

SECTION 6.1 GRAVITY SEWER PIPELINE DESIGN

6.1.1 PURPOSE

The purpose of this section is to provide guidelines for the use, location, alignment and design of gravity sewer collection pipelines for conveying raw sewage.

6.1.2 STANDARD TERMS AND DEFINITIONS

Wherever technical terms occur in these guidelines or in related documents, the intent and meaning shall be interpreted as described in Standard Terms and Definitions.

The following terms and definitions as found in this section shall have the following meaning:

- SDR: Standard Dimension Ratio (SDR) is the pipe diameter divided by the pipe wall thickness and provides a method of specifying product dimensions to maintain mechanical properties regardless of size. For a given dimension ratio the pipe stiffness remains constant for all pipe sizes.
- Collector: Generally eight inch (8") through fifteen inch (15") pipe that collects sewage from neighborhoods and groups of business and delivers sewage into a single, larger interceptor pipe.
- Interceptor: Generally fifteen inch (15") and larger pipe that gathers sewage flow from several smaller collector pipe connections and transports this sewage to a treatment facility or outfall.
- Outfall: Generally eighteen inch (18") and larger pipe having no (or minimal) collector pipe connections that carries sewage flow to a treatment facility.

6.1.3 GENERAL

It is the responsibility of the user of these documents to make reference to and/or utilize industry standards not otherwise directly referenced within this document. The Engineer of Work may not deviate from the criteria presented in this section without prior written approval of the District's Engineer.

- A. Use and placement of manholes and cleanouts shall be in accordance with Section 6.2.
- B. Use and placement of sewer laterals in gravity sewer collection shall be in accordance with Section 6.3.
- C. Use and design of Sewer Force mains shall be in accordance with Section 6.4.

6.1.4 GUIDELINE

Gravity sewer systems are designed for steady flow conditions based on ability to self-clean at peak hour pipe velocity. Factors to consider in determining gravity system hydraulics include the design formula, roughness coefficient, velocity and slope, and sulfide control. PVC gravity sewer pipe is considered flexible pipe material and shall be designed accordingly.

- A. Requirements: Pipe to be used to convey raw sewage shall comply to the following:

1. Gravity sewer mains and appurtenant components shall primarily be Polyvinyl Chloride (PVC) sewer pipe, in accordance with the District Approved Materials List.

Polyethylene Lined Ductile Iron Pipe (DIP) and High Density Polyethylene Pipe (HDPE) may be used in some circumstances. Prior written approval of the District's Engineer is required when pipe materials other than PVC are proposed for use by the designer.

2. Minimum size pipe for sewer mains shall be eight inch (8"). Six inch (6") sizes may be allowed in some circumstances only with prior approval of the District's Engineer.
3. PVC pipe shall have common profiles for inter-changeability between rough-barrel dimensions, couplings, ends, and elastomeric gaskets to facilitate future repairs.
4. Pipe, fittings, couplings, and joints shall comply with the size, dimensions, materials, and performance requirements of the following ASTM designations:

Pipe Sizes	ASTM Designations
6" through 15"	ASTM D 3034, SDR 35
18" through 27"	ASTM F 679, SDR 35 (T-I)
21" through 48"	ASTM F 794, Closed Profile

5. Curves: Horizontal and vertical curve alignments in sewer mains are allowed in accordance with the manufacturer's recommendations and as follows.
 - A. Horizontal and vertical curves are not permitted in the same stretch of pipe between manholes.
 - B. Generally horizontal curves shall match the centerline radius of the road in which the sewer main is to be installed. Curves in sewer pipe shall be as recommended by the pipe manufacturer with a minimum radius of two hundred feet (200').
 - C. Vertical curves should be avoided whenever possible. Vertical curves may be allowed for changes in slope without the use of an additional manhole in accordance with the manufacturer's recommendations and prior written approval of the District's Engineer. If vertical curves cannot be avoided, specific design calculations shall be provided to the District's Engineer with a minimum radius of two hundred feet (200').
6. Change in Direction: The maximum change in direction allowed is ninety degrees (90°) for mains fifteen inches (15") in diameter and less, and forty five degrees (45°) for mains eighteen inches (18") and larger.

Whenever a change in deflection occurs a manhole will be required at the change in direction in accordance with Section 6.2.

7. Trench Loads: PVC sewer pipe is considered flexible pipe material and shall be designed accordingly. Trench loads shall be calculated and a detailed report provided to the District's Engineer when the pipe depth exceeds twelve

feet (12'). Calculations shall consider dead loads (i.e. soil above the pipe and asphalt or concrete) and live loads (i.e. vehicle traffic). Maximum long-term deflection of gravity sewer pipe shall not exceed the manufactures recommendations. Thicker wall pipe may be required at the those depths.

8. Pipe slopes: Sewer mains shall be designed to have minimum and maximum slopes in accordance with Section 4.2.
9. Depth of Flow: Depth of flow within a sewer main shall be in accordance with Section 4.2.
10. Junctions or intersection sewer mains shall have a manhole placed in accordance with Section 6.2. The crown elevations shall be matched within the manhole.
11. Inverted Siphons: Inverted siphons are used in gravity sewer systems to overcome grade obstructions that cannot be resolved in any other practical fashion.

Every effort shall be made to avoid a siphon. Siphons will not be permitted without prior approval of the District's Engineer. Alternates to siphons include, but are not limited to aerial crossings, separation structures, relocation of obstructions, relocation of sewer mains, low head pipes, and gravity flow beneath the obstruction. Inverted siphons are a specialty design and a design report shall be provided to the District's Engineer for evaluation and consideration.

B. Locations: Sewer mains shall be located, based on the above needs, at areas described below.

1. In general, sewer mains should be located on the centerline of streets or easements. Refer to Section 1.5 for easement widths required.
2. Depth of sewer mains shall be as described as follows:
 - A. Minimum Depth: Sewer mains shall be a minimum five feet (5') deep to flow line, unless otherwise approved by the District's Engineer. Greater depths may be required where it is necessary to extend mains to serve other areas, or to achieve required depth of laterals at the property line. Anything less than five feet (5') requires the approval of the District's Engineer.
 - B. Maximum Depth: Sewer mains shall have a maximum depth to flow line of twelve feet (12'), unless otherwise approved by the District's Engineer. The maximum depth of pipe is based on sewer cleaning and maintenance access requirements. Request for approval of deeper mains shall include a sewer main alignment and profile study showing that no other way of providing a main with less than twelve feet (12') of cover is feasible. District Engineer may require thicker pipe wall material class.
3. Parallel and perpendicular separations between water and sewer mains shall be in accordance with instruction from the State Water Resource Control Board per Exhibit 2.3A.
4. Mains shall be placed on straight lines between structures wherever possible.

5. Generally sewer mains shall be accessible for cleaning equipment, maintenance and repair. Access roads shall have a minimum forty-five foot (45') centerline radius to accommodate cleaning equipment.

Mains shall not be located in the following locations:

- a. Inaccessible areas.
 - b. Under median strips.
 - c. Parking lanes.
 - d. Within heavy landscape areas that receives more than just ground cover. Bushes, trees or brush should not be planted around the area of the lateral.
- C. Appurtenances: Sewer main appurtenances will be required in accordance with Standard Specification 15065 and the Approved Materials List.
- D. Installation: Sewer mains shall be installed at locations shown on the approved plans in accordance with Standard Specification 15065 and applicable Standard Drawings.

6.1.5 NOTATIONS ON PLANS

Sewer mains shall be shown in the plan and profile views of the sheet(s) and shall include, but not be limited to the following:

- A. Standard symbols, stationing and plan callouts in accordance with Section 1.1.
- B. Plan View: Indicate size, class, type of pipe materials and locations of laterals, manholes and pipe connections in accordance with Section 1.1.
- C. Profile View: Indicate size, class, type of pipe materials and locations of manholes, flow-line/invert elevations, and slopes in accordance with Section 1.1. If vertical curves cannot be avoided the curve shall be indicated by showing invert elevations at fifteen foot (15') to twenty five foot (25') intervals.

6.1.6 MATERIAL SELECTION

Selection of pipeline materials and appurtenances to be used with the installation of gravity sewers shall be in accordance with Standard Specification 15065 and the Approved Materials List.

6.1.7 REFERENCE

Should the reader have any suggestions or questions concerning the material in this section, contact the District Engineer.

The publications listed below form a part of this section to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said publications unless otherwise called for. The following list of publications, as directly referenced within the body of this document, has been provided for the users convenience. It is the responsibility of the user of these documents to make reference to and/or utilize industry standards not otherwise directly referenced within this document.

1. Valley Center Municipal Water District Standards:

A. Design Guidelines

- i. Section 1.1, Drafting Guidelines
- ii. Section 1.5, Easements and Encroachments
- iii. Section 4.2, Sewer Planning
- iv. Section 6.2, Sewer Manholes and Cleanouts
- v. Section 6.3, Sewer Laterals
- vi. Section 6.4, Sewer Pressure Systems (Force Mains)

B. Standard Drawings

- i. S-1 through S-17

C. Approved Materials List for Sewer Facilities

D. Technical Specifications

- i. Section 15065, Polyvinyl Chloride (PVC) Gravity Sewer Pipe

2. American Society for Testing and Materials (ASTM):

- A. ASTM D3034, Type PSM Poly (vinyl chloride) (PVC) Sewer Pipe and Fittings.
- B. ASTM F 679, PVC Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
- C. ASTM F 794, Poly (vinyl chloride) (PVC) Profile Gravity Sewer Pipe and Fittings.

END OF SECTION