joints.

### High Density Polyethylene (HDPE)

HDPE shall be used for the construction of lift station applications, sub-aqueous canal crossings, and water and irrigation services. Any other applications involving directional drilling will require prior City approval. HDPE mains shall have the same equivalent internal diameter and equivalent pressure class rating as the corresponding PVC or DIP pipe, unless otherwise approved. The design value for the Hazen-Williams Roughness Coefficient for HDPE shall be

150.

Pipe shall be continuously and permanently marked with the manufacturer's name, pipe size, and SDR rating or minimum pipe stiffness in psi. Pipe shall be marked with a one-inch-wide stripe of continuous color (green-sewer, blue-water, and purple-irrigation).

Pipe shall be high molecular weight, high density polyethylene pipe. The material shall have a standard PE code designation of PE 4710 and have a cell classification of 345464C as described in ASTM D 3350.

All joints for the buried polyethylene pipe shall be of the thermal butt fusion or electrofusion type unless otherwise specified. Flanged adapters may be butt welded or electrofusion welded. Mechanical joints to PVC, other materials, equipment, valves, and appurtenances will not be considered. For transitions between PVC and HDPE pipelines, HDPE molded flanges with 316 stainless steel backup rings shall be used and be American made. HDPE pipe for storm drain use shall not be welded.

For more specifications on HPDE pipe, refer to Section 02594 of the City of Cape Coral's "Technical Specifications".

### **2.2.2 Fittings**

Table 2.3 and 2.4 summarizes material used for fittings on different pipe sizes. All fittings shall have a 250-psi minimum pressure rating. All fittings on mains that change direction shall be equipped with an electronic marker. All points shall be located in both latitude and longitude as well as Northings and Eastings.

**Table 2.3 - Potable and Irrigation Water Fittings**

Pipe Size		Below Ground	Above Ground	Under Paved Roads
2" and smaller	Material	HDPE	HDPE	HDPE
	Code	ASTM D-2737	ASTM D-2737	ASTM D-2737
	Grade	PE 4710	PE 4710	PE 4710
	Install.	Polyethylene Encased (as req'd)		Polyethylene Encased ( as req'd)
4"-48"	Material	DI-Mechanical Joint	DI-Flanged	DI-Mechanical Joint
	Code	AWWA C-153 or C-110	AWWA C-153 or C-110	AWWA C-153 or C-110
	Grade	Pressure Rating 250	Pressure Rating 250	Pressure Rating 250
	Lining	Cement lined	Cement lined	Cement lined
	Coating	As per MFR	As per MFR	As per MFR
	Install.	Polyethylene Encased (as req'd)		Polyethylene Encased ( as req'd)

**Table 2.4 - Sanitary Sewer and Force Main Fittings**

Pipe Size		Below Ground	Above Ground	Under Paved Roads	Inside Casings
4"-48" Force	Material	DI-Mechanical Joint	DI-Flanged	DI-Mechanical Joint*	DI-Mechanical Joint
	Code	AWWA C-153 or C-110	AWWA C-153 or C-110	AWWA C-153 or C-110	AWWA C-153 or C-110
	Grade	Pressure Rating 250	Pressure Rating 250	Pressure Rating 250	Pressure Rating 250
	Lining	Ceramic Epoxy Lined	Ceramic Epoxy Lined	Ceramic Epoxy Lined	Ceramic Epoxy Lined
	Coating	As per MFR	As per MFR	As per MFR	As per MFR
	Install.	Polyethylene Encased (as req'd)		Polyethylene Encased (as req'd)	
8"-15" Gravity	Material	PVC		PVC	PVC
	Code	ASTM D3034		ASTM D3034	ASTM D3034
	Grade	SDR 26		SDR 26	SDR 26
18"-24" Gravity	Material	PVC		PVC	PVC
	Code	ASTM F679		ASTM F679	ASTM F679
	Grade	SDR 26		SDR 26	SDR 26

\* Under CITY Approved Circumstance

### **2.2.3 Pipe Joints**

PVC pipe shall have provisions for expansion and contraction provided in the joints. These joints shall be integral bell elastomeric gasket joints for gravity mains. Pressurized mains shall have integral bell push-on type joints.

All DIP pipe joints shall be mechanical or “push- on” joints. Joints between pipes of different materials shall be made with couplings specially made for the various applications.

HDPE mechanical joint adapter shall be joined to the HDPE pipe by butt fusion. HDPE mechanical joint adapter shall be molded or fabricated conforming to AWWA C906. Molded fittings shall conform to ASTM D2683 for socket-type fittings, ASTM D3261 for butt-type fittings or ASTM F1055 for electro fusion-type fittings.

Connection of PVC pipe to DIP shall require the use of transition fittings in the form of ductile iron mechanical joint sleeves. The spigot end of one pipe type shall not be permitted to be inserted into the bell end of a dissimilar pipe type. The use of bell joint restraints as transition fittings is not permitted.

### **2.2.4 Butterfly Valves**

All potable and irrigation water shut-off valves sixteen inches and larger shall be Butterfly valves. Butterfly valves for water working pressure up to 150 psi shall conform to ANSI/AWWA C 504 – Rubber Sealed Butterfly Valves. Flanged valves shall have ANSI 125-lb flanges.

Shaft seals shall be designed for use with standard split-V type packing, or other acceptable seal. The interior passage of butterfly valves shall not have any obstructions or stops. The seats shall be positively clamped or bonded on the body of the valve. Cartridge-type seats that rely on a high coefficient of friction for retention shall not be acceptable.

The valve interior shall be epoxy coated per NSF/AWWA C-550-Protective Epoxy Interior Coating for Valves and Hydrants.

Butterfly valves shall be manually actuated valves and shall be provided with a 2-inch square actuating nut and position indicator. Screw-type (travelling nut) actuators shall not be acceptable for valves 30 inches in diameter and larger.

Valves 30 inches and larger, as well as submerged and buried valves, shall be equipped with worm-gear actuators, lubricated and sealed to prevent entry of dirt or water into the housing.

### **2.2.5 Gate Valves**

All potable and irrigation water shut-off valves twelve inches (12”) and smaller shall be resilient

seat gate valves. All buried valves shall be of the inside screw, resilient wedge, non-rising stem type. The valve actuators shall be as indicated, with counterclockwise opening stems. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve. Two stem seals shall be provided, and the stem seals shall be of the o- ring type. The stem nut must be independent of the gate.

#### **2.2.6 Check Valves**

Swing check valves for sewage shall be of the gravity operated type, in accordance with ANSI/AWWA C 508. Swing check valves for pressurized systems, 2” through 24” NPS, unless otherwise indicated, shall be provided with full-opening passages, designed for a water-working pressure of 150 psi. They shall have a flanged cover piece to provide access to the disc. The valve must be fully opening, tight seating and its seat shall be renewable and must be securely held in place by a threaded joint.

#### **2.2.7 Plug Valves**

Plug valves shall be of the non-lubricated eccentric type, epoxy lined and coated, with resilient faced plugs and shall be furnished with end connections. All plug valves shall be installed so that the direction of flow through the valve is in accordance with the manufacturer’s recommendations.

#### **2.2.8 Sluice Gates**

Sluice gates shall be constructed of American made 316 stainless steel. Sluice gates shall at a minimum conform to ANSI/AWWA C560-07.

#### **2.2.9 Valve Boxes**

Cast iron three-piece valve boxes shall be provided for all valves installed underground which do not have extended operators, such as is required by plug valves. Valve boxes shall be located in pavement whenever practicable and shall not straddle the edge of pavement. Heavy weight valve box covers shall be used in roadways with a design speed of 45 MPH or greater.

Valve boxes shall be adjustable to fit the designated depth of each cover over the valve and shall be designed so as to prevent the transmission of surface loads directly to the valve or piping. Valve boxes shall have an interior diameter of not less than 5". The covers shall be so constructed as to prevent tipping or rattling. The valve boxes shall be provided with covers marked with the words, "IRR" or “WATER” or “SEWER”. Valve boxes will be equipped with a 3-inch brass ID tag.

#### **2.2.10 Air Release Valves**

Air release valves shall be of the short body, automatic type. All combination air/vacuum

release valves shall be installed so that the flow through the valve is in accordance with manufacturer's recommendations. All combination air release valves shall have an isolation valve connection for control. All air valves shall be fitted with throttling devices or regulated exhaust devices where suggested by the valve manufacturer. The use of throttling devices is critical when air valves are used on pump discharge pipe/fittings.

#### **2.2.11 Castings**

Castings refer to manhole covers, manhole lid rings, vault lids and other cast metal and/or composite structures. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects in positions which would impair their strength or otherwise make them unfit for the service intended.

The seating surfaces between frames and covers shall be machined to fit true. No plugging or filling shall be allowed. Lifting or "pick" holes shall be provided but shall not penetrate the cover. Casting patterns shall conform to those shown or indicated on the drawings. The words "IRRIGATION" or "WATER" or "SEWER" shall be cast in the manhole cover. Manhole frames and covers shall be H-20 traffic bearing.

#### **2.2.12 Tapping Sleeves and Valves**

Refer to the City's QPL for approved tapping sleeves. Hardware shall be 304 or 316 stainless steel and American made. Tapping valves shall conform to ANSI/AWWA C 500- Standard for Metal-Seated Gate Valves for Water Supply Service except as modified for passage and clearance of tapping machine cutters.

Tapping sleeves shall allow ANSI/AWWA C 515-Resilient Seated Gate Valves for Water, and eccentric type plug valves for Sewerage. Seats in the body shall be replaceable without removing the valve from the pipeline. Sleeves shall be capable of withstanding a 200-psi working pressure. Gasket shall be vulcanized natural or synthetic rubber.

#### **2.2.13 Concrete**

Design, materials, workmanship, and practices shall conform to FDOT Standards and Specifications.

#### **2.2.14 Hydrants**

Fire Hydrants shall be designed for a working pressure of 200 psi and shall conform to AWWA Standard C502, "Fire Hydrants for Ordinary Water Works Service." Hydrants shall not be placed within five feet of power poles, communications pedestals, and other obstructions that will interfere with the proper operation of the hydrant.

Hydrants shall be located within 12 feet of the adjacent pavement. Hydrants shall be set so that the lowest hose connection is, at least 18-inches above, but no more than 24-inches above the finished grade. A raised blue pavement marker shall be provided at all potable water hydrants in

pavement perpendicular to the fire hydrant five feet of the edge of pavement.

Public potable water hydrant bodies shall be painted yellow. The bonnets shall be painted based on the line size as follows: 6" = red, 8" and 10" = orange, 12" and above = green. Irrigation water hydrants body shall be painted lavender with white bonnet. Please note fire hydrants on irrigation lines are for flushing purposes only and are not intended for fire protection. Private potable water hydrants shall be completely painted red.

Fire hydrants shall be cast within three (3) years of notice to proceed. Lubricating grease consisting of acetate or acetate compounds shall not be used.

## **2.3 SEPARATION AND LOCATION REQUIREMENTS**

### **2.3.1 Location of Water, Wastewater, Irrigation Mains**

Water, wastewater, and irrigation mains shall be located within dedicated rights-of-way or utility easements. Whenever possible, water mains will be placed to the north or west side of the road. Sewer and irrigation mains will be placed to the south and east side of the road. On looped roadways, water mains are located on the outside, irrigation mains are on the inside. In cases where it is not practical to maintain the stated locations, deviations may be allowed on a case-by-case basis, if approved by the City of Cape Coral Utilities Department. For looped roads, alignment on the same side of the road is permitted to avoid mid-block crossings.

Mains shall not be placed under or within 7 feet of buildings, retention ponds, courts, swimming pools, walls, fences, fountains, or other structures.

When installed in right-of-way, mains shall maintain a consistent alignment with respect to the centerline of the road. Force mains and reclaimed water mains shall typically be installed on the opposite side of the right-of-way from the water main to meet required minimum separation requirements. Mains shall be installed along one side of the road, with crossings kept to a minimum.

### **2.3.2 Gravity Sewer**

Gravity sewers shall be located within dedicated rights-of-way or utility easements. Whenever possible, sewers shall be located under pavement in dedicated rights-of-way. All sewers located outside of dedicated rights-of-way shall require a minimum 20-foot easement. Additional easement widths shall be provided when the pipe size or depth of cover so dictates. If a gravity sewer is located adjacent to a road right-of-way, a minimum 10-foot easement shall be provided. No gravity sewers shall be placed under retention ponds, tennis courts, or other structures. In general, gravity sewers shall not be located along side or rear lot

lines. When the pipeline crosses other utilities, the minimum separation requirements listed below shall be met.

### 2.3.3 Horizontal Separation

The preferred minimum horizontal separation requirements for all underground utilities are shown in the table below. In cases where it is not practical to maintain adequate separation, deviations may be allowed on a case-by-case basis, if supported by data from the Design Engineer and approved by the City of Cape Coral Utilities Department.

Such deviation may allow installation of the sewer closer to a water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the water main is at least 18 inches above the top of the sewer.

### 2.3.4 Vertical Separation

Water mains shall be designed to provide a minimum vertical separation of 12 inches between the bottom of the water main and the top of the sewer. In cases where it is not practical to maintain adequate separation, deviations may be allowed on a case-by-case basis, if supported by data from the Design Engineer and approved by the City of Cape Coral Utilities Department.

Water mains shall be above the sewer whenever they cross. Adequate structural support for both the water main and sewers shall be provided to prevent excessive deflection of joints and settling.

The following table represents the minimum separation requirements as described in F.D.E.P. rules of the Florida Administration Code (F.A.C.) and as requested by the City of Cape Coral. These separation requirements shall apply between newly proposed utility lines and existing or proposed utility lines.

The City of Cape Coral separation requirements may be greater as noted on the project plans.

**Table 2.3 – Piping Separation Requirements**

Horizontal and Vertical Separation Requirements								
Proposed Utility	Potable water		Irrigation Water		Sanitary Sewer (Gravity & F.M.)		Storm Sewer	
	Horiz.	Vert.	Horiz.	Vert.	Horiz.	Vert.	Horiz.	Vert*.
Potable Water	-	-	5' O/O	12"	10' O/O	12"	5' O/O	12"

Irrigation Water	5' O/O	12"	-	-	5' O/O	12"	5' O/O	12"
Sanitary Sewer	10' O/O	12"	5' O/O	12"	-	-	5' O/O	12"
C/C – pipe centerline to pipe centerline O/O – outside edge to outside edge * Unless pre-approved by the City of Cape Coral								

### 2.3.3 Field Adjustment of Existing Utilities

Where clearance between existing pressure mains and proposed storm drain or gravity sewer is insufficient, the existing utilities shall be rolled down as necessary. Existing pressure mains 16" or larger that require a roll down to provide adequate clearance shall require approval by the City of Cape Coral Utilities Department.

## 2.4 GENERAL SYSTEM DESIGN

### 2.4.1 Connection to Existing System

All connections to existing mains shall be made as authorized by the City of Cape Coral. Valves separating the mains being installed from existing mains shall be operated by or under the direction of the City of Cape Coral Utilities Department and a representative of the City of Cape Coral Utilities Department must be present at all tie-ins and wet taps.

### 2.4.2 Air Venting

Where the pressurized main profile is such that air pockets or entrapment could occur, air release valves shall be provided. All pressurized mains shall be equipped with below ground automatic air release valves. Air venting capabilities shall be provided for distribution mains by appropriately placing fire hydrants or utilizing a blow-off. At critical points on major mains, automatic air release assemblies shall be installed. Air release valves shall be suitably housed in a properly vented below ground vault with the exception of air release valves located on above ground piping for aerial crossings, which shall be suitable housed in a properly vented enclosure. All dead-end mains, whether temporary or permanent, shall be equipped with a manually operated blow-off assembly at the terminal end. Combination Air-Vacuum Release Valves shall be installed such that the vents are above the 100-year flood elevation.

### 2.4.3 Restraining Devices

Restraining joints shall be placed at all bends, tees, plugs, reducers, and other fittings to provide lateral support per the City's Restraint Joint Schedule located within the Utility Details section. Joint restraining systems shall be designed for the maximum pressure condition and

the safe bearing load for horizontal and vertical thrust. At a minimum, the thrust restraining system shall have a working pressure equal to or greater than the pipe material maximum pressure rating.

A reasonable safety factor shall be determined by the Design Engineer in specifying all restraining devices. All restrained fittings and joints shall be shown on the plan and profile and must be included on the record drawings.

#### **2.4.4 Electrolysis Prevention**

All systems shall be designed to best avoid electrolytic action through the contact of dissimilar metals. Preventative action, if required, may consist of installing insulating or dielectric couplings between the two materials.

#### **2.4.5 Corrosion Protection**

Design shall include considerations for corrosion protection for interior concrete surface of wet wells, structural steel, hardware, and fasteners, HVAC systems, electrical, mechanical, and other components that could be affected by the corrosive environment. Protection shall be provided for underground ductile iron pipe and fittings within areas of severe corrosive conditions. This shall be accomplished by the installation of polyethylene encasement through the area of concern. The soil test evaluation to determine the necessity for extra protection in suspect areas shall be those set forth in ANSI Standard A21.5. Additionally, where other existing utilities are known to be cathodically protected, ductile iron pipe crossing the utility shall be protected for a distance of 20 feet to each side. If ductile iron pipe is to be installed parallel to and within 10 feet of cathodically protected pipe, then protection shall be provided for the entire length.

#### **2.4.6 Odor Control**

Design features that promote turbulence, and hence encourage corrosion and off-gassing, shall be avoided. Where necessary, recommendation for sulfide control and corresponding odor control in the proposed sewerage system shall be made by the Design Engineer.

An odor control system shall be provided at master pumping stations and other lift stations as designated by the City, for the removal of odorous compounds consisting of primarily hydrogen sulfide. The odor control system shall be as specified by the City of Cape Coral.

#### **2.4.7 Dead End Lines**

Dead end lines shall not be allowed unless justified by the Design Engineer and specifically approved by the City of Cape Coral. When approved by the City, dead ends shall be minimized by making practical tie-ins whenever possible. Where dead end mains occur, they shall be provided with a hydrant or blow-off for flushing purposes. Flushing devices shall be sized to provide flows that shall give a velocity of at least 2.5 feet per second in the water main being

flushed. Where specified by the City, hydrant flushing units are to be installed. Installation shall include a valve, and a tee with hydrant and a plug.

#### **2.4.8 Cross Connection Control**

In order to protect the public water supply system from contamination due to cross- connections, backflow prevention devices shall be installed where there is the potential of a non-potable substance coming into contact with the public water system.

All commercial and industrial projects shall, as a minimum, require installation of approved double detector check valve assembly. All projects with fire sprinkler and standpipe systems, and projects with on-site water systems shall be required, as a minimum, to install a double detector check valve assembly. All irrigation systems shall have a double detector check valve assembly installed. Positive identification shall be performed on services to eliminate cross connections. Please refer to the City of Cape Coral Cross Connection Control (CCC) Manual.

#### **2.4.9 Backflow Prevention**

All backflow prevention devices are to be located directly following the water meter on the owner's property, per the City's Utility Details. Backflow prevention devices shall be installed above ground to facilitate maintenance and testing. Backflow prevention devices shall be tested by a certified cross- connection control technician. The devices shall be installed so as to be readily accessible for maintenance and testing. Reference City Code Ordinance 1965-149 for additional regulations. The owner of the property where the backflow device is located shall be the owner of the backflow device and responsible for all maintenance and testing. Please refer to the City of Cape Coral Cross Connection Control Policy.

## **SECTION 3 - POTABLE WATER SYSTEMS**

### **3.1 SYSTEM DESIGN**

The Design Consultant shall comply with the design and installation requirements as specified by City of Cape Coral, the Florida Department of Environmental Protection, the Florida Department of Health, Florida Department of Transportation and any other relevant state and local regulatory agencies.

Mains shall not be placed under buildings, retention ponds, courts, swimming pools, fountains or other structures. Landscape and privacy walls and foundations shall not be placed over mains. Mains placed less than 10 feet deep shall be placed a minimum horizontal distance of seven feet from structures. City direction is required for mains greater than 10 feet deep.

#### **3.1.1 Average Daily Flow and Peak Flow Demands**

Flow demands for design shall be calculated on the basis of full development as known or projected. The average daily flow for domestic use shall be calculated at the minimum rate as follows:

- Single-Family (SF) Residence = 200 gpd for a 10,000 square foot lot.
- Duplex Residential = 2 units, 170 gpd per unit for a total flow of 340 gpd.
- Multi-Family Residence = 12 units, 150 gpd per unit for a total flow of 1800 gpd.
- Speculative Buildings = 0.1 gpd per square feet of building coverage, with 60 percent of the lot area used as the building coverage

Reference Chapter 64E-6, Table 1, of the Florida Administrative Code for commercial flows.

A minimum peak day factor shall be 2 times the average daily flow and the peak hourly flow shall be 4 times the average daily flow rate.

#### **3.1.2 Fire Flows**

Fire flow requirements shall be determined in accordance with the applicable city, county, state, and federal standards. Fire flows shall meet the current requirements set forth by the National Fire Protection Association (NFPA) fire code. Where main mains serve different uses (I.E., residential on one side of the street and commercial on the other) the more stringent requirement shall apply. Where fire flow requirements exceed the anticipated available fire flow for the water system, on-site fire protection systems or other mitigation measures shall be utilized.

### **3.1.3 System Size Computation**

The minimum design for water distribution systems shall provide for at least 100% of the combined average day demand rate times the peak factor of 2 plus the required fire flow or the peak hourly flow, whichever is greater. All water mains shall be sufficiently looped and in no case shall water mains be less than 6" in diameter unless specifically approved by City of Cape Coral.

When selecting pipe diameters, the minimum and maximum flow capacities that may be expected over the life of the water system shall be considered.

Minimum water main size is established by the following criteria:

- One and two dwelling unit developments shall be no less than 6" in diameter.
- 8" is the minimum size allowed in non-loop systems that have fire hydrants connecting to the main.
- Minimum 6" looped systems shall be required in low-density residential projects. Where looping of mains is not practical, minimum 8" mains are required, and cannot exceed 1000 feet in length.
- In commercial, industrial, and high-density residential areas, minimum 8" looped systems shall be required.
- Larger size mains shall be required, if necessary to allow the withdrawal of the required fire flow while maintaining the minimum residual pressure specified

### **3.1.4 System Alignment**

Waterlines shall be located as described in Section 2.3.

### **3.1.5 Pressure**

The system shall be designed to maintain a minimum residual pressure of 35 psi under potable water demands and 20 psi for fire flow conditions. Higher pressures may be required at commercial, industrial, and high-density residential areas. The normal working pressure in the distribution system shall be approximately 55 psi, but in no case less than 35 psi on the downstream side of a meter for potable water lines and no less than 20 psi for fire flow conditions. For pressures greater than 90 psi special provisions may be required.

### **3.1.6 Valves and Valve Locations**

Valves shall be provided at intersecting water mains, fire hydrants, on both sides of all canal crossings, and all other locations necessary to provide an operable, easily maintained, and repaired water distribution system. Typically, provide 2 valves on a “T” and 3 valves on a “Cross”, unless approved otherwise by the City of Cape Coral Utilities Department.

Maximum length of water main between valves, which can be used for shutting down the line for repair work, shall not exceed 1000 feet in both commercial and residential areas. Potable water valves shall be provided to isolate every street to allow potable water pipes to be disconnected from system.

### **3.1.7 Fire Hydrants**

Fire service shall be provided in all developments. Fire hydrants shall be installed with a valve at the connection to the main line. Fire hydrant spacing shall be in accordance with the most recent NFPA requirements or City Ordinances whichever is more stringent. Fire hydrants are required on both sides of divided roadways.

If the pipeline run for the fire hydrant, (fire lines), exceeds 100', a second fully restrained valve shall be required within 5' of the hydrant base. Hydrant leads lines that cross medians on divided roadways shall require fully restrained valves on both sides of the road. Appropriate valving shall be provided where water mains intersect to ensure effective isolation of water line for maintenance. Hydrants should not be located at power poles, pedestals, or other obstructions which may interfere with the operation of the hydrant. A 36" clear space shall be maintained around the circumference of fire hydrants except as otherwise require or approved by the City of Cape Coral.

All fire lines or private hydrant laterals entering private property will require the installation of a double detector check valve assembly to be located at the right of way line.

Owners and developers shall make provisions to install potable water lines and fire hydrants to meet spacing and fire flow requirements. Where fire mains exist but do not meet the fire flow requirements, alternative arrangements may be made, prior to construction, with the authority having jurisdiction. Due to the concern for public safety, failure to meet the fire flow requirements or come to alternative agreement shall be grounds for refusal for the City to issue building permits. Please defer to the City of Cape Coral Code of Ordinance Section 8.10, Section 18.3.1.3 for further reference.

### **3.1.8 Bacterial Sample Points**

For the purpose of new potable water main construction, bacterial sampling points shall be positioned at the beginning of each new system, at 1000-foot intervals and all dead ends unless otherwise directed by the Lee County Health Department. At the completion of the

project, permanent sampling points shall remain every 3000 feet or one at the 2/3 point if the line is less than 3,000 feet long. The permanent sampling points shall be designated by the City staff during final plan review and shall be identified by station numbers on the plans.

### **3.1.9 Pipe Depth**

The standard minimum cover for a water main, which is not under the pavement, is 36" below finish grade. The minimum cover for water mains placed under the pavement is 36". If the mains are placed beneath a swale, the depth of cover may be reduced to 30" below the finished grade of the swale.

## **3.2 WATER METERING**

All water service connections shall be metered. Single and double services shall be installed at property lines for single family, duplex, and multi-family subdivisions in the public right-of-way. In general, each building in a commercial or industrial area shall be individually metered. Meters shall be located in the public right-of-way at the property line. Commercial businesses located in large shopping centers or industrial parks shall have their meters located in the public right-of-way as determined by the Utilities Department.

All projects with private fire lines shall require installation of a fire line master meter. Shopping centers shall require installation of a fire line master meter. Individual meters to each unit may be considered on a case-by-case basis subject to the developer executing a meter installation and easement agreement. Fire lines cannot be used for potable water service.

## **SECTION 4 - IRRIGATION WATER SYSTEMS**

### **4.1 SYSTEM DESIGN**

The Design Engineer shall comply with the design and installation requirements as specified by the Department of City of Cape Coral and the Florida Department of Environmental Protection. When selecting pipe diameters the minimum and maximum flow capacities that may be expected over the life of the irrigation water system shall be considered.

#### **4.1.1 Flow Demands**

Average daily flow calculations were based on an irrigation application rate of 1.5 inches per week. This application rate is applied to 60 percent of the property area two times a week during a 4-hour period and shall only be applied to 50 percent of the properties at any given time.

Design irrigation demand shall be eight gallons per minute for each 10,000 square foot single family residential lot, but only half the residence shall be irrigating at any given time. Therefore, the average flow demand for any given time shall be 4 gpm per residential unit.

The irrigation water system shall not be utilized to accommodate fire flows.

#### **4.1.2 System Size Computations**

Irrigation water mains shall have sufficient hydraulic capacity to transport peak hourly flows. Minimum irrigation water main diameter is four inches. Minimum irrigation main pipe diameter in cul-de-sac areas that exceed 500 feet of pipe shall be six-inch . Where looping of mains is not practical, minimum six-inch diameter mains shall be installed. In commercial, industrial, and high-density residential areas, minimum six-inch diameter looped mains are required.

#### **4.1.3 System Alignment**

Irrigation lines shall be located as described in Section 2.3.

#### **4.1.4 Pressure**

The system shall be designed to maintain a minimum pressure of 35 psi at all points in the distribution system under all conditions of flow. Higher pressures may be required at commercial, industrial, and high-density residential areas. The normal working pressure in the distribution system shall be approximately 45 psi. For pressures greater than 90 psi special provisions may be required.

#### **4.1.5 Valves and Valve Locations**

Appropriate valving shall be provided where irrigation water mains intersect to ensure effective isolation of irrigation water lines for testing and maintenance. Valves shall be appropriately located to allow flushing at 2 feet per second in all sections of the system.

Valves shall be provided at intersecting mains, on both sides of all canal crossings, and all other locations necessary to provide an operable, easily maintained and repaired water distribution system. Typically, provide 2 valves on a “T” and 3 valves on a “Cross”, unless approved otherwise by the City of Cape Coral.

The minimum valve size for all irrigation mains is 4”.

Irrigation water valves shall be provided to reasonably isolate neighborhoods.

Valves less than 6” diameter are strongly discouraged. Valve locations shall be designed such that they are installed in-line with 6” mains or in branches of 6” tees upstream of reducers down to main diameters less than 6”.

#### **4.1.6 Flushing**

In order to provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins whenever practical. Where dead end mains occur, a blow-off valve shall be installed for flushing purposes.

Blow-offs shall also be provided to allow adequate flushing of the system. Hydrants shall be provided in lieu of blow-offs on irrigation lines 6-inch and larger.

#### **4.1.7 Large Blowoffs**

Large blowoffs (5-1/4” hydrant style) shall be provided for flushing on irrigation lines 6-inch and larger. These large irrigation blowoffs shall not be used for firefighting purposes except as directed by the City of Cape Coral Fire Department.

#### **4.1.8 Pipe Depth**

The standard minimum cover for an irrigation water main is 36” below finish grade. If the mains are placed beneath a swale, the depth of cover may be reduced to 30” below the finished grade of the swale.

## SECTION 5 - SANITARY SEWER GRAVITY SYSTEMS

### 5.1 SYSTEM DESIGN

#### 5.1.1 General

Gravity flow systems are designed for steady flow conditions. Major factors to consider in determining gravity system hydraulics include the pipe material, design formula, velocity, and slope.

For gravity systems, the formula to be used for evaluation of gravity sewers shall be Manning's "n" formula/coefficient as specified previously for the type of pipe material. Pipelines shall be deemed deficient when peak flows cause them to surcharge or when peak flows cause them to flow completely full and it can be seen that continued growth in tributary areas shall soon cause the pipe to flow in a surcharged condition.

The minimum velocity allowed in gravity sewer pipe shall not be less than 2.0 fps at peak flow. Gravity systems shall be designed to exclude infiltration/inflow.

#### 5.1.2 Flow Demands

Flow demands for design shall be calculated on the basis of full development as known or projected. For phased developments, the design shall be based on total build out conditions for the development, or the anticipated service area of the proposed lift station.

**Average Day Flow** - The average daily flow for domestic use shall be calculated at the minimum rate as follows:

- Single-Family (SF) Residence = 200 gpd per lot.
- Duplex residential = 170 gpd per unit (340gpd for both units)
- Multi-Family Residence = 150 gpd per unit
- Speculative Buildings = 0.1 gpd per square feet.

Reference Chapter 64E-6, Table 1, of the Florida Administrative Code for commercial flows.

**Peak Hour Flow** - Sanitary sewer systems shall be sized to provide ample capacity for the required peak flow rates. The peak flow rates are the appropriate peak factors multiplied by the accumulative average daily flow. In general, the following minimum peak factors shall be applicable for the range of average daily flow rates.

**Table 5.1 – Sanitary Sewer Minimum Peaking Factors**

Flow Range	Minimum Peaking Factor
< 100,000 GPD	4
100,000 – 250,000 GPD	3.5
250,000 – 1,000,000 GPD	3
> 1,000,000 GPD	2.5

### 5.1.3 Sewer Size Computation

Sanitary sewer pipes shall be sized to provide ample capacity for the required peak flow rates. The minimum allowable size for any gravity sewer, other than service connections, shall be 8” in diameter. All gravity sewers pipes shall be designed at slopes providing minimum velocities of 2 fps and velocities of 6.0 fps when flowing full or ½ full, based on Manning’s formula. The following minimum slopes shall be used as a design guideline:

**Table 5.2 – Gravity Main Minimum Slopes**

Sanitary Sewer Pipe Diameter (inches)	Preferred Slope (Feet per 100 Feet)	Minimum Slope* (Feet per 100 Feet)
8	0.40	0.33
10	0.28	0.24
12	0.22	0.20
15	0.15	0.14
18	0.12	0.11
21	0.11	0.09
24	0.08	0.08
30	0.08	0.08
36	0.08	0.08

\*Use of the minimum slope requires an FDEP variance and City approval.

Design computations shall be prepared to verify the design slopes utilized. The computations shall contain data on sewage flow rate, number of contributing sources, minimum and maximum flows anticipated between manholes, depths of flow, velocities at minimum and maximum flow conditions, recommended pipe slopes, etc.

When selecting pipe diameter and slope, the minimum and maximum velocities to be expected in the pipe over a range of flow capacities that may be expected over the life of the sewer system

shall be considered.

Typically, gravity sewers are 8-inch diameter. For situations where force mains discharge into the gravity system, hydraulic analysis based on the design flow will dictate the pipe size. Sewers between lift station wet well and master manholes shall be a minimum of 10-inch at 0.33% slope.

The objective in designing the sewer alignment is to optimize the overall configuration to minimize construction cost. This is generally achieved by minimizing the overall sewer depth. Some general principles include gravitating away from canal crossings as the ground level rises and creating deep cut classes; and minimizing the number of deep sewer runs and or critical runs. Also, steeper slopes can be used for short runs to avoid drop manholes or to provide adequate cover by matching the topography.

Gravity sewer systems typically include at least two critical runs in each direction away from the lift station in which case slopes of 0.33 percent apply until a particular run becomes non-critical as follows:

- Determine lowest invert if both runs are critical. Responsible run is set as critical.
- Set non-critical competing run at .40% grade.
- Starting from the master manhole work backwards changing legs from .40% grade to .33% grade until no longer critical.

#### **5.1.4 Manhole**

The construction of new manholes for sanitary sewers shall be precast concrete with a crystalline technology waterproofing admixture (see QPL). Manholes shall be located at the center of pavement for local roads and in the mid-lane location for divided roads. Manholes 8-foot and deeper shall have eccentric cones. Manhole coatings shall be in accordance with the Technical Specifications Section 09800. The top of buried manholes, cone, riser rings, iron frame, cover and all joints shall be encapsulated with concrete with a minimum thickness of 2”.

All connections to an existing manhole shall be constructed by core drilling the approximate size hole into the manhole. Breaking into the manhole by means other than core drilling is prohibited. A representative of the City of Cape Coral must be present during the work.

The use of “doghouse” manholes at locations where new gravity sewer is designed to connect to existing gravity sewer mains requires prior written approval from the City of Cape Coral. The use of “doghouse” manholes will be reviewed and considered by the City on a case-by-case basis.

Sanitary gravity sewers shall be installed with straight alignment and grade between manholes with manhole spacing not to exceed 600 feet for maintenance access. Manhole spacing shall be maximized to minimize the number of manholes. Manhole spacing between intersecting sewers should be evenly spaced. A 0.1-foot drop is required across all manholes.

Typically, terminal manholes shall be designed to have a minimum depth to invert of 4 feet for an 8-inch sewer, depending on the diameter and location of parallel water, irrigation and/or storm drain piping. Terminal manholes shall be located 5-feet past the terminal service, except when serviced directly into the manhole. Serving directly into a manhole shall only be at terminal manholes and shall be at the approval of the City of Cape Coral Utilities Department.

All master manholes and manholes within 100 feet of the wet well shall be coated to a minimum of 60 mils (125 mils for repair lining) on the inside. Manholes receiving force main discharges and the first manhole downstream shall also be coated on the inside.

Acute angles less than 90-degrees shall not be allowed without the approval of the City of Cape Coral Utilities Department.

Corrosion protection of existing sewer mains and manholes shall be provided when design velocities greater than 6 fps are anticipated or attained.

Special attention shall be given to gravity lines which receive flow from sanitary sewer force mains. Care shall be taken in these areas to ensure excessive flow rates do not create surcharge conditions downstream. Drop pipes must be installed to reduce odors emitted due to turbulent discharge conditions.

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

For sewers 24-inch diameter and smaller, the minimum manhole diameter shall be 48 inches. For sewers between 24- and 36-inches diameter the manhole shall be 72 inches. For sewers larger than 36 inches in a diameter, a 72-inch inside diameter manhole shall be provided. All drop manholes which include the use of an inside drop shall be a minimum of 72-inches in diameter. All master manholes (the last manhole prior to a lift station) shall be 72-inches in diameter. The access cover shall provide a minimum of 24-inches clear opening for standard manholes and 30-inches clear opening for master and receiving manholes.

**Table 5.3 - Minimum Manhole Diameters**

Gravity Main Diameter (inches)	Minimum Inside Manhole Diameter (inches)
Up to 24	48
24 to 36	72
>36 and Masters	72

### **5.1.5 Connection to Existing System**

From time to time, the City of Cape Coral may elect to absorb existing private wastewater systems into the City system. Prior to acceptance by the City of Cape Coral, this wastewater system shall be tested and inspected to assure compliance with the City of Cape Coral's Utility standards. In no case shall substandard private systems generating excessive inflow/infiltration be allowed to connect into the City's system.

Reference "Technical Specifications – Section 02623" for further detail on videoing.

### **5.1.6 Depth**

The standard minimum cover for sewer pipe is 36". If the mains are placed beneath a swale, the depth of cover may be reduced to 30" below the finished grade of the swale.

Maximum depth of gravity sewers shall be 18 feet. Deeper sewers may be considered on a case-by-case basis. Depths greater than 18-feet will require approval by the City of Cape Coral Utilities Department.

## **SECTION 6 - SANITARY SEWER FORCE MAINS**

### **6.1 SYSTEM DESIGN**

#### **6.1.1 General**

Pressure systems, or force mains, shall be designed in coordination with the pumping system design, and the Utilities Master Plan. Major factors to consider in analyzing system hydraulics include the pipe material, design formula, velocity, and maintenance.

The formula to be used for evaluation of force mains shall be the Hazen-Williams formula. If the pumping stations under consideration have functioning flow meters, of the roughness coefficient (“C”) value shall be determined by conducting pump flow tests. The pump flow tests shall also include a determination of the existing pumps’ characteristics at both high and low wet well conditions.

If there is no flow meter available, then a value for “C” shall be assumed by the Design Consultant. The value of “C” shall consider the pipe type, age, and size. Note: Selecting an appropriate value for “C” is critical for accurately estimating the pressure and surge characteristics of the system.

#### **6.1.2 Vertical Alignment**

Mains shall be designed with uniform positive or negative slopes to minimize high points and low points in profile.

#### **6.1.3 System Capacity**

Design data and City Utility Department approval is required for all force mains. Force main systems shall be of adequate size to efficiently transmit the total ultimate peak operational flow. Average daily flow and peak design flow calculations are addressed in the section on Sanitary Sewer Gravity Systems. The minimum size for City-owned force mains shall be 6-inch diameter. A 4-inch diameter force main may be approved for private installations when operational conditions warrant the smaller diameter piping.

Consideration shall be given to possible future connecting pumping stations. Capacity computations shall be coordinated with the proposed pumping system and future flow requirements, if applicable.

In order to provide adequate pipeline cleansing, force main flow velocity shall not be less than 2 fps at minimum pumping capacity. The following are minimum flow rates for various

force main pipe sizes.

**Table 6.1 – Minimum Force Main Flow Rates**

Minimum Flow Rates	
Pipe Size (inches)	Flow Rates (gpm)
4	100
6	200
8	350
10	550
12	880

Where minimum velocity requirement cannot be met, the system shall be designed to consider hydrogen sulfide formation and control, and cleaning and maintenance must be facilitated by installation of pressure clean outs or other appropriate methods or devices.

Maximum velocity at design pumping rates shall not exceed 8 fps. The following table contains the maximum flow rates for various size force mains:

**Table 6.2 – Maximum Force Main Flow Rates**

Maximum Flow Rates	
Pipe Size (inches)	Flow Rates (gpm)
4	275
6	615
8	1100
10	1715
12	2465

When selecting pipe diameters, the minimum and maximum flow capacities that may be expected over the life of the sewer system shall be considered.

#### **6.1.4 Valve Locations**

Plug valves shall be installed on all subsidiary force mains at the point of connection to the major main in order to isolate the mains for maintenance. Typically, provide two valves, one on each upstream leg of the wye fitting. Where force mains are to be extended, valves shall be placed at the future connection point to preclude line shutdown at the time of extension. Valves shall be provided on both sides of a canal crossing. Valves shall be installed at least every 1,500 feet.

#### **6.1.5 Design Pressure**

The force main and fittings shall be designed to withstand pump operating pressures and pressure surges.

#### **6.1.6 Clean-Out Connections**

Should force mains appear to be susceptible to sedimentation clogging created by depressed crossings or extended low flow and low velocity periods, suitable clean-out connections shall be provided. Clean-outs, such as plugged wye or tee wye fittings, shall be located to facilitate maintenance.

#### **6.1.7 Terminal Discharge**

Force mains shall enter the gravity sewer system at a point not more than 1 foot above the flow line of the receiving manhole. At manholes, the point of force main entry shall be in the same direction as the flow line. In addition, the receiving (and next downstream) manhole shall be coated.

Where circumstances warrant, force main discharges into a manhole may be approved by the City of Cape Coral Utilities Department. When discharging into a manhole, force mains shall discharge in a manhole no closer than the downstream manhole of a terminal manhole, where feasible.

Should an elevation drop be required to obtain the outlet connection, the slope of the force main shall not exceed 45 degrees and adequate air venting shall be provided at the profile breakpoint. The force main profile shall be designed so that the pipe upstream of the breakpoint remains full at all times.

For new force main connections to existing manholes, a coating system for corrosion protection of the manhole structures shall be installed. Additionally, for discharge of new force main flow into an existing lift station basin, a new inline master manhole shall be installed, unless one already exists. For discharge of new force main flows to an existing lift station basin, see Section 7 – 7.1 General Hydraulic Computations.

### 6.1.8 Depth

The standard minimum cover for a force main is 36". If the force main is placed beneath a swale, the depth of cover may be reduced to 30" below the finished grade of the swale.

## **SECTION 7 - LIFT STATIONS**

### **7.1 GENERAL HYDRAULIC COMPUTATIONS**

The pumps shall be designed for the larger of the pumping rate based on peak hourly flow or the pumping rate required to maintain minimum flow velocity in the discharge force main.

Design flows shall be based upon the peak design flow, as defined for sanitary sewer gravity system design (see Table 5.1). The effect of the proposed lift station on the hydraulic capacity of the existing sewer system must be evaluated prior to the City of Cape Coral approval for connection of the proposed lift station.

A hydraulic analysis must be performed to demonstrate that the increase in wastewater flow from the proposed lift station (1) shall not surcharge any existing gravity sewers and (2) shall not reduce the design pumping capacity of all manifolded existing lift stations and (3) shall not cause the downstream lift stations to exceed their design capacity.

Hydraulic analysis of pumping stations discharging to a header force main system are much more involved than analysis involving a single force main. Although the design criteria presented herein are valid for multiple force main systems, the calculations are much more complex and iterative. A computer analysis shall be used to evaluate the hydraulic impact to the City's pumping system, unless otherwise directed by the City.

### **7.2 SYSTEM HEAD CALCULATIONS**

The system head curve is a plot of the total discharge head losses versus flow rate. The total discharge head losses shall be plotted based on calculations described below for a minimum of 5 points on the curve. The mid-point on the curve shall be as close as possible to the design pumping rate for the station. Regular incremental flow rates shall be chosen for system head calculations.

Calculations shall include high head and low head condition system curves plotted on the manufacturer's pump curve.

A pump shall be selected from manufacturer's pump curves, and then plotted over the system head curves to obtain a pump that shall have a discharge flow rate that closely matches the design flow conditions. The intersection of the manufacturer's pump curve and the system head curves shall give the actual discharge flow and head conditions for the pump.

#### **7.2.1 Total Discharge Head Loss**

The Total Discharge Head (TDH) losses, in feet, for the entire piping system at a particular flow rate is the total sum of static head, friction head, and minor head losses calculated for that particular flow rate.

### 7.2.2 Static Head Loss

Maximum Static Head Loss, in feet, is defined as the difference between the elevation of the lowest pumping level (Pump Shut “Off” Level) and the highest pumping level (Lead Pump “On” Level) in the discharge wet well.

Minimum Static Head Loss, in feet, is defined as the difference between the elevation of the highest pumping level (Lead Pump “On” Level) and the lowest pumping level (Pump Shut “Off” Level) in the discharge wet well.

### 7.2.3 Friction Head Loss

Friction Head Loss, in feet, is based on the Hazen-Williams Formula. The roughness coefficient (“C”) shall be 120 for PVC pipe, 120 for proposed lined ductile iron pipe, and 100 for existing ductile iron pipe, and 130 for HDPE pipe, but may be adjusted by the Design Engineer based on actual pump flow and line pressure data to calibrate the model.

### 7.2.4 Minor Head Loss

Minor head losses, in feet, shall be determined based on multiplying resistance coefficients for various fittings (“K” coefficients) by the velocity head in the fitting ( $V^2/2g$ ). Separate minor head calculations shall be required for all different size fittings in the system piping. Equivalent pipe length calculations shall not be used for minor head loss determinations.

The following values for “K” coefficients shall be used for minor head loss calculations:

**Table 7.1 – Minor Head Loss Coefficients**

Fitting	Coefficient, K
Plug Valves (Fully Opened)	1.1
Swing Check Valves (Fully Opened)	2.50
90 Bend	0.80
45 Bend	0.20
22-1/2 Bend	0.15
11-1/4 Bend	0.10
Tees or Wyes (Straight Run)	0.60
Tees or Wyes (Branch Run)	1.80
Reducers	0.25

Fitting	Coefficient, K
Pipe Exit	1.00
Entrance	0.50
Increaser	0.60

## 7.3 WET WELL DESIGN

### 7.3.1 Wet Well Depth

Allowable depth from top of wet well lid/hatch to floor is 25 feet. Depths greater than 25 feet require approval by the City of Cape Coral Utilities Department.

### 7.3.2 On/Off/Alarm Levels

Low water levels shall be set to provide adequate submergence of pumps and facilities to preclude inlet vortexing and air-binding. In general, the normal operational water level shall provide positive suction head for the pumps.

High water alarm shall be at least 6 inches below invert elevation of the lowest influent gravity sewer. The Lag Pump “On” liquid level shall be at least 6 inches below the high-water alarm elevation. The Lead Pump “On” liquid level shall be at least 6 inches below the Lag Pump “On” elevation. The Pumps “Off” liquid level shall be at least 2 feet below the Lead Pump “On” liquid level. However, the vertical dimension between the Lead Pump “On” liquid level and the Pump “Off” liquid level may have to be increased to comply with the minimum pump run times.

### 7.3.3 Run Times

The minimum pump run time during a cycle is 2.5 minutes. The pump run time is determined by dividing the storage in the wet well from the Lead Pump “On” level to the Pump “Off” level by the actual design pumping rate determined above in the system head curve calculations. The design pumping rate used for pump run time and cycle time calculations shall be the average of the maximum and minimum pumping rates determined from the system head curves.

The minimum of cycles per hour for the pumping station is 2 cycles per hour or 30 minutes per cycle. The maximum number of cycles per hour for the pumping station is 10 cycles per hour or a minimum cycle time of 6 minutes per cycle for motors less than 50 H.P. The minimum cycle time for pump motor horsepower between 50 and 100 H.P. shall be 10 minutes and the minimum cycle time for pump motors over 100 H.P. shall be 15 minutes. One complete cycle is defined as the time required to fill the storage volume of the wet well from the Pump “Off”

level to the Lead Pump “On” level plus the time required to pump down the wet well to the Pump “Off” level.

The formula for minimum wet well volume is:

$$V = \frac{(T_{\min})(Q)}{4N}$$

*Where:*

- $T_{\min}$  = minimum cycle time in minutes
- $Q$  = pump capacity in gpm
- $V$  = volume (gallons)
- $N$  = number of pumps operating to pump down this volume

## 7.4 PIPING DESIGN

Each individual pump discharge pipe shall be equipped with a check valve, followed by a shut-off eccentric plug valve prior to connecting into the station header and force main. All influent pipes discharging into the wet well shall be designed for submerged discharge below the lead pump “pump-off” level. This may be accomplished using a drop pipe connection using PVC or HDPE only. The gravity sewer influent pipe to the wet well from the last manhole shall be a minimum one size larger than required by hydraulic design. The pump discharge shall be designed to prevent pump damage by cavitation at possible extreme pumping rates.

All EPO cam-locks shall be a maximum of 6-inches on all lift stations with valves and piping 6-inches or larger. All other lift stations shall require 4-inch cam-locks.

## 7.5 LIFT STATION GENERAL REQUIREMENTS

### 7.5.1 Location/Accessibility

The lift station shall be located such as to be accessible by maintenance vehicles during all weather conditions. Special care shall be taken to site the lift station wet well away from existing overhead utility poles. A 15-foot minimum horizontal clearance shall be provided between the wet well perimeter and overhead lines.

Submersible pumps shall be readily removable and replaceable without dewatering the wet well or disconnecting any piping into the wet well.

Landscaping around lift station sites shall be designed on a case-by-case basis but shall not interfere with the operations or access to the lift station site.

New pumping stations shall be constructed so as to remain fully operational and accessible during a 25-year flooding event. The electrical and mechanical equipment shall be protected from physical damage by the 100-year flood, and at a minimum 18" above ground level.

### **7.5.2 Buoyancy**

Buoyancy of the lift station structures shall be considered for the 100-year flood elevation and adequate provisions shall be made to prevent flotation.

### **7.5.3 Ventilation and Odor Control Devices**

Wet wells for submersible installations or others without free access shall be ventilated with not less than one 6" diameter open vent pipe.

Odor control equipment shall be required for all Master Lift Stations where the City designates it necessary and where wet well hydrogen sulfide air concentrations are expected to cause an annoyance to the surroundings. Drop pipes, as shown in the standard detail drawings, shall be installed to minimize turbulence and release of sewer gases.

Design features that promote turbulence and encourage corrosion and off-gassing shall be avoided. Where necessary, recommendation for sulfide control and corresponding odor control in the proposed sewerage system shall be made by the Design Engineer.

### **7.5.4 Connections at Structures, Wall Pipes and Sleeves**

Where pipes are to extend into or through structures from the exterior, flexible connections shall be provided at the exterior wall face. For pipes passing through structural walls, wall pipes with water stops or manhole boots shall be installed.

### **7.5.5 Wet Well Coatings**

Wet well coatings shall be required on all concrete wet wells. The wet well coatings must be installed, tested, and inspected after installation per manufacturer's recommendation. The coating system must coat the entire concrete interior including floors, ceilings, and walls (entire wall height) of the interior surfaces of lift station wet wells. For valve vaults and meter vaults the coating system must cover the entire exterior of the vault. The coating system must extend and seal onto wet well hatch frame, around pipe openings and any other protrusions, to prevent contact between wet well structure and corrosive sewer gases. The full interior of the wet well including the wet well bottom shall be coated prior to installation of the stainless-steel base plate for the pumps. The maximum elapsed time between coats, as stated by the coating manufacturer, shall not be exceeded. Wet wells and valve vaults shall be precast concrete

with a crystalline technology waterproofing admixture (see QPL).

### **7.5.6 Covers**

Access covers for lift station wet wells shall be above the 25-year flood elevation unless the structure is located within a documented velocity and tidal flood zone and elevation differentials prohibit such installation. In those cases, watertight access covers shall be utilized.

Door leaf shall be 1/4-inch-thick aluminum diamond plate reinforced for an AASHTO H-20 live load as indicated on the drawings. A staple for padlock shall be included for security. The hatch shall be provided with an automatic American made stainless steel hold-open arm with release handle and latch.

Approved manufacturers are listed in the Qualified Products List.

For every wet well hatch that is installed, the Contractor shall provide two (2) spare pistons or springs to the City of the same type as installed on the hatch.

### **7.5.7 Emergency Connection**

An emergency bypass connection shall be provided down-stream from the in-line discharge piping valves. The connection shall be readily accessible and be equipped with a plug-type isolation valve and 4- or 6-inch male camlock type quick coupling and cap.

### **7.5.8 Valves**

All valves installed on force mains and in wastewater lift stations shall be Plug valves shall be eccentric type plug valves. All plug valves shall be installed so that the direction of flow through the valve is in accordance with the manufacturer's recommendations.

Check valves for ductile iron pipelines shall be swing type and meet the material requirements of AWWA C500. Jacking plugs shall be included with all check valves.

All associated plugs, bolts, hardware, and other miscellaneous items for valves shall be 316 stainless steel and American made unless otherwise specified.

Actuators and hand wheels are required on valves 6-inch and greater. The actuator must be the same manufacture or brand of the installed valve. Valves with actuators in valve vaults shall require a manual hand wheel.

### **7.5.9 Pumps and Motors**

Sewage pumps shall be of submersible type suitable for operation in sewage temperature not exceeding 115 degrees Fahrenheit. For lift stations with a peak design flow of 1,500 gpm or less, a minimum of two pump units shall be provided. Where the peak design flow exceeds

1,500 gpm, three or more units shall be provided.

Sewage pumping units shall be capable of handling raw, unscreened sewage. Pump suction and discharge opening shall be at least 4 inches in diameter. Pumps shall be electric motor driven. The lift station shall be capable of pumping the peak design flow with the largest pumping unit out of service and be suitable for operation within the total hydraulic range of operation without overloading the motors. In addition, a minimum 5 HP motor is required.

The pump design shall provide easy removal and replacement for inspection or maintenance purposes without bolts or other fastening to be removed or personnel to enter the wet well. The units shall be non-clog, mechanical seal, and submersible sewage pumps. Certified pump curves shall be furnished with the pumps. Pump curves shall include high head and low head condition system curves plotted on the manufacturer's pump curve. Pump and motor selection and head capacity curve shall reflect hydraulic conditions in cases where receiving force main systems are interconnected to additional pumping stations.

Lift station shall be capable of pumping the peak design flow with the largest pumping unit out of service. Pumps shall be capable of meeting all system hydraulic conditions without overloading the motors.

#### **7.5.10 Pump Controls**

Each lift station control system shall include a liquid level controller which shall sense the sewage level in the wet well and provide appropriate signals to the logic circuits to produce the required mode of operation for the pumping facilities. The liquid level controller shall utilize a pressure transducer to produce a digital signal that will be converted to provide wet well water depth to the station logic controller.

The liquid level control system and any alternative level sensing and control system shall include a high-level float and a low-level float as an alarm.

#### **7.5.11 Lift Station Water System**

All wastewater lift stations shall be provided with a water system with adequate capacity and pressure for station wash down and other requirements. The station water system shall be supplied from the irrigation water system. Where no irrigation service is available, potable water service shall be provided with backflow prevention.

#### **7.5.12 Emergency Generators**

Fixed emergency generators or diesel pumps shall be provided at all lift stations that receive flow from one or more lift stations through a force-main or lift station discharging through pipes 12" or larger. The generators or diesel pumps shall provide for uninterrupted pumping capabilities as per DEP requirements.

If a generator is used, the generator installation shall be an engine-generator of adequate size to automatically start and operate the pumps required for design flow conditions, lights, controls, and other critical items. The engine-generator installation shall be in accordance with all applicable manufacturers' requirements. If a diesel pump is used, it shall be of sufficient size to handle the peak design flow of the lift station.

Lift stations not supplied with emergency generators or diesel pumps on site shall have a service generator receptacle, type, and size of sufficient capacity to operate all necessary equipment and connect to a portable generator.

Lift stations shall be provided with a separate power disconnect switch located in line with the power meter and before the control panel. The switch shall be NEMA 4X, stainless steel only, housing fitted with locking hoop and padlocks, master keyed to City standard.

For every three (3) new lift stations that are installed, one (1) portable backup generator or diesel pump capable of providing adequate power generation or pumping capacity to each of the lift stations constructed shall be purchased by the developer and turned over to the city. The number of generators and/or diesel pumps provided shall be designated in the project plans and or specifications, at the direction of the City.

#### **7.5.13 Lift Station Start-Up Procedures**

All lift station start-ups shall be in accordance with the technical specifications, Section 11150.

#### **7.5.14 Lift Station 3-Day Testing Procedures**

All lift station 3-day testing shall be in accordance with the technical specifications, Section 11150.

### **7.6 LIFT STATION ELECTRIC PANELS**

Electric panels shall be of the type recommended by the pump manufacturer and shall be compatible with the requirements of the pumping operation. All panels shall include provisions for turning pumps on and off, manually and automatically, alternating lead pump with each pump cycle manually or automatically, indications for operation and alarm conditions, testing and indication of all operational features, and terminal strip for telemetry contacts.

A minimum of 8 spare terminal strip contacts shall be provided to allow for expansion, repair, or alterations. One 20A GFI outlet and spare 20A circuit shall be provided.

For all lift stations operating on 480V, an appropriately sized transformer shall be installed to step down the voltage to 120V and provide 5kW power to the 120-volt side of the panel.

A waterproof wiring schematic showing the color-coded wiring and corresponding descriptions

shall be affixed to the inside of the pump control panel door. A lightning arrestor, sized for voltage, current and phase shall be mounted on the outside bottom of the disconnect box.

A non-fused disconnect shall be provided to isolate the pump control panel. Electrical disconnects shall be 316 US manufactured stainless steel switches. Circuit breaker disconnects are not allowed. Control panel surge arrestor is to be mounted outside of the panel. The disconnect shall be installed on the service line before the electric meter and control panel for 480V service. All other electrical service, the meter shall be placed before the disconnect. The bottom of the electrical panel shall be above the 100-year flood elevation and a minimum of 18-inches above grade.

#### **7.6.1 Electric Meter**

The electric meter servicing the lift station shall be located on the rear of the pump control panel. It must be located and wired to service only the lift station facility.

#### **7.6.2 Motor Circuit Protectors**

A 3-pole Motor Circuit Protector shall protect each pump motor. The Motor Circuit Protector shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free from the handle so that the contacts cannot be held closed against a short circuit and abnormal currents which cause the Motor Circuit Protector to trip. Tripping shall be clearly indicated by the handle automatically assuming a position midway between the normal on and off positions. All poles shall be so constructed that they open, close, and trip simultaneously. Motor Circuit Protector must be completely enclosed in high-strength glass polyester molded case. Ampere ratings shall be clearly visible. A manual push-to-trip button shall be provided for manual exercising of the trip mechanism.

#### **7.6.3 Electric Service**

All underground services shall be fully conduited, in 2-inch or 4-inch PVC pipe as necessary from the power company source point to the pump control panel. One spare conduit shall be provided. The gauge of wire of the electric service from the power company transformer to the pump control panel shall be sized to comply with voltage drop requirements. Voltage drop across the service shall not exceed 5% of the power company's line voltage at full load start-up of the lift station pumps. Only copper service wire shall be allowed.

#### **7.6.4 Motor Starter and Selector Switches**

The panel shall contain two motor starters. The motor starter shall be of the type shown on the standard details with individual overload protection on each power leg with a reset installed through inner door unit.

### **7.6.5 Pump Alternator**

An eight-pin plug-in solid state alternator shall be provided to change the pump starting sequence on each pumping cycle. A three-position alternator test switch shall be provided to control the alternation operation.

### **7.6.6 Electrical Grounding System**

A grounding system shall be installed as per National Electrical Code, Local Codes and Ordinances. The drawings shall clearly show the electrical grounding system. An underground perimeter cable grounding system shall be installed with connections to at least the wet well cover, control panels, generator, utility transformer, main disconnect switch, meter box, and all wet well rails.

### **7.6.7 Pumping Wire**

Power wiring for each pump, from the control panel to wet well shall be carried in separate 2-inch PVC conduits and an appropriately sized seal lock fitting must be installed on each line rated for Class 1 Division 2 hazardous locations. A spare parallel 2" PVC conduit from the panel to the wet well shall be provided. All wire shall be stranded THHN or MTW copper wire.

## **7.7 LIFT STATION CONSTRUCTION REQUIREMENTS**

Lift stations shall be constructed in accordance with all City of Cape Coral Utility Standards. The following steps and requirements shall be followed for the design, construction, and turnover of all lift stations:

- A. The engineer, developer, and contractor shall thoroughly review all drawings, specifications, and design procedures prior to commencing any work. A current copy of the approved construction drawings must be kept on site at all times.
- B. Prior to construction, a preconstruction meeting must be scheduled with the City of Cape Coral. The developer, the engineer of record, the prime contractor, and all subcontractors performing work on the lift station must be in attendance.
- C. The lift station site easement/boundaries must be clearly marked (staked) and approved by the contractor, engineer of record and city personnel prior to proceeding with any construction.

D. The contractor and or developer shall schedule periodic inspections throughout construction of the lift station. The following critical steps of construction must be inspected and approved by the City of Cape Coral:

1. Stake all lift station easements and boundaries.
2. Site layout of the wet well, valve vault, and electrical panel.
3. All excavations for wet wells and valve vaults must be dry, compacted and bedded in accordance with the technical specifications prior to the installation of structures. The City of Cape Coral must be on site during the installation of all concrete structures.
4. Installation of underground electrical conduit – the location of the electrical service conduit must be clearly marked (staked) and approved before any installation can proceed.
5. All concrete structures must be inspected by the City of Cape Coral prior to installation.
6. Layout and installation of all underground electrical conduit and grounding between the wet well and electrical control panel shall be reviewed in the field for approval by the City.
7. Compaction and framing of control panel pad shall be in accordance with technical specification 02200. Any concrete pad not level or the same height (flush) with the wet-well lid, or has settled during the warranty period, will be removed and re-poured.
8. All HDPE piping shall be properly aligned before the installation of any electrofusion couplings or any welding of HDPE piping can commence.
9. All underground lift station piping shall be inspected by the City of Cape Coral prior to backfilling.
10. The City of Cape Coral shall be present for the installation of wet well and valve vault lids (position of hatches to be field verified).
11. Compaction and framing of concrete pads between the wet well and valve vault and/or control panel pad shall be in accordance with the City's technical specifications. Any concrete pad not level and same height (flush) with the wet-well lid, valve vault lid and/or control panel pad, or has settled during the warranty period will be removed and re-poured.

12. Lift station fence and/or shrubbery boundaries (layout) must be clearly marked (staked) and approved before any installation can proceed.

## **7.8 LIFT STATION TURNOVER REQUIREMENTS**

Upon successful completion of the lift station start-up and 3-Day test, the following items must be completed and supplied to the City of Cape Coral before the lift station may be turned over for operation and maintenance:

- A. All inspections and punch list items must be complete and approved by the City of Cape Coral.
- B. The electrical service shall be transferred to the City of Cape Coral.
- C. All spare parts must be delivered to the City of Cape Coral.
- D. A hard cover, tabbed, three-ring binder containing hard copies of the following:
  1. All permits obtained by the contractor, developer, and developer's engineer (including all clearance letters).
  2. All manufacturer's warranties for all components installed.
  3. Copies of all testing results (compaction tests, station start-up & 3-day test, etc.)
  4. All approved shop drawings.
  5. Surveyed as-builts and signed & sealed record drawings.
  6. A copy of the completed punch list.
  7. Start-up reports from the pump manufacturer.

## **SECTION 8 - SERVICE CONNECTIONS**

### **8.1 GENERAL**

Where possible, utility services should be provided along local roadways and not four lane roads, to minimize service lengths.

Provide double-service connections where possible. Where storm drain piping extends from the right-of-way along the side property line between two parcels, single services shall be provided so as not to cross the storm drain.

Consider future potential lot splits as part of design of service lateral placement. Parcels made up of more than 3 lots shall be serviced as if every two lots could be developed separately. In the case of an odd number of lots greater than 3, lots shall be served as 2-lot parcels with one 3-lot parcel and one 2-lot parcel.

### **8.2 WATER AND IRRIGATION SERVICES**

Each residential connection shall be provided with a 1" service line, including dual services. Dual residential irrigation service connections shall be a 1" service line with a 1" curb stop. Only lead-free brass is allowed.

Commercial and industrial connections shall be provided with a service line whose size is based on the type of development and the anticipated water consumption. All commercial property shall be serviced with a 2" minimum WM and IRR service equipped with 2" minimum RSG valves. If the property fronts more than one street, it may be serviced from each face with a 2" minimum WM and IRR service as required by the City of Cape Coral. Potable water lines shall be entirely colored blue and irrigation lines shall be entirely colored lavender.

No irrigation or potable water services will be allowed in the radius of a corner lot. Irrigation or potable water services are to be located at side lot or parcel lines.

Locate water services on the same side of the driveway as the existing well if the location is known. Water and irrigation services are always located together. Water services are always located closest to the side property boundary. Double water services are located either side of the common property boundary to avoid interference with property pins.

Single water and irrigation services can be located on the same boundary as a double sewer service provided the water service is located 3-feet from the property boundary. Service boxes shall be 2-feet away from property line and away from power poles.

All water and irrigation services located under major roads must be sleeved.

Refer to the Service Layout Details within the City's Standard Drawings and Details for more specific information.

### 8.3 SEWER SERVICES

A minimum of one service connection shall be installed to service every property fronting a gravity sewer line and can be accomplished by a single service lateral for a lot. Two (2) single services shall be used in tandem for a double service connection. Service connections shall be a minimum of 6". Service laterals shall have a minimum slope of 1%.

Service laterals shall be connected to the tee-wye provided in the gravity sewer utilizing approved fittings or adapters. Service laterals shall terminate at the right-of-way line. The owner shall place a cleanout at the easement or at the right-of-way line, or any directional change, at the time of connection. The service wye connecting to the main line shall point in the direction of flow.

Sewer services shall be located on the same side of the lots as the septic tank (location of the cleanout) if this location is known. Single sewer service shall be at the middle of a vacant lot. Single services can be provided at the property line where a Catch Basin exists. Double sewer services can be located around power poles or hydrants. This may require the relocation of the hydrant 5-feet from the property line.

Existing duplexes may require 2 separate services. Multiple services shall be approved by the Utilities Department. On empty lots where zoned multi-family and no interferences exist, single services may be located at the property line as directed by the Utilities Department.

Sewer services may be located in the roadway intersection ROW radius.

Sewer Services shall tie into the main line at least 5-feet downstream from the manhole. Sewer services into terminal manhole (100' maximum service) may be allowed for one service line (or 1 double), if the terminal manhole cannot be extended, or results in the elimination of a manhole and a significant length of sewer pipe. This shall be on a case-by-case basis and must be approved by the City of Cape Coral and FDEP. There shall be a maximum of 75 feet between cleanouts.

Refer to the Service Layout Details within the City's Standard Drawings and Details for more specific information.

## **SECTION 9 - STORM WATER SYSTEMS**

### **9.1 STORM DRAIN SIZE**

Storm drains to be replaced will typically be replaced one size larger than existing. Upsize 15" to 18", 18" to 24", 24" to 30", 30" to 36", 36" to 42". The same size can be replaced to avoid sewer conflicts, or if can be shown that the storm drain has been recently upsized.

Oval/Elliptical storm drain pipe will not be used unless to avoid sewer conflicts. Oval/Elliptical pipe shall be Class III RCP only.

### **9.2 STORM DRAIN SLOPE**

A preferred slope of 0.25% shall be provided. The minimum slope shall be 0.10%. In rare situations, to avoid lowering the critical sewer run, storm drains can be designed flat but shall require the approval of the City of Cape Coral.

Proposed pipe crown shall match the existing pipe crown unless it has to be lowered to provide minimum cover.

Conflict boxes shall not be allowed.

### **9.3 DEPTH**

Minimum cover for storm drains is 2.2 feet below the edge of pavement. Depth of cover less than 2.2 feet requires the approval of the City of Cape Coral.

Example: Centerline of road elevation less 0.2 feet (10-foot lane) to EOP less 2.2 feet to Top of Pipe (TOP) less pipe diameter to invert at Catch Basin.

### **9.4 CATCH BASINS**

Catch Basins shall have grate covers. Catch basin grate elevations shall be 0.8-feet below centerline for 10-foot lane, 1.0-feet below median edge on 4-lane road. The bleeder elevation shall be set at 0.6-feet from the grate or at existing inlet throat elevation, whichever is the lower. If the existing side drains connecting into a proposed inlet are not replaced, the grate elevation must be at least 0.5 feet higher than the top of the existing pipe but no higher than the road.

Junction Boxes shall have grate covers for access unless under pavement. In paved areas, round manhole covers shall be used.

Two bleed downs will be provided at the front of the inlet and two on the sides. If inlet is located at the bottom of the swale the two front bleed downs will be filled with grout. If the inlet is located in the bank of the swale, the 2 side bleed downs will be filled with grout. Junction boxes will not be provided with bleed downs.

## 9.5 CATCH BASIN TYPE

Different types of Catch Basins will depend on the storm drain size (refer to Standard Details). Typically

Type “C”: 2’-0” wall - 18-inch maximum inlet pipe size.

3’-1” wall - 24-inch maximum inlet pipe size.

Type “E”: 3’-0” wall - 24-inch maximum inlet pipe size.

4’-6” wall - 36-inch maximum inlet pipe size.

Type “P”: 30-inch maximum inlet pipe size.

Inlet pipes at an angle may require larger boxes. Junction Boxes shall be Type “J” structure bottom with Type “C” riser. All other sizes not indicated above shall be per FDOT Index 232.

## 9.6 OUTFALLS

Outfall inlets shall be provided with a 2-foot sump to account for silt accumulation.

Inlets with non-replaced storm drain pipe will be manufactured with a hole large enough to accommodate both the existing outfall pipe and the future outfall pipe. The future outfall pipe will be one pipe size diameter larger than the existing pipe diameter. The future outfall pipe invert will be determined by matching the crown of the future outfall pipe to the crown of the existing pipe.