How an Onsite Wastewater Treatment System Works

At one time an onsite wastewater system was little more than a concrete tank and a pump that would take all the waste created in a house and send it out into the woods never to be thought of again. However, with more and more concern over protection of groundwater supplies, this type of system is being replaced by more complex and environmentally friendly systems. Newer systems actually reduce the amount of harmful bacteria in the liquid before it enters the groundwater. This provides a cost effective and efficient method of wastewater treatment for those who have chosen to trade the hustle and bustle of city life for the more relaxed rural pace.

It is important to note that these systems are called Onsite Wastewater Treatment Systems and not just disposal systems. For the most part, the old "Pump and Dump" systems are no longer being permitted because they do not reliably treat the wastewater. The perception that failed septic systems cause pollution to local groundwater, lakes and streams also has in the past made these types of systems unpopular. However, most of these failures are due to poor design, maintenance, and installation or inadequate site evaluations. The newer systems, discussed in the next section, provide treatment to the wastewater both before and after it is released from the septic tank.

The Saskatchewan Onsite Wastewater Disposal Guide is available online at www.health.gov.sk.ca

Advantages

- Simple and effective wastewater treatment if operated and maintained properly
- Less disruptive to install and maintain
- Less expensive to operate when compare to many central wastewater systems
- Provides wastewater treatment in areas where it is not available centrally
- When functioning properly, can help replenish groundwater supplies

Disadvantages

- Must be pumped routinely
- Water use must be monitored so as to not over load the system
- Must use care not to use dispose of chemicals and other toxic substances through your drains and toilets.
- Most onsite wastewater treatment systems are not designed to remove nitrogen.

What's Inside:

Saskatchewan Ministry of Health

How and Onsite Wastewater Treatment System Works

The septic system depends on natural processes to treat waste: gravity separates solids and liquids; soils filter the wastewater by absorbing contaminants; and bacteria break down biodegradable materials. Grass roots also play a role by taking up liquid and using nutrients. In fact, a septic system is like a small underground ecosystem. Like any ecosystem, it has limits. If it gets drowned with too much water - or if it gets clogged up because of misuse or poor maintenance - or if it is poisoned with contaminants it is not designed to handle - a septic system can present a serious health threat to homeowners and their neighbors. Waste, including nitrates, bacteria and phosphates can contaminate the underground water used for household wells or municipal water supplies. It can enter lakes and streams, or bubble up on the ground surface. But a properly designed, operated and maintained system can function very effectively for a long time.

A traditional onsite wastewater treatment system has three main components:

1. Septic tank

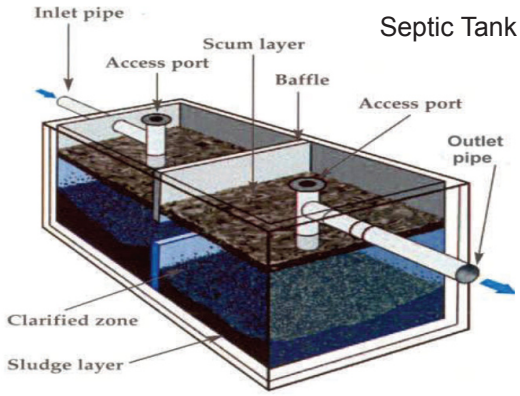
A septic tank is divided into two compartments, with access ports at the top for inspection and service. Gravity will separate the waste into three layers:

i. heavy materials, which settle to the bottom where they are broken down into sludge by naturally occurring bacteria

ii. light soaps, greases, fats and similar materials, which rise to the top and form a scum layer, and;

iii. liquids with some suspended solids.

Waste water from sinks, appliances and toilets flows from the house into the first compartment and pushes an equal amount of liquid from that first compartment into the second one -- in a gravity system, a siphon periodically activates and discharges liquid out of the second chamber and into the pipes leading to the leaching bed. For a pressure distribution system, the second chamber will be periodically pumped to the distribution system. If the tank is *properly* operated and pumped out regularly, only the liquid effluent leaves the tank.



NOTE: Toxic gases, including methane and hydrogen sulfide, are produced by the natural treatment processes in septic tanks. These gases can kill in minutes. Extreme care should be taken when inspecting your tank, even when just looking in. Never enter a septic tank or try to inspect the tank alone. Contact a qualified professional to perform these duties.

2. Distribution System

A distribution system is a series of pipes leading from the septic tank to the leaching bed. It may include a distribution chamber to direct waste water evenly to all areas of the leaching bed. Traditionally these systems used gravity, but some sites use pumps to move effluent uphill from the septic tank.

Other systems also use pumps to distribute the waste water evenly over the leaching bed area and provide increased treatment capacity and system longevity.

3. Leaching Bed

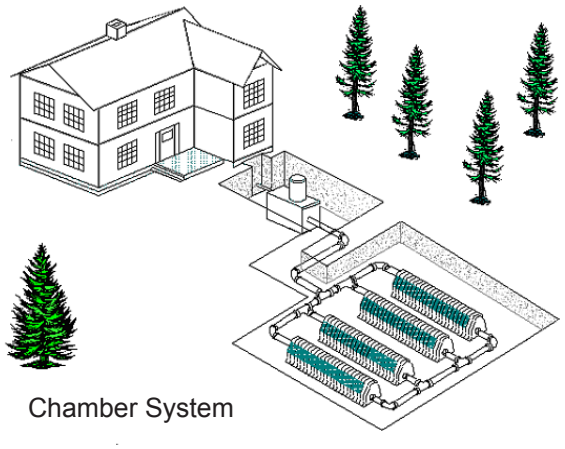
A typical leaching bed is an arrangement of connected pipes with holes along the sides and bottom, surrounded by stone, gravel, or a chamber and properly draining soil or other filtering material. Liquid leaving the septic tank travels down the pipe, seeping through holes into the gravel and soil filtering materials. Oxygen-using bacteria breakdown "waste particles" and natural organisms form a "biomat" (a layer of organic material. If it becomes too thick, it can prevent proper drainage). In the soil filter (an extremely important component of the septic system) chemical, physical and bacteriological reactions remove most of the remaining solids and bacteria before the treated effluent meets the underground water table.

Types of Onsite Wastewater Treatment Systems

In Saskatchewan the two most common types of OWTS are the absorption field and the mound. They are similar in design and function and are selected depending on the quality and type of soil in which the system is to be used.

A. Absorption Field or Chamber Type System

This type of system is used where the natural soils are suitable filter materials and the ground is well drained. An Absorption Field System is a series of perforated pipes laid in trenches, which spread effluent from a septic tank over a medium of stone before entering the surrounding soil. A chamber system is a type of absorption field system consisting of trenches or beds, together with one or more distribution pipes or open-bottomed plastic chambers, installed in appropriate soils.

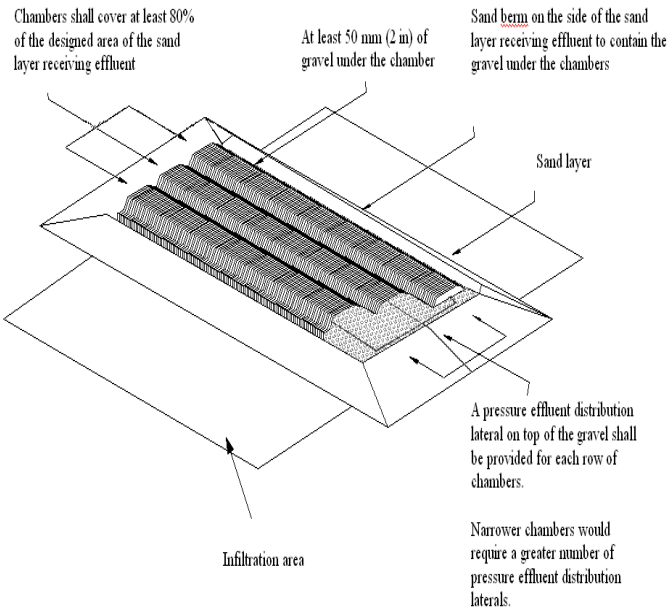

Chamber System

These chambers receive wastewater flow from a septic tank or other treatment device and transmit it into the soil for final treatment and disposal.

B. Mound System

Mounds are used where natural soils are not suitable filter materials (i.e. clayey soils), or the site has a high water table, or bedrock is close to the surface. Mounds are an excellent treatment and disposal choice. However, it cannot be overemphasized that careful planning and design, filter media selection, construction and maintenance of the mound is critical. Mound systems require an environment for microbial activity so care in the material selection and construction steps must be taken to provide such an environment. There are two types of mounds.

A **Type I Mound** is a OWTS consisting of a series of perforated pipes on a rock bed above the natural soil surface. These perforated laterals receive wastewater effluent from a septic tank through a distribution box. The effluent is transmitted into the rock bed and natural soil for final treatment and disposal.

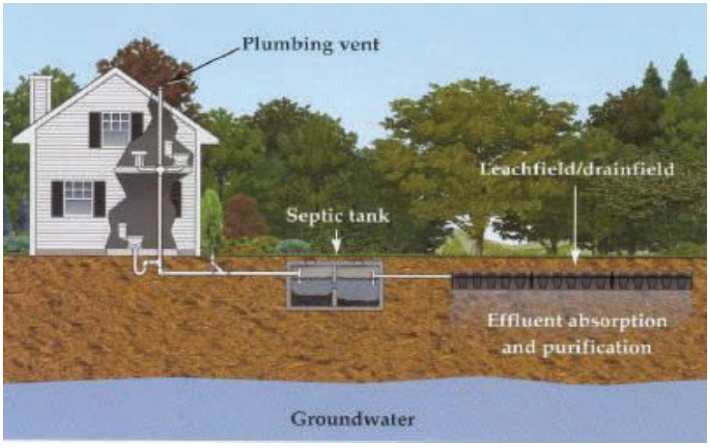


Type II Mound

A **Type II Mound** is a OWTS that is raised above the natural soil surface in a specific graded, clean sand media. Perforated laterals, under pressure, receive wastewater effluent from a septic tank. These laterals distribute the effluent over a gravel bed and sand media. Gravel is laid over the sand layer or chambers to assist in the distribution of the effluent over the entire surface of the sand layer and provide a brief storage layer for the effluent as it is pumped onto the mound. The covering soil, loamy sand, must be porous to provide good aerobic conditions in the sand layer. It is important to note that most bacteria require air to digest sewage so using a clay soil for covering material would limit air movement into the mound causing anaerobic (without air) conditions and greatly reduce the effectiveness of the sand layer.

When Selecting a (OWTS) System, Consider:

- A thorough site evaluation is essential to a properly sized and effective septic system. This should require an individual be onsite and perform a number of tasks such as digging test pits and testing the soil.
- If you would like the system to operate by gravity the septic tank must be installed at a higher elevation than the drainage field (i.e. you'll need some slope on the property).
- The size of the septic field is based on the largest possible size of the residence; usually by estimating the number of bedrooms in the home at final completion (i.e. after the basement is finished). Calling the basement room a study will decrease the size and cost of the field however, this will significantly increase the chances of the system failing, sewage backing up in your home, or contamination of groundwater resources.
- The actual size of the field or mound is also based on the local site conditions (in addition to the number of people served). For example, a field located in a silt loam requires a much greater area than one based on a sand area.
- The easiest way a home builder can save money on their septic system is to NOT install a garburator.
- Garburator adds a significant amount of material to the system, which requires additional treatment capacity.



» Water conservation practices will not save you money on the installation of your system, however, less water into the system will improve treatment and increase the life span of the system, which will decrease the chances that groundwater contamination will occur or sewage will back up. On the flip side, the installation of high water using fixture such as multiple head showers, jet tubs, etc, can dramatically increase the volume of water to a system over a short time period. This can cause problems with the system as material is flushed from the septic tank to the field. If these types of fixtures are desired, excess capacity in the septic tank and field should be added.

The type of OWTS that may be installed is based on the characteristics of the area (location and density).

Location

Adequate Location:
All locations not considered sensitive

Sensitive Location:

1. Where the subdivision containing the parcel/ lot is less than 1.0 km (0.6 miles) from the boundary of any municipality (city, town, village, organized hamlet, park subdivision or approved subdivision containing at least two parcels/lots) that utilizes groundwater source(s) for drinking water purposes.
2. The presence of course soils over an unconfined aquifer, that is of sufficient quality and quantity to be used as a drinking water source. The presence of high levels of aesthetic constituents should not be used to determine drinking water suitablility.
3. The presence of subsurface water (seasonal or permanent), which is less than 1.5 meters (5 ft) below natural ground surface elevation.
4. Historical concerns with well water quality (in particular nitrate) believed to be due to human activities.

Density

L*ow Density:* <5 parcels on 1/4 section or parcels > 4Ha with all lots > 1Ha on 1/4 section.

Medium Density: All developments not considered to be high density or low density.

High Density: 40 or more parcels on a 1/4 section; or parcel size is < 1Ha on 1/4 section.

See the table at the end of this booklet for the type of system in various areas.

Septic Tank Don'ts

- Don't drive or park vehicles on septic tank or leaching field as this may damage the tank and also could compact the soil in your leaching bed.
- Don't dispose of household cleaners, bleach, paints, gas, solvents etc, down the sinks. Remember there are bacteria living in the tank and this will kill them. Small amounts of cleaners are ok.
- Don't flush diapers, cat litter, cigarette filters, coffee grounds, grease, feminine hygiene products, etc.
- Don't overload your septic system with more wastewater than it was designed to accept.
- Don't use more soap or detergents than necessary.
- Don't put ground up food scraps, coffee grounds, grease and cooking oils down the drain.
- Don't plant trees in or near the bed. Roots have the potential to clog the tiles.
- Don't pave over the bed. Your bed needs to breathe to function properly.
- Don't attempt to repair the septic system without obtaining the required permits and when making repairs use a septic contractor.
- Don't install a waste heat recovery system, if a septic field is used. The septic system requires the heat in the wastewater to provide a comfortable environment for the 'bugs' that consume the sewage.

Onsite Wastewater Treatment System Do's and Don't's

Note: Deadly gases are present in a septic tank or sewage holding tank. Never enter septic or sewage holding tanks without knowing and following Occupational Health and Safety requirements.

- A septic tank or sewage holding tank must be CSA certified and/or constructed and tested in accordance with the CAN/CSA-B66 Standard by a recognized testing agency.
- To prevent buildup, sludge and floating scum need to be removed through periodic pump-outs.
- Regular inspections and pumping as necessary are the best and cheapest way to keep your septic system in good working order.
- Septic tanks with electrical floats switches, pumps, or mechanical components need to be inspected more often. Any screens in the tank should be inspected regularly for rips, tears, or clogs.
- An access opening of 60 cm (24 in) in diameter is necessary for pumping sewage, observing the inlet and outlet baffles, and for servicing. In order to be accessed quickly, it should be above the final grade and must be secured to prevent unwanted access. A cover of at least 30 kg (66lbs) may be considered secure.
- Capacity is one of the most important considerations in septic tank design. Liberal tank capacity is important from a functional and economic perspective. It is important that the capacity be ample to permit reasonably long periods of trouble-free service and to prevent frequent and progressive damage to the effluent absorption systems due to discharge of sludge by the tanks. For this reason the capacity of residential septic tanks should not be less than 3820L (840gals). Tank capacity of the working compartment should be at least 1.5 times the average daily flow rate.
- Septic tanks should not be buried deeper than the depth of burial recommended by the manufacturer.
- Divert other wastes. Make sure roof drains are directed away from the leaching field, keep the lot graded so rainwater runs away from leaching field.
- Spread water loading. Instead of washing four loads of laundry in one day, do one or two loads a day, don't use your washing machine and dishwasher at the same time.
- Use environmentally friendly cleaning products.
- Protect the leaching bed. Don't plant any trees, shrubs, on or near the bed (their roots can clog pipes), keep area grassed to promote evapotranspiration and avoid erosion. Don't install automatic sprinklers in the area.

If you're sitting there reading this thinking that this is all common sense read a few examples of how homeowners can cause problems for their septic systems.

"That large, flat piece of land was just sitting there, so we...

... used it for our in-ground pool."

Removing the system will prevent the proper treatment and disposal of sewage

... wanted to keep the lawn nice."

Put the septic tank under the driveway right beside the main road. A sure way to void the manufacturer's warranty.

... used it for our above-ground pool."

The weight of an above-ground pool will almost certainly crush the leaching bed.

... flooded it so the kids could have a skating rink."

Leaching beds are carefully built to accept water -- even if it comes from a hose sprayed in the middle of winter. Creating a rink will freeze the entire leaching bed solid, and end up with water backing up into the house.

... rototilled it for a vegetable garden."

Pipes can be very shallow and may easily get damaged. Also, vegetables don't protect the soil from erosion like grass does.

... made it look pretty with trees and nice landscaping."

Perforated pipes don't stand a chance against roots from trees and shrubs. They get clogged or crushed. Either way, the septic system doesn't work properly.

...built a driveway (patio, deck, tennis court) over it."

Just covering the grass over the leaching bed will stop evapotranspiration and keep out the oxygen the system requires. Any weight can crush the pipes, and make the leaching bed useless.

Regional Health Offices

Regina Qu'Appelle	Regina	(306) 766-7755
Saskatoon	Saskatoon	(306) 655-4605
Prairie North	North Battleford	(306) 446-6400
Prince Albert Parkland	Prince Albert	(306) 765-6600
Kelsey Trail	Melfort	(306) 752-6310
Five Hills	Moose Jaw	(306) 691-1500
Cypress	Swift Current	(306) 778-5280
Sun Country	Weyburn	(306) 842-8618
Sunrise	Yorkton	(306) 786-0600
Heartland	Rosetown	(306) 882-6413
Mamawetan Churchill River	La Ronge	(306) 425-8512
Keewatin Yatthe	Buffalo Narrows	(306) 235-5811

For more information, go online to: http://www.health.gov.sk.ca/health-region-list

Types of Onsite Wastewater Treatment Systems

Parcel Size	Holding Tank	Chamber System	Absorption Field	Type 1 Mound	Type 2 Mound	Open Discharge Systems	Lagoons
10 Acres or >	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<10 Acres> 465m2 (5000 ft 2)	Yes	Yes	Yes	Yes	Yes	No	No
≤ 465m² *(5000ft²)	Yes	*	*	*	*	No	No
*Consult local Public Health Inspector							
Shoreland Pollution Control							
0' – 100' From High Water Mark	Yes	No	No	No	No	No	No
100' – 500' From High Water Mark	Yes	No	No	No	No	No	No
500' + From High Water Mark	Yes	No	No	No	Yes	No	No
Environmental Sensitivity Area and Density							
Adequate Location Low Density	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adequate Location Medium Density	Yes	Yes	Yes	Yes	Yes	No	Yes
Adequate Location High Density	Yes	Pressure	Pressure	No	Yes	No	Yes
Sensitive Location Low Density	Yes	Pressure	Pressure	No	Yes	No	Yes
Sensitive Location Medium Density	Yes	Pressure	Pressure	No	Yes	No	Yes
Sensitive Location High Density	Yes	**	No	No	**	No	**
Soil Type							
Sand	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sandy Loam	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loam	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Silt Loam	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clay Loam	Yes	No	No	Yes	Yes	Yes	Yes
Clay	Yes	No	No	No	No**	Yes	Yes
Cost							
Aesthetics	Small port required for removal of sewage	Flat ground required; large manhole on septic tank for inspection and maintenance	Flat ground required; large manhole on septic tank for inspection and maintnance	Raised hill for mound; large manhole on septic tank for inspection and maintenance	Raised hill for mound; large manhole on septic tank for inspection and maintenance	Flat ground required; large manhole on septic tank for inspection and maintenance; pooling water and strong odour where pumpout occurs	Large hole; area should be fenced off

** Consult local Public Health Inspector