



Bureau of Environmental Health
 7178 Columbia Gateway Drive Columbia, Maryland 21046-2132
 (410) 313-2640 Fax (410) 313-2648
 TDD (410) 313-2323 Toll Free 1-866-313-6300
 website: www.hchealth.org

Peter Beilenson, M.D., M.P.H., Health Officer

How to Design a Residential Septic System

The following is a quick summary of the Howard County regulations concerning on-site sewage disposal systems. The regulations are effective as of January 2, 2007. For more detailed information consult the Howard County Code, Title 3.807 to 3.823, or call the Well and Septic Program at 410-313-1771.

Designing a Drainage Field

First determine the volume of wastewater that will be coming from the house. This volume is a rough estimate, and not an exact value. Use the following formula to determine the “Design Flow” volume:

$$150 \text{ gallons} \times \text{Number of Bedrooms}^* = \text{Volume of Wastewater / Day}$$

*A bedroom, as defined in Howard County Code 3.801, is any space in the conditioned area of a dwelling unit or accessory structure that is 90 square feet or greater in size, may be used as a private sleeping area, and has at least one window and one interior door.

Next determine the size of the drain field for the onsite sewage disposal system that will be needed. The size will be based on the ability of the soil to absorb and treat the wastewater and the amount of wastewater coming from the house. Locate the percolation rate from the percolation testing for this calculation, then find the rate on the table below.

<u>PERCOLATION RATE</u> (Minutes / Inch)	<u>APPLICATION RATE</u> (Gallons Per Day / Square Foot)
LESS THAN 2	NOT SUITABLE
2-5	1.2
6-15	0.8
16-30	0.6

(EPA, 1980, Design Manual, *Onsite Wastewater Treatment and Disposal System*, EPA 625/1-80-012, U.S. Environmental Protection Agency, Washington D.C.)

The corresponding “application rate,” or the rate at which the soil can absorb the wastewater, is used to determine the size of the drainage field for the system in the following formula:

$$\text{Design Flow} \div \text{Application Rate} = \text{Square Feet of Trench required}$$

A couple of factors can affect the length of the drainage trenches in the system. The first is the width of the trenches. If they are greater than one foot, use the following formula to adjust the required size of the system:

$$\text{Square Feet required} \div \text{Width of Trench (in feet)} = \text{Length of Trench required}$$

Another factor affecting the length of the drainage trenches is the effective depth of the trenches. Standard trenches used for septic drainage fields have a minimum of 6 inches of gravel below the perforated drainage pipes. If a deeper trench will be used, the length of the trenches can also be adjusted to account for the added absorption area. Use the following table to find the “percentage of length” by which the trenches may be reduced.

Effective Depth of Gravel below Pipe (in Inches)	Trench Width	
	2 Feet	3 Feet
12	0.80	0.83
18	0.66	0.71
24	0.57	0.62
30	0.50	0.55
36	0.44	0.50
42	0.40	0.45

To calculate the adjusted length of drainage trenches based on increased depth, use the value from the table in the following formula:

$$\text{Square Feet required} \times \text{Percentage of Length} = \text{Length of Trench required}$$

The final size of the drainage field is also affected by the layout of the drainage trenches. One factor that affects the size of the system is the spacing between the trenches. There should be a minimum of 6 feet between the trenches (from the edge of each adjacent drain field); however, the spacing does not need to exceed 18 feet. To calculate the minimum space required between trenches with depths greater than 24 inches use the following formula:

$$2 \times \text{Effective Depth} + \text{Width of Trench} = \text{Minimum Spacing}^*$$

*The spacing cannot be less than 9 feet for 3 foot-wide trenches.

The number of trenches may also affect the size of the drainage field. The maximum length of a drainage trench cannot exceed 100 feet. If more than 100 feet of drainage trench is required, multiple trenches should be designed so that they are equal lengths, unless equal distribution is accomplished by low pressure dosing.

Sizing a Septic Tank

The septic tank for the on-site sewage disposal system depends on the size of the house. Use the following table to determine the size of the tank required.

Square Footage of House	Minimum Tank Capacity (Gallons)
0 TO 1,500	1,000
1,501 TO 3,500	1,500
3,501+	2,000

Example: A 3,505 square foot four bedroom house is being constructed. The results of the percolation testing found that the soils in the proposed on-site sewage disposal area absorbed water at 9 minutes / inch. A system with 3 foot wide trenches with an effective depth of 18 inches is being installed.

Calculations:

Design flow = $150 \text{ gallons} \times 4 \text{ bedrooms} = 600 \text{ gallons per day}$

Square feet of trench required = $600 \text{ gpd} \div 0.8 \text{ (application rate)} = 750 \text{ square feet}$

Length of trench (width adjustment) = $750 \div 3 \text{ foot wide trench} = 250 \text{ square feet}$

Length of trench (depth adjustment) = $250 \times 0.71 \text{ (% from table)} = 177.5 \text{ square feet}$

Proper Design: Since the maximum trench length is 100 feet, two 89 foot trenches should be installed.

The spacing according to the formula below is 6 feet; however, the minimum spacing for a 3 foot trench is 9 feet.

$$\text{Minimum Spacing} = 2 \times 1.5 \text{ feet} + 3 \text{ feet} = 6 \text{ feet}$$

The house would also require a 2,000 gallon septic tank.