

SECTION 3 - SANITARY SEWER SYSTEM DESIGN REQUIREMENTS

3.1 GENERAL:

- A. Design criteria for all sanitary sewer systems shall comply with Texas Commission on Environmental Quality (TCEQ) Chapter 317 (Design Criteria for Sewerage Systems), latest revision.
- B. Sizes and grades for sanitary sewer shall be as required by the Town Engineer, and consideration shall be given as to possible extensions for future development. No sanitary sewers, other than laterals and force mains, shall be less than eight (8) inch in diameter.
- C. Railroad, State Highway, Tollroad crossings, etc... in addition to connections to NTMWD shall be as approved by the Town Engineer. Permits to agencies other than the Town must be submitted through the Town.
- D. The Engineer shall include on the design plans a summary of pipe sizes and pipe materials.
- E. All grades shall be shown to the nearest one hundredth (0.01) of a foot.
- F. Where applicable, line sizes shall comply with the Sanitary Sewer Layout Master Plan or subsequent revisions.
- G. Sewer lines shall be sized and extended through the limits of a development to serve adjacent properties. In phased construction of thoroughfares, the sewer lines shall be extended the entire length of the thoroughfare being constructed.
- H. Construction Staking - Line and grade stakes for construction of all mains and laterals shall be furnished by the developer's Engineer or their designated representative. Property lines and corners must be properly staked to ensure correct alignment. The Town will not be liable for improper alignment or delay of any kind caused by improper or inadequate surveys by the developer or by interference of other utilities.
- I. In the interpretation and application of the provisions of these standards, it is the intention of the Town Council that the principles, standards and requirements provided herein shall be minimum requirements for the development of property in the Town of Prosper, and where other ordinances of the Town are more restrictive, such other ordinances shall control.
- J. All deviations from the provisions presented herein shall be approved by the Prosper Town Staff which includes the Town Administrator, Town Engineer, Director of Planning and Development Services, Director of Public Works, Building Official, Town Fire Chief, and any others deemed necessary by the Town Administrator. If Prosper Town Staff denies a deviation request, the applicant may request in writing an appeal of the denial to be considered by the Town Council within thirty days from the submittal of the written request for appeal.

3.2 SEWER LINE LOCATION:

- A. If feasible, sewers shall be placed in streets under paving. Sewers are usually located in the center of the street. Each project is unique; therefore, no fixed rules will apply to all cases.
- B. No public sewer line shall be located nearer than five (5) feet from any tree.
- C. No sanitary sewer shall be located in alleys unless approved by the Town Engineer.

3.3 SEWER LINE MATERIALS:

- A. The material used for the sanitary sewer shall be designed for a minimum structural life cycle, of fifty (50) years. If the pipe material will deteriorate when subjected to corrosive conditions, the Engineer shall provide, for an acceptable corrosion resistant liner or provide calculation and data that

demonstrated that the design and operational characteristics will provide for the minimum life cycle.

- B. All gravity sewer pipe shall be in green in color. Four (4) inch to fifteen (15) inch pipe shall be PVC SDR 35 or 26 (ASTM D3034). Eighteen (18) inch and larger pipe shall be PVC ASTM F679. PVC fittings may be either green or white in color.
- C. Ductile Iron Pipe, minimum class 51 or 52, shall be used for all aerial crossings. It may also be used on a case by case basis with written approval from the Town Engineer.
- D. Reinforced Concrete Pipe is allowed only on a case by case basis and then only, on lines larger than thirty (30) inches in diameter. The Town of Prosper will issue written approval for use of RCP on those projects.
- E. All mains to be installed under existing roadway should be installed by bore unless otherwise approved by the Town Engineer. Rust resistant steel casing minimum one fourth (1/4) inch thick, or thicker if deemed necessary by the design engineer, shall be used with Raci patented casing spacers, or approved equal. No wood skids will be allowed.
- F. Vitrified clay pipe will not be allowed in the Town of Prosper.
- G. PVC pipe used for force mains shall be white in color. Twelve (12) inch and smaller pipe shall be ASTM 2241 SDR 21. Pipes larger than twelve (12) inch shall be C905 DR25.
- H. Profile wall pipe shall not be permitted in the Town of Prosper without written authorization by the Town Engineer. If allowed by the Town Engineer, twenty four (24) inches and larger profile wall pipe shall conform to ASTM 794 and the Town of Prosper specifications. "Helically wound" or "pipe stiffness series 10" profile wall pipe will not be allowed.

3.4 CLEANOUTS AND MANHOLES:

- A. The sizes and locations of manholes, wyes, bends, tap connections, cleanouts, etc., shall be approved by the Town Engineer. In general, manholes shall be placed at all four (4) way connections and three (3) way connections, changes in grade and direction, and at a maximum spacing of three hundred (300) feet.
- B. In order to provide access to sewer lines for cleaning, manholes and/or cleanouts shall be so located that one hundred and fifty (150) feet of sewer rod can reach any point in the line. Spacing between a manhole and an upstream cleanout shall be limited to three hundred (300) feet. Cleanouts may be located at the end of the line or on a line that may be extended in the future.
- C. Manholes shall have a 400# traffic bearing frame and cover with a design strength of 4000 psi at twenty eight (28) days. Manhole frame and covers shall be Bass & Hayes #400-24 with the Town of Prosper Logo on the cover.
- D. Drop manholes shall be required when the inflow elevation is more than twenty four (24) inches above the outflow elevation. Drops shall be located outside the manhole with its flowline elevation located between the centerline and top of sewer main.
- E. The diameter of a manhole constructed over the center of a sewer should vary with the size of the sewer. The manhole diameter for all line sizes up to twenty seven (27) inches shall be a minimum of five (5) feet. The manhole diameter for all line sizes over twenty seven (27) inches shall be a minimum of six (6) feet.
- F. In Flood Plains, sealed manholes "Type S" with a Bass & Hayes casting shall be used to prevent the entrance of storm water. Where more than three (3) manholes in sequence are to be bolted and gasketed, every third (3rd) manhole shall be vented two (2) feet above the one hundred (100) year floodplain elevation or ten (10) feet above the adjacent ground line, whichever is higher. The Engineer

shall provide the elevation of the one hundred (100) year flood. Sealed manholes shall also be used in all areas subject to carrying drainage flow or in drainage ways.

- G. Where pipes enter a manhole there shall be a minimum of one tenth (0.1) of a foot drop between inverts. Where unequal size pipes enter a manhole, crown of pipes should be at the same elevation.
- H. Manholes shall have inflow protection inserts, minimum thickness of one eighth (1/8) inch, made of HDPE meeting ASTM D 1248 Class A, Category 5, Type 111. Insert shall include a lift strap and vent hole with vent disk as manufactured by Knutson Manhole Inserts or approved other.
- I. Construct manholes at each end of lines that are installed by other than open cut and at each end of aerial crossing lines.
- J. A property line cleanout shall be installed for all residential services. Cleanouts in the sidewalk or driveway shall have a cast iron boot. Cleanouts not located in a sidewalk or driveway shall be located on a reinforced concrete pad a minimum of twelve (12) inches by twelve (12) inches by six (6) inches thick. All property line cleanouts shall include a lid that is green in color.

3.5 CURVED SEWERS:

- A. No vertical curves will be allowed.
- B. Horizontal curvature may be by joint deflection or pipe flexure but not both. The Engineer must specify on the plans the method of deflection allowed and the allowable radius or joint deflection for each pipe size.
- C. When pipe flexure is used, the minimum radius of curvature shall be equal to that recommended by the pipe manufacturer or $300 \times D_o$, where D_o is the average outside diameter of the pipe in inches, whichever is greater. The Engineer shall note on the plans that, when using pipe flexure, all joints are to remain fully seated.
- D. If joint deflection will be used to provide horizontal curvature, the allowable deflection shall be eighty (80) percent of the Manufacturer's recommended maximum joint deflection, or eighty (80) percent of the National Reference Standard ASTM criteria maximum recommended joint deflection or by TCEQ Criteria, whichever is less. In no case shall the radius be less than two hundred (200) feet.
- E. Horizontal curves for sanitary sewers running lateral with public right-of-ways shall match change in street direction as near as possible. Horizontal curves will not be allowed across residential single family and duplex lots, without prior approval from the Town Engineer.
- F. Manholes on curved sewers shall be located at the P.C. or P.T. of the curve and a maximum spacing of three hundred (300) feet along the curve. Sewage flow shall be computed in accordance with Table 3.1 shown below, with the exceptions, as required by the Town Engineer.
- G. The minimum acceptable "n" factor for use in design of sanitary sewers shall be 0.013. Pipes should be placed on such a grade that the velocity is not less than two (2) fps or more than ten (10) fps. Minimum grades based on $n = 0.013$ shall be as shown on Table 3.2 below.

3.6 DEPTH OF COVER:

- A. Minimum cover shall be four (4) feet. In general, the minimum depth for sewer to serve a given residential property with a four (4) inch lateral shall be three (3) feet, plus two (2) percent, times the length of the house lateral (the distance from the sewer to the center of the house). Thus, for a house one hundred thirty five (135) feet from the sewer, the depth would be three (3) feet, plus two (2) percent x one hundred thirty five (135) feet = $3.0 + 2.7 =$ five and seven tenths (5.7) feet. The depth of the flow line of the sewer should then be at least five and seven tenths (5.7) feet below the elevation of the ground at the point where the service enters the house. Profiles of the ground line twenty (20) feet

past the building line will be required to verify that these criteria are met.

- B. The Town Engineer shall authorize any exceptions. Concrete protection may be required.
- C. On lines deeper than twelve (12) feet, a parallel sewer line will be required when laterals are to be attached.
- D. Two (2) inch detector tape shall be installed six (6) inches above all buried sewer lines.
- E. No piping or valves shall be covered until they have been inspected by the Town.

3.7 LATERALS:

The sizes and locations of laterals shall be designated as follows unless otherwise directed by the Town Engineer:

- A. In general, for single family dwellings, the lateral size shall be a four (4) inch minimum. House laterals shall be installed ten (10) feet downstream from the center of the lot and shall have a ten (10) foot separation from the water service. All residential sewer services shall be extended to a point ten (10) feet from the back of the property line at a maximum depth of five (5) feet. The service shall then be extended at a forty five (45) degree angle to four (4) feet above the finished grade and capped.
- B. Multiple units, apartments, local retail and commercial – six (6) inch minimum.
- C. Manufacturing and industrial – eight (8) inch minimum, or larger as required.
- D. Manholes will be required on six (6) inch and larger laterals where they connect to the main line.
- E. Laterals will not be attached to sewer mains that are deeper than twelve (12) feet.
- F. Fittings are not permitted on laterals between the wye and the property line.
- G. Deep cut or drop connections shall not be permitted.
- H. A minimum of one (1) lateral per building shall be required. Also, a minimum of one (1) lateral per residential lot shall be required. Duplexes shall have two (2) laterals that shall be independently attached to the main.
- I. All mains installed in future developed areas shall install laterals; the use of boots will not be permitted.
- J. All sewer laterals crossing water mains shall conform to the requirements of the Texas Commission on Environmental Quality (TCEQ) Chapter 317 (Design Criteria for Sewerage Systems), latest revision.

3.8 TESTING:

All sanitary sewer lines shall be tested for infiltration and exfiltration in accordance with standard specifications and as shown on the plans. Video camera inspections, low pressure air testing, vacuum testing of the manholes and mandrel testing are required on all sewer lines. In addition, all residential and commercial sanitary sewer services shall have video camera inspections. All testing shall be completed, reviewed and approved by the Town of Prosper prior to any initiation of sub-grade work.

3.9 SANITARY SEWER LIFT STATIONS:

Subdivisions will be laid out so that all sanitary sewer lines will be gravity flow lines when possible. If the use of a sanitary sewer lift station is approved, the lift station will be connected to the Town's Systems Control and Data Acquisition (SCADA) system. The developer will pay all cost associated with the SCADA to include all labor, equipment, materials, and programming of the Town's computer and testing. The SCADA equipment installed shall conform to the standard as noted per this section – Computerized Monitoring and Control Specifications for Sanitary Sewer Lift Stations.

3.10 SANITARY SEWER EASEMENTS:

The following minimum width exclusive sanitary sewer easements are required when facilities are not located within public rights-of-way or easements:

- A. Sanitary sewers are to be located within the center of a fifteen (15) foot sanitary sewer easement.
- B. In residential developments, sanitary sewer mains shall not cross residential lots unless specifically approved by the Town Engineer or his/her designee, in which case the easement shall be located within a single lot.
- C. For sanitary sewer lines deeper than ten (10) feet, the easement width shall be equal to one and a half (1½) times the depth of the line rounded up to the nearest five (5) feet. Thus, for a sanitary sewer line twelve (12) feet deep, the sanitary sewer easement would be one and a half (1½) x twelve (12) feet = 1.5 x 12 = eighteen (18) feet, rounded up to the nearest five (5) feet = twenty (20) feet.

3.11 TABLES:

TABLE 3.1: Sanitary Sewer Daily Flow Calculations (Design for Peak Flow)

<u>Land Use</u>	<u>Design</u>	<u>Calculation</u>
Apartment	<ul style="list-style-type: none"> • 100 gallons per person per day. • 15 units per acre. • 3 persons per unit. 	$(100 \times 15 \times 3 \times \text{daily peak factor}) + \text{infiltration} =$ $(100 \times 15 \times 3 \times 3) + 650 = \underline{14,150}$ gallons per acre per day.
Residential	<ul style="list-style-type: none"> • 100 gallons per person per day. • 3.5 units per acre. • 3.5 persons per unit. 	$(100 \times 3.5 \times 3.5 \times \text{daily peak factor}) + \text{infiltration} =$ $(100 \times 3.5 \times 3.5 \times 3) + 650 = \underline{4,325}$ gallons per acre per day.
Town Home	<ul style="list-style-type: none"> • 100 gallons per person per day. • 10 units per acre. • 3.5 persons per unit. 	$(100 \times 10 \times 3.5 \times \text{daily peak factor}) + \text{infiltration} =$ $(100 \times 10 \times 3.5 \times 3) + 650 = \underline{11,150}$ gallons per acre per day.
Hospital	<ul style="list-style-type: none"> • 200 beds. • 200 gallons per day per bed. 	$(200 \times 200) + \text{infiltration} =$ $(200 \times 200) + 650 = \underline{40,650}$ gallons per day.
Nursing Home	<ul style="list-style-type: none"> • 150 beds. • 90 gallons per day per bed. 	$(150 \times 90) + \text{infiltration} =$ $(150 \times 90) + 650 = \underline{14,150}$ gallons per day.
Commercial/ Industrial/ Office	<ul style="list-style-type: none"> • 3,100 parking spaces per 34.7 acres. • 1 person per parking space. • 35 gallons per person per day. 	$3,100/34.7 \text{ acres} = 90 \text{ persons per acre}$ $(90 \times 35) + \text{infiltration} =$ $(90 \times 35) + 650 = \underline{3,800}$ gallons per acre per day.

Note: Infiltration shall be 650 gallons per acre per day (GPAD) and the daily peak factor shall be 3 or based on time of concentration calculations as approved by the Town Engineer.

TABLE 3.2: Minimum and Maximum Grades for Sanitary Sewer Mains

<u>Size of Pipe (Inches)</u>	<u>Minimum Slope in (Percent)</u>	<u>Horizontal Curve (Percent)</u>	<u>Maximum Slope in (Percent)</u>
8	0.33	0.35	8.40
10	0.25	0.27	6.23
12	0.20	0.22	4.88
15	0.15	0.17	3.62
18	0.11	0.13	2.83
21	0.09	0.10	2.30
24	0.08	0.09	1.93
27	0.06	0.07	1.65
30	0.055	0.065	1.43
33	0.05	0.06	1.26
36	0.045	0.055	1.12
39	0.04	0.05	1.01
>39	*		*

Note: For lines larger than thirty-nine inches (39") in diameter, the slope shall be determined using the following equation to maintain a minimum velocity of two feet per second (2 fps) and a maximum velocity of ten feet per second (10 fps).

$$V = (1.486/n) \cdot (R^{2/3}) \cdot (S^{1/2})$$

- Where:
- V = Velocity of flow in conduit in feet per second.
 - n = Roughness coefficient of the conduit, dimensionless.
 - R = Hydraulic radius of the conduit in feet, which is the area of the flow divided by the wetted perimeter (R=A/P).
 - S = Slope of the hydraulic gradient in feet per foot.