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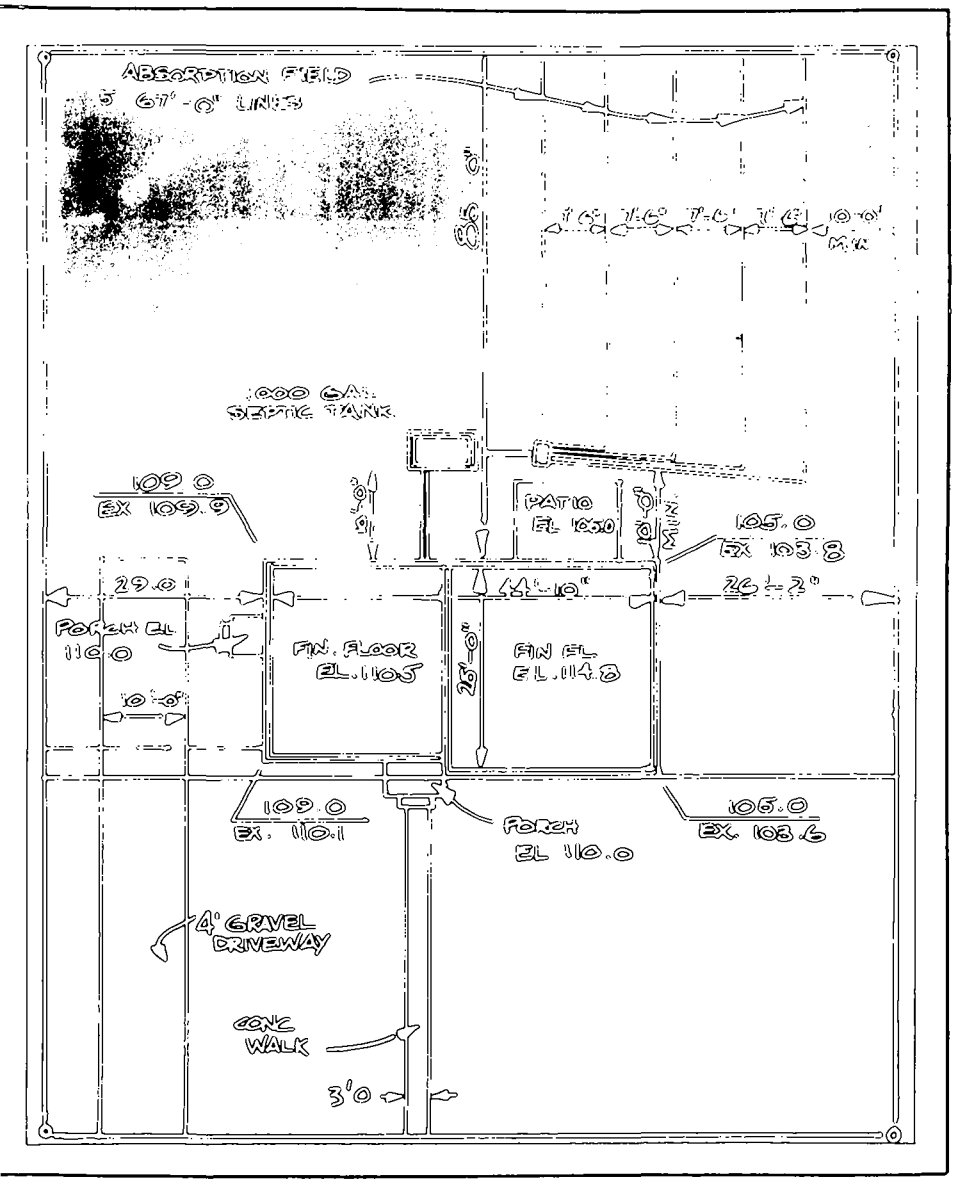

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A Homeowner's Guide to Septic Systems

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5930 · ISN 2155
323.2 85H0
KD 5930

Virginia Water Resources Research Center
Virginia Polytechnic Institute and State University
Blacksburg • 1985

The preparation of this document was financed in part through a grant from the United States Environmental Protection Agency under Section 1143(b) of the Safe Drinking Water Act (Grant No. C-003281-01). The contents do not necessarily reflect the views and policies of EPA, nor does the mention of trade names or commercial products constitute an endorsement or recommendation

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A publication of the
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Acknowledgments

The Water Center wishes to acknowledge the members of the groundwater advisory committee for assistance in the development of this booklet: David Bailey and Moira Lux, Environmental Defense Fund; Robert Peters, John E. Sirine and Associates; L.S. Button and Helen Jeter, Soil Conservation Service; Peter Brooks, Gerard Higgins, and Robert Taylor, State Health Department; Kenneth Hinkle and P.J. Smith, State Water Control Board; John Powell and Winfield Wright, U.S. Geological Survey; Keith Cheatham, Virginia Farm Bureau Federation; Blake Ross, Virginia Tech; and Stuart Kerzner, U.S. Environmental Protection Agency, Region III. We particularly wish to thank Mr. Brooks of the State Health Department and Raymond B. Reneau, Associate Professor of Agronomy at Virginia Tech.

Introduction

Population growth and distribution patterns in the United States make it impractical to build central sewage treatment plants everywhere. Where community sewers are not available, *septic systems* may be used to treat sewage from individual homes. One-third of the homes in the United States use septic systems, which discharge about 800 billion gallons of wastewater into the soil around them each year. About 400,000 households in Virginia are served by septic systems. More than 30,000 applications for constructing new septic systems are made annually in the state. When properly designed, installed, and maintained, septic systems can be a cost-effective method for treating household sewage.

Because septic systems are underground and do not require daily maintenance, many homeowners rarely think about them. Many people who rely on a septic system to treat household wastewater also rely on groundwater, tapped by a well, to meet their drinking, household, and farm water needs. The well and the septic system are usually located on the same property. This is important because *if the septic system and the well are not properly designed, located, and maintained, the groundwater that supplies the well may become contaminated.* According to the U.S. Environmental Protection Agency, septic systems are the most frequently reported sources of groundwater contamination in the nation. They are regulated by all states to protect the health of septic tank users and their neighbors.

To ensure that your septic system operates properly, you should understand its operation and maintenance. Fewer than half of the septic systems in the United States are expected to perform satisfactorily over their design life of 15 to 20 years. Septic system failure is not only costly but is also a potential health hazard. With a basic knowledge of septic systems, you can avoid septic system failures, unnecessary expenses, and health hazards such as well water contamination, and you can expect reliable service from your septic system for as long as you own your home.

The following discussion outlines what current and prospective homeowners need to know about septic systems, how septic systems work, the basics of proper septic system use and maintenance, what to do if your septic system fails, and where you can get more information about septic systems.

Septic System ABC's

A typical septic tank sewage disposal system consists of an underground, watertight receptacle called a septic tank, a distribution box, and a soil absorption drainage field (*Figure 1*). Wastewater from the bathroom, kitchen, and laundry leaves the home through an underground pipe connected to the septic tank. Baffles or "tees" in the septic tank slow the flow of incoming wastewater and prevent sewage from flowing directly through the tank. Heavier solids settle to the bottom and accumulate as sludge. Grease, foam, and some lighter solids float on the surface of the wastewater and form a mat of scum (*Figure 2*). Bacteria present in the tank digest some of the heavier solids and grease. During the decomposition process some solids are liquefied. The digestive or "septic" process releases a foul-smelling gas that escapes through the sewer pipe and is discharged by a vent through the roof of the house. The remaining solids and scum accumulate in the tank. As this matter accumulates over time, it fills the tank and has to be removed.

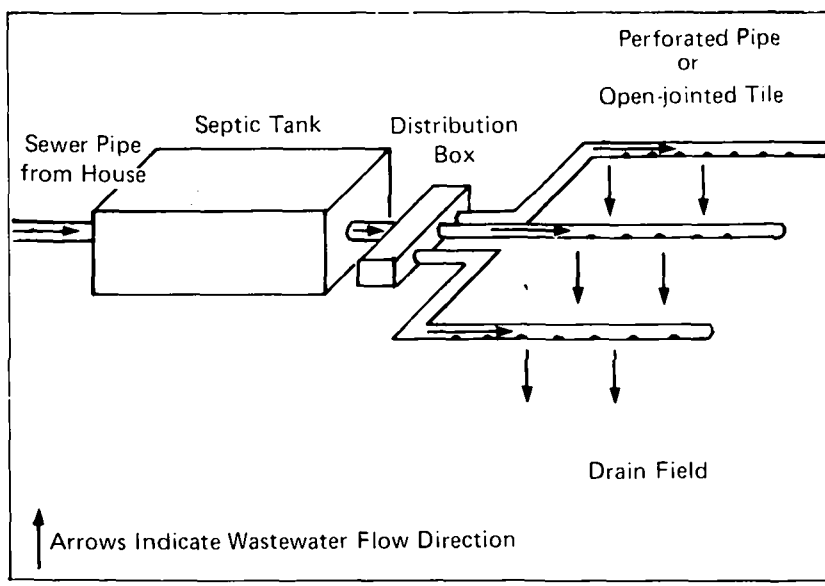


FIGURE 1
Components of a Household Septic System

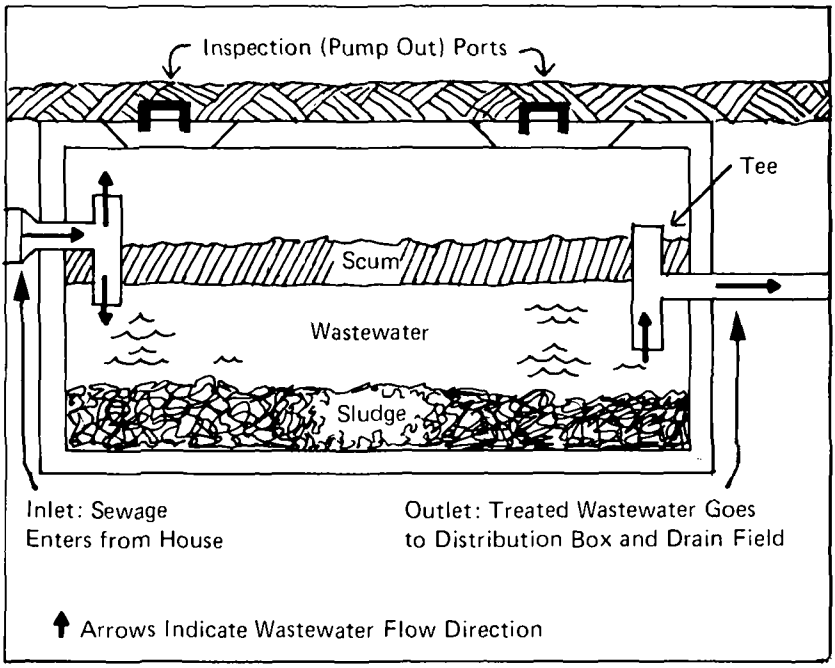


FIGURE 2
Septic Tank (Cross-Section)

The partially treated wastewater, or effluent, flows out of the tank into lines of perforated pipe or open-jointed tile that distribute the liquid throughout the drain field. A distribution box divides the flow to prevent one line from becoming overloaded. The distribution box has one inlet connected to the septic tank, and many outlets connected to the lines in the drain field (*Figure 1*).

The drain field consists of several lines of perforated plastic pipe or open-jointed drain tile buried in a series of parallel trenches. Liquid seeps out of the holes in the pipe or the seams between the tile sections, then filters through a layer of coarse gravel and into the soil. The wastewater is filtered and treated by organisms in the soil and by physical and chemical reactions with the soil. Eventually this effluent reaches the groundwater below.

The main function of the septic tank is to remove solids from household wastewater so that the effluent can more readily filter through the soil in the drain field. Removing solids from the wastewater protects the drain field from clogging.

Proper Use of Your Septic System

Be Selective

A properly designed, installed, and maintained septic tank disposal system will function well for many years. For a septic system to work effectively, appropriate precautions should be taken in everyday use of the system. The following substances should NOT be disposed of in household plumbing: coffee grounds, dental floss, disposable diapers, cat box litter, cigarette butts, sanitary napkins, tampons, plastics, facial tissues, paper towels, and bulky wastes. Disposal of these items adds to the solids load and fills the septic tank more rapidly. This decreases its efficiency and increases maintenance costs.

Pouring liquid fats, grease, or oils down the kitchen sink drain should be avoided. Fats and greases solidify and may block parts of the system. Use of a garbage disposal unit in the kitchen sink also should be avoided unless the septic system is specifically designed to handle the extra load a disposal unit imposes. A disposal unit sends solids to the septic tank, adding to the tank's load and necessitating more frequent pumping out. Use of a garbage disposal can increase the solids load to the septic tank by 50 percent. For new homes in which a disposal is planned, the septic system should be designed to accommodate the extra solids load. If a disposal is added to an existing plumbing system, major alterations may be needed in the septic system.

Keep toxic and hazardous chemicals out of the septic system. These items include paints, varnishes, thinners, waste oils, photographic solutions, poisons, pesticides, and herbicides. All toxic and hazardous substances and their containers should be disposed of with extreme caution. If you are unsure about the best way to dispose of large quantities of potentially hazardous materials, consult your local health department. Moderate use of household cleansers, disinfectants, and bleaches will do little harm to the septic system.

Conserve Water

Excessive amounts of water entering the septic system increase the wastewater load on the drain field and reduce the soil's capacity to absorb wastewater. Water flow to the septic system can be substantially reduced through water conservation. Low-flow faucets,

water-saving showerheads, conservation equipment for toilets, and water-saving appliances can be installed with a minimum of expense. Some other hints for conserving water include:

- Repair leaky faucets and toilet tanks promptly. Water leaking from the tank into the toilet bowl can waste up to 500 gallons of water a day.

- Use dishwashers and washing machines only when they are fully loaded. Distribute the clothes washing throughout the week to avoid overloading the drain field.

- Do not let water run while shaving, shampooing, washing hands, brushing teeth, or washing dishes.

- Keep showers short and reduce the amount of water used for baths.

- Reduce the amount of water used for flushing toilets. Rinse out an empty, one-gallon milk jug; cut off the top portion; place clean stones in the bottom to add weight; and submerge it in the toilet tank so it does not interfere with the flushing mechanisms.

- Teach family members, especially children, about water-saving practices.

For more information on water conservation, request the free brochure, *Be Water-Wise, Some Water-Saving Tips from the Virginia Water Center,* from the Virginia Water Resources Research Center, 617 North Main Street, Blacksburg, Virginia 24060-3397.

Septic System Maintenance

One major advantage of a septic system is that it has no moving parts and normally does not require weekly or monthly maintenance. A septic tank that is properly designed, used, and managed, can last up to 50 years. A septic tank's drain field can absorb thousands of gallons of sewage effluent over its life and last many years if it is not abused. A healthy grass cover should be maintained over the drain field to prevent soil erosion, since the drain field lines are often within 2 feet of the surface. Do not plant trees or shrubs on, or near, the drain field because roots may eventually damage or block the distribution lines.

Do not connect a sump pump or roof gutters to the septic system. Likewise, do not connect footing drains (which prevent basements from becoming wet) to the septic system. Also, be sure to direct gutter drains, downspouts, and footing drains away from the drain field. Do not pile snow or soil on the drain field.

Know Where Your Septic System Is Located

To facilitate cleaning and maintenance, draw a map of your septic system on graph paper. (If you do not know where your septic system is located, call the local health department for help; construction permits on file there should contain an accurate map of the system.) The map should show the location of the house, the tank's inspection ports, the piping, and the drain field. This information should stay with the house—along with a permanent record of all septic system maintenance—regardless of a change in occupancy; serious injuries have resulted from the cave-in of abandoned septic tanks. You might place a marker on the ground above the septic tank to avoid the expense of hiring someone to locate the inspection ports.

An accurate diagram showing the septic system's location allows the homeowner to prevent damage to the system. Septic tanks and drain fields are frequently damaged when construction equipment or other heavy equipment is driven over them. A line of cast-iron building sewer pipe, instead of plastic sewer pipe, should be installed under all vehicle crossings. No structures should be built over drain fields.

Routine Inspection

A tank should be inspected at least once every two years to determine rates of scum and solids (sludge) accumulation. With ordinary use and care, a septic tank usually requires pumping out every three to five years. However, in many cases septic tanks can be satisfactorily operated for a longer time period.

Failure to have the septic tank pumped out regularly is the most frequent because of damage to the drain field. When the tank is not emptied, solids build up until they are carried along with the wastewater into the drain field where they clog soil pores. When this happens, a new drain field must be built. By periodically inspecting and pumping out the tank, this major expense can be avoided.

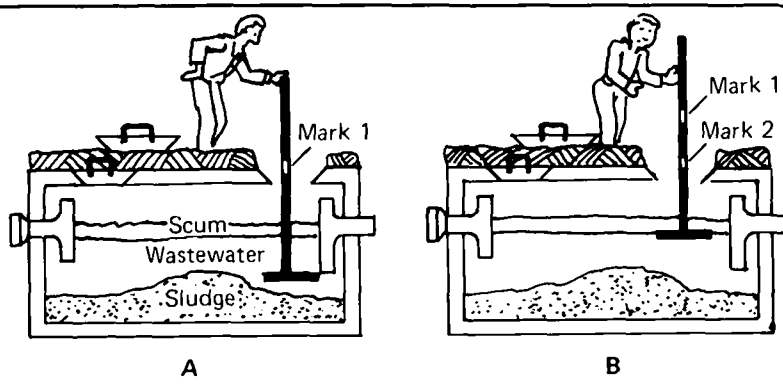
By inspecting the tank as shown in *Figure 3* you can determine when the tank needs to be pumped out by a septic tank service.

NEVER ALLOW ANYONE TO GO DOWN INTO A SEPTIC TANK. Toxic, flammable gases build up in the septic tank and can kill in minutes. Extreme caution should be exercised even if you simply peer into the tank. Do not use torches or flames near the opening of a septic tank.

Pumping Out the Tank

Septic tanks should be pumped out on a regular basis by a reputable septic tank service. Septic tank pumpers must have a state permit to handle and dispose of the material removed from a septic tank, known as *septage*, by an approved sanitary method. Consult your telephone directory for a list of businesses that pump out septic tanks. Your local health department can also provide information about septic tank pumpers in your area. You should obtain estimates of the cost of having the tank pumped out; there may be considerable variation in charges for tank cleaning.

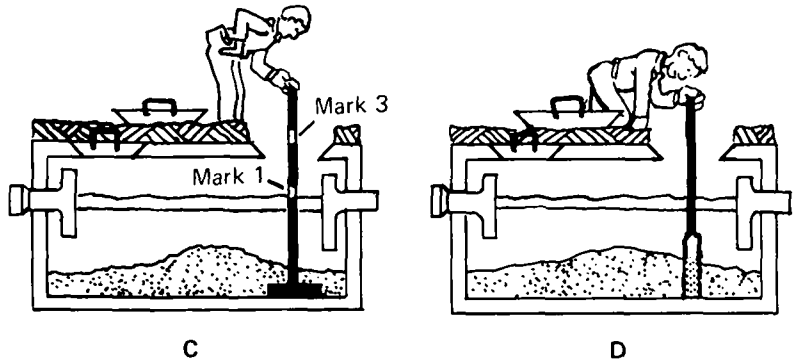
To service the septic tank, the liquid level in the tank is first lowered below the outlet to keep sludge and scum from overflowing into the drain field as the tank is being cleaned. Then, some of the liquid is pumped back into the tank under pressure to agitate all the solids into suspension. If the scum layer is hard, agitation is done with air under pressure, or a long-handled shovel is inserted in the pumpout ports to break up the scum. When all the solids become suspended, the remainder of the mixture is pumped out of the septic tank into the pumper tank. The tees are checked before the septic tank is closed, and any missing or damaged ones are replaced. The distribution box should be checked and cleaned at the same time.



Scum Measurement

Step A: Nail a 6" x 6" board to an 8' stick. Lower the stick through the inspection port near the discharge end of the tank. Move the stick until you can feel the bottom of the outlet tee. Mark the stick at the top of the port *(Mark 1)*.

Step B: Raise the stick until you feel increased resistance at the bottom of the scum layer. Mark the stick *(Mark 2)*. If *Mark 1* and *Mark 2* are within 3" of each other, the tank should be pumped out.



Sludge Measurement

Step C: Lower the stick to the bottom of the tank. Mark the stick *(Mark 3)*. The distance between *Mark 1* and *Mark 3* on the stick is the distance between the bottom of the outlet tee and the tank bottom.

Step D: Wrap a white towel around the bottom 3' of another 8' stick. Lower the stick (through the outlet tee, if possible) to the tank bottom. Remove the stick after one minute. If the top of the sludge layer (marked by black particles on the towel) is within 12" of the bottom of the outlet tee, the tank should be pumped out.

FIGURE 3
Inspection to Determine Whether Septic Tank Needs to be Pumped Out

The State Health Department recommends that a few inches of sludge be left in the tank after cleaning to help reactivate bacterial action. Never wash, scrub, or disinfect the septic tank. Washing can destroy bacteria that are needed to decompose waste in the tank.

Additives

Most authorities agree that biological and chemical additives are not needed to aid or accelerate decomposition in the septic tank. There is no evidence that these additives will prevent septic system failure or improve performance. Some products that manufacturers claim will clean the tank contain compounds that will actually harm the septic action, damage the soil absorption system, and contaminate groundwater. Many of these chemicals have been found in drinking water drawn from wells. Do not use products containing more than one percent by weight of the following chemicals:

- Halogenated Hydrocarbons:
  Trichloroethane
  Trichloroethylene
  Methylene chloride
  Halogenated benzenes
  Carbon tetrachloride

- Aromatic Hydrocarbons:
  Benzene
  Toluene
  Napthalene

- Phenol Derivatives:
  Trichlorophenol
  Pentachlorophenol
  Acrolein
  Acrylonitrile
  Benzidine

Septic System Failure

When a septic system is abused or poorly maintained, liquid waste may rise to the ground surface or back up into the house's plumbing. Overflows create offensive odors and can be a health hazard because sewage may contain organisms that cause dysentery, hepatitis, typhoid, or other infectious diseases. In addition to being unsightly, ponded sewage creates breeding places for mosquitoes and other insects. When a septic system fails it can also contaminate groundwater with bacteria, viruses, degradable organic compounds, synthetic detergents, and chlorides.

One of the most frequent causes of septic system failure centers around the system's distribution box. The box can shift from its level position, causing the effluent to tilt toward one side of the box and travel to the drain field through only one or two of the distribution lines from the lowered side of the box (*Figure 4*). Because most of the effluent travels to the drain field through only one or two lines, one section of the drain field becomes saturated with wastewater. This section of the drain field then becomes overloaded with wastewater, cannot function properly, and wastewater can back up into the household plumbing or pond on the land surface.

Whenever problems arise, the distribution box should be checked first to determine if it has shifted. Improper installation and packing under or around the box can cause the box to tilt as settling occurs after installation. Driving equipment on the land surface over the box can also result in shifting of the box.

Another common cause of septic system problems is drain field failure. In some cases it is easy to determine when the drain field is not working. The system has failed when the soil does not adequately absorb the wastewater, and the wastewater rises to the surface of the ground. Unusually lush, green grass may indicate the point of failure, or a grey-black, odorous liquid may be visible.

Septic system failures are a serious health hazard and children and pets should be kept away from the location. Fence-in or block-off the area to keep people and pets out and phone your local health department for help.

Many drain fields fail to work properly because they are located in soils that are poorly drained. During wet weather these soils

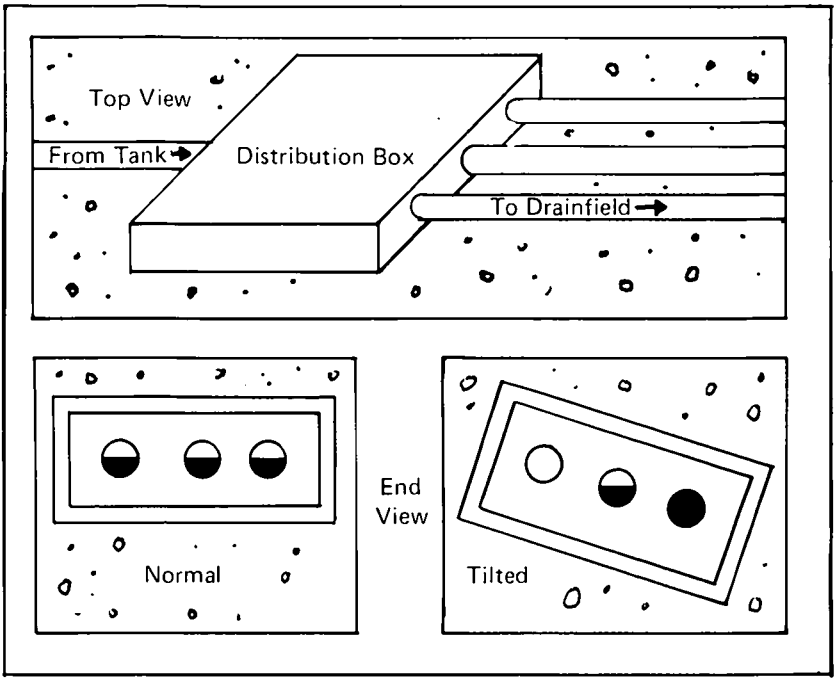


FIGURE 4
Tilted Distribution Box Overloads Distribution Line on Lower Side of Box

become saturated and cannot absorb the wastewater load from the tank. Other drain field problems are created by compact soils whose absorption rates are very low. Wastewater entering a drain field in such soils may rise to the ground surface even in dry weather. Steep land, seasonally high water tables, thin soil cover over bedrock, runoff from gutters, or flooding can contribute to drain field failure.

At some locations, groundwater moves into the area in which the drain field lies and may create saturated soil conditions underneath and around the distribution lines. When augmented by the incoming flow from the septic system, such conditions do not allow wastewater from the distribution lines to filter through the soil properly. Household water conservation attempts may sufficiently reduce the wastewater load to the drain field to solve this problem. If not, then installation of "French drains" may be considered. These drains collect excess soil water, which is then diverted away from the drain field.

Another possible solution to drain field failure is to not use the drain field for a period of time while the flow is diverted to a new

drain field. Research has shown that biological degradation, or breakdown, of the substances that cause soil clogging occurs while the field is "rested." A diversion valve is used to divert flow from the tank to a newly constructed drain field. The old field is rested for six to twelve months and then put back in service. If diversion works adequately, alternation between the drain fields is continued at one-year intervals.

Before installing a new drain field, contact your local health department to obtain a permit. *Do not* dig up the existing drain field unless there is no room to install a new one; drain fields will often recover given sufficient time to "rest."

Other problems involve blockage between the house and septic tank. A house sewer blockage should be cleared by a professional. If the blockage is from tree roots, the roots should be removed and pipe joints resealed. If the blockage occurs at the inlet pipe into the tank, the tank should be pumped out and all baffles should be checked. Outlet pipes should also be checked. In some cases, a plugged sewer vent can slow the rate of flow. The roof vent openings should be checked by a plumber to see if they are blocked.

Before You Buy Property

Before buying land on which to build a home or business, if the property is not served by a central sewage system, you need to know whether a suitable site for a septic system exists on the lot. You may wish to hire a professional soil scientist to assess soils on the lot and recommend a construction site for a septic system. The State Health Department has specific regulations regarding the location of septic systems in relation to various landforms, buildings, water supplies, and property lines (*Table 1* and *Figure 5*). When planning the building site, do not plan to locate the septic tank or drain field under a patio, garage, storage building, driveway, parking lot, sidewalk, or other paved area.

Consult a sanitarian at your local health department to determine the proper procedure to follow in applying for a septic system construction permit. The sanitarian will evaluate the site and its soils. If the site location and soils are judged satisfactory—based on a soil survey of the area, soil sample tests, and percolation ("perk") tests—the sanitarian will design a septic system, and issue a construction permit. Once the septic system is constructed, the sanitarian *must inspect and approve* the system before it is covered with backfill, and before an operation permit is issued and the system placed in service. Any plans for installing a well on the property must also be considered when choosing a septic system site. Approval of the water supply is an integral part of issuing an operation permit for a sewage disposal system.

If you plan to buy an existing home or business, you should determine if the septic system has been properly designed, installed, and maintained. Copies of the original installation and operation permits for the septic system can be obtained from your local health department if the system is not extremely old. You should make sure that the system is located where it is not likely to endanger well water and that the drain field is capable of handling the year-round liquid waste load. Pay particular attention to the ground surface above the system's drain field to determine if wastewater from the distribution lines has risen to the surface. Many older homes have septic systems that are inadequate to handle the large amounts of water used in modern appliances. Special attention should be paid to homes that have been enlarged without expansion of the septic system.

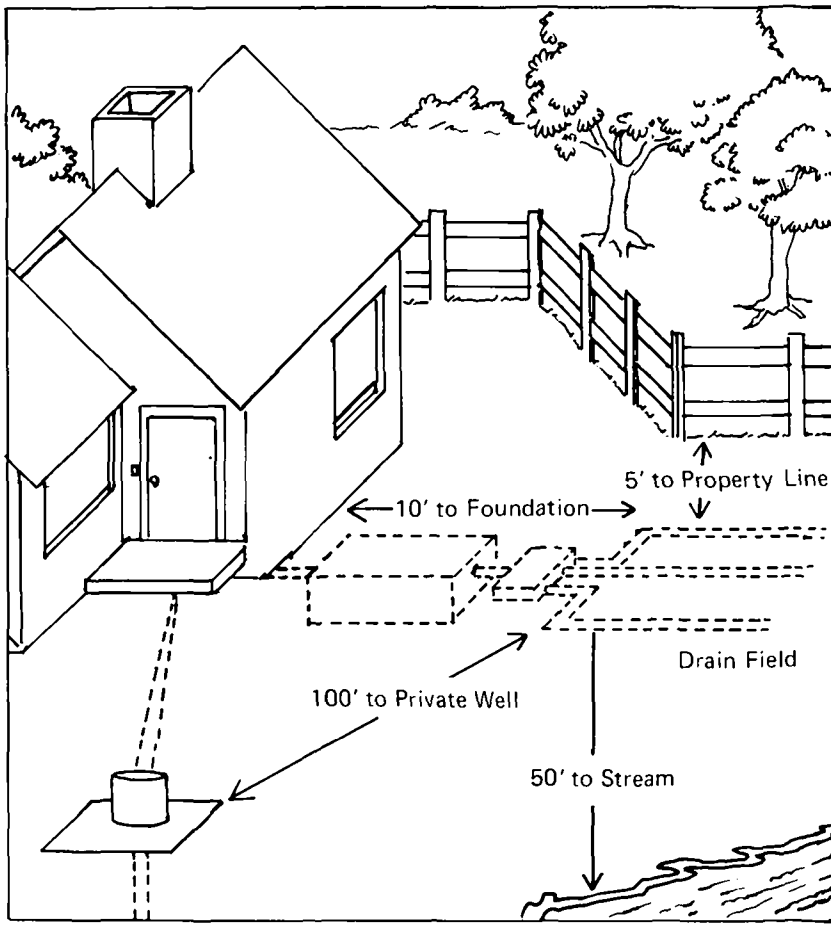


FIGURE 5
Typical Layout of Septic System
Showing Required Minimum Separation Distances

A permit to install, alter, or extend a sewage system *must* be obtained from your local health department. Any agreement with a contractor who installs a septic system should stipulate that no payment will be made until the system has received approval from the health department. You can be prosecuted for installing a septic system without a permit or for using one without health department approval.

TABLE 1
Minimum Horizontal Separation Distances
from Bottom or Sidewall
of Subsurface Soil Absorption System Trench

Feature	Distance (Feet)
Property Lines	5
Building Foundations	10
Basements	20
Drinking Water Wells	
Class I and II (Public)	50
Class III (Private)	100
Development Springs (Upslope)	200
Cisterns	100
Drainage Ditches	
Above Seasonal Water Table	10
Below Seasonal Water Table	70*
Utility Lines	10
Natural Lakes and Impoundments	50
Streams	50*
Shellfish Waters	70
Low Point of Sinkholes	100
Rock and Impervivous Layers	1**

*These distances may be reduced in some cases depending on soil type and system design.
**Minimum vertical separation is also 1 foot.

Source: Virginia Department of Health, 1982. *Sewage Handling and Disposal Regulations*. Richmond.

For More Information

Your municipal or county health department is the first place to check for more information. It can answer your questions or refer you to someone who can. It can also explain regulations governing construction of septic systems. As of November 1, 1982, new regulations governing sewage handling and disposal in Virginia took effect. These regulations are intended to guide Virginians in installation of on-site sewage disposal systems and private water supply systems (wells, springs, cisterns). An application for a septic system construction permit can be obtained from your local health department. Your area telephone directory lists local health departments and extension agents.

For more detailed information on domestic sewage disposal request *Onsite Domestic Sewage Disposal Handbook, MWPS-24,* from Midwest Plan Service, 122 Davidson Hall, Iowa State University, Ames, Iowa 50011. Price: $4.00.

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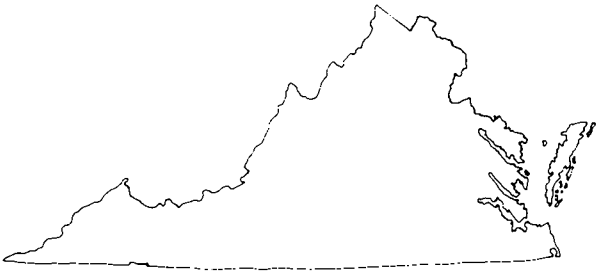

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