

TABLE OF CONTENTS

PART 4

4.1	GENERAL	2
4.2	SUBMITTALS	2
4.3	DESIGN REQUIREMENTS	2
4.4	CONNECTIONS TO EXISTING SYSTEM	2-4
4.5	PRODUCTS	5-10
4.6	INSTALLATION – GENERAL	10-12
4.7	GRAVITY SEWER CONSTRUCTION	12
4.8	GRAVITY SEWER TESTING	12-14
4.9	FORCE MAIN CONSTRUCTION	15-16
4.10	FORCE MAIN TESTING	16-17
4.11	WARRANTY	17
4.12	AS-BUILTS	17

CITY OF LAKE WALES

WASTEWATER COLLECTION AND TRANSMISSION STANDARDS

4.1 General

Any new sewerage system to be connected to the public sewer shall not be constructed until final plans are approved by the Public Works Department. Contractor shall furnish all labor, equipment, and materials and shall perform all operations in connection with installation of a complete wastewater collection and pumping system ready for use in accordance with the specifications and the City's requirements, either specific or implied. This includes any and all restoration required to duplicate original site conditions prior to the commencement of construction.

4.2 Submittals

The Department shall be furnished three (3) sets of plans and specifications prepared by a registered engineer certified to do business in the State of Florida. Plans shall be in sufficient detail to accurately indicate all pertinent design and construction details for a comprehensive interpretation of the work to be performed. Two (2) copies of shop drawings shall be submitted to the Director of Public Works for review on any materials, which are requested as a substitute for previously approved materials. The City retains the right to refuse any proposed substitution.

4.3 Design Requirements

9.3.1 Minimum size

All new gravity sanitary sewer lines shall be a minimum of eight (8) inches in diameter. All new force mains shall be a minimum of six (6) inches in diameter.

9.3.2 Alignment

All gravity sanitary sewers shall be laid with straight alignment and uniform grade between manholes. Where feasible, both gravity sanitary sewers and force mains shall be laid parallel to the right-of-way line.

9.3.3 Depth of cover

The depth of cover on all lines carrying wastewater shall not be less than thirty-six (36) inches unless otherwise approved by the City.

9.3.4 Slope

Minimum grades in gravity sewers shall not be less than those required to produce a velocity of approximately two (2) feet per second when the size pipe selected is flowing full and using an “n” value of 0.013 in the Manning Formula.

Sewers shall be designed with the following minimum grades:

8"	0.40%
10"	0.28%
12"	0.22%
14"	0.17%
15"	0.15%
18"	0.12%
21"	0.10%
24"	0.08%

4.3.4 Velocity

Force mains shall be designed to have a mean velocity of not less than 2.5 feet per second, with one pump operating at full speed. The maximum mean velocity, with all pumps operating, shall not exceed six (6) feet per second.

4.3.5 Service Laterals

A separate and independent service lateral shall be constructed from the main to each building, lot, or two adjacent lots. Minimum size for services shall be four (4) inches, with a minimum slope of 1/8" per foot. Service lateral connections to the sewer main shall be made using wye fittings. Solvent-weld or strap-on saddles are not acceptable for new construction. Service laterals shall extend from the main to the edge of the road right-of-way and shall in no case be longer than 50'. A cleanout shall be provided at the right-of-way line on each service lateral. All service lateral stub-outs shall be marked with a pressure treated 2'X4" piece of lumber no less than 4' in length. The 2"X4" shall extend approximately one foot above grade and shall be painted green. The depth to the lateral shall be noted on the 2X4.

4.3.6 Manholes

Manholes shall be installed on gravity sanitary sewer lines at all changes in grade, size, or alignment, at all intersections, and at the end of the line. The maximum distance between manholes shall be 400 feet. A manhole shall be constructed at the end of all lines, regardless of length. Minimum inside diameter of all manholes shall be 48 inches for all sewers up to 24 inches in diameter. Manholes for sewers larger than 24 inches shall have an inside diameter of not less than 60 inches.

Where practical, manholes shall be placed on undisturbed soil. Where manholes must be installed in fill areas, the fill shall be compacted to 95% of the optimum density, as

determined by AASHTO T-99 to an elevation not less than 36" above the proposed invert before excavation begins. Certification of compaction at the manhole location shall be provided before setting the manhole base.

4.3.7 Air and Vacuum Venting

Where the force main profile is such that air pockets or entrapment could occur, provisions for air release valves shall be provided. Unless authorized by the Public Works Department, all air and vacuum valves shall be automatic. Manual valves shall be allowed only on minor force mains with small changes in grade. Air and vacuum valves shall be installed on all profile break points. Air release valves shall be installed as directed by the Utilities Department. All air valves shall be in accordance with the standard specifications and details.

4.3.8 Valve Locations

Where two force mains join, valves shall be installed on all force mains at the point of connection. Where force mains are to be extended, valves shall be installed at that location. These valves shall be restrained by methods other than thrust blocking.

4.3.9 Manifold Vaults

Force mains to be manifolded shall be provided with plug and check valves inside concrete valve vaults to enable isolation of force main branches.

4.4 Connections to Existing System

4.4.1 Connections to existing gravity sewer mains

Shall be made only after 48 hours notice to the Director of Utilities. A water-tight plug shall be installed to prevent any discharge to existing sewers until the City has accepted the completion of all tests and inspections and the new system.

4.4.2 Connections to existing force mains

Shall be made only after 48 hours notice to the Director of Utilities. All tapping sleeves, cutting-in sleeves valves and fittings shall be provided by Contractor. Valve shall be locked shut until all tests and inspections are complete and the City has accepted the new system. All connections shall be made by contractor using HOT TAP method into a stainless steel sleeve. The Director of Utilities may specify times and/or locations for connections to minimize the disruption of service to existing customers.

Products

4.5.1 Materials

All materials shall be new, of first quality, manufactured in the United States, and shall conform to the appropriate ASTM and/or AWWA standard, latest revision.

4.5.2 Fittings

All fittings and materials shall be inspected by the City Utilities Department after delivery and prior to being installed.

- (1) All fittings shall be rated for not less than 150 psi working pressure.
- (2) Grade for ductile-iron fittings shall conform to Standard or ANSI/AWWA C11A21.11, and shall be polyethylene lined inside and bituminous coated outside. Mechanical joint ductile-iron fittings complying with AWWA 0153 are acceptable.
- (3) Malleable iron fittings shall be galvanized conforming to the applicable provision of Federal Specification WW-P-521D, Type II, and may be used in sizes two (2) inches and under only.

4.5.3 Polyvinyl Chloride (PVC) Gravity Sewer Pipe

- (1) Provide ring-tight gravity sewer pipe and fittings to meet or exceed the requirements of ASTM D 3034 SDR35. Specified length per section of pipe is 12.5 feet. Pipe shall be dyed green. Bell shall consist of an integral wall section with a solid cross-section rubber ring.
- (2) PVC gravity sewer pipe and fittings 18" and larger shall meet or exceed the requirements of ASTM F674. Pipe shall be dyed green.

4.5.4 Ductile Iron Gravity Sewer Pipe

- (1) Provide push-on joint ductile iron pipe to meet or exceed the requirements of AWWA C111JA21.1. Pipe shall have exterior bituminous coating and cement lining with bituminous seal coat.
- (2) Pipe thickness (class) shall be as recommended by the pipe manufacturer for the actual field conditions.

4.5.5 Sanitary Sewer Manholes

- (1) Sewer manholes shall be constructed in accordance with the City's standard

details. Excavation shall be made in accordance with applicable sections of these specifications.

(2) Concrete manholes shall be constructed of 4,000 pound, Type II Acid Resistant Concrete. Pre-cast manholes shall be in accordance with ASTM C478. For pre-cast manholes, all joints between manhole sections shall be sealed with two concentric rings of preformed plastic sealing compound, installed in accordance with manufacturer's recommendations. The sealing compound shall be "Ram-Nek" as manufactured by K.T. Snyder Co., or equal.

(3) Pre-cast concrete manholes shall have a minimum wall thickness of 5 inches. Cast-in-place manholes shall have a minimum wall thickness of 5 inches.

(4) Manholes shall have channel inverts accurately and smoothly formed for each connecting pipe. The channel shall have a smooth "U" shape with the bottom conforming to the radius of the sewer pipe and a total depth equal to 90% of the pipe diameter. Channel inverts may be constructed of half pipe with finished surfaces shaped as shown on the detail. Use of brick or concrete block to form the invert is not acceptable.

(5) Only one exiting pipe shall be allowed per manhole.

(6) Where pipe diameters change across a manhole, the upper "0.8 points" shall be at the same elevation.

(7) When the manhole is completed, the frame and cover of dimensions shown shall be set in place in mortar. In paved areas, the top of the cover shall be flush with surrounding pavement. In unpaved areas, the top of the cover shall be two inches (2) above finish grade.

(8) Interior and exterior of all manholes shall receive two (2) coats of Devco Devtar 5A, or equal, epoxy.

(9) Backfill shall be made in accordance with applicable sections of these specifications.

(10) All connections of pipes to manholes shall be made utilizing resilient pipe connectors.

(11) The Contractor shall install drop manhole connections when the difference in elevation of the incoming sewer invert and the manhole invert exceeds two feet, or where directed by the Director of Public Works. The difference in elevation shall be measured from the invert of the incoming pipe to the invert at the center of the manhole.

Drop connections shall be ductile iron pipe or PVC pipes backfilled in six (6) inch lifts and compacted by hand tampers.

(12) All castings for manhole covers and other purposes shall conform to specifications of the ASTM, Designation A48-74 for Class 30 gray iron. The castings shall be true pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow-holes, and other defects in position affecting their strength and value for the service intended.

(13) Manhole frames and covers shall have the words "CITY OF LAKE WALES" and "SANITARY SEWER" cast thereon. Minimum clear opening of the cover shall be 24". Cover shall weigh not less than 150 pounds. Circular covers must fit the frames in any position. Contact surfaces of both frames and covers shall be machined and any tendency to rattle, as determined by test before or after installation, will be sufficient cause for rejection of the frames and cover.

(14) Where required, water-tight frames and covers shall be Neenah Foundry Figure No. R-1916F, or equal, with rubber gasket.

4.5.6 Ductile Iron Force Main

(1) Ductile iron force main shall comply with (AWWA C150-81)

(2) All ductile iron force mains six (6) inch diameter and greater shall be a minimum of thickness Class 52 with mechanical joint or push-on joints. Where indicated, flanged pipe shall be thickness Class 53 with 125 pound standard flanges with full face rubber gaskets.

(3) All ductile iron piping four (4) inch diameter and smaller shall be a minimum of thickness Class 53.

(4) Pipe manufacturing shall be in accordance with (AWWA 0151-81).

(5) Ductile iron force main shall be bituminous coated in accordance with (AWWA 0104-71). Interior lining to be 40 inil polyethylene. All ductile iron force main shall be lettered with the words "SANITARY FORCE MAIN" running longitudinally along the pipe at three foot (3?) intervals.

(6) Polyethylene encasement meeting the requirements of (AWWA 0105) shall be utilized on all ductile iron pipe and fittings installed in corrosive soils.

(7) Above ground and exposed pipe to be painted green with high build epoxy paint system.

4.5.7 Polyvinyl Chloride (PVC) Force Main

- (1) All PVC force mains four (4) inch diameter and greater shall be Class 200 pipe meeting ASTM D1784 and D2241 (DR) to be 21.
- (2) Each length should be clearly labeled so as to allow identification and specification conformance. Force Main Pipe shall be dyed green or shall have green identification markings at 120 degree intervals around the pipe circumference.
- (3) Force main piping two (2) inch diameter and smaller ASTM-2241 with an SDR of 21.

4.5.8 Plug Valves

Plug valves shall be of the eccentric plug type, non-lubricated, with port area equal to a minimum of 100% of pipe area. Minimum pressure rating shall be 150 psi. Valve bodies to be cast iron ASTM A126, Class B. Plugs shall be cast iron with neoprene facing and shall be of the single piece design. Plug shall be of same configuration for all valves and shall require no stiffening member opposite the plug for balance or support. Valve body seats shall have a welded in overlay not less than 90% nickel. Packing shall be adjustable and shall be replaceable without removing the valve from service, depressurizing the line, or removing the valve operator. Bushings in both upper and lower journals to be type 316 stainless steel. Valve shall be drip tight in both directions to the full pressure rating. All exposed nuts, bolts, springs and washers to be stainless steel. All plug valves to be DeZurik Figure 118 or equal. Coat valve exterior with two (2) coats of DeVoe Devtar 5A, or equal, twelve (12) mils each coat, in accordance with manufacturer's directions.

4.5.9 Sewage Combination Air Valves

Valves to be APCO Series 440 SCAV as manufactured by Valve & Primer Corporation, Schaumburg, IL or approved equal. The Combination Air Valves shall be *fitted* with inlet isolation valves, blowoff valves, flush valves and minimum of five (5) feet of rubber hose with quick disconnects for backflushings. Isolation valves shall be bronze gate valves. Valves shall have phenolic red oxide primer and shall be coated with two (2) coats Koppers Torex 800, or equal, chlorinated rubber base coating to a minimum dry film thickness of 2.0 mils.

4.5.10 Valve Operators

- (1) Provide suitable handwheels for gate, globe, angle, and drain valves and inside hose bibbs mounted above-ground. Provide wrench operator having adjustable, open stop memory positions for exposed plug valves smaller than four (4) inches.

- (2) Provide two (2) inch AWWA operating nut for all buried valves.
- (3) Provide gear operators for plug valves four (4) inches and larger. Gear operators for plug valves four (4) inches through twenty (20) shall be of the worm and gear type. Operator shall include spur gears, AWWA input stops, stainless steel bolting, and shall be outfitted for buried service, if applicable.
 - (a) Gear operators shall be enclosed, suitable for running in oil, with shaft seals to prevent entry of dirt and/or water. The actuator shaft and sector gear shall be supported on permanently lubricated bronze bushings. Actuators without bronze bushings will not be allowed.
 - (b) Gear operators shall be of the totally enclosed design and shall be proportioned to permit operation of the valve under full rated pressure in either direction with a maximum force of 80 pounds on the handwheel or crank Provide stop limiting devices in the operator at the open and closed positions. Operators shall be of the self locking type to prevent creeping. Design components between input and stop limiting devices to withstand without damage a pull of 200 pounds for handwheel and crank operators and an input torque of 300 foot-pounds for operating.
 - (c) Worm gear shall be one-piece design of gear bronze material (ASTM B427), accurately machine cut. Sector gear shall be hardened alloy steel. Reduction gearing shall run in proper lubricant. Operators shall be Lirnitorque or EIM.
 - (d) Gear operators for above-ground service shall be handwheels with a minimum diameter of twelve (12) inches. Operator shall contain a dial indicating position of the valve plug. Chain operators shall be provided as required.
 - (e) Gear Operators for underground service shall have two inch AWWA operating nut. Provide watertight shaft seals and actuator cover gaskets. Provide operators designed for buried service.

- (4) All operators to open by turning counter clockwise.

4.5.11 Valve Boxes

- (1) Boxes shall be cast iron of standard design with adjustable drop section to fit disc or cover over valve. Interior diameter shall be not less than five (5) inches, with cast iron cover marked "SEWER?". Boxes shall be Glow F2454, or equal.

4.5.12 Steel Pipe Sleeves and Carrier Pipe

All construction projects requiring steel sleeves shall conform to the minimum D.O.T

requirements for roadway crossings. Railroad crossings shall conform to railroad requirements. The following casing sizes shall be used for the corresponding carrier pipes:

<u>CARRIER PIPE</u> (Normal O.D.)	<u>STEEL CASING</u> (Required Dia.)
4"	8"
6"	12"
8"	16"
10"	18"
12"	24"
16"	30"
20"	36"

4.5.13 Tracer wire

Shall be green-coated #12 gauge and installed on all force mains. Tracer wire shall be taped to the pipe and stubbed up at all valves.

4.6 General Installation

4.6.1 Preparation

Remove scale and dirt, on inside and outside, before assembly.

4.6.2 General

- (1) Trenches shall be maintained in a dry condition at all times unless otherwise approved by the Public Works Director.
- (2) Maintain 10' minimum horizontal or 18" minimum vertical separation of water main from sewer piping in accordance with State requirements.
- (3) The trench shall be dug so that the pipe can be laid to the alignment and depth required, and it shall be excavated only so far in advance of pipe laying as permitted by the Public Works Director. The trench shall be so braced and drained that the workmen may work therein safely and efficiently.
- (4) All excavations deeper than three (3) feet shall be dewatered as required to maintain the water level at a minimum of two (2) feet below the excavation throughout excavation, bedding, and backfilling. Discharges of dewatering pumps shall be conveyed to natural drainage channels, drains, or sewers. Contractor shall treat discharge as required to prevent violations of state water quality standards. Trenches shall be of such extra width, when required, as will permit the convenient placing of timber supports, sheeting and bracing, and handling of

(5) Pipe trench shall be prepared in accordance with pipe manufacturer recommendation.

(6) The following are minimum trench widths measured at the horizontal centerline of the pipe without undercutting:

<u>Pipe Size</u>	<u>Minimum Trench Width</u>
8"	24"
10"	26"
12"	30"

(7) Bell holes shall be provided at each joint to permit the jointing to be made properly.

4.6.3 Sheeting and Bracing

(1) During construction, the side slopes of all the excavations shall be maintained at an inclination no steeper than two horizontal to one vertical. Vehicles shall be at least five feet away from the top of slope. If site conditions do not permit such side slopes, excavation shall be performed using sheeting, shoring, and bracing.

(2) Open-cut trenches shall be sheeted and braced as required by any governing Federal and State Laws and municipal ordinances, and as may be necessary to protect life, property, or the work. Comply with the Florida Trench Safety Act and the related OSHA requirements of 29CFR.S.1926.650 Part P. When close sheeting is required, it shall be so driven as to prevent adjacent soil from entering the trench either below or through such sheetings. Where sheeting and bracing are used, the trench width shall be increased accordingly.

(3) Sheeting and bracing which have been ordered left in place must be removed for a distance of 3 feet below the established street grade or the existing surface of the street, whichever is lower. Trench bracing, except that which must be left in place, may be removed when the backfilling has reached the respective levels of such bracing. Sheeting, except that which has been left in place, may be removed after the backfilling has been completed or has been brought up to such an elevation to permit its safe removal.

(4) Sheeting and bracing may be removed before flooding the trench, but only in such manner as will insure that adequate protection of the completed structures and adjacent underground or surface structures, and prevent the disturbance of adjacent ground.

4.6.4 Handling Material

(1) All pipe and accessories shall be loaded and unloaded by lifting with hoists or skidding in a manner that will avoid shock or damage. Under no circumstances will such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

4.7 Gravity Sewer Construction

- 4.7.1 Trenching and backfill shall be in accordance with the pipe manufacturer recommendations. Pipe shall not deflect more than 5% from true round diameter after fully backfilled thirty days.
- 4.7.2 Gravity sewers shall be laid to exact line and grade by the use of a grade line supported on batter boards spaced at not more than 25-foot centers or by laser beam. Sewers will be inspected with a light at each manhole when the line is completed and backfill has been placed to a depth of one-foot over the pipe. Backfill may be completed only after approval of each section is given for alignment and grade. Laser beam control is encouraged. Faulty sections of sewer lines rejected by the City shall be removed and relaid by the Contractor at his own expense.

4.8 Gravity Sewer Testing

- 4.8.1 Each gravity sanitary sewer, upon completion, or at such time as the Public Works Director may direct, is to be cleaned, tested, and inspected. All repairs or alterations shown necessary by these tests shall be made; all broken or cracked pipe removed; all excessive infiltration stopped; all deposits in pipe and manholes removed and the sewer left clean, true to line and grade, and ready for use.

Before final acceptance, gravity sewer lines shall be televised by a contractor with qualifications suitable to the City. Each line will be recorded using a VHS videocassette. Each run will be clearly labeled showing the manholes and with a counter indicating the lineal number of feet run from the reference point. Film shall be in color and shall include inspection of all newly installed laterals. The original videocassette shall be provided to the City.

Any deviation from grade greater than 1/2" for slopes of 0.4% and less, and greater than 1" for grades greater than 0.4%, shall be cause for rejection of the installation. The following requirements for televising the gravity sewer must be met prior to acceptance by the City of Lake Wales.

- A. All gravity sewer lines to be cleaned using high pressure flusher trucks prior to being televised with a closed circuit television camera. Flusher truck should vacuum any dirt and debris, along with cleaning water, out of manhole for disposal elsewhere.
- B. Any debris remaining in the line shall be a cause for canceling the television inspection.
- C. Within 24 hours of start of start of TV inspection, verify contractor adds enough

water to upstream manhole to cause water to flow into downstream manhole. This is to ensure that all sags in sewer line are filled with water prior to start of construction.

- D. Starting at uppermost reach, each line segment to be televised from downstream manhole to upstream manhole to allow better inspection of service connections.
- E. At start of each line segment inspection camera is turned on and panned around to show identifying landmarks to positively identify manhole being televised. Once camera starts recording, ensure that the camera is not turned off until the inspection is complete.
- F. After showing identifying landmarks, camera to be lowered into the manhole and positioned into the downstream end of the segment being inspected.
- G. The camera is to be towed behind a 1/2" target gauge. The gauge is used to judge the depth of any sags or bellies in the line.
- H. Verify the camera does not travel at a rate greater than 30 feet per minute. All service wyes to be thoroughly inspected.
- I. Ensure that there is **NO** leakage (infiltration) at any pipe joint or at connections to manholes. Any infiltration shall be grounds for failing the inspection.
- J. Any line segments that require repairs to be re-televised prior to final acceptance.
- K. Gravity sewers will also be tested or gauged to determine the amount of infiltration or exfiltration.

4.8.2 Maximum infiltration or leakage limit:

"50 gallons per 24 hours per mile of sewer pipe per inch of nominal diameter where the invert of the sewer is constructed above the usual ground water elevation."

4.8.3 Water Table Determination

The water table present at the time of testing shall determine the test method to be utilized. If the water table is greater than one foot above the crown of the sanitary sewer, then infiltration testing shall be utilized. If the water table is less than one foot above the crown of the pipe, or is below the crown of the pipe, then exfiltration testing will be used.

4.8.4 Infiltration Tests

An exfiltration test or low pressure air test as described below may be utilized in lieu of an infiltration test. All data from infiltration tests shall be recorded on forms provided by the City.

4.8.5 Exfiltration Tests

The sewer section to be tested shall be filled with clear water to a specified elevation of three feet (3') above the sewer crown, or the water table surface, whichever is higher measured at the highest point of the section. The amount of exfiltration is determined by the volume of water required to maintain the specified elevation over a two-hour test period. Manholes or standpipes may be used to maintain the specified water level.

4.8.6 Low Pressure Air Test:

(1) All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to raise the pressure inside the plugs to 25 psi. The sealed pipe shall then be pressurized to 5 psi. The plugs must hold against this pressure without having to be braced.

(2) Equipment used shall be Cherne Air-Loc as manufactured by Cherne Industrial, Inc., Model 52-A as manufactured by United Survey, Inc., or City approved equal.

(3) After each manhole to manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs have been tested, plugs shall be inserted into each end of the line to be tested and shall be inflated to 25 psig. Low pressure air shall be introduced into the sealed line until the internal air pressure is 4 psig greater than the average back pressure of any ground water that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize. Minimum air pressure at the end of this period shall be 3.5 psig.

(4) After the stabilization period, the air hose from the control panel to the air supply shall be disconnected. The portion of the line being tested shall be deemed "acceptable" if the time required in minutes for the pressure to decrease from 3.5 psig to 2.5 psig greater than the average back pressure of any ground water that may be over the pipe) is greater than the times shown in the following table.

<u>Pipe Diameter</u> <u>In Inches</u>	<u>Minutes</u>
4"	2.0
6"	3.0
8"	4.0
10"	5.0
12"	5.5
15"	7.5
18"	8.5

In lieu of the above table, acceptance of the line may be based upon the rate of air loss not exceeding 0.0003 cubic feet per minute per square foot of internal pipe surface when pressurized to an average pressure of 3.0 psig greater than the groundwater hydrostatic pressure on the sewer pipe.

4.8.6 Manhole Leakage Test

Manholes shall be examined for visible leakage due to infiltration of ground water if the water table is greater than five feet above the manhole invert or by filling

with water to the base of the manhole frame. Infiltration or exfiltration shall not exceed the requirements specified above.

4.9 Force Main Construction

- 4.9.1 All pipe shall be laid to a minimum cover of 36 inches from established grade if not otherwise indicated. Any variation shall be approved by the Public Works Director.
- 4.9.2 The pipe fittings shall be inspected for defects and while suspended above grade.
- 4.9.3 Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. If the pipe-laying crew cannot put the pipe in the trench and in place without getting earth into it, the City may require that before lowering the pipe into the trench, a heavy, tightly woven canvas of suitable size shall be placed over each end and left there until connection is to be made to the preceding joint. During laying operations, no debris, tools, clothing, or other materials shall be placed into the pipe.
- 4.9.4 After placing a length of pipe into the trench, the end shall be centered in the coupling and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the joints. Pipe and fittings, which do not allow a sufficient and uniform space for joint, shall be removed and replaced with pipe fittings of proper dimensions to insure such uniform space. Precautions shall be taken to prevent dirt from entering the joint space.
- 4.9.5 At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the City. Joints of pipe in the trench which cannot be poured shall be caulked with packing to make them as watertight as possible. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.
- 4.9.6 The cutting of pipe for inserting fittings or closure shall be done in a neat and workmanlike manner without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe.
- 4.9.7 Install trace wire with all force main installations in accordance with City requirements.
- 4.9.8 All plugs, caps, tees, and bends deflecting 22-1/2 degrees or more on main four (4) inches in diameter or larger shall be provided with restraining glands in accordance with City standards.
- 4.9.9 Reaction backing shall be ready-mix concrete having a compressive strength of

not less than 2,500 psi in 28 days. Hand mixing will not be permitted. Backing shall be placed between solid ground and the fitting to be anchored. The backing shall, unless approved by the Director of Utilities, be so placed that the pipe and fitting joints will be accessible for repair.

4.10 Force Main Testing

4.10.1 Before pressure testing force main, place a minimum cover of six (6) inches above the top of pipe but leave all joints exposed. The backfill should be free of stones and hard earth. Pressure test the pipe in the presence of the City Inspector and carefully examine joints for leaks. After pressure testing, joints should be covered with same select backfill as used for pipe.

4.10.2 Each valved section of force main shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test, and corrected to the elevation of the test gauge, shall be applied by means of a gasoline driven test pump connected to the pipe in a manner satisfactory to the City. The Contractor shall make arrangements for metering the amount of water used during the test.

4.10.3 All joints shall be left uncovered during the test. If they become covered they shall be re-dug. If the ditch is wet, each joint shall be pumped dry for inspection of loose bolts and leaks. Sufficient manpower shall be employed to insure the inspection of each joint during the two-hour test period.

4.10.4 Before applying the specified test pressure, all air shall be expelled from the pipe. Taps at points of highest elevation shall be made before the test is made and plugs inserted after the line has been flooded.

4.10.5 All exposed pipes, fittings, and joints will be carefully examined during the open trench test. Any cracked or defective pipes or fittings discovered in consequence of this pressure test shall be removed and replaced with sound material and the test shall be repeated until satisfactory to the City.

4.10.6 Pressure test shall be conducted at a minimum pressure of 150 psi. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or in any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filed with water and the air expelled.

No pipe installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{ND^2P}{7,400}$$

in which L equals the allowable leakage in gallons per hour; N is the number of joints in the length of the pipe line tested; D is the nominal diameter of the pipe in

inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge. (The allowable leakage, according to the formula is equivalent to 10.5 U.S. gallons per 24 hours, per mile of pipe, per inch nominal diameter, pipe in 20-foot lengths evaluated on a pressure basis of 150 psi.)

Where any section of main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least five days have elapsed after the concrete reaction backing was installed. If high early strength cement is used in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least two days have elapsed.

4.11 Warranty

All portions of the installed sewer system and site restoration shall be fully guaranteed against material defects of improper workmanship for a period of one year from acceptance by the City. During this time, repairs will be made by the developer at no cost to the City. Any repairs made on the newly installed system by the City during this period will be charged to the developer.

4.12 As-Builts

The engineer of record, or such Registered Engineer as may apply, shall submit to the City two sets of certified "As-Built/Record Drawing" (Blueprint), one set on mylar and one set on electronic media compatible with the City systems shall be provided to the Utilities Department for the water system. The "As-Built" shall contain a certification from a registered Engineer in the state of Florida that indicated that the project has been substantially completed in accordance with the approved plans and specifications, or that the deviations noted on the "Record Drawings" will not prevent the project from complying with the design function of the project.

In order to effectively comply with this requirement, it would be necessary for the certifying Engineer to have provided periodic review and inspection of the installation of those facilities within the project. The Engineer may supplement his review and inspection of the project by utilizing information taken from a valid survey. The "As-Built/Record Drawings" shall provide information on project facilities that indicates sufficient horizontal and vertical dimensional data so that the constructed improvements may be located and delineated. All dimensions both horizontal and vertical shall be placed on the "As-Built/Record Drawings" and certified by a Professional Surveyor or Mapper and Professional Engineer before submitting to the City.

"As-Built/Record Drawings" that contain disclaimers that essentially render the Professional Engineer's certification meaningless will not be accepted.