

## 6. SSO Flow Estimation Procedures

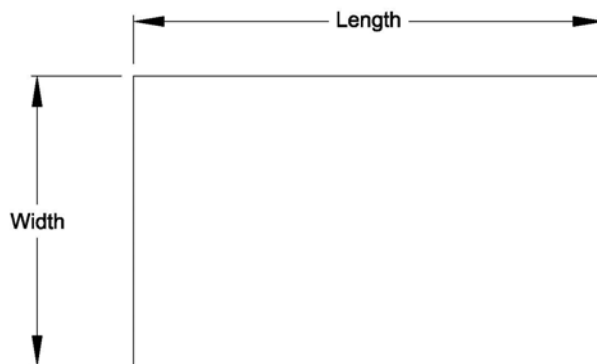
A variety of approaches exist for the estimation of the volume of a sanitary sewer overflow. This section documents the two methods that are most commonly employed. Other methods are also possible. Every effort shall be made to estimate the overflow volume as accurately as possible.

### 6.1 Method 1 - Estimating Measured Volumes

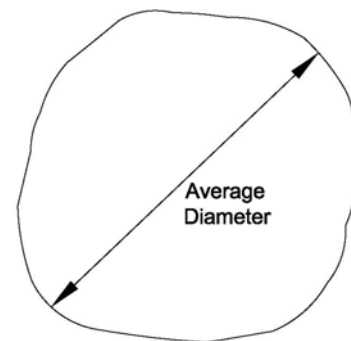
#### 6.1.1 Contained Volume

The volume of some small overflows can be estimated if the overflow is contained in one area. The shape and dimensions are used to calculate the area of the overflow and the depth is used to estimate the volume. Follow the steps below to estimate a contained volume:

1. Sketch the shape of the contained sewage.
2. Measure or pace off the dimensions.
3. Measure the depth at several locations.
4. Calculate an average depth for the entire area by adding all measured depths together and dividing by the number of measurements taken.
5. Convert all dimensions, including depth, to feet.
6. Calculate the volume using the following formulas. Refer to drawings below for dimensions.
  - a. Rectangular Shape (gallons)= length x width x depth x 7.48
  - b. Circular Shape (gallons) = diameter x diameter x depth x 5.87



Rectangular Shape



Circular Shape

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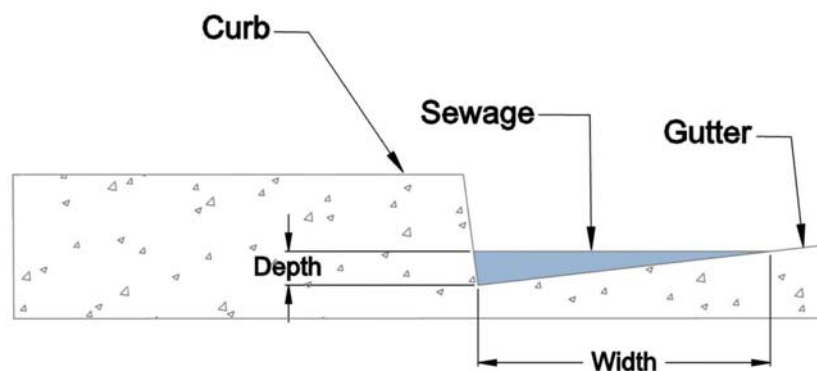
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### 6.1.2 Volume Contained in Roadway Gutter

The volume of an overflow contained in a roadway gutter can be estimated by following these steps:

1. Measure the length of gutter containing the overflow.
2. Measure the depth and width of the overflow in the gutter. Refer to the drawing below.



3. Convert all measurements to feet.
4. Calculate the overflow volume using the following equation:

$$\text{Volume (gal)} = \text{length} \times \text{width} \times \text{depth} \times 3.74$$

### 6.2 Method 2 - Duration and Flow Rate

In this method, separate estimates are made for the overflow duration and flow rate.

Flow Rate - There are four methods to estimate the overflow rate:

1. SSO Flow Estimation Pictures: Pictures presented in Tab 7 of this procedures manual show sewage flowing from a maintenance hole at different rates. The observations of staff members are used to select the appropriate value from the pictures.
2. Tabulated Values: Table 1, Table 2, and Table 3 in Tab 7 contain tabulated values for different maintenance hole overflows.

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3. **Open Channel Flow:** Overflows often run into nearby ditches, channels, gutters, etc. Flow can be quantified by measuring the cross sectional area and velocity of the overflow. First, measure the depth of flow and the dimensions of the channel. Then measure the velocity by dropping a floating object into the flow and measuring the time it takes to travel a set distance. The resulting velocity will be in the units of feet per second. Several measurements should be taken and the average flow rate should be used in volume estimates. Calculate the flow into the channel using the following formula:

$$\text{Flow (gal/min)} = \text{Velocity (ft/sec)} \times \text{Area (ft}^2\text{)} \times 449$$

4. **Pump Stations:** Sewer pump stations often have flow or pump run time data available through the SCADA system. Pump curves may need to be obtained to determine pump discharge rates.

Overflow Duration - The start and end times of the overflow can be estimated by Sacramento Area Sewer District staff or public bystanders who saw the overflow begin and/or end. Flow meters and information from the SCADA system can be useful in estimating overflow duration.

Volume Calculation - The overflow volume can be estimated with the following equation:

$$\text{Volume (gal)} = \text{Flow Rate (gal/min)} \times \text{Duration (min)}$$

**See Tab 7 for Flow Estimation Pictures and Tables**