Conventional Septic Systems

Almost 20 million housing units sheltering approximately 29 percent of the U.S. population (1.7 million or 38 percent of the homes in Indiana) dispose of domestic waste through on-site disposal systems. Approximately 85 percent of these systems are conventional septic-absorption fields, making them by far the most common on-site disposal method.

Conventional septic systems, while common, are not suitable for all areas. Among the limitations which might preclude installation of a conventional system are: high groundwater tables; shallow limiting layers of bedrock or fragipan; very slowly or rapidly permeable soils; topography; and lot size. ID-163 and ID-164 explain alternative wastewater systems that can overcome many of these limitations.

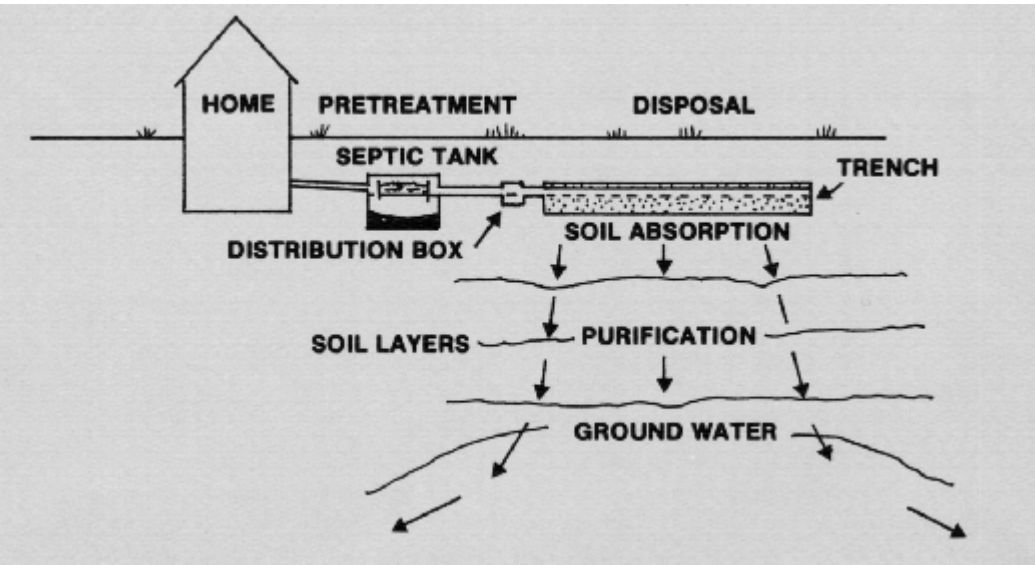
Where suitable, however, conventional septic-absorption fields will remain common for many years to come because of their relatively low initial cost and low operating cost. They have proven very satisfactory when properly located, designed, installed, and maintained. This publication outlines the proper procedures to ensure satisfactory performance of a conventional septic system.

Before arranging for installation, contact your county Extension office or County Health Officer for the names of experienced installers, and also consult homeowners who have had good performance from their systems over a number of years for the names of competent installers.

Conventional Septic Tank-Absorption Field System

The conventional septic tank-absorption field home sewage treatment system is composed of two major element: the septic tank and the soil absorption field (Figure 1). The septic tank (a settling and decomposition chamber) allows the sewage solids to separate from the liquid, undergo partial decomposition, and be stored as sludge at the bottom of the tank. The effluent from the septic tank then flows by gravity into the subsurface absorption field where it infiltrates into the soil.

Figure 1. Typical conventional septic tank and soil absorption system



Septic systems require care in site selection, design, and construction. Every individual conventional septic tank-absorption field system must be designed and constructed according to State Board of Health regulation, 410 IAC 6-8, as explained in *Residential Sewage Disposal Systems* (available through your County Board of Health). A FACTS computer program is available at your local county Extension office which can make recommendations for several types of on-site septic systems for use with various site and soil conditions. If a conventional system is suitable for your situation, the program will provide the following design information: estimates of the septic gravel volume, total trench bottom area required, and depth to the trench bottom. It will also plot specific layouts of the septic field for various trench widths that will best fit the shape and size of the disposal area. Construction Procedure

The following construction steps explain the correct procedure for installation of a conventional septic system. They will aid in applying the design information provided by the FACTS program. If the guidelines are carefully followed, they should help insure many years of troublefree operation.

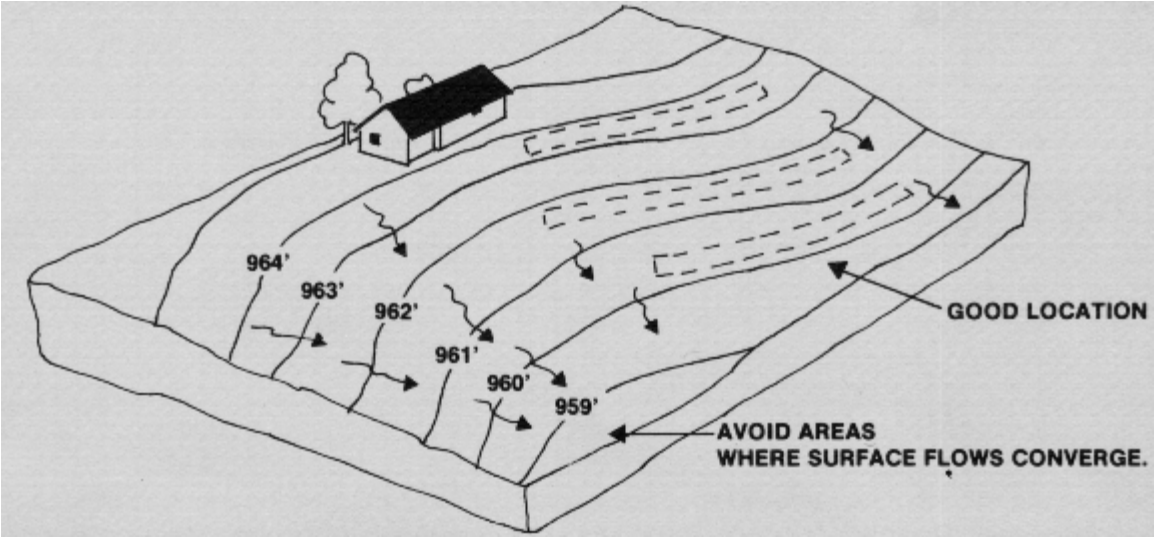
Site Selection and Layout

Step 1

All soils within the boundaries of the property should be identified to evaluate their suitability for an on-site soil absorption field by a knowledgeable professional. The absorption field should be located in the most suitable soils and should even have location priority over a new home. The absorption area should also be one that sheds water. The long axis of the soil disposal area should be oriented parallel to the contours of the slope (i.e. lines 9f equal elevation). Areas where

the long axis would run up and down the slope or where wastewater movement would converge should be avoided (Figure 2).

Figure 2. Proper orientation of trenches on complex slopes.



Traffic and construction must be avoided over and immediately downslope from the soil disposal area to prevent compaction and to minimize frost penetration.

Step 2

The locations of the septic tank, feedline trench, and center line of all soil trenches should be laid out and staked (Figure 3). Their exact location may be dictated by minimum distance requirements from water supplies, structures, property lines, and bodies of water as outlined by local and Indiana State Board of Health regulations and listed in Table 1. Some of these setback distances are also part of the FACTS program's printed recommendations.

Figure 3. Before any construction on the lot, the spetic tank and distribution box should be staked and the absorption field should be laid out, staked, and fenced.

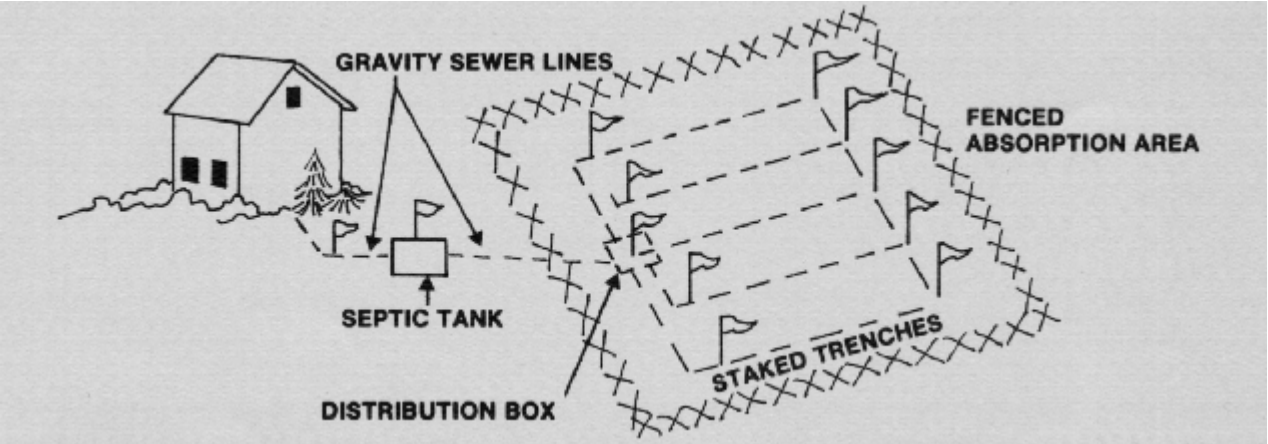


Table 1. Absorption field minimum distance requirement

Lot Features	Minimum Distance (ft.)
Water supply source	50
Lake or reservoir	50
Stream, ditch, or drainage tile	25
Dwelling or other structure	10
Side or rear lot lines	5
Front lot lines	5
Water lines continually under pressure	10
Suction water lines	50

Step 3

When the center lines of the field trenches are staked, the trenches should be spaced a minimum of 7-½ feet center to center or as specified by the computer program. As the slope increases or the subsoil becomes more impermeable, a greater spacing between trenches is needed to keep from overloading the soil around the lower trenches. This is because wastewater entering the soil from upslope trenches will tend to move downhill. The trenches should not be longer than 100 feet to ensure relatively uniform application of wastewater. The area of trench bottom is based on the estimated volume of wastewater from the home (number of bedrooms x 150 gal/bedroom/day) and the average loading rate of the 24-inch depth of soil below the proposed depth of the trench bottom.

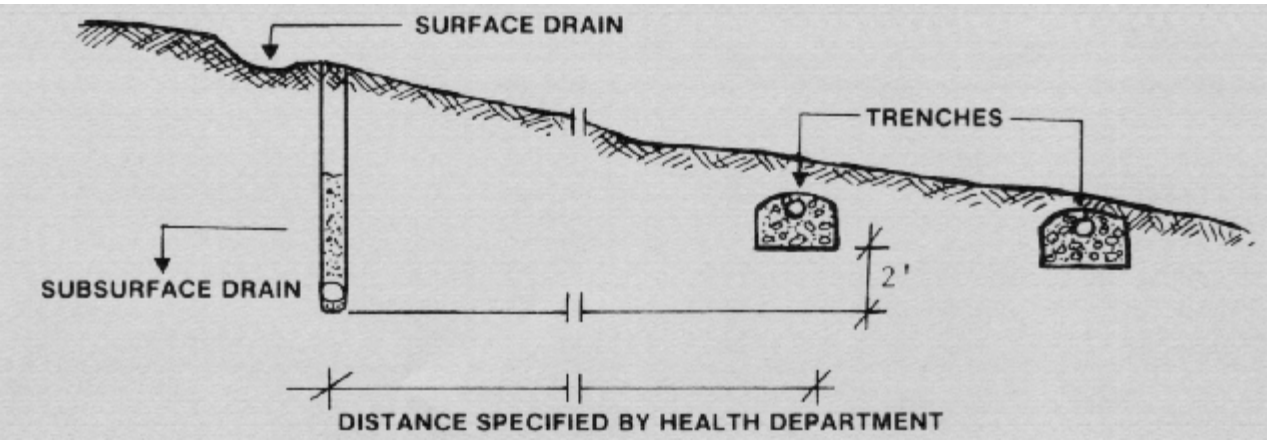
Step 4

The total area required for the soil absorption field plus an additional distance of at least 50 feet downslope should be fenced. This will prevent soil disturbance, scalping, or compaction by vehicular traffic or construction equipment. All traffic should be prohibited from the area before, during, and after installation of the system to prevent damage to the soil structure.

Step 5

If the trenches are constructed in the side or at the base of a slope, a diversion ditch and/or subsurface curtain drain should be installed. It should be backfilled with gravel and extend to the limiting soil layer or at least 2 feet deeper than the elevation of the proposed trench bottom (Figure 4). It should be located above the system to keep upslope run- off and seepage water away from the system. Curtain or perimeter subsurface drains generally are necessary to help control the water table beneath the field. Any subsurface drains around the absorption field should be kept at the distance specified by the health department.

Figure 4. Locations of subsurface and surface drains.



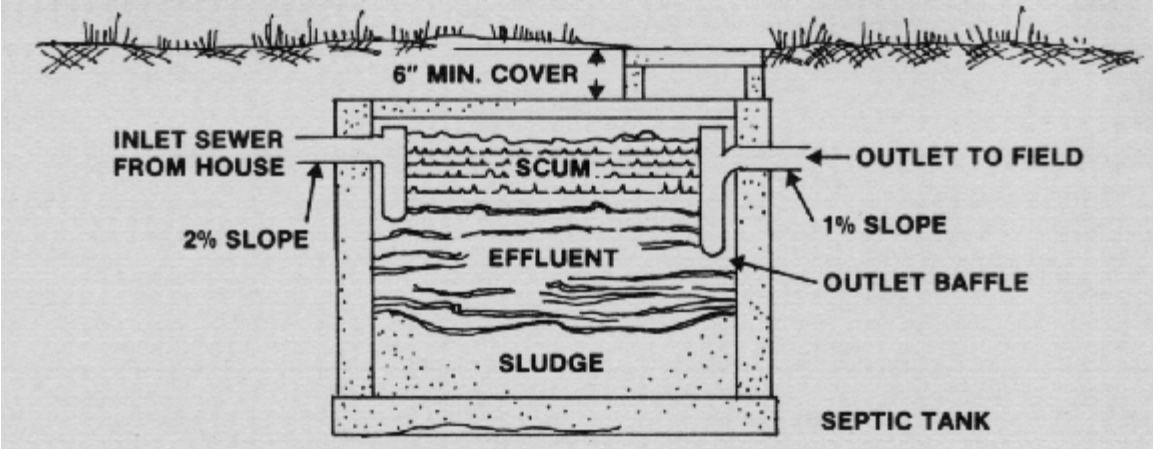
Septic Tank and Distribution Box Installation

Step 1

Excavation depths for the septic tank and distribution box are determined largely by what is necessary to obtain gravity flow in the sewer from the point where it leaves the house (Figure 5). A 2 percent slope is required from the house sewer pipe to the septic tank, while a 1 percent slope is sufficient for the pipe carrying septic effluent to the distribution box. To ensure that absorption field trenches are located in the more permeable soil horizons, the septic tank and distribution box should be installed at as shallow a depth as possible, with a minimum soil cover of at least 6 inches. The FACTS program will compute this automatically for the site by

assuming a 1 percent slope for the effluent supply line to the distribution box once the depth to the septic tank outlet depth is specified.

Figure 5. Inlet and outlet slope of septic tank sewer lines



Step 2

Both the septic tank and distribution box should be carefully leveled for proper operation after their installation. Access must be provided to the tank and distribution box for future inspection and maintenance.

Tank seams and inlet and outlet connections should be sealed with an appropriate material against groundwater seepage and tree root intrusions. Four-inch minimum diameter sewer pipe (PVC: ASTM-D-2665, 3033, 3034 or other health department approved piping) with watertight connections between the house and septic tank and between the septic tank and the distribution box should be used.

Soil backfill should be crowned over the tank and distribution box to a height of 6 inches to allow for settling and to divert surface runoff. Footing and roof drains must not be connected to the septic system.

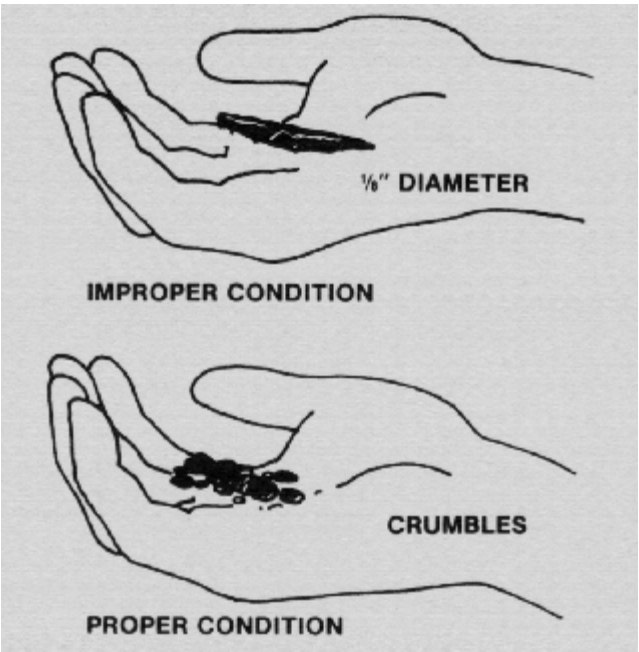
Trench Excavation

Step 1

The trenches should only be excavated when the soil is dry and friable. Smearing and compaction due to construction in a wet soil decrease the ability to absorb waste water. If a

sample of the soil at the trench bottom depth forms a ribbon (e.g. 1/8-inch diameter) when rolled between the palms of the hands, the soil is too wet to excavate. If the soil crumbles, excavation may proceed (Figure 6). This pre-excavation investigation is essential to help ensure proper operation of the system.

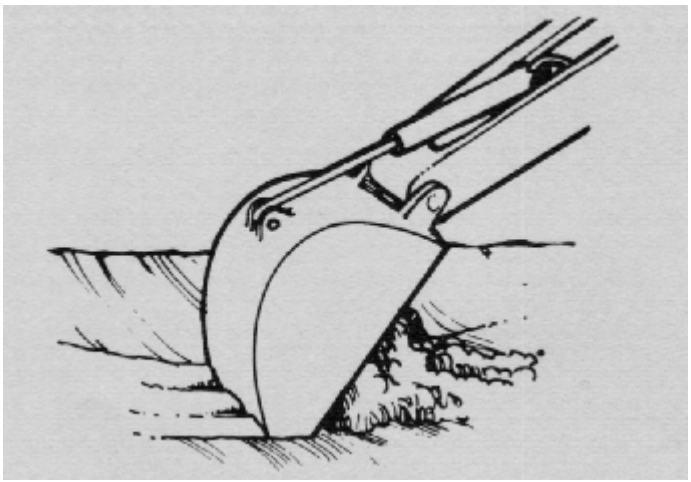
Figure 6. Construction must not take place if soil is too wet.



Step 2

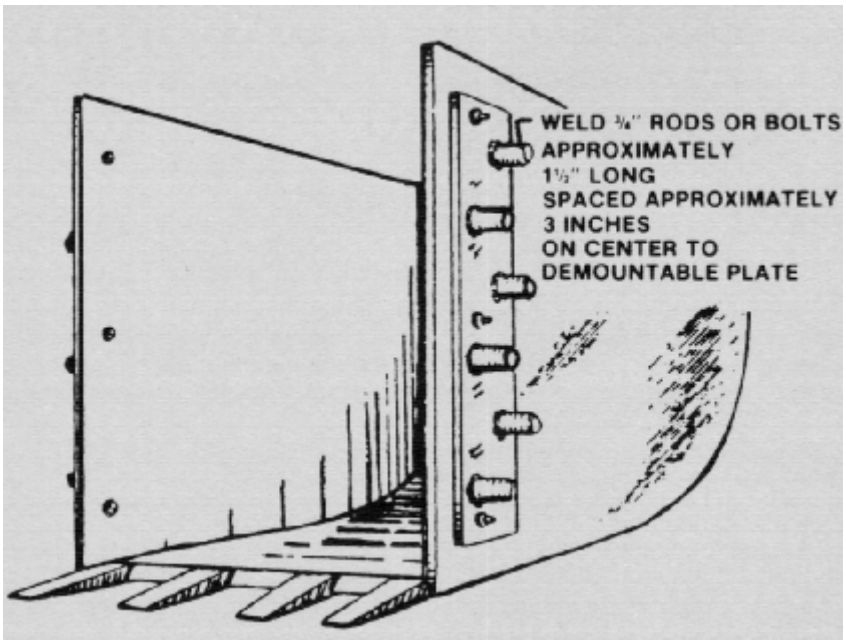
The lateral trenches should be excavated to the design depth and width recommended by the FACTS program. The bottom elevation should be checked with an engineer's level to ensure that the trench bottoms are level over the length of each trench. After most soil is removed, an excavating bucket with teeth should be used to rake each trench bottom to final bottom elevation (Figure 7).

Figure 7. Keep backhoe bucket perpendicular to trench bottom to minimize compaction.



The sides of the lateral trenches should also be raked to a depth of 1 inch to expose the natural soil structure and to remove any smeared and compacted soil surface caused by the excavating bucket. This can be done by attaching fabricated raker teeth to each side of the bucket (Figure 8). Foot traffic on the excavated trench bottom should be minimized to prevent further compaction. If foot traffic is necessary, planks should be used to spread out the workers' weight. For both level and sloping sites the trenches should be connected individually to the distribution box by a header or manifold trench. Distal ends of the trenches may be tied together on level sites to further improve wastewater application.

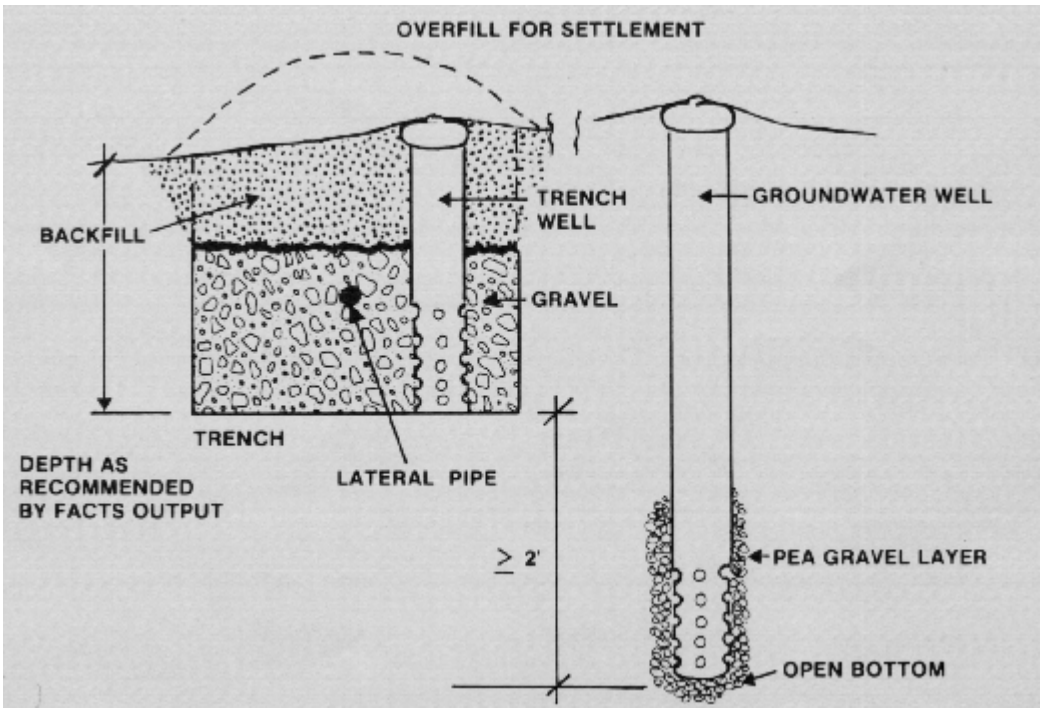
Figure 8. Fabfricated raker teeth to reduce compaction and smearing of trench side walls.



Step 3

Monitoring wells, sometimes installed to permit evaluation of the performance of the absorption field once it is in operation, can be installed at this point in construction of the system. These wells are usually 4-inch diameter PVC pipe. Each monitoring pipe is perforated with ½ inch holes over the lower 6-inch length. The well should extend to the ground surface and be covered with a friction-fit cap or screw cap. If used, monitoring wells should be located in several trenches, extending from the trench bottom to the final surface grade (Figure 9). This will provide a means of evaluating the depth of ponding in a trench, a measure of the system's performance. Distribution Network Installation

Figure 9. Monitoring wells shown in completed trench and outside of absorption field.



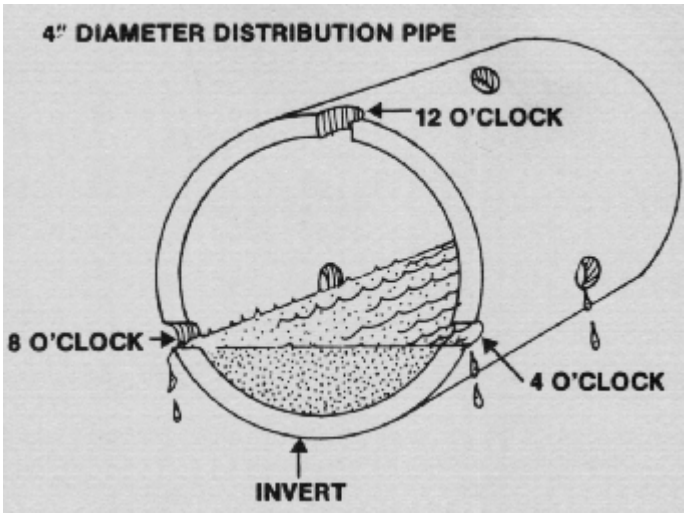
Step 1

Washed Indiana State Highway Specification (Spec #5) aggregate or other trench fill material that has been approved by the County Sanitarian should be carefully placed to a depth of 6 inches over the bottom of the trenches. Finally, the aggregate should be leveled. If trenches are constructed in a wooded area, at least 12 inches of fill material should be placed below the pipe or tile to discourage root growth within the distribution line.

Step 2

A 4-inch diameter perforated distribution line of plastic or vitrified tile should be laid on a maximum grade of 4 inches per 100 feet. Pipe for the distribution lines must meet local and state health department specifications. Coiled perforated plastic tubing should not be installed because the tubing will not maintain grade or lay flat. All open joints in the distribution lines should be covered with a non- decomposing material to prevent the entry of stone. Each lateral line for the absorption field at a sloping or level site should be individually connected to a leveled distribution box by a nonperforated header pipe at the same invert elevation to ensure equal distribution to all the trenches. During the assembly of the plastic piping in the trenches, it is important to ensure that the perforations are not on the invert side of the pipe (Figure 10).

Figure 10. Ensure outlet holes are at 4 and 8 o'clock positions and not at the invert position.



Backfilling the Trenches

Step 1

The pipe network should be carefully covered with additional washed Spec #5 gravel or approved aggregate to a depth of at least 2 inches above the crown of the pipe.

Step 2

Next, a backfill barrier such as a synthetic fabric filter, 4-6 inches of marsh hay or straw, or untreated building paper (red rosin) should be placed over the aggregate cover.

Step 3

The trenches should be backfilled with excavated soil and compact slightly. The soil should be mounded 4-6 inches over the top of the trench to allow for settlement. Individual trenches can be excavated and completed m sequence for ease of construction.

Step 4

Since settlement may take 6-12 months, the construction area should be sodded or seeded immediately, using grasses adapted to the area.

Maintaining the System

To maximize the uptake of water, good grass or vegetative cover should be maintained over the area. The homeowner should have a layout diagram of the septic system, referenced to the house and lot boundaries. This will facilitate location of the tanks and absorption field for future maintenance.

Sludge should be removed from the septic tank every 3-5 years. This clean-out schedule is important with standard gravity-fed systems to avoid carryover of solids which can plug the disposal trenches.

Homeowners should monitor the performance of the septic system by routinely checking the depth of water in the monitoring wells during spring, summer, and fall. Any progressive increase m ponding depth within the trenches over time may be indicative of future problems.

Water conservation measures in the home help to ensure that the soil disposal area will not be overloaded. It would be wise to install faucet aerators and low-flow fixtures and appliances when possible.

Operating and Maintaining the Home Septic System (ID-142) is a Cooperative Extension publication written for homeowners. This publication and the above recommendations should help homeowners better understand the operation and maintenance of their on-site septic system for many years of troublefree operation.