12-2003

On-Site Wastewater Treatment System

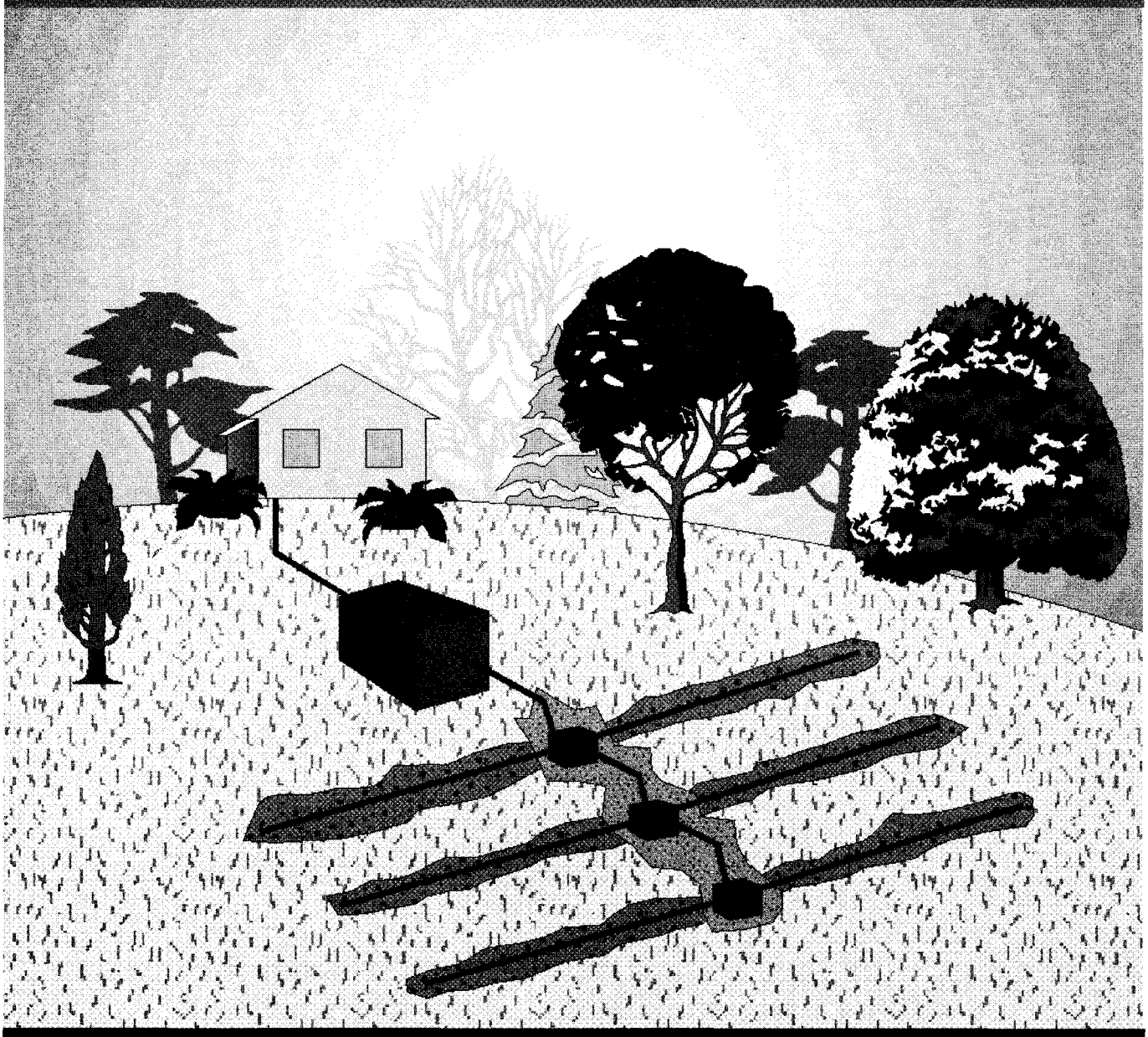
Phil Kappen

Russell Dickerson

EC 907

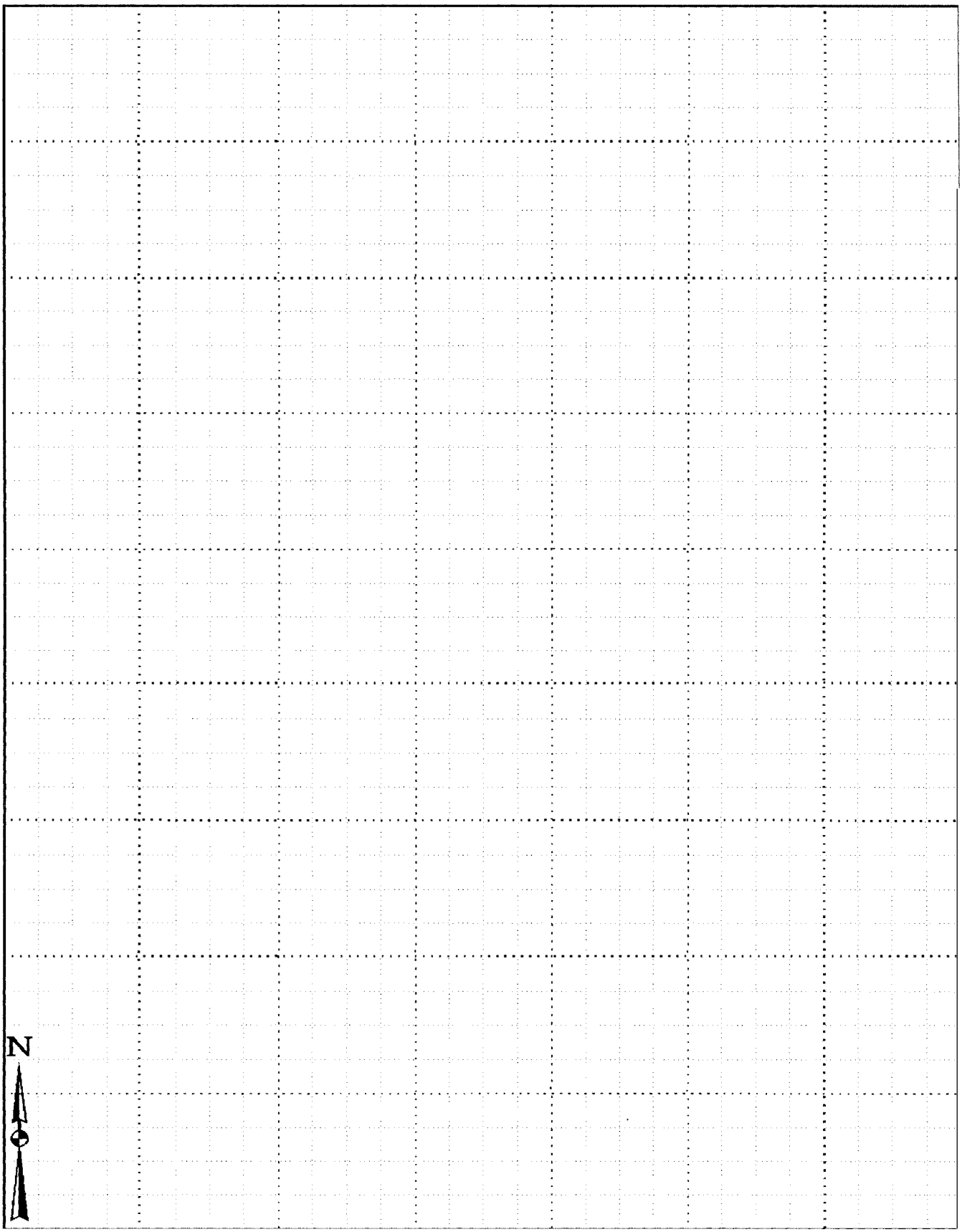
On-Site Wastewater Treatment System

A HOMEOWNER'S MANUAL



Cooperative Extension Service · College of Agriculture and Biological Sciences · South Dakota State University · USDA

Include a map of your system or draw your own map.



Septic System Homeowner's Manual

Phil Kappen: *Minnehaha County, Assistant Planning Director* & Russell Derickson: *Extension Associate, Water and Natural Resources*

Most rural homes in South Dakota are served by an on-site, wastewater treatment system or septic system, but many rural residents do not have the basic information they need to properly operate and maintain their septic systems. There is often a sense of "out of sight, out of mind" when dealing with an on-site system. The purpose of this manual to provide the homeowner with that information.

If an on-site system is to fulfill its intended function and properly treat wastewater, three items are necessary. The first two items, proper system design and installation, are the responsibility of the system installer. The third, proper system operation and maintenance, is the responsibility of the homeowner and is the primary factor in system longevity.

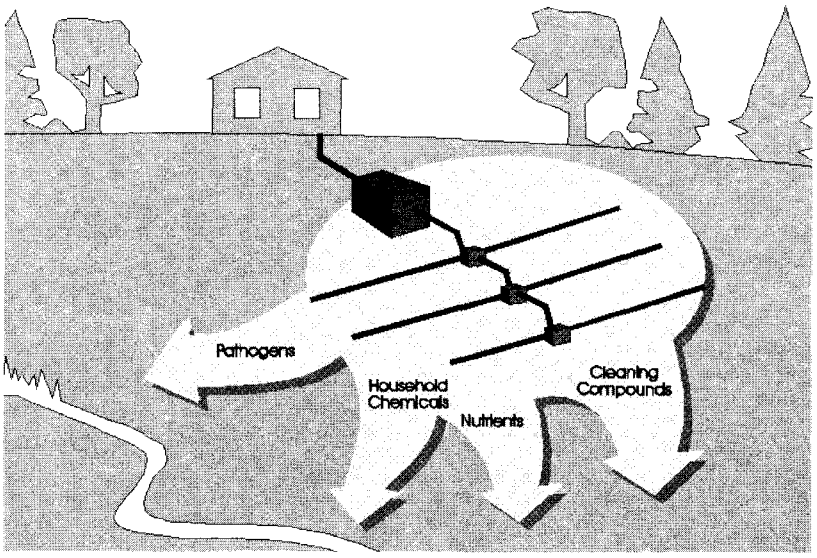
Why Treat Wastewater?

Wastewater is any water that has been used. That originating from a home may be classified as either grey water or black water. Grey water does not include any human waste and does not require the same level of treatment as black water. Blackwater – any wastewater which includes human waste – may contain a variety of bacteria, viruses, other disease organisms, parasites and nutrients and must be properly treated (Figure 1).

The inadequate treatment of wastewater can pose serious health and environmental risks. Exposure to untreated wastewater, either through contact or the drinking of contaminated water, can cause diseases such as hepatitis, dysentery or salmonella. According to the Environmental Protection Agency wastewater from on-site systems is this country's most frequently reported source of groundwater contamination resulting in water-borne disease outbreaks. Even the simple acts of a pet walking through wastewater or flies and mosquitos coming into contact with untreated human waste provide an avenue for disease organisms to enter our home and possibly cause infection. Because of the serious health risks, South Dakota prohibits the disposal of untreated human waste on the surface of the ground and prohibits the use of an on-site system which is allowing wastewater to surface or is contributing to the pollution of surface or groundwater.

Another component of wastewater, nutrients such as nitrogen or phosphorus, can also cause problems if the wastes are allowed to reach lakes and streams. Excessive phosphorus can lead to algal blooms, noxious odors, and excessive weed growth in lakes and streams that can impair water quality for fish and wildlife. Nutrients such as nitrates, if consumed in drinking water, can also lead to health problems such as methemoglobinemia or "Blue Baby Disease." Toxic home cleaning products also may be present in domestic wastewater and may enter surface or groundwater from improperly operating on-site systems.

Figure 1. Ingredients in domestic wastewater.



System Design and Installation

The design, location, and installation of the system are primarily the responsibility of the installer. Any person engaged in the business of installing on-site systems in South Dakota must be certified by the Department of Environment and Natural Resources. The certification process tests the individual to ensure that they are familiar with the minimum requirements for designing and installing on-site systems.

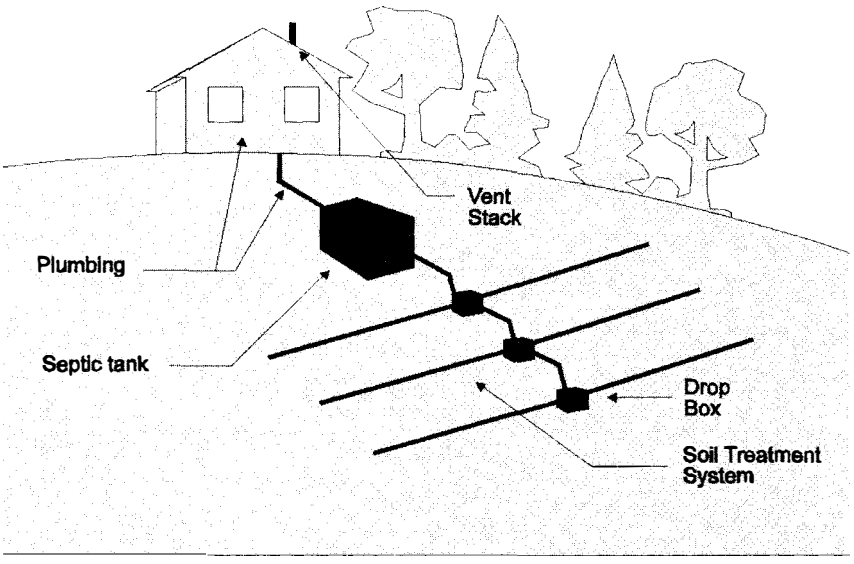
The installer must evaluate two soil factors when designing a system. First, a test hole must be dug or drilled to determine whether there are any restrictive layers in the soil. Restrictive layers may include bedrock, a seasonal high-water table, layers of highly permeable sand or gravel, or a tight, clay layer. A seasonal high-water table may be indicated, even in dry years, by the colors of the soil or the soil mottles. The bottom of the on-site system must be placed at least four feet above any restrictive layer. The test hole must extend to a depth of four feet below the bottom of the proposed system or to a maximum depth of eight feet, unless bedrock, standing water, or a seasonal high-groundwater table is encountered first. This test determines the type of system that will be required and the depth to which it may be constructed. The maximum depth of any soil treatment area is four feet.

The second evaluation consists of a measure of the percolation rate of the soil, or the rate at which the soil will absorb water. Since a tighter, clay soil absorbs water slower than a sandy soil, a system in a tight soil would need to be larger than a system installed in a sandy soil in order to treat the same amount of wastewater per unit time. The percolation test, along with information on the amounts of water to be treated, determines the size of the system. Water usage may be determined from the size of the structure, the number of bedrooms or a measured amount of usage. "Perc" tests holes are dug to the depth at which the system will be installed.

The installer is also responsible for ensuring that the system is installed according to state and local specifications. The construction of any new system, the repair of an existing system or the replacement of an existing system may require that the installer obtain a permit from the local government. In some counties, an inspector must inspect each system before the below-ground components are covered to ensure that the system has been properly installed.

It is the homeowner's responsibility to ensure that their system installer is properly certified by the state and that the percolation test is completed. It is also the responsibility of the homeowner to address the third requirement for a properly operating on-site system, that of system maintenance. The maintenance of the system is as important as the design and installation. Proper maintenance will not only ensure the system's proper operation, but it can extend the life of the system and minimize costly repairs.

Figure 2. On-site wastewater treatment system components.



How an On-site System Works

An on-site system has three components: 1) the plumbing in the house (collection system), 2) the septic tank (primary treatment), and 3) the soil treatment area (secondary treatment) (Figure2).

Each component must meet certain standards in order to properly provide for the safe collection and treatment of the wastewater.

On-site systems are designed to treat a specific amount of wastewater each day. This design is commonly based on the normal volume of wastewater expected from a house. An increase in the daily water flow, either through changes in living habits, an increase in the number of users, the infiltration of clean water into the wastewater system, or other factors can cause a system to fail.

Plumbing - Collection System

The plumbing collects the wastewater from the home and carries it to the treatment system. This collection system must conform with applicable plumbing codes to ensure its proper construction both to provide containment of the wastes and venting to prevent sewer gases from entering the home.

Caution! Septic tanks contain toxic and highly flammable gases. Never enter a tank unless all appropriate safety precautions have been fully employed!

The plumbing must be designed to ensure that water from roof drains, basement sump pumps, hot tubs, and swimming pools does not drain into the wastewater treatment system. The increased volume of water from such sources could easily overload the on-site system and result in system failure.

At times the wastewater plumbing in the home may be separated into two separate system, one for grey water and one for black water.

Septic Tank - Primary Treatment

Once the wastewater leaves the house it first enters a septic tank. The tank performs the primary treatment of the wastewater by separating out the solids and allowing anaerobic (without oxygen) bacteria to begin breaking down the waste (Figure3).

Inside the tank the lighter solids such as grease, soaps, and toilet paper rise to form a floating layer of scum. The heavier solids settle out to form a layer of sludge on the bottom of the tank. A properly operating system retains both of these layers within the tank. This is accomplished through the use of baffles near the inlet and outlet of the tank. The inlet baffle directs the incoming wastes into the liquid layer between the sludge and the scum. The outlet baffle retains the floating scum and ensures that only the liquid portion exits the tank for treatment in the soil treatment area. The scum and sludge layers must be periodically removed by a septic pumper.

Inspection pipes above both the inlet and outlet of the tank allow the inspection of the inlet and outlet pipes and the baffles. These inspection pipes should be at ground level or above the finished grade and should always be capped. There is also a manhole located in the top of the tank to allow access for cleaning the tank. The top of this manhole should be only from 6-12 inches below the surface of the ground.

The tank size depends on the type of use and the amount of water used. Installation of an under-sized tank or the increased agitation from an excessive wastewater flow will not allow adequate time for solids and scum to be removed from the wastewater (Figure 4). If solids reach the soil treatment area, it could result in system failure and expensive repairs.

Figure 3. The septic tank.

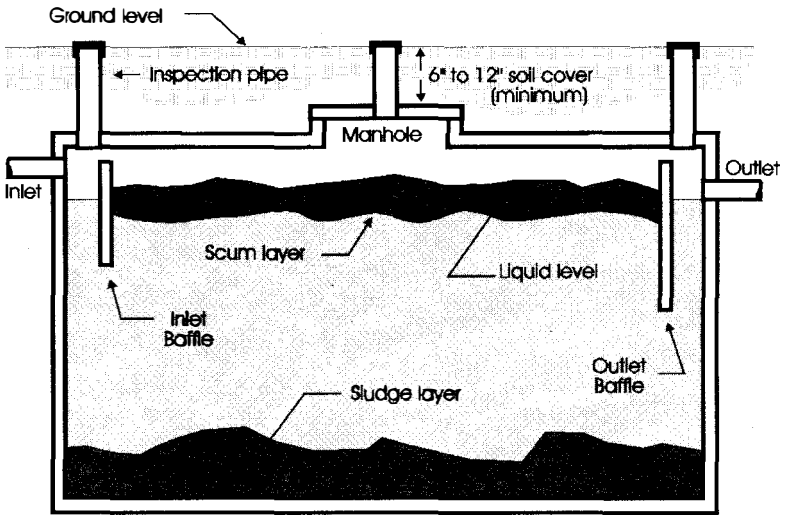
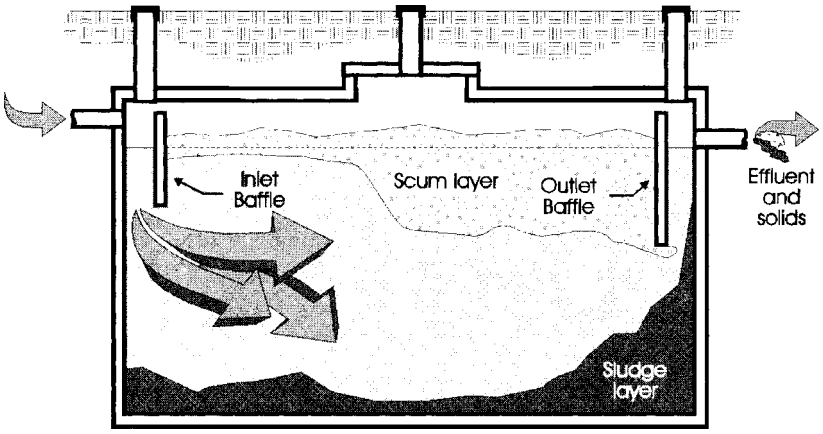


Figure 4. Agitation due to large volumes of wastewater.



South Dakota regulations require that a septic tank size be at least 1000 gallons. However, larger homes require increased sizes. For example, an additional 250 gallons of capacity must be added to the 1000 gallon minimum tank size for each bedroom more than three in the home. The following chart shows required tank sizes for homes. The use of a garbage disposal also will require an additional 20% storage capacity in the tank to ensure increased storage for solids.

Minimum Septic Tank Capacities For Residences

Number of Bedrooms	Minimum Liquid Capacity	Minimum Capacity with Garbage Disposal
2	1000	1200
3	1000	1200
4	1250	1500
5	1500	1800
6	1750	2100

The wastewater, or effluent, leaving the septic tank is not clean and has not been completely treated. Many dangerous pathogens and other ingredients still remain. This wastewater must undergo secondary treatment.

South Dakota regulations requires that a grey water system include a tank which must provide at least three days of storage. After the grey water has settled in the tank for three days it may be recycled for toilet use or may be used to irrigate lawns or other areas not intended for food production.

Soil Treatment Area - Secondary Treatment

The soil treatment area provides the final treatment of the effluent from the septic tank. The area is commonly referred to as the drainfield, leach field, drain trenches, soil absorption area, soil treatment unit, or mound. The proper operation of the soil treatment area is highly dependent on the type and condition of the soil.

The soil particles and microbes absorb nutrients, break down organic matter, and remove bacteria, viruses, and other pathogens. These aerobic microorganisms require oxygen in order to live; therefore, the system cannot be installed at too great a depth or in saturated soil which does not allow for ample supplies of oxygen. The maximum depth of a soil treatment area is four feet. Surface runoff should also be directed away from the soil treatment area to prevent the site from being overly saturated. Within the treatment area the soil microbes and dead pathogens form a layer along the surface of the trench called a biomat. This layer further regulates the rate at which wastewater passes from the trench into the soil and aids in the filtration and destruction of wastewater components.

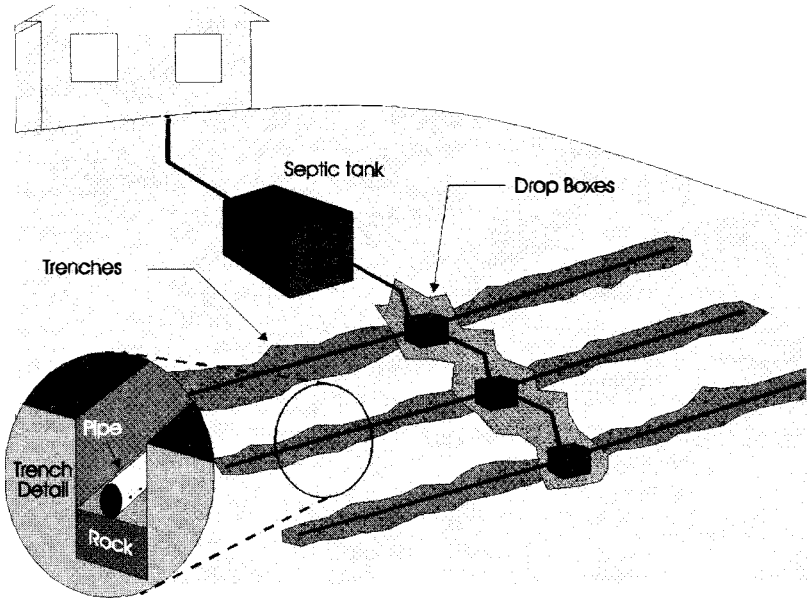
Though the soil treatment area can be effective in removing various pathogens and phosphorus, it cannot remove all components of the wastewater. Some, such as nitrates, are not completely removed. Therefore, minimum distances are required between the treatment area and site features such as a buildings, wetlands, lakes or streams, wells, or groundwater. The setbacks required by South Dakota regulations are shown below.

Minimum Setbacks Between Soil Treatment Areas and Site Features

Selected Site Features	Minimum Setback
Occupied Buildings	20
Wells (over 100 feet deep)	100
Wells (less than 100 feet deep)	150
Cisterns, Reservoirs, Lakes or Streams	100
Pressurized Water Lines	25
Property Lines	10

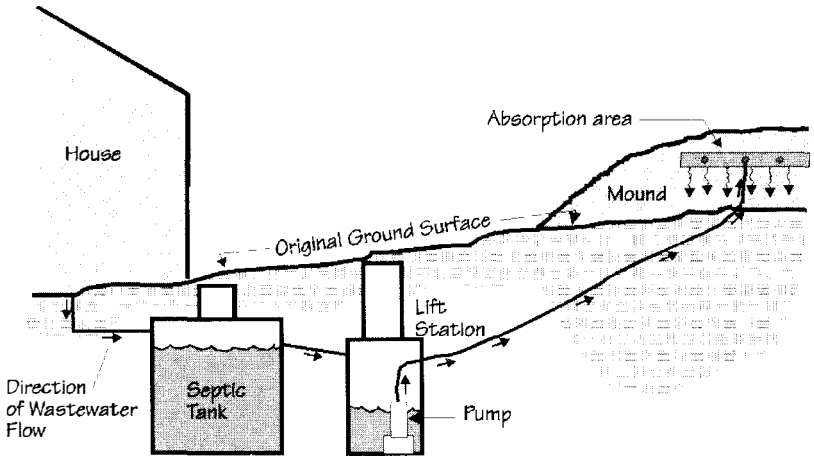
The septic effluent is carried from the tank to the soil treatment area by a series of solid pipes. Within the treatment area perforated pipes distribute the effluent in the trenches. South Dakota regulations allow the use of interconnected pipes within the soil treatment area when the ground surface does not vary more than 6 inches throughout the treatment. If there is 6 to 28 inches of elevation difference throughout the treatment area then the pipes should be connected to distribution or drop boxes which ensure a more efficient transfer of the effluent into the drainfield pipes. When there is an elevation difference greater than 28 inches throughout the soil treatment area, then drop boxes must be used (Figure 5).

Figure 5. Drop boxes and trenches.



In many cases, wastewater is carried to the soil treatment area by the force of gravity. In some situations however, a lift station may be required to carry the waste to a more suitable site. Within the lift station there is a pump that distributes the wastewater to the treatment area.

Figure 6. Mound or No-Dak system.



Problem Sites

When a restrictive layer is present in the soil, a mound system, sometimes called a "No-Dak "system, may be required to achieve the minimum four feet of separation (Figure 6). Such a system is constructed from a mound of clean sand which elevates the treatment area to the required height above a restrictive layer. The effluent is distributed to a layer of rock within the sand mound. South Dakota allows the use of either a lift station or gravity flow to carry the effluent to the mound. Some local regulations, however, require that the effluent be pumped into the mound by a lift station to ensure that the entire absorption area is utilized each time the pump or siphon cycles.

In some instances, a soil absorption system cannot be used. This may be due to a extremely high restrictive layer in the soil or a very small lot. For situations such as this, a holding tank may be required. The holding tank is a closed tank which receives the wastewater from a home. South Dakota regulations require that the tank have a minimum capacity to hold at least seven days worth of the estimated, maximum wastewater flow and a high-water alarm that indicates when only three days of storage capacity remain in the tank. When the tank is full it must be pumped and the effluent properly treated and disposed. The effluent may not be pumped onto the ground. South Dakota regulations explicitly prohibit the disposal of the effluent from a septic tank or holding tank on the surface of the ground.

System Operation and Maintenance

How To Use the System

Water Use

The wastewater treatment system is uniquely designed for a specific amount of daily wastewater flow on a specific parcel of land. The size of the soil treatment area is based on both the type of soils found in the soil treatment area and the potential daily wastewater flow from the house.

South Dakota regulations require that the daily water use be determined from either the estimated maximum water use based on similar types of structures or on an actual measured water use. A system designed with a measured water use must consider that the average daily wastewater flow is 150 percent of the measured flow.

If there is a greater amount of wastewater than the system was designed to treat, then there is a real risk of system failure. A system is considered to be failing when it does not fully treat the wastewater. This happens when untreated wastewater is allowed to reach groundwater, the surface of the ground, or back up into the house. South Dakota prohibits any person from using a system which allows wastewater to surface on the ground or contribute to the pollution of water.

Every effort should be made to ensure that all wastewater flows are well within the capacity of the system. This may be accomplished through the use of water conservation techniques and by ensuring that extraneous water does not enter the system. Extraneous water would include water from eaves, sump pumps, pools, or hot tubs. The basic landscaping in the yard should be completed to direct surface runoff away from the treatment area.

Water conservation techniques may range from simple to complex. Techniques include installing low-flow shower heads, washing full loads in the washing machine, and low-flush toilets, or grey water systems. Remember that simply using bricks or water bottles in the tank of an existing toilet may not work as efficiently as a low-flow toilet.

Some older toilet models are designed to require the full amount of water and the use of less water may result in a less than total flush.

Water Conservation Measures

Simple

- Use low-flow shower heads (typical - 5 gal/min; low-flow - 2 1/2 gal/min).
- Do not run faucet continuously while brushing teeth or shaving (teeth - 1/8 gallon compared to 1 - 2 gallons if you let the water run; shaving - 1 gallon for rinsing only or 3 - 5 gallons if water runs continuously).
- Repair leaky faucets.
- Take showers instead of baths (shower - 7 1/2 - 25 gallons; bath - 30 gallons if tub 1/2 full - approximately 5 gallons of water per inch in tub).
- Take shorter showers (7 1/2 gallons for 3 minute shower, 25 gallons for 10 minutes).
- Flush toilets less often (liquid wastes do not have to be flushed every time).
- Wash only full loads in the washing machine and dish washer or use partial load settings.
- Distribute laundry and dishwasher loads throughout the week.
- Recharge the water softener only when necessary (reroute softener recharge water away from the treatment system, it does not need to be treated).
- Keep a pitcher of drinking water in the refrigerator rather than letting the tap run in order to cool water.
- Direct water from roof eaves, sump pumps, pools, and hot tubs out of the on-site system and away from drain field.

More Complex

- Low-flow toilet (uses 1 1/2 - 3 gallons per flush while a standard toilet uses 6 gallons).
- Suds savers on washing machine (reuses most of the wash fill for the next load).
- Front loading washing machine (uses less water - 17 - 28 gallons per load compared to 40 gallons for top loading model).
- Low water use dish washer (6 - 9 gallons per cycle compared with 12 - 15 gallons for standard model).
- Grey water system (only for wastewater that does not contain human waste).

- Shut off valve on water treatment system so that it runs when the reservoir is full.
- Secondary soil treatment area and alternate use of the two areas.

Product Use and Disposal

Many items used in the home for cleaning and daily living are disposed of in the wastewater system. Most of these materials will not cause damage to the on-site system if used in proper amounts. Care must be taken, however, that no items are placed into the system which will impair it's capacity for treating wastewater.

Cleaners and Detergents - The overuse of these items may impair the bacteria which are necessary for the proper operation of your wastewater system. To help prolong the life of your system, use low-phosphate dishwasher soap (less than 11%) and no-phosphate detergents. Use the minimum amount of soap, detergent, or bleach necessary for a job (this may be less than the amount suggested by the manufacturer). Use liquid soaps, or biodegradable powders. Use suds-saver washing machines (requires much less soap on the second load).

Drain and Bowl Cleaners - Use these products only as needed (the overuse of these products can adversely impact the beneficial bacteria in the treatment system). Do not use products which are placed in the tank or bowl and release cleaner each time the toilet is flushed (these products can greatly decrease the amount of beneficial bacteria in the tank and soil treatment area). More "elbow grease" and fewer cleaners will improve the efficiency of your system. Decrease the need for drain cleaners by reducing the amounts of items such as grease or hair that go down the drain. Water treatment equipment also can be used to remove minerals that cause discoloration of plumbing fixtures.

Hazardous Waste Products - *Never dispose of chemicals such as pesticides or photographic chemicals, solvents, paints, lubricants, or antifreeze in the wastewater treatment system!* These materials can kill beneficial bacteria, will not be treated by the system, and may pose serious threats to water quality. Dispose of such materials through recycling or hazardous waste programs. Never let wash water with latex paint enter the system; latex paint can coat portions of the system, resulting in clogging and potential system failure.

Paper and Other Solids - Do not flush facial tissues, paper towels, personal hygiene products, disposable diapers, or cigarette butts down the toilet. These items do not break up as easily as toilet paper. Do not dispose of coffee grounds, dental floss, kitty litter, bandages, fats, grease or oils, condoms, and any other items that are non-degradable in the wastewater system. Do not dispose of medications in wastewater systems as antibiotics may reduce the concentration of beneficial bacteria. Use a toilet paper that breaks up easily in water; even white paper may be better than colored paper as some of the dyes used in colored paper are not readily broken down by wastewater systems.

Septic Additives (Starters, Feeders, Cleaners, and Excessive Solids)

There is no quick-fix or reliable substitute for proper system operation and regular maintenance. Starters, feeders, cleaners, and other on-site system additives are either not effective or not safe and should not be used.

Starters - These are not needed. Many people believe that a starter such as a commercial product, yeast or even a dead animal is necessary to begin the bacterial action in the tank. This is not true, there are ample bacteria present in the wastewater to "start" the system.

Feeders - It is not necessary to feed a system with yeast to correct a low bacteria count. There are ample bacteria in the wastewater. If there are, in fact, a low number of bacteria in the system, it is likely the result of overusing cleansers or the introducting inappropriate materials into the system. Identify the problem and corrected it.

Cleaners - Do not use on-site or septic system cleaners that are promoted as a way to reduce system maintenance. Many of these products may actually result in damage to your wastewater system. Some of the products break up the scum and sludge layers and allow them to be suspended again in the liquid layer. These solids are then carried out into the soil absorption area where they can cause system failure by clogging pipes and soil pores. Other additives or cleaners, such as degreasers, may be toxic or may contain carcinogens. These materials may also impact the operations of the system and contribute to water quality problems.

Garbage Disposals - The use of a garbage disposal generally is not compatible with on-site systems. The disposal requires the use of greater amounts of water and adds large amounts of solids to the system. Materials disposed of in this manner are ground so fine so that they are less likely to settle out and, therefore, are more likely reach the soil absorption area. The use of a garbage disposal requires a larger tank to provide additional storage and more frequent maintenance to ensure that solids do not overaccumulate. The overuse of a disposal may greatly reduce the life of the wastewater treatment system.

How To Maintain the System

Proper maintenance of your wastewater treatment system helps ensure that it will operate safely and efficiently for many years. The maintenance of the system is equal in importance to proper system design. Proper maintenance is a low-priced insurance against expensive repairs.

Caution! The anaerobic processes in the septic tank result in highly toxic and explosive gases such as carbon dioxide, hydrogen sulfide, and methane. Never enter a septic tank, breathe the fumes from a tank, smoke, or use electrical devices near an open tank!

Tank Maintenance

Regular pumping of a septic tank prevents excessive build up of the sludge and the floating scum layers. If not removed, these solids enter the soil treatment area and can result in the contaminating of water, the surfacing of wastewater, or the backing up of the wastewater into the home and expensive repairs. It is recommended that the tank be pumped by a qualified professional. The homeowner must ensure that the pumper has easy access to the tank without having to drive over the soil treatment area.

A septic tank should be pumped when either of the following occurs:

- Excessive sludge buildup (the distance between the top of the sludge and the bottom of the outlet baffle is less than 12 inches).
- Excessive scum buildup (the distance between the bottom of the scum layer and the bottom of the outlet baffle reaches less than three inches).

To manually determine scum accumulation, use a three-inch-square piece of wood attached to the bottom of a long stick. Pushing the stick through the scum layer and pulling up to note the resistance on the "foot" should locate the bottom of the scum layer. Mark the stick to note this depth. Using the same stick, pull it up until the "foot" meets the bottom of the baffle, then mark this depth. A comparison between the two marks will show the distance between the bottom of the scum layer and the outlet baffle.

To measure sludge accumulation, fasten an old bath towel around three feet of one end of a stick long enough to reach the bottom of the tank. Push the stick to the bottom, and twirl it between your hands. When you withdraw the stick, note the black layer representing sludge depth. The depth of this layer can be compared to the depth of the outlet baffle to determine the difference in depth. An alternative to measuring the thickness of the scum and sludge layers is to pump the tank approximately every 2 - 4 years, or every year if you have a garbage disposal.

The pumping must be done through the manhole in the top of the tank rather than through an inspection port. Pumping through an inspection port does not allow for the complete removal of the sludge and scum layers and can also result in damage to the inlet or outlet baffles. The pumper should pump and back flush the contents of the tank in order to break up and agitate the sludge and scum layers so that they may be completely removed from the tank.

Soil Absorption Area Maintenance

The soil pores in the treatment area can become clogged by overloading the system with solids and excessive effluent. It is not feasible to rehabilitate a soil treatment area after clogging occurs; therefore, prevention must be practiced in order to avoid expensive repairs.

Keep all traffic and livestock off the soil treatment area. Driving vehicles on the absorption area, either before or after construction, or grazing livestock can compacted soil and reduce efficiency of the system. Proper wastewater treatment in the absorption area requires undisturbed, noncompacted soil. Frost also penetrates deeper in compacted soil and could result in reduced treatment capacity.

Ensure that all surface runoff is routed away from the treatment area to prevent the area from being saturated. Should the soil become saturated, it will greatly reduce the soils capacity for treating wastewater.

Maintain a vegetative cover of grass on the treatment area. This cover helps the system remove nutrients from the wastewater. Do not plant trees and shrubs on any soil treatment area and particularly not on any mound system as the plant roots may interfere with the system operation. Willows and silver maples may be particularly problematic for on-site systems. Do not cover the treatment area with hard surfaces such as buildings, asphalt or concrete; this could result in compacted soil, a reduction in the amount of oxygen in the soil, and an incomplete treatment of the septic effluent.

Troubleshooting

Locating an Existing System

Locating an unknown, on-site system may not be an easy task; it is necessary both for providing proper maintenance and for making future plans for the property. Some counties may have plans on file for newer systems, but probably have limited records for older systems.

If the on-site system location is unknown and cannot be determined from plans, the following steps may be taken:

Locate the septic tank. Look for manholes or inspection pipes that are visible. In many situations, however they may be buried from a few inches to several feet below the ground. If not readily visible, look in the basement for the sewer pipe and determine which direction it exits through the wall or floor. Once the direction of the sewer pipe is determined, start probing through the soil with a metal rod beginning about 10 to 15 feet from the house in an attempt to locate the tank. Be careful to work slowly to avoid breaking or collapsing pipes. **First make sure that any underground utilities lines such as gas, water or electrical lines have been marked.** Many tanks and manholes also contain metal reinforcements so a magnetic detector may also prove helpful. If the location of the soil treatment area is known but not that of the tank, you can work backwards from the treatment area towards the house.

Next, locate the soil treatment area. A mound system will be easy to locate due to the raised mound, but an underground system will be more difficult. Begin by looking around the yard in the general direction in which the sewer pipe exited the house for an area where the grass grows differently. The following clues may provide evidence of the location of the drain field:

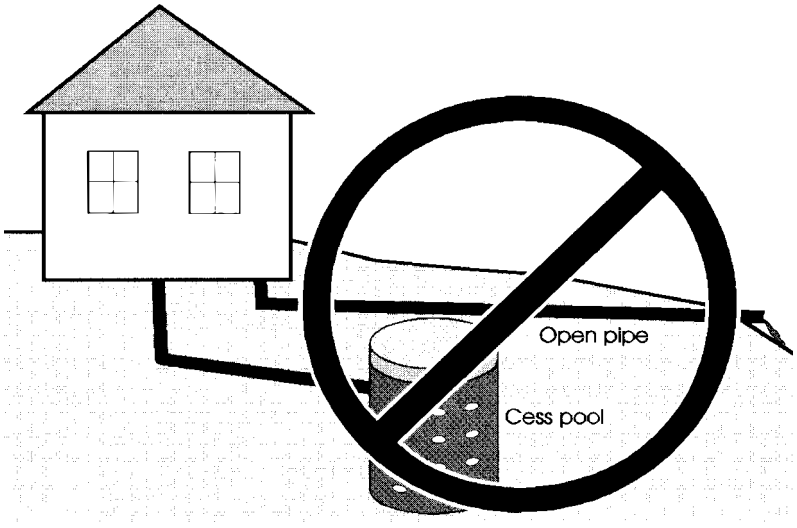
- An area where the grass isn't growing well or where the grass is greener and grows faster.
- An area where there is a slight depression or mound.
- An area where the soil is soggy when the rest of the yard is dry.

Probing along the pipe that exits the septic tank may also lead to the treatment area. Once the components of the system have been located, draw a map for future reference.

Common Problems

There are a number of reasons why on-site treatment systems fail. A system is considered to be failing if it is not adequately treating the wastewater. Common causes of failure are excessive water entering the system or improper systems such as cess pools (Figure 7). A cess pool is a covered underground chamber that allows untreated wastewater to seep into the ground. Cess pools are not allowed in South Dakota. The chart on page 12 shows some common problems and their possible causes and remedies.

Figure 7. Cess pools



Conclusion

Proper on-site system maintenance is essential to ensure the proper operation of the system and to protect the effective life of the system. While the first two requirements for wastewater treatment – proper system design and installation – are the responsibility of the system installer the final step, that of proper system maintenance, is the responsibility of the homeowner. In addition to having the septic tank pumped periodically, the homeowner can also maintain system operation and prolong the effective life of the system through attention to water use and conservation measures, ensuring that inappropriate wastes are not disposed of in the system, and protecting the adsorption area from compaction and damage. Careful maintenance of the on-site system will help preserve the treatment capacity of the system and prevent expensive repairs.

Glossary of Terms

Aerobic Bacteria - Bacteria which require oxygen in order to survive. Aerobic bacteria in the soil help provide the final or secondary treatment of wastewater in on-site systems.

Anaerobic Bacteria - Bacteria which survive with a lack of oxygen. Anaerobic bacteria in the septic tank help perform the initial treatment of wastewater in an on-site system but do not perform the final treatment.

Black Water - Domestic wastewater that contain human wastes.

Drain Field (or Leach Field) - See soil treatment area.

Drop Box - A underground receptacle that provides a more efficient distribution of effluent to the pipes in the soil treatment area.

Effluent - Partially treated wastewater such as that exiting the septic tank.

Grey Water - Domestic wastewater that does not contain human wastes.

Grey Water System - An on-site system that provides the primary treatment of grey water and allows for its reuse.

Holding Tank - A watertight, wastewater receptacle used to hold the wastes until the materials can be pumped for proper treatment and disposal.

Lift Station - A receptacle containing a pump or siphon that is used to push the effluent to a soil treatment area.

Mottled Soils - Soils with spots of contrasting color or shades of color, usually red, grey or blue, which indicate a zone of altering chemical activity usually associated with seasonally fluctuating water tables or a saturated soil condition.

Mound System or No-Dak System - A raised mound of clean sand containing a bed of rock with distribution lines which helps ensure that the minimum four foot separation is maintained above a restrictive soil layer.

Percolation test - A measure of the absorption of water by a particular soil.

Primary Treatment - The first stage of treatment that occurs in a septic tank and consists of the removal of the solid portions of the wastewater from the liquid portions and the action of anaerobic bacteria in beginning decomposition of the wastes.

Restrictive Soil Layer - A layer in the soil, either a seasonal high water table, bedrock, gravel or coarse sand, or groundwater, that does not allow for the complete secondary treatment of wastewater.

Scum - The layer of floating solids, greases, and soap scum that accumulates at the top of the liquid layer in a septic tank.

Seasonal High Water Table - The portion of the soil profile, commonly associated with mottled soils, which indicates the depth to that the water table fluctuates on a seasonal basis.

Secondary Treatment - The second stage of wastewater treatment that in an on-site system occur in

the soil treatment area and consists of the absorption of wastewater to soil particles and the action of aerobic bacteria in treating the wastes.

Septic Tank - A watertight receptacle which receives the wastewater flow from a residence or business and provides primary treatment of the waste by allowing solids to be separated from the liquid portion of the wastewater and anaerobic bacteria to begin the decomposition of the wastes.

Sludge - The layer of heavier-than-water solids that accumulates at the bottom of a septic tank.

Soil Treatment Area - The portion of the on-site system that provides the secondary treatment of the wastewater through both microbial action and absorption by soil particles.

Wastewater - Any water that has been used, in this publication, synonymous with domestic wastewater that derives from a residence or business. May consist of grey water (no human wastes) or black water (includes human wastes).

For Further Information:

South Dakota State University Extension
Service-Agricultural Engineering
Brookings, South Dakota 57007
(605) 688-5141

South Dakota Department of Environment
and Natural Resources
Foss Building, 523 East Capitol
Pierre, South Dakota 57501
(605)773-3351

Minnehaha County Planning and Zoning
415 North Dakota Avenue
Sioux Falls, South Dakota 57102
(605) 367-4204

Other Related Extension Publications:

EC 665 *Rural Wastewater Treatment*
EXEX 1025 *Primary Drinking Water Standards*
EXEX 1032 *Wastewater Treatment for Rural Homes and Cabins*
EXEX 1033 *Periodic Maintenance for On-Site Wastewater Treatment Systems*
EXEX 1034 *Solving On-site Wastewater Treatment System Backups*
EXEX 1035 *Septic System Additives – Not Needed*
SS 43WQ *Home-A-Syst*
FS 891 *Plugging Abandoned Waterwells*
FS 877P *Indentifying and Correcting Water Problems*

References

Environmental Protection Agency
Design Manual Onsite Wastewater Treatment and Disposal Systems

Environmental Protection Agency
Septic Systems and Ground-Water Protection

Minnehaha County Planning Department
On-site Wastewater Treatment Systems Ordinance

Minnesota Cooperative Extension Service
Septic System Owner's Guide

Minnesota Cooperative Extension Service
Onsite Sewage Treatment Manual

South Dakota Department of Environment and Natural Resourses
Indivdual and Small On-Site Wastewater Systems (ARSD 74:03:01)

On-site System Troubleshooting Guide for Homeowners

Problem	Risks	Possible Causes	Potential Remedies
Wastewater backs up into house and/or plumbing fixtures don't drain or are sluggish.	Human contact with waste water is a serious health risk. Many waterborne diseases exist in household sewage. AVOID CONTACT.	• Excess water is entering the system. • Improper plumbing. • Blockage in plumbing. • Improper operation. • Lift station failure. • Improper system design. • Roots clogging pipes.	• Fix Leaks. • Install water-saving fixtures. • Stop using garbage disposal. • Clean septic tank and check pumps. • Replace broken or cracked pipes and remove roots. • Seal pipe connection. • Avoid trees near system.
Wastewater surfacing in the yard.	Human contact with waste water is a serious health risk. Many waterborne diseases exist in household sewage. Fence off the area to avoid contact.	• Excess water use. • System blockages. • Improper system elevations. • Undersized soil absorption area. • Lift station failure or improper operation.	• Fix leaks. • Install water-saving fixtures. • Clean septic tank and check pumps. • Consult professionals.
Wastewater odors - indoors.	Toxic gases can cause discomfort and illness.	• Wastewater surfacing in yard. • Improper plumbing. • Wastewater backup in house. • Unsealed ejector sump pump. • Roof vent pipe frozen shut. • Empty sewer trap	• Repair plumbing. • Clean septic tank and check pumps. • Replace water in plumbing traps. • Thaw vent with warm water. • Fill trap with water
Wastewater odors - outdoors.	Major nuisance but no serious health risk.	• Source other than homeowner's system. • Wastewater surfacing in yard. • Inspection pipe caps damaged or removed.	• Clean septic tank and check pumps. • Replace damaged caps. • Repair or replace drain field.
Contaminated drinking or surface waters.	The above public risks are magnified by possible ingestion of contaminated water. Drinking contaminated water can cause health problems such as dysentery, hepatitis, and, for infants, methemoglobinemia (blue baby disease).	• System too close to well, water-table or fractured bedrock. • Cesspool or dry well in use. • Wastewater discharges to surface or groundwater. • Improper well construction. • Broken water supply pipe. • Source other than homeowner's system. • Broken sewer lines.	• Replace your well and/or on-site system. • Contact a local unit of government to investigate other potential sources. • Have neighbors evaluate their system.
Lift station alarm activated.	Tank effluent may back up into house.	• Pump or siphon failed. • Circuit breaker tripped. • Pump unplugged. • Controls malfunctioning. • Power outage.	• Check breaker and plugs. • Check pump and controls. • Make sure pump or siphon replaced with proper size unit.
Distribution pipes and/or soil absorption area freezes in the winter.	The system may be inoperable.	• Improper construction. • Check valve in lift station not working. • Foot or vehicle traffic over piping. • Low flow rate. • Lack of use.	• Check construction. • Examine check valve. • Keep people and vehicles off area. • Increase water use. • Have someone use water in your house if you are away. • Increase frequency of pump cycling. • Operate septic tank as a holding tank. • Pump system in fall and use carefully over winter months. • Don't use antifreeze!

Notes

Maintenance Record

Date of Cleaning	Maintenance Contractor/Telephone No.	Projected Date of Next Cleaning