

WATER AGENCIES' STANDARDS

Design Guidelines for Water and Sewer Facilities

SECTION 6.2 SEWER MANHOLES AND CLEANOUTS

6.2.1 PURPOSE

The purpose of this section is to provide guidelines for the use and placement of manholes and cleanouts in gravity sewer collection pipelines.

6.2.2 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.

6.2.3 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 Agency Engineer.

- A. Design for gravity sewers mains shall be in accordance with Section 6.1.
- B. Use and placement of sewer laterals in gravity sewer collection shall be in accordance with Section 6.3.

6.2.4 GUIDELINE

- A. Requirements: Manholes are required in gravity sewer pipelines to provide access for maintenance.

Manholes are generally located in the following areas:

- Change in direction of flow.
- Change in pipe size or material.
- Change in grade.
- Intersections of mains.

- B. Locations: Manholes shall be located at areas described as follows:
 - 1. Manhole spacing is typically determined by the available sewer maintenance methods and equipment. Maximum spacing of manholes shall be four hundred feet (400') for mains twelve inch (12") and smaller and five hundred feet (500') for mains over twelve inch (12") unless otherwise approved by the Agency Engineer.
 - 2. Manholes shall be located in areas where a change in the direction of flow is made. Whenever a change in direction occurs with a radius less than five hundred feet (500'), a manhole shall be located within approximately ten feet (10') of the downstream end of the curve (EC). One exception to this is when a reverse curve is used, in which case the manhole should be located at the

point of reverse curve. Maximum distances between manholes are to be maintained.

3. Manholes shall be placed at areas where a change in the pipe size occurs. A change in pipe diameter greater than six inches (6") is not allowed without prior approval of the Agency Engineer. A smooth transition within the manhole must be provided between all changes in pipe size.
4. Manholes shall be placed at areas where a change in the pipe grade occurs. Where the change in grade is greater than ten percent (10%), or the potential for a hydraulic jump within the manhole exists, the grade change shall be made in a smooth vertical curve with a manhole twenty five feet (25') downstream from where the sewer levels out to the lesser grade.
5. Manholes shall be located at the ends of mains larger than eight inches (8"), on mains that have four (4) or more laterals at or near the end or on mains extending beyond two hundred feet (200') from the nearest manhole. Manholes at end of mains shall be limited to no more than four (4) laterals entering directly into the manhole.
6. Manholes shall be located at junctions or intersection of side mains.
 - a. Manholes with multiple angled inlets and outlets shall be spaced to provide adequate clearance between penetrations to assure clearance and water tightness.
 - b. Manholes shall be installed on the existing sewer main where a proposed side main is to be connected.
 - c. Typically sewer laterals intercepting the main do not require a manhole in accordance with Section 6.3 and Standard Drawings SS-01 and SS-02 except as follows:
 1. Laterals shall be connected to the sewer main at a manhole when the lateral serving a property has two (2) or more branches installed to serve more than one facility on the property. Residential lots with a second dwelling may be excluded from this requirement at the direction of the Agency Engineer.
 2. Laterals matching the size of the sewer main shall be connected to the main at a manhole.
7. Manholes shall be located at the beginning point and ending point of vertical curves if the curve is longer than two hundred feet (200').
8. Manholes shall not be located in the following locations:
 - Inaccessible areas.
 - Gutters and other depressions or areas subject to inundation.
 - In sidewalks or crosswalks.
 - In driveways.
 - In freeway ramps.
 - Between railroad or trolley tracks. Manholes within a railroad or trolley right-of-way shall be located a minimum of fifteen feet (15') from the track bed.

- C. Manhole Appurtenances: Manhole appurtenances will be required as indicated below in accordance with WAS Standard Specification 03461.

1. All manholes will include thirty-six inch (36") diameter frames and two concentric covers. Locking manhole lids may be required in areas where manholes are located in unpaved areas and other areas as determined by the Agency Engineer.
2. Manhole bases may be poured in place, in accordance the WAS Specification Section 03000, or precast concrete, in accordance with WAS Specification Section 03461, with a minimum drop through the manhole as follows:
 - a. Mains fifteen inch (15") and smaller: A minimum drop of 0.20 feet and a maximum of 0.60 feet shall be used on a straight-through line.
 - b. Mains eighteen inches (18") and larger: The drop across for the manhole shall be calculated using the following formula:

$$\text{Drop in feet} = D \times [(S_1 + S_2) / 2] + 0.20$$

Where D equals the inside diameter of the manhole, S₁ equals the invert slope entering the manhole, and S₂ equals the invert slope leaving the manhole. (All dimensions in feet and slopes are feet/foot.) Calculations shall be provided for review with final requirements summarized on the plans in a data table.

- c. Provide a minimum two tenths of a foot (0.20') drop from any new sewer side inlet invert elevation to any new manhole sewer outlet elevation.
3. T-shaped PVC liner shall be integrally cast into the shaft sections, cone section and grade rings in accordance with WAS Standard Specification 03461 and Standard Drawing SM-07. The base shall incorporate a polyurethane coating. The PVC liner and polyurethane coating are required in the following cases:
 - Mains eighteen-inch (18") in diameter and larger.
 - All manholes where entering pipe slope is 5% or greater.
 - Canyon areas where manholes are normally sealed permanently.
 - Known locations of higher sulfide concentration, such as the discharge from sewage pump station force main.
 - All manholes within one thousand feet (1,000') of receiving a force main discharge.
 - All drop manholes.
 - Other areas, where a corrosive atmosphere is anticipated.
 - Siphon inlet and outlet manholes/structures.

- D. Installation: Manholes shall be installed at locations shown on the approved plans in accordance with WAS Standard Specification 03461 and Standard Drawing SM-01 through SM-07.

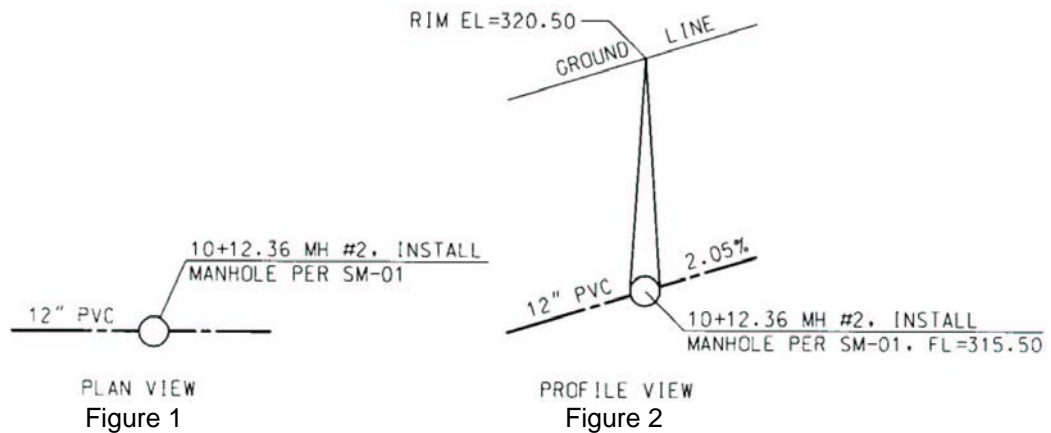
6.2.5 NOTATIONS ON PLANS

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

- A. Standard symbols, stationing and plan callout notes shall be in accordance with Section 1.1.

- B. A numbering system shall be incorporated on the plans numbering each manhole to be constructed. The Engineer of Work shall make an inquiry to the Agency whether an existing numbering system is in place. If no system exists, manholes shall be numbered starting with manhole number one (#1) and increase in the direction matching the direction of stationing.
- C. Plan View: Manholes shown in the plan view shall be shown with stationing and incorporate a numbering system on the plans. Refer to Figure 1 below.
- D. Profile View: Along with stationing and a numbering system, manholes shall also show rim elevations and flow line/invert elevations. Refer to Figure 2 below.

Manhole Plan Callouts



6.2.6 DROP MANHOLES

Due to cleaning problems associated with drop manholes, it is desirable not to use drop manholes. Drop manholes may be used only with prior approval of the Agency Engineer. Drop manholes may be considered when two collection lines have a vertical difference of four feet (4') or more and are connected at a manhole. Drop manholes shall be installed in accordance with WAS Standard Drawing SM-09 and SM-10.

6.2.7 SEWER CLEANOUTS

Size-on-size cleanouts are required at the upstream end of mains eight inches (8") and smaller that extend no more than two hundred feet (200') past the manhole and have no more than three (3) laterals installed at or near the end of the main. Cleanouts shall be in accordance with WAS Specification Section 15065 and Standard Drawing SC-01.

6.2.8 MATERIAL SELECTION

Manholes and appurtenant components to be used with the installation of gravity sewers shall be in accordance with WAS Standard Specification 03461 and the Approved Materials List.

6.2.9 REFERENCE

- A. Should the reader have any suggestions or questions concerning the material in this section, please contact one of the agencies listed.

B. 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. Water Agencies' Standards (WAS):
 - a. Design Guidelines
 1. Section 1.1, Drafting Guidelines
 2. Section 4.2, Sewer Planning
 3. Section 6.1, Sewer Pipeline Design
 4. Section 6.3, Sewer Laterals
 - b. Standard Specifications
 1. Section 03000, Cast in Place Concrete
 2. Section 03461, Precast Concrete Manholes
 3. Section 15065, Polyvinyl Chloride (PVC) Gravity Sewer Pipe
 - c. Standard Drawings
 1. SC-01
 2. SM-01 through SM-11
 - d. Approved Materials List for Sewer Facilities

END OF SECTION