Improving Household Wastewater Treatment

Keeping Idaho's Water Clean

Satisfactory treatment and disposal of residential wastewater can be accomplished by on-site systems. For these systems to function over a long period of time, they need to be properly designed, installed, and maintained. When all site-specific criteria have been met, there will be minimal impact by the system on surface or ground water.

There are many types of wastewater treatment systems. A licensed Environmental Health Specialist (EHS) must evaluate the site to determine the system that is best suited to your site and needs.

In Idaho, minimum standards for on-site household wastewater systems are set by the Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ). These standards are detailed in the Idaho Administrative Procedures Act (IDAHO) 16.01.03. The codes are a minimum, so consider whether the minimum requirement is sufficient for your site.

The conventional septic system is the most common form of on-site wastewater treatment and, where soil conditions are suitable, it is the most desirable on-site system to use. Since the septic tank and drain field are completely covered with soil, the system is not visible and odor is nonexistent as long as wastewater does not surface.

1. Quantity and collection of wastewater

Strategy: Minimize the volume of household wastewater. Collect all wastewater that needs treatment, but exclude from the system all water that doesn't need treatment.

Reducing the volume of wastewater entering the treatment system is important because less flow (volume) means better treatment, longer system life, and less chance of overflow. Excess flow is a principal reason for system failure (wastewater surfacing or backing up in house). All wastewater needing treatment should be collected, however, to avoid contamination of surface or ground water.

Water use

The quantity of wastewater is dependent upon the number of people using the dwelling, how water is used, and maintenance of the water distribution system. Average water use in rural households is 40 to 50 gallons per person per day. With low-use fixtures and individual awareness and concern, a reduction to fewer than 25 gallons per person per day is possible. However, even conservative use by several people may exceed the capacity of a wastewater treatment system.

Less flow entering the system improves treatment by increasing the time waste spends in the septic tank, thus providing more time for solids' separation, settling, and decomposition. Less flow also means improved aeration and increased soil contact, providing better treatment in a soil absorption field.

Consider the following ways to minimize water use:

- Eliminate wasteful uses, such as flushing toilets to dispose of tissues or other wastes that should be handled as solid waste. Turn off water between uses and fix plumbing fixture leaks.

- Consider which actions use the most water. Toilet flushing usually ranks highest (40% of house hold use). Low-flow models could decrease water use by more than half. Composting toilets allow even greater reductions, but they can present other waste disposal challenges (See "alternative treatment systems" section).

- Bathing (30%) and clothes washing (15%) are usually next in order of water use. For bathing, consider such reduction options as using low-flow or controlled-flow showerheads which give good cleansing with less water, taking shorter showers, or turning the water off while soaping up.

- For clothes washing, use a suds saver, and run full loads. Front-loading washers use much less water, although finding one to buy may present a challenge. When running small loads, be sure to use the reduced water level setting. Wash clothes throughout the week rather than on one day.

- Modern efficient plumbing fixtures, including 1.5 to 2.5 gallon toilets, 1.5 to 2.0 gallons per minute (gpm) showerheads, faucets of 1.5 gpm or less, and front-loading washing machines of 20 to 30 gallons per 10 to 12 pound dry load, offer the potential of substantial reduction in residential water use. These reductions have commonly amounted to between 30 and 70 percent of total in-house water use (*Table 1*).

- **Your awareness of your family's water use, and how each of you can reduce it, is as important as using water conservation devices.**

Conventional fixture	Gallons used	Water-saving fixture/device	Gallons used
Toilet	4-6/flush	Low-volume toilet	1.6/flush
Showerhead	4-6/min.	Low-flow shower head	2.5/min.
Faucets: Bathroom and kitchen	4-6/min.	Faucet-flow-control aerators: Bathroom and Kitchen	2.5/min.

Table 1: Water use by conventional and water-saving fixtures and devices.

Collection of wastewater

Leaky piping or septic tanks ("leakage losses") can allow wastewater to enter the ground-water supply without adequate treatment and can cause contamination. Don't allow water that doesn't need treatment (foundation drains, infiltration of rain water, roof drainage) to add to your waste volume. This is prohibited by Section 16.01.03.004.03 of the Rules for Individual and Subsurface Sewage Disposal System. Divert clear water, which doesn't require treatment, away from the house, well, and wastewater treatment system. For example, divert roof drains and surface runoff away from the soil absorption field.

In hard water areas, the water softener may be a significant user of water. Proper adjustment and timing of the softener's regeneration mechanism and using softened water for only essential uses can reduce excessive water use.

2. Quality of wastewater

Strategy: Minimize the amount of contaminants in wastewater.

The quality of water refers to what is in the water, not to the water itself. Even waste-water is more than 99 percent water. Wastewater usually contains relatively small amounts of contaminants, but they make a substantial difference in the usefulness of the water.

Contaminants found in wastewater include:

- **Bacteria and viruses**. Some can cause disease in humans. These microorganisms are usually removed by settling or through filtration in the soil. Many will die from aging or the adverse conditions in the soil absorption system.

- **Suspended solids**. These are composed of particles which are more dense (sludge) or less dense (scum) than water. Most can be separated from liquid waste by allowing enough time in a relatively calm septic tank. Grease and fats are also considered suspended solids. Soil absorption fields can be quickly clogged by wastewater high in suspended solids.

- **Organic chemicals.** These include cleaning solvents, pesticides, and fuels which usually are not degraded or removed through treatment and can pass along with the wastewater into the water supply.

- **Inorganic chemicals.** These agents may seriously compromise your on-site treatment system. Household on-site systems are generally designed to degrade only biological contaminants. Inorganic chemicals introduced into your on-site system may even harm the microorganisms which break down household wastes.

- **Nutrients**. Nitrogen from human wastes and phosphorus from detergents and some chemical water conditioners are the most notable nutrient sources. Nitrate-nitrogen is a common ground-water contaminant. In addition, phosphorus can contaminate surface water.

Oxygen demand is used as an indicator of wastewater strength. The microorganisms that decompose organic contaminants in wastewater use oxygen. The amount of oxygen required to break down wastewater is measured as biochemical and chemical oxygen demand, commonly known as BOD and COD, respectively. Organic wastes or contaminants such as blood, milk residues, and garbage grindings have high oxygen demand. Aerobic processes (in the presence of oxygen) produce stable, low-odor effluent when given enough time. Wastewater with excess oxygen demand can cause problems for soil absorption fields, ground water, streams, and lakes by reducing levels of oxygen.

Improving wastewater quality

Consider the following ways to improve wastewater quality:

- Do not use a garbage disposal unit unless the system was designed and sized for one. Garbage disposals contribute a large load of suspended solids and organic matter with their higher oxygen demand to wastewater and use additional water.

- Do not put items that may clog your disposal system, such as fats, grease, coffee grounds, paper towels, sanitary napkins, tampons, or disposable diapers, down the drain. Dispose of these as solid waste.

- Toxic substances, such as solvents, degreasers, acids, oils, paints, disinfectants, and pesticides, should not be put down drains since they may end up in ground water. This does not include bleach used to disinfect laundry or to wash clothing worn for pesticide applications.

- Do not use additives to clean or "sweeten" a septic system. They may interfere with the biological action in the tank, cause the drainfield to be clogged by sludge and scum to be carried into the field, or add toxic chemicals to ground water. Introducing additives may be prohibited by your local public health district; check with them for further information.

3. Treatment and disposal of wastewater

Strategy: Make wastewater more suitable for further treatment, disperse wastes, take advantage of the additional treatment afforded by contact with soils, and minimize the opportunity for wastewater to contaminate water supplies.

In areas where a municipal sewage system is not available and suitable soils are present, an on-site system for treatment and disposal of household wastewater is needed. The systems available for use in Idaho include septic tank-soil absorption systems, and other alternative treatment systems. Direct discharge of household wastewater to the soil surface or surface water is prohibited by regulations.

A sketch of the existing wastewater disposal system should always be retained by the owner. Any underground components should be shown on the sketch with reference points and distances to at least two permanent objects at cross angles to each other. This allows location of buried components with minimal problems.

Septic tank-soil absorption system — the most common system

In the septic tank-soil absorption system, wastewater flows from the household sewer into an underground septic tank and is then introduced to the soil through a piped distribution system (*Figure 1*). In the septic tank the waste components separate — the heavier solids (sludge) settling to the bottom, and the grease and fatty solids (scum) floating to the top. Up to 50 percent of the solids retained in the tank are decomposed by bacteria in the anaerobic digestion process. The partially treated water moves on to additional treatment and disposal in the soil absorption system.

Septic tanks and other chambers must be designed and constructed to be water tight. Among the most important components of a septic tank are the baffles. Baffles are placed in the tank to provide maximum retention of solids, prevent inlet and outlet plugging, and prevent short circuiting of wastewater through the tank.

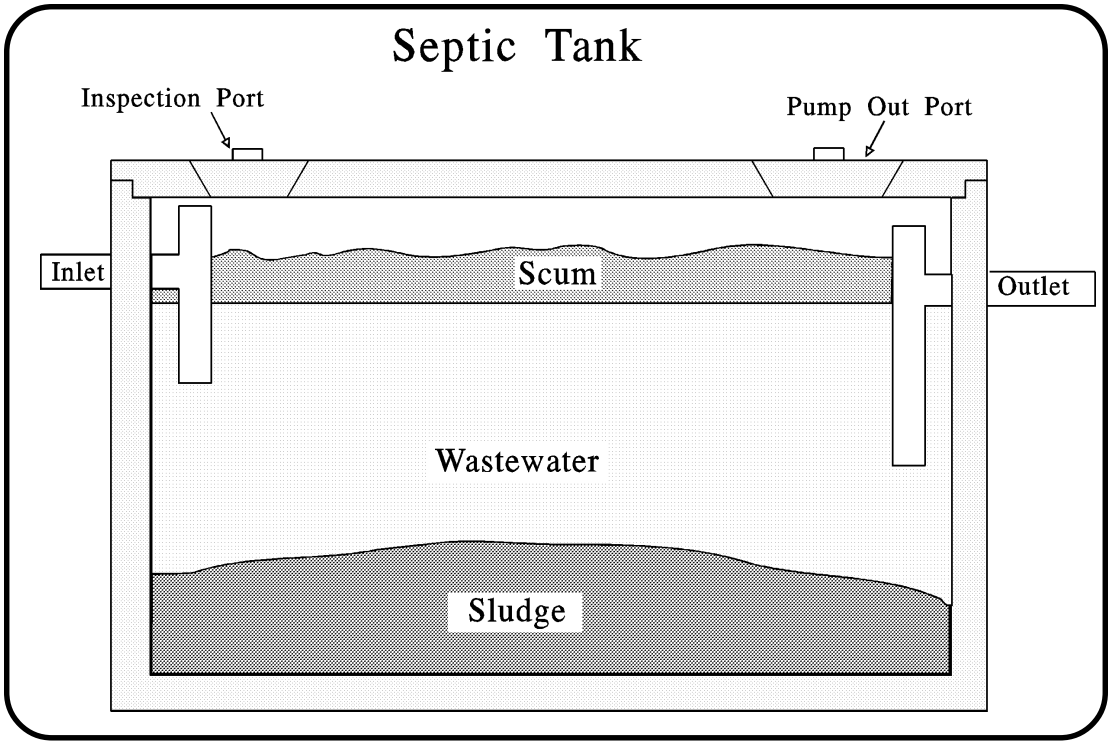


***Figure 1*: Septic tank-soil absorption system.**

Septic tanks remove solids by holding wastewater in the tank. This allows the solids to settle and the scum to rise to the top. Septic tank size is based on the number of bedrooms present in the house. For a one or two bedroom house, the minimum septic tank size is 900 gallons. A three or four bedroom house is required to have a 1,000 gallon septic tank. Properly selected tanks have enough space for sludge to accumulate for an average of three years without needing solids removal.

Subsurface treatment and disposal using soil absorption — such as trenches and beds — is the common practice for household wastewater after treatment in a septic tank. The liquid portion (effluent) flows through the septic tank outlet to the soil absorption field, which is usually a series of trenches (laterals), each containing a distribution pipe embedded in drainfield gravel or rock. The effluent flows out through holes in the pipe, then down through the drainfield gravel or rock and into the soil. The soil filters out remaining solids and pathogens (disease-producing microorganisms), and dissolved substances degrade, as the wastewater slowly percolates through the soil to ground water.

Absorption fields must be maintained properly to operate at peak efficiency and minimize potential health hazards:

- Do not drive over an absorption field. Compaction from vehicles or equipment will cause settling, shifting, or breakage of lateral lines. This can lead to the surfacing of wastewater, and the creation of a health hazard.
- Never plant a vegetable garden over an absorption field. Microbes from the effluent may travel through the soil and contaminate the crop, especially root crops.
- Do not allow trees to grow over the system. Roots from the trees can cause damage to lines, as well as plug them.
- Keep a grass cover over the absorption field. This will help use some of the nutrients available and aid in evapotranspiration.

Soil absorption systems are not suitable on some sites because of slow soil permeability, shallow depth to restrictive soil layer or bedrock, shallow water table depth, or other factors. Deep, well-drained, well-developed, medium-textured soils (such as silt loam and loam) are more desirable for soil absorption systems. Coarse, sandy soils allow effluent to flow too quickly downward to ground water and do not provide adequate time for solids and pathogens to filter from the liquid.

Between three and six feet of suitable, aerated soil beneath the bottom of a soil absorption system is needed to renovate wastewater before it reaches a limiting layer. A limiting layer may be bedrock, impervious soil (claypan, hardpan, or fragipan), or extremely permeable material. Unsaturated soils allow movement of air, which helps keep the soil profile aerobic.

Disposal sites that are more distant and downslope from your well increase the isolation of your water supply from contaminated wastewater. An individual soil absorption system is required to be at least one hundred feet from any water supply, twenty feet from the foundation of the house, and five feet from property lines. However, separation distances of greater than 200 feet to water supplies are highly recommended because they provide greater protection to your drinking water supply.

Septic tank maintenance

Pumping the tank before it is 40 percent filled with scum and sludge improves functioning of the system. When the tank is filled beyond this point, sewage has less time to settle and solids can pass through to the absorption field causing premature failure. The tank is pumped through the access manhole. Consider installation of an outlet screen or filter, with service access to ground surface.

When the tank is pumped, have the baffles checked, check for tank leaks, and make any needed repairs. All other components of the septic system should be checked at this time. Keep a record book on the system and record all maintenance procedures in it. Septic system maintenance is required to be performed by a licensed professional.

The frequency of pumping depends on the capacity of the septic tank, the flow of wastewater (related to number of people in the household and water-use habits), and the volume of solids in the wastewater (more solids if garbage disposal is used).

The importance of safety around septic tanks should not be overlooked. The space within a septic tank contains gases which are toxic when inhaled. Because of this, never go into or lean into a septic tank. Fatalities have occurred from unsafe acts during septic tank maintenance and repair.

Alternative treatment systems

The Idaho Department of Health and Welfare defines alternative treatment systems as any system other than a conventional septic tank and drainfield. Although use of alternative treatment systems is encouraged, design and maintenance of such systems should be consistent with the State Technical Guidance Manual for Individual and Subsurface Sewage Disposal. Systems approved for use in Idaho are briefly described below.

Capping fill trench is a standard drainfield trench constructed so that its bottom is at least three (3) inches into the natural soil but less than two feet deep in the natural soil. A selected fill material caps the trench to provide cover.

Gravelless trench system is a standard trench design except that the drain rock is replaced by either a large diameter, nylon fabric-wrapped plastic pipe or a plastic domed chamber. Gravelless domed chamber systems are awarded a 40 percent reduction in size if arranged in trenches.

Evapotranspiration systems are a sand and gravel bed contained within an impervious lining which receives septic tank effluent and in which evapotranspiration through the surface of the sand and or plant life is the sole means of effluent removal.

Sand filters are enhanced wastewater treatment systems that are characterized by a large container with means for distributing septic system effluent atop a layer, or layers, of medium sand. As the wastewater moves downward, it undergoes biochemical degradation. There are many different

designs of sand filters, but they can generally be divided into three types: in-trench sand filters, intermittent sand filters, and sand mounds.

Further information on guidelines for these and other wastewater treatment systems is available from your local public health district or IDHW-DEQ.

4. Septage disposal

Regular pumping of septic tanks is essential to ensure proper functioning of a septic system (*see section on septic tank maintenance*). Wastes pumped from the septic tank are known as septage. Septage should be removed and disposed of only by septage haulers licensed by your local public health district. Homeowners are responsible for the proper disposal of septage, and local ordinances should be followed in all instances. Contact your local public health district for further information and a list of licensed septage haulers.

5. Assistance with failing systems or new designs

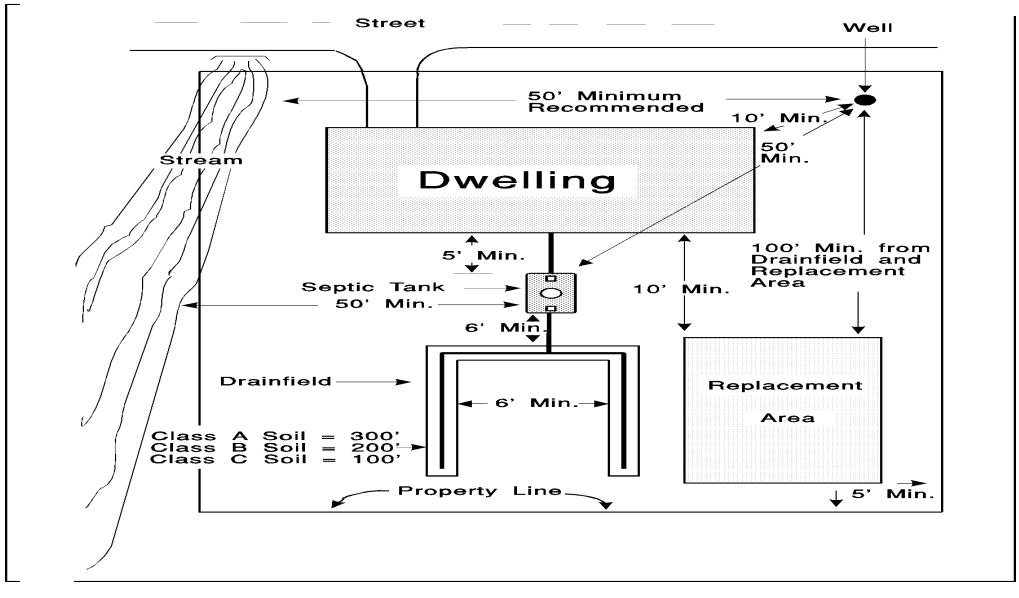
If your household wastewater treatment system is backing up or your distribution system is clogged, contact your plumber or treatment system installer. If your septic system is discharging to the soil surface or otherwise failing, contact your local public health district for permits to repair or replace your wastewater treatment system.

If you have a septic tank-soil absorption system, do not wait for the system to fail before pumping the septic tank. Once a system fails, it is too late to pump the tank and salvage the absorption field. Also avoid using septic tank additives, they can contaminate ground water. If wastewater is surfacing near or above your soil absorption field, don't cover it with more soil. This costs money and does not fix the system. The wastewater will soon surface again.

If your wastewater treatment system is leaking or showing signs of failure, seek help to correct the problem. **Do not pipe the sewage to the road ditch, storm sewer, stream, canal, or farm drain tile -- this pollutes the water, creates a health hazard, and is illegal.** Also, do not run the sewage into a sinkhole or drainage well because it can potentially pollute ground water.

A properly designed, constructed, and maintained system can effectively treat wastewater for many years. For more information on septic systems and wastewater lagoons, or for advice on alternative wastewater systems, contact your local public health district.

6. Dimensional requirements for a standard drainfield



Contacts and References

Who to call about...

Household wastewater treatment

- Your local public health district, or IDHW-DEQ, Community Programs, Onsite Wastewater Tretment, (208) 334-5860.
- Regulations are available from the Administrative Rules Coordinator, 700 W. State, Boise, ID., 83720, (208) 334-3577.

What to read about...

Publications are available from sources listed at the end of the reference section.

Ground water contamination, protection, and testing

- Idaho Groundwater Quality Plan: Protecting Ground Water Quality in Idaho, 1992. Ground/ Water Quality Council, Boise, ID., 109 pp.
- Idaho Groundwater Quality Protection, A Manual for Local Officials, 1989. IDHW-DEQ, Boise, ID., January 1989. 41 pp.
- Idaho Lake Management Guide, 1987, IDHW-DEQ, Water Quality Bureau Report. Boise, ID., 42 pp.
- Rupert, M., T. Dale, M. Maupin, and B. Wicherski. 1991, Groundwater Vulnerability Assessment Snake River Plain, Southern Idaho, IDH&W-DEW, Boise, ID. 25 pp.
- Tolman, J. and R. Fox, 1987. Idaho Guidelines for Non-public Water Systems, District Health Departments, Boise, ID. 29 pp.
- Technical Guidance Manual for Individual and Subsurface Sewage Disposal. 1993, IDHW-DEQ, Community Programs. 149 pp.
- Burnell, B., 1994, A Homeowners Guide to Septic Systems. (In Press). IDHW-DEQ, Community Programs, Boise, ID. 4 pp.

Rules

- IDAPA 16.01.03 Rules for Individual and Sub Surface Sewage Disposal.
- IDAPA 16.01.08 Rules Governing Drinking Water.
- IDAPA 16.01.15 Rules Governing the Cleaning of Septic Tanks.
- US EPA 40 CFR Part 503 Standards for the use or Disposal of Sewage Sludge. Federal Register 58 (32); 9248-9415, Friday Febryary 19, 1993.
- US EPA, 1993. Domestic Septage Regulatory Guidance: A Guide to the 503 Rule, EPA 832-B-92-005 September, 1993.

Installation and maintenance

- Installation and Maintenance of Septic Systems. 1988. North Central District Health Department. Lewiston, ID. 9 pp. brochure.

Publications available from...

- Your county Cooperative Extension System office. There may be charges for publications, postage, and sales tax.
- U.S. Environmental Protection Agency, 401 M Street S.W., Washington, D.C. 20460. USDA, National Center for Environmental Publications and Information, Cincinnati, OH 45268.
- Dick Hetherington, USDA Water Division, mail stop WD134, 1200 6th Ave., Seattle, WA 98101. (206) 553-1941
- Sonja Ross, US EPA, WH-586, EPA Sludge Risk Assessment, 401 "M" St. S.W., Washington, D.C. 20460.

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Idaho Soil Conservation Commission (SCC)
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Information derived from **Home*A*Syst** worksheets is intended only to provide general information and recommendations to rural residents regarding their own homestead practices. All results are confidential.