

Activity 2.3.10 Wastewater Management

Introduction

As urban centers grew in size, it became apparent that dumping raw sewage into streets, creeks, rivers, and lakes ultimately threatened the drinking water supply. The concept of wastewater management was born.

Once water has entered a structure, it is inevitable that the water will be used and the quality changed – usually for the worse. The used water is called wastewater. The constituents (impurities) within wastewater are dependent upon how the water has been used.

Sanitary wastewater is generally accepted to consist of human waste, household cleaning solutions, oil and grease from cooking activities, small solid particles from garbage grinders, or soil from cleaning clothes and floors. Wastewater from commercial establishments may include metals, strong acids and bases, cleaning solvents, oil and grease, and grit (small plastic, glass, stone, or metal particles), in addition to sanitary wastewater. Sometimes water is used for cooling purposes; thermal pollution is created and must be managed correctly.

The selected method of wastewater management depends upon the quantity (i.e., flow rate) and quality of the wastewater, available treatment technologies, codes and regulations and economics.

A civil (environmental) engineer must decide how to manage the wastewater by considering three broad categorical options:

Reuse: Wastewater that can be used again without treatment of any kind

Recycling: Wastewater that is treated either on-site or off-site and used again

Discharge/treatment: Wastewater that is simply discharged from the structure for treatment either on-site or off-site

In this activity you will learn to select an appropriate wastewater management method and perform fundamental layout calculations.

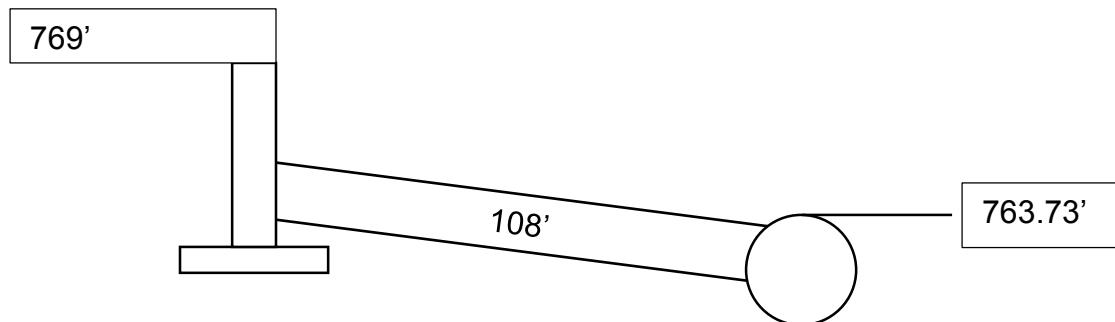
Equipment

- Pencil
- Engineering notebook
- Calculator
- Computer with internet access
- Example Residential Plumbing Code Requirements

Procedure

For the purposes of this activity, you will assume that the primary contaminant in the wastewater is organic matter and NOT toxic to microorganisms.

1. Apply what you have learned about wastewater management and the Example Residential Plumbing Codes Requirements to choose a wastewater treatment method for your Affordable Housing project.
2. Design the lateral connection from the house to the system. Show all work and document your design. Assume that the **invert** elevation of the 14 inch sewer main where the sewer lateral will connect is 763.15 feet.
 - a. Create a sketch showing the sewer main, the sewer lateral, the house foundation, and the lowest floor elevation.



- b. Calculate approximate crown elevation of the existing 14 inch sanitary sewer main. Show this elevation on your sketch.

$$\underline{763.15' + (14''/2) = 763.73'}$$

- c. Assume that the sewer lateral must connect to the main on 10th Street. Determine horizontal distance from the structure to the existing sewer main. Indicate this dimension on your sketch.

$$\underline{108'}$$

- d. Determine the minimum size allowed for the building sewer (sewer lateral).

$$\underline{3''}$$

- e. Determine the maximum sewer lateral pipe invert elevation at the structure foundation and indicate this elevation on your sketch. Assume that the sewer invert must be at least 2 feet below the lowest floor requiring sanitary sewer drainage and that the sewer crown must be below frost depth. Frost depths are available at

http://www.soundfootings.com/pdf/US_Map_Frost_DepthAVG.pdf

$$\underline{20''}$$

- f. Calculate the slope of the proposed sewer lateral from the structure to the sewer main.

$$\text{Slope} = \frac{(769-2)' - 763.15' + \frac{1}{2}(7/12')}{108'} = 3.8\% \text{ slope}$$

- g. What is the minimum slope allowed for the wastewater pipe? Does your design meet the requirement?

2% minimum. Yes, this meets requirements

3. Revise the drawings of your affordable home to reflect the location and size of the sewer lateral.

Conclusion

1. When would the use of a septic system for wastewater management be appropriate?

When the public works system is not accessible

2. What course of action should an architect or civil engineer take if the proposed slope of the sewer lateral is less than 2% (¼ in. of drop per foot) of pipe?

Try accessing a different sewer main, or begin the sewer lateral at a different position

3. Why is it important that the wastewater from a structure(s) is not toxic to microorganisms?

Because the goal is to leave the existing ecosystem as untouched as possible to preserve the environment

4. Why is proper wastewater management critical for the health and welfare of society and the environment?

Because it is harmful to the environment as well as the occupant if the waste management system fails