

EWD SPECIFICATIONS FOR CONSTRUCTION OF
WASTEWATER COLLECTION SYSTEMS AND PUMPING STATIONS

1.0 COLLECTION SYSTEMS - GENERAL

Collection systems shall be designed in accordance with these regulations and applicable requirements of Chapter 62.600 and 62.604, Florida Administrative Code, as amended. In case of conflict between these requirements and Federal, State, or County requirements, the most stringent shall apply.

1.1 Design Period

Except for parts of the system that can be readily increased in capacity, sewer systems shall be designed for the estimated ultimate tributary population 20 years hence.

1.2 Design Factors

In determining the required capacities of sanitary sewer, the following factors shall be considered:

- A. Maximum hourly quantity of wastewater.
- B. Additional maximum wastewater flows from industrial plants.
- C. Groundwater infiltration.
- D. Rainwater from roofs, streets, and other areas, and groundwater from foundation and drains shall be excluded.

1.3 Design Basis

When no water use information is available, sewer systems shall be designed on the basis of an average daily per capita flow of wastewater of not less than 100 gpd. This figure is assumed to cover normal infiltration, but an additional allowance should be made where conditions are unfavorable. Sewers shall be designed to carry, at maximum capacity, not less than the following daily per capita contributions of wastewater:

- A. Lateral and sub-main sewers 400 gallons
- B. Main, trunk, and outfall sewers 275 gallons

As an alternate method, when the need for deviations from the foregoing per capita rates is demonstrated, a brief description of the rationale and the methodology used for sewer design shall be submitted to EWD for consideration and approval.

1.4 Design Standards

All collection system elements shall, unless specifically modified herein, be in compliance with applicable guidelines on The Standard Manuals and Publications Described in Chapter 62-600.300 (4).

2.0 DETAILS OF DESIGN AND CONSTRUCTION OF SEWER PIPELINES

2.1 Minimum Size

No public gravity sewer shall be less than eight (8) inches in diameter. Minimum service line to a single family lot to be four (4) inches in diameter. Minimum service line to a double single family residential lot to be six (6) inches in diameter.

2.2 Depth

Gravity sewers shall maintain at least 4.0 feet of cover under roadways and paved areas, and at least 3.0 feet of cover, as final grade, under open areas, unless concrete protection is utilized.

The minimum vertical clearance between sewer and storm culverts shall be 18 inches, unless concrete protection or ductile iron pipe is utilized.

2.3 Slope

All sewers shall be so designed and constructed to maintain mean velocities, when flowing half full, of not less than 2.0 feet per second, based on using a Manning "n" value of 0.013 for full flow.

Required Diameter (inch)	Sewer Minimum Slope (foot/100 feet)	Recommended Minimum Slope (foot/100 feet)
0.40	0.522	0.28
0.387	0.22	0.304
0.17	0.247	0.15
0.226	0.14	0.206
0.12	0.177	0.10
0.144	0.10	0.120

2.4 Alignment

Sewers shall be laid with straight alignment and uniform slope between manholes. This shall be accomplished by acceptable laser type methods.

2.5 Increasing Size

When a small sewer joins a larger one, the invert of the larger sewer shall be lowered sufficiently to maintain the same energy gradient. An approximate method for securing these results is to place the 0.8 depth point of both sewers at the same elevation.

2.6 High Velocity Protection

Where velocities greater than 10 feet per second are attained, special provisions shall be made to protect against displacement by erosion and shock. Ductile iron pipe shall be used with mechanically restrained joints and concrete anchors.

2.7 Pipe Materials

Any generally accepted material for sewers that has a crushing strength of 2,000 pounds per linear foot or more in accordance with ASTM D 3034 shall be acceptable, but material selected should be adapted to local conditions, such as character of wastes, possibility of septicity, soil characteristics, abrasion, and similar factors. Flexible pipe shall have an SDR ratio of 35 or less. ABS thross pipe ends shall be sealed. ABS and PVC pipe shall be protected from sunlight while in storage.

2.8 Pipe Bedding and Trench Backfill

All sewers shall be designed to prevent damage from superimposed loads. Proper allowance for loads to the sewer pipe shall be made due to the width and depth of trench.

A. Rigid Pipe - Rigid pipe shall be bedded in accordance with ASTM C-12

B. Flexible Pipe - All PVC sewers shall be installed in accordance with ASTM D-2321 and bedding requirements of Class I or II.

Flexible pipe shall pass a go/no-go mandrel size to 95% of the pipe diameter actually being used with the pipe in place and covered. Flexible pipe is considered to have reached the limit of service ability when a deflection of 5% is attained (WPCF MOP #9, page 222).

The appropriate allowable deflection when installed (must be less than 5%) may be calculated using the pipe stiffness formula in ASTM D-2321.

C. Alternate Bedding Option As an alternate to 2.8 A or 2.8 B above, all sewers shall be bedded with a minimum of 6 inches of granular (crushed stone) material over and under the pipe.

D. Trench Backfill

1. Backfill material shall consist of any of the following well graded coarse granular materials with maximum particle size not exceeding 4 inches; sands, gritty sands, or clayey sands. Solids having more than 35% of its weight passing a No. 222 sieve shall not be used as backfill.

2. Backfill area shall be compacted to not less than 95% of maximum density as determined by AASHTO T-99.

2.9 Joints and Infiltration

The method of making joints and the materials used shall be indicated in the drawings. Sewer joints shall be designed to minimize infiltration and to prevent the entrance of roots. Standard laying lengths for PVC shall not exceed 14 feet. Rubber gaskets, PVC, and other types of premolded (factory-made) joints are required. Hot-poured joints are not acceptable except in special cases where a factory-made joint is not available. Cement mortar joints are not acceptable, nor are field solvent welds.

When leakage tests are used to determine the acceptability of gravity lines, the leakage outward or the infiltration shall not exceed 200 gallons per inch pipe diameter, per mile, per day for any section of the system less than 30 inches in diameter. All infiltration shall be eliminated from sewer line segments less than 1,200 feet in length. Low pressure air testing for all pipe shall be as specified in ASTM C828-76T. The pressure drop shall be calculated as the number of seconds for the air pressure to drop from a stabilized pressure of 3 1/2 PSIG to 2 1/2 PSIG. The following minimum times are calculated for one pipe size only. Times for mixed pipe sizes of varying length should be calculated as described in ASTM C828-76T.

Minimum Time (Seconds)	Pipe Size (inches)	Length (feet)
227	8	350
283	10	275 to 350
340	12	225 to 350
425	15	175 to 350
510	18	150 to 400
595	21	125 to 400
680	24	125 to 500

3.0 MANHOLES

3.1 Location

Manholes shall be installed at the upper end of each line, at all changes in grade, size or alignment, at all intersections, and at distances not greater than 500 feet. Manholes shall be precast concrete or poured in place concrete.

3.2 Drop Manhole

A drop pipe shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert shall be U-shaped to prevent deposition of solids.

3.3 Diameter

The minimum diameter of manholes shall be 48 inches. The entrance tube shall be a minimum of 24 inches in diameter.

3.4 Flow Channel

The flow channel through manholes shall be made to high-water level.

3.5 Watertightness

Solid manhole covers are to be used in all cases. Wherever the manhole tops are

subject to flooding by street run-off or high water, the manhole cover shall have gaskets and be bolted. Where gasketed manholes are required for long distances, a vent shall be provided every third manhole with the top of the vent above the high water level. Manholes shall be waterproofed on the exterior with bitumastic coal tar epoxy.

3.6 Precast Manhole Bases

Manhole bases and their installation shall be addressed in the detail in the plans and specifications.

Where adverse (wet, spongy, soft, or unstable) soil conditions are encountered, a sub-base of poured-in-place concrete or crushed stone shall be placed under the precast base, as required.

A flexible, watertight wall to pipe joint, capable of accommodating differential settling or other potential stresses, shall be installed between the manhole wall and pipe to reduce the incidence or sheared pipe lines and groundwater infiltration.

4.0 INVERTED SIPHONS

Under normal conditions, inverted siphons should not be used; however, when such siphons are used, the following conditions must be met:

4.1 Inverted siphons must have not less than two barrels, with a minimum pipe size of six inches, and must be provided with the necessary appurtenances for convenient flushing and maintenance.

4.2 Manholes must have adequate clearance for rodding; and, in general, sufficient head must be provided and appropriate pipe sizes selected to secure velocities of at least 3.0 feet per second for average flows.

4.3 The inlet and outlet details must be arranged so that the normal flow is diverted to one barrel, and so that either barrel may be out of service for cleaning.

4.4 The design engineer must furnish hydraulic calculations with the plans.

5.0 PROTECTION OF WATER SUPPLIES

There will be no physical connections between a public or private potable water supply system and a sewer, or appurtenances thereto, which would permit the passage of any wastewater or polluted water into the potable supply.

Sewers shall be kept remote, insofar as possible, from public water supply wells or other water supply sources and structures.

Whenever possible, sewers should be laid at least 10 feet, laterally, from any existing or proposed water main. Should local conditions prevent a lateral separation of 10 feet, a sewer line may be laid closer than 10 feet to a water main, if it is installed in a separate trench and if the elevation of the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.

Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the crown of the sewer is at least 18 inches below the invert of the water main. When the elevation of the sewer cannot be changed to meet the above requirement, the water main shall be relocated to provide such separation, or reconstructed with ductile-iron mechanical-joint pipe for a distance of 10 feet on each side of the sewer. One full length of water main shall be centered over the sewer so that both joints will be as far from the sewer as possible.

When it is impossible to obtain proper horizontal and vertical separation as stipulated above, both the water main and sewer must be constructed of mechanical joint ductile-iron and must be pressured tested to ensure watertightness.

State approved reduced pressure backflow prevention devices are required on all potable water mains which service wastewater treatment plants, and pumping stations.

6.0 PUMPING STATIONS - GENERAL

Wastewater pumping stations shall not be subject to flooding. A suitable superstructure, preferably located on the right-of way of streets and alleys, shall be provided and shall be readily accessible. Wet and dry well entrances must be at an elevation higher than the 25 year flood elevation.

Each station must be fenced, or both wet and dry well entrances must be lockable.

Where it may be necessary to pump wastewater prior to grit removal, the design of the wet well must receive the appropriate special attention and the discharge piping must be designed to prevent grit from settling in discharge lines and pumps not operating.

Suitable all weather access roads must be provided to all stations.

7.0 PUMPING STATIONS - DESIGN

7.1 Type

Wastewater pumping stations must be of the wet/dry well, or the suction-lift type.

7.2 Structures

Wet and dry wells, including their superstructure shall be completely separated. Submersible pumps may be used.

Provisions must be made to facilitate the removal of pumps and motors.

Suitable and safe means of access shall be provided to dry wells of pump stations and shall be provided to wet wells containing either bar screens, mechanical screens or other mechanical equipment requiring inspection or maintenance. Stairways are preferred.

7.3 Pumps

A. Duplicate Units: At least two pumps must be provided. Each pump must be capable of handling flows in excess of the expected maximum flow. Where three or more pumps are provided, they must be designed to fit actual flow conditions and must be of such capacity to handle maximum wastewater flows. Variable flow pumps are required on large installations.

B. Protection from clogging: Pumps handling raw sewage must be the non-clog type or must be otherwise protected from clogging or damage. Such appurtenances and equipment must be readily accessible. On pumping stations rated higher than 350 gpm, a mechanically cleaned bar screen with grinder must be installed. For screens located below ground, convenient facilities must be provided for handling screenings. For larger or deeper stations, duplicate units or proper capacity must be provided.

Pump Openings: Pumps must be capable of passing spheres of at least three inches in diameter. Pump suction and discharge openings must be at least four inches in diameter. The EWD Administration may grant variances to this requirement upon proper justification.

D. Priming: The pump must be so placed that under normal conditions, it will operate under a positive suction head.

E. Suction Lift: The engineer of record must submit suction lift calculations to EWD for review and approval.

F. Electrical Equipment: Electrical equipment in enclosed places where gas may accumulate must comply with the National Board of Fire Underwriters' specifications for hazardous conditions. (NEMA Type 7)

G. Intake: Each pump should have an individual intake. Wet well design should be such as to avoid turbulence near the intake.

H. Dry Well Dewatering: A separate sump pump must be provided in dry wells to remove leakage or drainage with the discharge above the overflow level of the wet well. Water ejectors connected to a potable water supply shall not be approved. All floor and walkway surfaces shall have an adequate slope to a point of discharge.

I. Controls: At a minimum, float type controls must be provided. For stations larger than 350 gpm, bubbler type air system (air pressure differential) must be provided. Provision must be made to alternate automatically the pumps in use.

J. Valves: Suitable shut-off valves must be placed on suction and discharge lines on each pump. A check valve must be placed on each discharge line, between the shut-off valve, and the pump. A shut-off valve is not required on suction lines or pumps that are not subject to a positive head on the suction side.

K. Lifting Points: Eyebolts or other lifting points of sufficient strength must be provided to facilitate hoisting for placement, maintenance, and/or removal of pumps, and motors over 100 pounds, and in areas where difficulty would be encountered in performing these actions with mobile equipment.

L. Emergency pumping facilities must be provided.

7.4 Wet Wells

A. Divided Wells: Where continuity of pumping station operation is important, consideration should be given to dividing the wet well into two sections, properly interconnected, to facilitate repairs, and cleaning.

B. Size: The effective capacity of the wet well must provide a holding period not to exceed ten minutes for the average design flow.

C. Floor Slope: The wet well floor must have a minimum slope of one to one to the hopper bottom. The horizontal area of the hopper bottom shall be no greater than necessary for proper installation, and function of the inlet.

7.5 Ventilation

Adequate ventilation must be provided to all pumping stations. Where the pump pit is below the ground surface, mechanical ventilation is required, so arranged as to ventilate independently the dry well and the wet well if screens or mechanical equipment requiring maintenance or inspection are located in the wet well. There must be no interconnection between the wet well, and dry well ventilation system. In pits over fifteen feet deep, multiple inlets and outlets are required. Dampers should not be used on exhaust or fresh air ducts, and fine screens or other obstructions in the air ducts must be avoided to prevent clogging. Switches for operation of the ventilation equipment must be marked and located conveniently. Consideration shall be given to automatic controls where intermittent operation is used. Consideration must be given to installation of heating and/or dehumidification equipment.

A. Wet Wells: Ventilation must be continuous and shall provide at least twelve complete air changes per hour. For intermittent operation, at least thirty complete air changes per hour shall be provided.

B. Dry Wells: Ventilation may be either continuous or intermittent. For continuous operation at least six complete air changes per hour shall be provided. For intermittent operation, at least fifteen complete air changes per hour shall be provided.

7.6 Flow Measurement

Suitable devices for direct measurement of wastewater flow shall be provided at all WWTF pumping stations unless flow is measured accurately elsewhere. Elapsed time meters shall be installed in all collection system pumping stations.

7.7 Water Supply

All pumping stations must have a source of water nearby for cleaning purposes. There must be no physical connection between any potable water supply and a wastewater

pumping station which under any condition might cause contamination of the potable water supply. An approved reduced pressure backflow prevention device is required on the potable water supply.

7.8 Bypasses

Bypasses are not acceptable at any point on wastewater collection systems.

7.9 Alarms

Audible and visual high level alarm systems are required on all lift stations.

7.10 Control Panel

A control panel incorporating the following elements shall be provided:

1. Main circuit breaker
2. Motor circuit breaker (for each pump)
3. Emergency circuit breaker, with interlock
4. Emergency generator receptacle
5. Motor starter switch (for each pump)
6. Elapsed time meters (for each pump)
7. Alarm system with silencer switch
8. Seal failure indicator (for each pump)
9. Pump alternator
10. Ampere meter and selector switch
11. Lightning arrester
12. Duplex receptacle with ground fault interrupter
13. Phase monitor
14. Pump control system
15. NEMA 4X stainless steel or fiberglass control cabinet with gasketed door, padlock hasp, internal "dead front" safety door.

Shop drawings of control panel shall be submitted to EWD for approval prior to ordering, and installation. The control panel shall be installed at an elevation higher than the 100 year flood elevation established by FEMA.

8.0 FORCE MAINS

At the minimum pumping flow, velocity shall be equal to or greater than, two feet per second.

An automatic air relief valve shall be placed at high points in the force main to prevent air locking.

When terminating in manholes, force mains shall enter the side of the manhole within twelve inches of the bottom, and the discharge shall point in the direction of flow through the manhole.

Force mains must be a minimum of four inches in diameter. A Hazen Williams "C" factor not to exceed 120 must be used. Force mains, using pipe that is acceptable for water lines, must be laid with a minimum of three feet of cover.