PENNSTATE

College of Agricultural Sciences Cooperative Extension

Agricultural and Biological Engineering

F 165

On-Lot Sewage Systems

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The purpose of this fact sheet is to describe the parts and function of on-lot sewage systems and the regulatory system governing their use. If you live in a rural area, it is likely that your home is not connected to a central sewer system. On-lot sewage treatment and disposal may be the only means of disposing of the wastewater flowing from toilets, sinks, and appliances within your home. An on-lot sewage system is a two-stage treatment system consisting of a treatment tank (most commonly a septic tank) and a soil absorption area. In short, the treatment tank removes most of the solids from the wastewater and the soil absorption system places the liquid where it can be absorbed into the soil and renovated. Since you are the owner and operator of this "mini" treatment plant, your knowledge and care of the system will help determine whether and how long it functions properly or fails. A Sewage Enforcement Officer (SEO) is hired by each township in Pennsylvania. This individual must approve the design and installation of all on-lot sewage systems. Once the system has been constructed and approved, the operation and maintenance of this sewage treatment system is in your hands. By understanding on-lot soil absorption systems, you can properly maintain your system and reduce the likelihood of failures. In the event of failure of an absorption area to adequately treat the wastewater the township SEO must approve repair or replacement work before it can be done.

Specifications for Your System

In Pennsylvania, design standards for on-lot sewage systems were created to protect your family, neighbors, and community from potential health effects caused by improperly sited or poorly functioning on-lot sewage systems. In-ground gravity absorption areas can be placed on sites that have soils with percolation rates (Perc Rates) between 6 and 60 minutes per inch and land slopes that do not exceed 25 percent. To provide adequate treatment of the liquid discharged from your treatment tank, 4 feet of suitable soil is required under the soil absorption area. The lower limit of the zone of suitable soil is defined as the limiting zone. The limiting zone is any layer that prevents proper treatment of wastewater. Such a layer causes very slow (or very fast) movement of water through the soil profile. Examples are bedrock, a very slowly permeable soil layer, a high water table, a seasonal high water table or a fractured rock layer with insufficient fines. Finally, the system must be placed at least 10 feet from property lines, 100 feet from all wells and springs used for consumption, and 50 feet from ponds or streams.

Septic Tank for Solids Removal

All on-lot sewage systems must have a treatment tank to receive the wastewater leaving your home. A very high percentage of all treatment tanks are septic tanks. Septic tanks are watertight compartments constructed of concrete, fiberglass, or other material that is resistant to decay and meets state specifications. Two septic tanks connected in series or a two-compartment septic tank is required. The wastewater leaving the home flows into the first septic tank or the first compartment of the two-compartment septic tank, see Figure 1. While detained in the first compartment for a day or two solids settle to the bottom of the tank as sludge and light particles such as grease, fats, and paper products, float to the surface as scum. The partially treated wastewater leaving the first compartment flows into the second compartment where the settling and floatation processes are

repeated, thus further improving the quality of the wastewater in the septic tank. Finally the wastewater, now called effluent, leaves the septic tank through the baffled outlet and makes its way to the absorption area. The tank must have a baffle at both the tank inlet and outlet to prevent the wastewater from short-circuiting across the liquid surface and to keep the scum layer and suspended particles from flowing with the wastewater into the absorption area. As Figure 1 indicates, septic tanks must also have inspection ports above both the inlet and outlet for checking the condition of the baffles and an access port to each compartment for pumping and cleaning the tank.

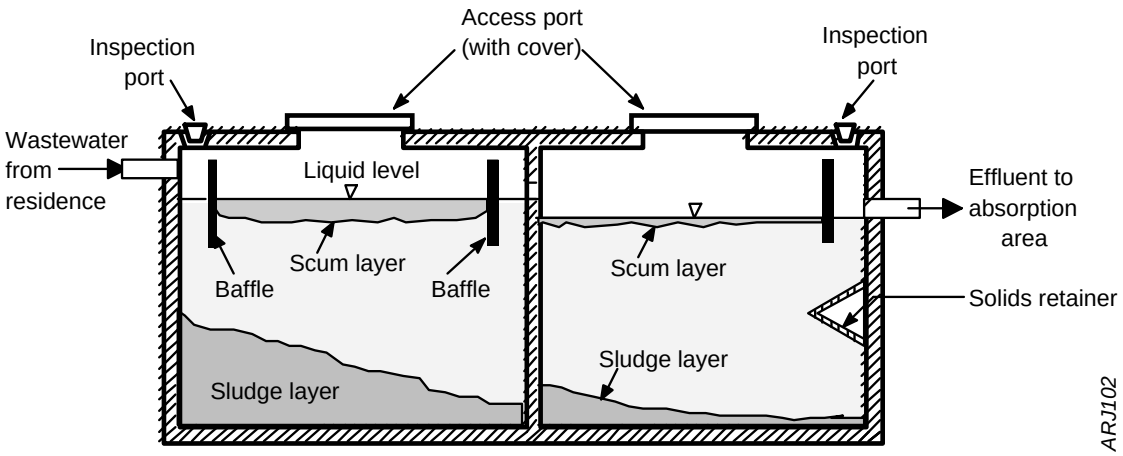

Figure 1. Cross-section of a typical two-compartment septic tank.

Precast concrete septic tanks usually are purchased with either one or two compartments. The total tank capacity is based on the number of bedrooms in the house. A 900-gallon tank is the minimum size allowed for a home with three or fewer bedrooms. For each additional bedroom, tank capacity must be increased by 100 gallons.

Soil Absorption Area For Wastewater Renovation

After the wastewater passes through the septic tank, where most of the solids are captured, the liquid effluent flows to the absorption area where the soil absorbs and treats it. Several options for absorption areas are available but the most desirable and commonly used is a seepage bed or a network of trenches.

A seepage bed is a rectangular excavation, 2 to 3 feet deep, at least 10 feet wide and up to 106 feet long that contains several perforated distribution lines. Because their rectangular geometry is more compact than a network of trenches, seepage beds usually cost less to build than trench systems. A seepage bed may be used on sites with up to 8 percent slopes.

Trench systems consist of a network of perforated pipes placed in trenches, 2 to 3 feet deep that follow the surface contours. They are most often used in areas with steep land slopes. Figure 2 shows a cut-away of a typical trench system.

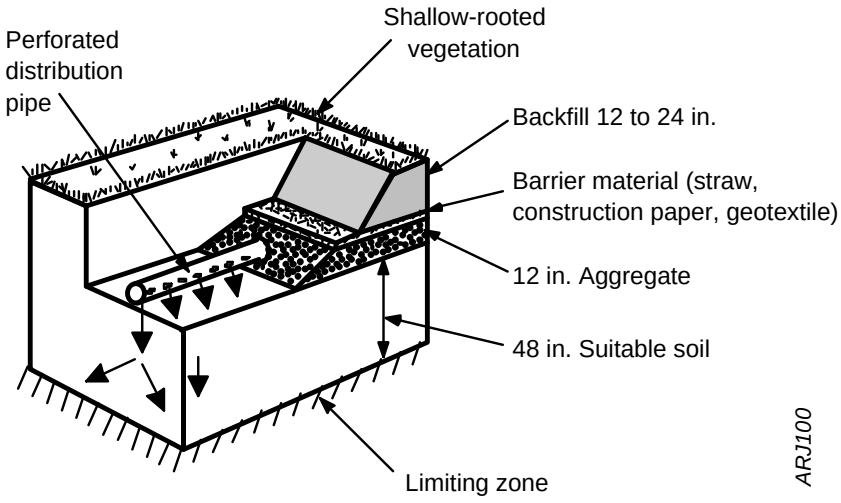

Figure 2. Cut-away of a typical trench soil absorption system.

A typical trench network or seepage bed absorption system on a site with a limiting zone 6 feet below the soil surface would be configured as follows. Excavate 24 inches of soil and fill the bottom of the trench or seepage bed with at least 6 inches of aggregate, the top of which must be level. Next, place 4-inch diameter perforated pipe on the aggregate and cover the pipe with enough additional

aggregate to provide at least 2 inches of aggregate over the perforated pipes. Before backfilling with soil, cover the aggregate with a thin layer of straw, untreated building paper, or a geotextile to prevent fill from migrating downward into the aggregate.

Regardless of whether you select a trench network or a seepage bed system, the function of the soil absorption area is to uniformly distribute the treatment tank effluent on to the soil located below the aggregate layer. From a wastewater effluent treatment perspective, the two most important characteristics of the soil under your absorption area are its ability to (1) absorb and (2) renovate the effluent. The goal is to get the effluent into the soil and have it percolate down through the 4 feet of suitable soil at a rate that will maintain an aerobic (or oxygenated) soil environment.

The Perc Rate is a measure of soil's ability to absorb water. Thus the absorption area must be proportional to the Perc Rate. For example, a site with a rather rapid Perc Rate (such as 6 to 30 minutes per inch) will require a smaller absorption area than a site with a slower Perc Rate (such as 45 to 60 minutes per inch). If the Perc Rate on your site is more rapid than 3 minutes per inch or slower than 180 minutes per inch an Individual Residential Spray Irrigation System (IRSIS) or a more expensive alternate system that does not utilize the soil as a treatment media will be required. For sites having rapid Perc Rates between 3 and 6 minutes per inch and slow Perc Rates between 60 and 180 minutes per inch more complex distribution systems that may include pressure dosing, elevated sand mounds or alternate technology will be required.

When the absorption area is correctly sized by taking into account the site's Perc Rate and the home's maximum expected wastewater flow, which is based on the number of bedrooms, the treatment tank's effluent will be properly treated as it flows into and downward through the 4 feet of suitable soil below the absorption area. For example, a three-bedroom home will require an absorption area as small as 476 square feet if the Perc Rate is 6 min/inch. The same three-bedroom home will require an absorption area as large as 1,064 square feet if the Perc Rate is 60 minutes per inch.

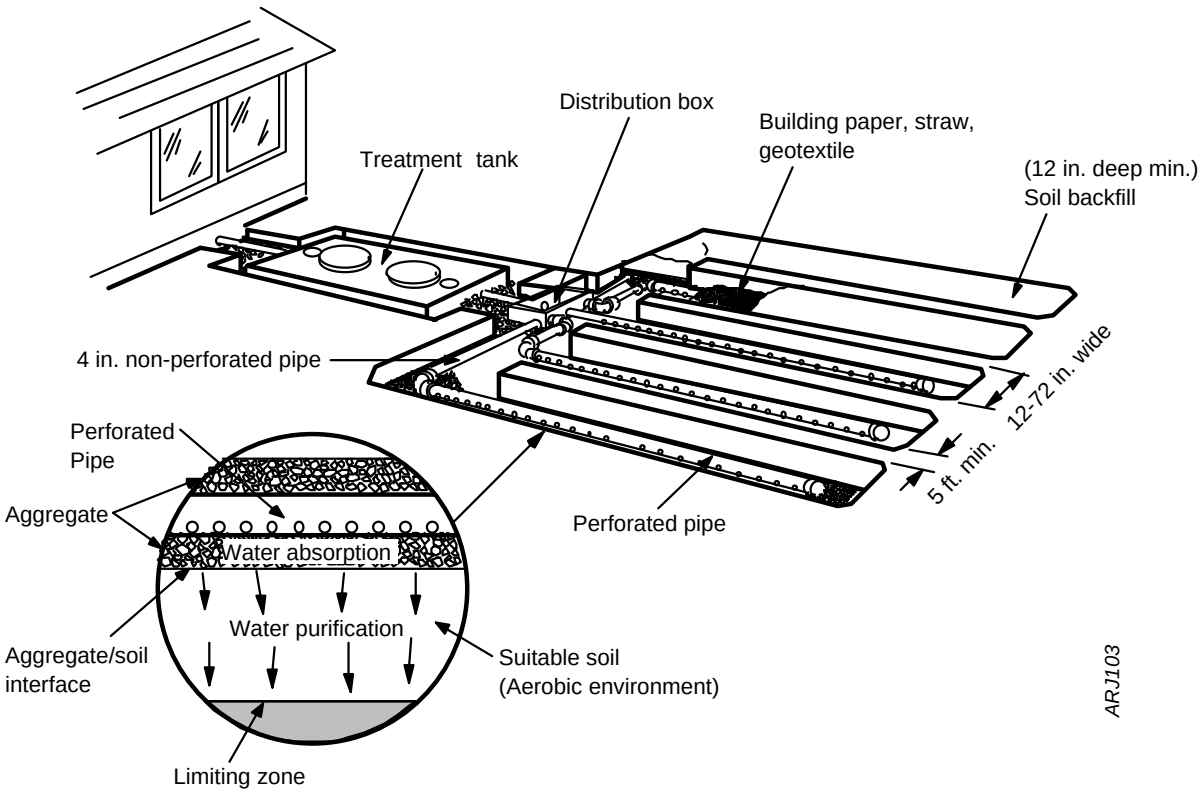

Figure 3. On-lot sewage system with a septic tank and trenches absorption area. The insert illustrates wastewater movement through the soil.

Wastewater Distribution For Disposal Into The Soil

Gravity distribution systems are commonly used if the site's terrain permits. In gravity distribution a non-perforated pipe carries the septic tank effluent to the absorption area. If you use a network of trenches, a distribution box is required to split the effluent flow equally to the individual trenches, see Figure 3. If you use a seepage bed, a distribution box or a header pipe may be used to split the effluent flow to the individual in-bed distribution pipes. The effluent is distributed throughout the absorption area through perforated pipes.

On sites where the treatment tank effluent must be transported uphill to the absorption area, or on sites that have a Perc Rate slower than 60 minutes per inch, pressure distribution is required. Pressure distribution (or pressure dosing) systems allow the treatment tank effluent to flow into a pump or dose tank equipped with a float-switch controlled pump that lifts the effluent to the absorption area where it is distributed uniformly to the soil under the absorption area.

Septic Tank-Soil Absorption Area Maintenance

Septic tank-soil absorption systems have a very short life unless they are properly maintained. The most important maintenance procedure is to have your septic tank pumped every two years. Better yet, have it pumped the day before you leave on your summer vacation every other year. For more information on system maintenance, refer to the appropriate information sources below.

For More Information

Refer to the following related Fact Sheets:
F 162 *Preventing On-Lot Sewage System Malfunctions*
F 163 *Site Evaluation for On-Lot Sewage Systems*
F 164 *Elevated Sand Mounds for On-Lot Wastewater Treatment*
F 166 *Individual Residential Spray Irrigation Systems*

For additional assistance contact:

Your local Sewage Enforcement Officer

Your County Extension Agent

Pennsylvania Association of Sewage Enforcement Officers (PASEO)
P.O. Box 7096
Mechanicsburg, PA 17050
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E-mail: paseo@aol.com

For further information or for a copy of our Fact Sheet Listing contact:
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