WATER Quality

K-STATE Kansas State University. Research and Extension

Onsite Wastewater Systems – Overview

When central sewers are not available, households, businesses, and institutions with indoor plumbing must use an onsite wastewater treatment and dispersal system. The simplest onsite systems are septic tanks — laterals (Figure 1) and lagoon (Figure 2). With proper design, good construction, and regular maintenance, onsite wastewater systems can effectively eliminate most health and environmental threats caused by pollutants in wastewater.

Treatment Regulations

The safe, effective treatment of wastewater has developed significantly since the time of privies and latrines when Kansas was first settled. However, in recent years there has been growing concern about water quality. Sewage that is not treated properly pollutes surface and groundwater, spreads disease, and attracts disease-transmitting vectors, especially flies. Therefore, proper treatment is essential.

The Kansas Department of Health and Environment (KDHE) administers the laws that require treatment of wastewater, establishes regulations, and oversees onsite wastewater programs. Enforcement and permitting is delegated to individual counties, generally through the health department, planning and zoning, or code enforcement. The county adopts a sanitary code, issues permits, and may inspect construction. KDHE, Bulletin 4-2, *Minimum Standards for Designing and Constructing Onsite Wastewater Systems* sets a baseline minimum condition that applies statewide. In counties that have no sanitary code, these minimum standards apply. This bulletin is available online at *www.kdheks.gov/nps/resources/mf2214.pdf*.

To ensure adequate treatment of wastewater and proper disposal of sewage, county codes require owners to obtain a septic permit before installing any onsite wastewater system. According to Kansas law and for environmental benefit, some sewage disposal requirements include:

- Avoiding surfacing wastewater from individual homes, small businesses, or institutions.
- Connecting wastewater sources to central sewers or adequate onsite systems.
- Maximizing the amount of water retained near the water source.

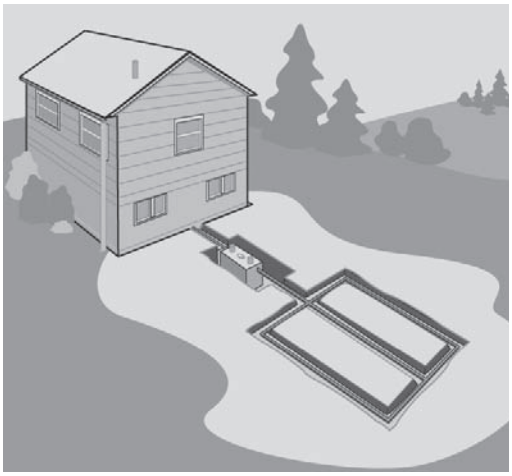


Figure 1. Rural home with septic system: septic tank and soil dispersal field.

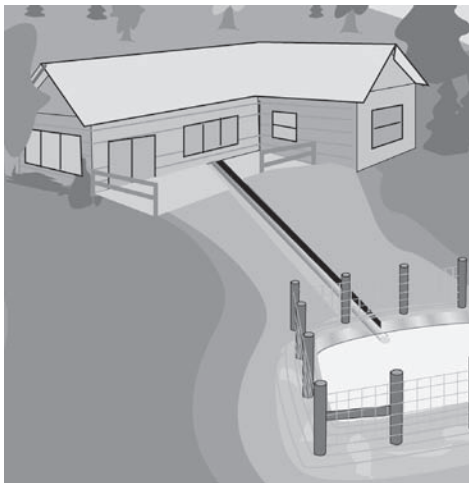


Figure 2. Rural home with lagoon system.

Site Requirements

Underground septic systems with a drainfield for wastewater dispersal are common and preferred onsite sewage systems (Figure 1). It is essential to match the type of treatment and dispersal system to the soil properties in the drainfield. Fine-textured soils with high clay are often not well-suited for traditional soil dispersal. Instead, a lagoon (surface system, Figure 2) may be viable when the code permits it, and there is adequate area. Because of soil and/or site limitations, a feasible onsite system may not be possible on all lots. For this reason, it is preferable to have an onsite soil evaluation done by a qualified person before obtaining a permit to install a wastewater system.

Each onsite system must be designed specifically for the flow and site conditions. What may be suitable for one location might not fit the needs at a different site. The area required by a typical system for a three-bedroom home could range from 2,000 square feet for a tank and lateral field to over 6,000 square feet for a lagoon. No part of an onsite system (septic tank, dispersal field, lagoon, or other component) should be placed on an easement or in an area subject to flooding.

In order to avoid possible backup or failure, all underground septic system components must be correctly designed for the maximum flow of wastewater expected during a defined time period, usually a day to a few days. A surface system (lagoon) should not be subject to backup by high wastewater flow, so it is usually designed for average flow.

Pretreatment and Dispersal Components

The simplest septic systems have two main components: the septic tank and the dispersal field (Figure 3). The dispersal field is also known as an absorption field or a lateral field. A brief discussion of these components, lagoons, and an overview of alternatives follows.

Septic Tank

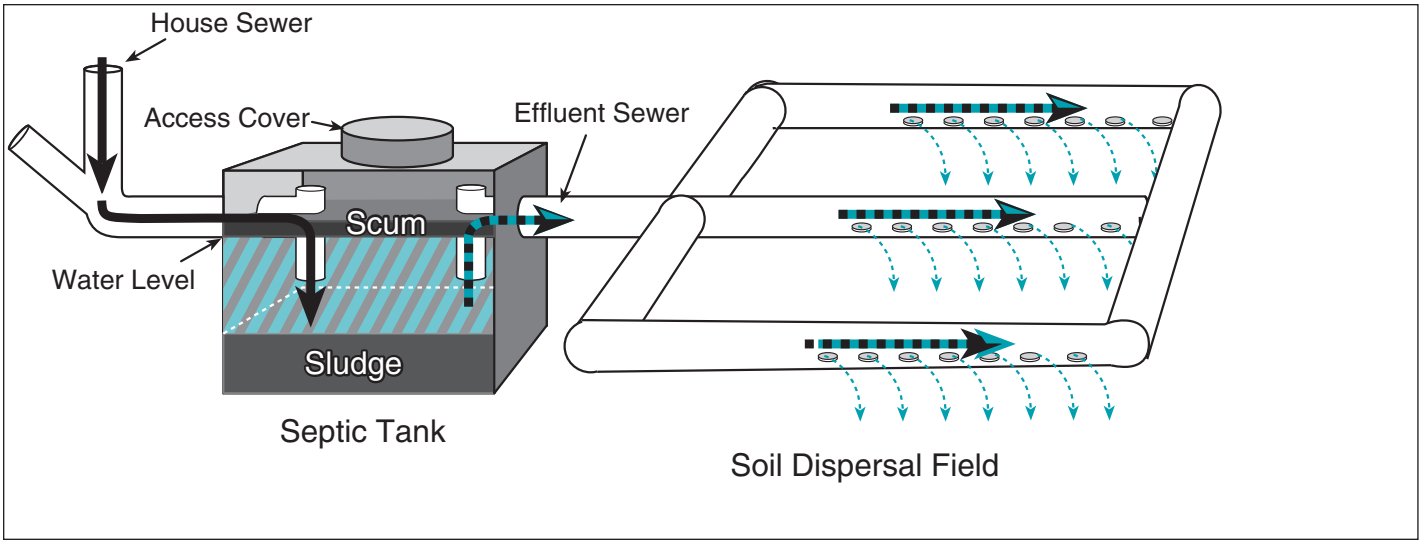
A septic tank is a buried, watertight container made of durable material — such as concrete, plastic, or fiberglass — that is strong enough to withstand soil forces and resistant to corrosion or decay. Septic tanks may have single or multiple compartments or tanks may be installed in series. Various environmental codes may require tanks that have multiple compartments or series, especially for large facilities.

The tank slows wastewater flow, allowing solids to settle or float to the top.* The clarified liquid protects the soil dispersal field from potential clogging and early failure. The septic tank wastewater, though mostly clear, is sewage and contains dissolved organics, microbes, and pathogens. The wastewater flows to the dispersal field where it is absorbed and treated as it percolates through the soil.

T-shaped outlets, or baffles, are vital components of a septic tank. The inlet tee directs incoming sewage down below the tank's water level to avoid disturbing the scum layer and aid in solid separation. The outlet tee keeps the floating scum layer from

* Solids are stored in the tank, where they can decompose.

Figure 3. Components of a basic septic tank – lateral system.



flowing into the soil dispersal field. An outlet screen is also often used to keep solids from entering the drainfield. If the tees are damaged or missing, solids are not retained in the tank, causing damage to the dispersal field and shortened life of the system.

Inspection ports, access manholes, and risers from the tank to the surface serve three important purposes:

1. Provide easy access to check the condition of the tees and sludge depth in the tank.
2. Allow access to the tank for inspection, maintenance, and removal of solids.
3. Allow quick identification of the tank's location.

Regular inspection and periodic pumping of the septic tank will ensure long-term, efficient functioning of the septic system (Figure 3).

Soil Dispersal Field

The dispersal field absorbs, filters, and treats the wastewater, making it suitable for re-entry into the groundwater. Dispersal laterals are typically 1.5 to 3 feet wide and the top is approximately a foot below the surface. In Kansas, at least 4 feet of suitable, aerated soil is required beneath the bottom of the lateral. This depth helps ensure adequate treatment (or purification) before wastewater reaches a limiting condition such as bedrock, impervious soil, groundwater, or seasonally saturated soil.

Septic permits usually require a depth of 6 feet of suitable soil above the limiting condition to allow construction of dispersal laterals and ensure adequate treatment. Minimum standards require the dispersal field be at least 50 feet from any surface water or well and at least 25 feet from the house and property lines. Greater separation distances from wells and surface water are recommended, and some county codes require these.

Septic system construction is limited by steep slopes, greater than 25 percent. Slopes less than 15 percent are preferred for easier construction of the

Table 1: Tips for Good System Function

- Install risers to the surface from the inspection ports and access manholes to facilitate inspection and maintenance.
- Inspect and pump the septic tank as needed, typically every 3 to 5 years.
- Remove trees and shrubs within 50 feet of the dispersal field or install a structural root barrier.
- Before and after field construction, avoid animal pens, traffic, or heavy equipment on and down slope from the dispersal field area. Soil compaction from frequent use and heavy equipment reduces permeability and causes premature field failure.
- Do not install the dispersal system in wet soil. Compaction and smearing often result from working wet soil. This reduces permeability and causes early system failure.
- Assure that dispersal laterals are level and allow wastewater to reach all parts of the field. Settling, frost action, or trees can cause shifting that may overload a part of the field while another part remains part dry.
- Install an inspection port for each lateral to enable easy checking of dispersal.
- Measure and mark on a permanent map the location of the tank and dispersal laterals for future reference.
- Prevent runoff onto the dispersal field from impervious surfaces (buildings, pavement, etc) and adjacent areas. Extra water on the field increases the wetness and may contribute to system malfunction or failure.
- Maintain a healthy, perennial, cool season grass over the dispersal field.
- Use water-saving fixtures and habits. Low flow toilets, showers, dish washer, clothes washer, and water-conserving habits can substantially reduce wastewater flow and extend the life of underground systems.
- Examine current and past water bills to evaluate usage. The average maximum water use is about 75 gallons per day per person. If water use increases drastically for no obvious reason, it may indicate a leaky faucet or toilet. This wastes water, increases cost, and hydraulically overloads the system.
- A septic tank ahead of a lagoon reduces solids accumulation and delays required solids removal; however, the tank should be pumped periodically (See *Septic Tank Maintenance*, MF947).
- Maintain a non-climb secure fence around lagoon for safety of people and animals.
- Remove tall vegetation at lagoon edge and inside the fence, and trees within 50 feet of lagoon.

dispersal field. The size of the dispersal field depends on the amount of wastewater flow, the site conditions, and the local code. The number and length of laterals are often determined by a county health or environmental department official.

Lagoons

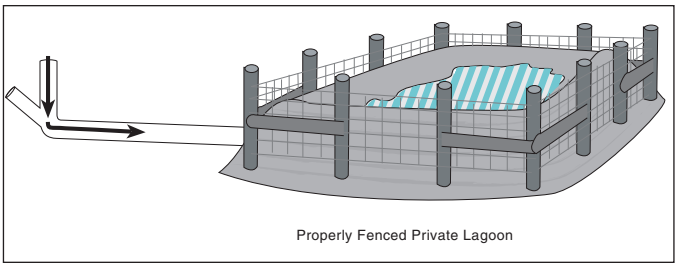
In areas of Kansas with slowly permeable, high-clay soils, a lagoon may be best suited for an onsite wastewater system (Figure 4). A lagoon treats the waste, and the wastewater evaporates or slowly seeps into the soil. Lagoons are simple in design, easy to construct, and, when correctly managed, have little or no odor. However, protective fencing is essential to avoid accidental drowning and disease transmission, especially for children, the elderly, and pets.

Alternative System Options

When soil, site, or code requirements are not the most suitable for a basic system, an alternative system may be a better option. Alternative systems include components that give higher levels of pretreatment and usually involve different methods of soil dispersal. Pretreatment alternatives include aerobic treatment unit; rock-plant, sand, or media filter; or a mound. Pretreatment reduces the strength of wastewater entering the soil and may reduce the dispersal area required.

When limitations such as space, soil profile, high groundwater, or shallow bedrock prevent use of a basic dispersal field, alternatives must be considered. Some alternatives include shallow laterals, bed, at-grade laterals, dosing low pressure pipe laterals, and a drip system. See *Selecting an Onsite Wastewater or Septic System*, MF-2542 for brief descriptions. The local health department can help with wastewater system options and design and provide a list of approved installers.

Figure 4. Fencing around a lagoon is essential.



Additional Resources

For more information about onsite wastewater systems, contact your county health department or your local K-State Research and Extension office. Some related Extension titles include:

Get to Know Your Septic System (Onsite Wastewater Treatment), MF-2179

Minimum Standards for Designing and Constructing Onsite Wastewater Systems, MF-2214

Selecting an Onsite Wastewater or Septic System, MF-2542

Septic Tank Maintenance – A key to longer system life, MF-947

Site and Soil Evaluation for Onsite Wastewater Systems, MF-2645

Why Do Onsite Wastewater (Septic) Systems Fail? MF-946

Your Wastewater System Owner/Operator Manual, S-90

Authors:

Morgan Powell, Extension engineer, water quality (retired)

DeAnn Presley, environmental soil specialist

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