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HAPPI-Home 11

Household Wastewater Treatment Systems

Many Hawaii residents use some type of on-site wastewater disposal system, such as a septic tank or cesspool. Household wastewater can contain contaminants that may cause water pollution. Wastewater can carry disease-causing bacteria, viruses, and other pathogens, as well as organic wastes containing nutrients, including nitrogen and phosphorus. Such nutrients promote weed growth and lower oxygen levels in surface water and thus affect fishing and recreational uses of rivers and lakes.

Wastewater treatment systems are designed to remove or break down contaminants before they enter groundwater, nearby streams, or the ocean. Wastewater treatment is often ignored until problems occur. This worksheet covers wastewater system design and location, maintenance, and proper use. It will help you determine if your wastewater treatment system has any problems and how to prevent problems in the future. A failed system can cost thousands of dollars to replace. Taking time now can help you decrease your risks.

Septic systems and cesspools

Septic systems and cesspools are the two common types of on-site wastewater treatment in Hawaii. Construction of new cesspools is now illegal on Oahu, but existing systems can still be used.

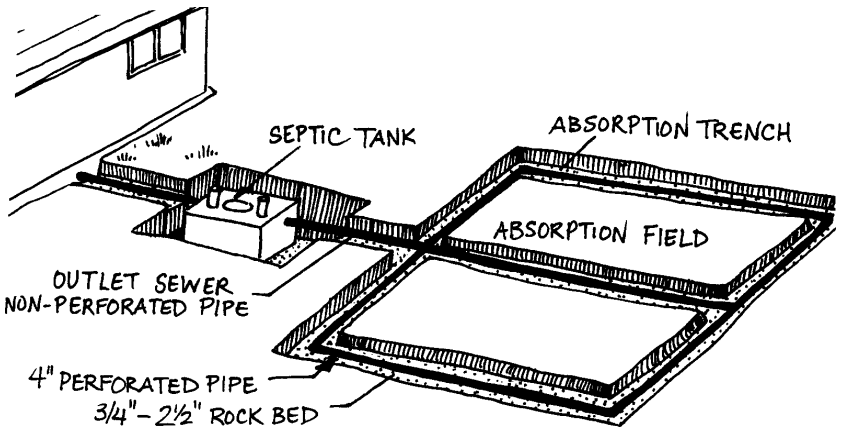
New cesspools can still be constructed on other islands. Cesspools, also called seepage pits, are perforated tanks or pits lined with concrete blocks or bricks through which wastewater can seep into the ground. They are usually less effective and have a higher risk of water pollution than septic tank and drain-field systems because they are located closer to the water table and have too little soil surface area for good wastewater treatment. If you have a cesspool, most of this worksheet still applies to your situation. However, installing a septic tank and drainfield system when you have the resources available to do so will reduce pollution risks.

A typical septic system

A conventional septic system has three components:

- a septic tank that separates, stores, and begins to treat solid waste (sludge and scum)
- a distribution system that distributes the liquid effluent (wastewater) over a large area of soil
- the soil in the drainfield or soil absorption field, which absorbs the effluent and treats it by natural physical, chemical, and biological processes.

Typical septic system



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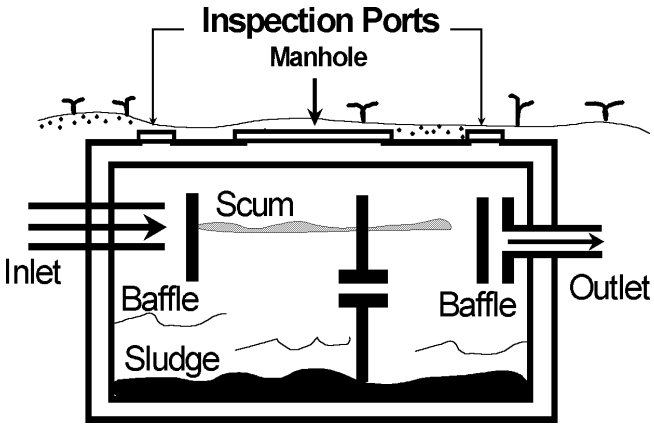
Wastewater flows through a sewer pipe out of your house and into the septic tank, a box or cylinder commonly made out of concrete. Fiberglass and polyethylene tanks are also used. The tank must be watertight to keep sewage from leaking out and groundwater from seeping in. Lighter solids in the wastewater like grease, hair, and soap float to the top of the tank and form a scum layer. Heavier solids settle to the bottom and form a layer of sludge. Bacteria in the tank begin to break down some of the sludge into nutrients, gas, and water. The remaining solids are stored in the tank until they are pumped out. A baffle or a sanitary "T" pipe at the tank inlet slows the incoming rush of water, so the sludge is not stirred up. A baffle or a sanitary "T" pipe located at the tank's outlet keeps solids from leaving the tank. Inspection pipes at the top of the tank are for inspecting the inlet and outlet pipes, baffles, and "T" pipes.

Next, the liquid waste, or effluent, flows out of the tank, through the distribution system, and into the drainfield or soil absorption field. The distribution system is a series of perforated plastic distribution pipes laid in the ground, usually in gravel-filled trenches. Effluent is fed into the pipes by gravity or by a pump. The effluent moves slowly out of the pipes and trenches and is absorbed into the soil. A filter at the tank outlet is recommended, because large particles carried out of the septic tank can clog the drainfield.

The soil must be of a suitable type and deep enough to treat wastewater before it reaches groundwater. The soil filters out larger particles and disease causing organisms called pathogens. The pathogens die off in the soil and beneficial soil microbes and natural chemical processes break down or remove most of the contaminants in the effluent. Two kinds of soil microbes can break down wastes from your septic systems. Aerobic microbes, which need air to live, digest wastes quickly. Anaerobic microbes do not need air, but they digest wastes slowly and give off bad odors.

The kind of soil on your property determines how well your drainfield will work. Well drained, medium textured soils such as loam are best. Coarse gravel or sandy soils allow wastewater to flow too quickly for treatment. In fine clay or compacted soils, water moves too slowly. If water stays in the soil because groundwater levels are high, surface runoff saturates the drainfield, or excessive amounts of water are used in your household, then anaerobic conditions will exist. Your system will not work well and will smell bad.

Septic system details and operation



The drainfield can be changed if soil or site conditions are a problem. In a mound system, the drainfield is built up to add soil depth for treatment. A sand filter is another option. It consists of layers of sand and gravel where wastewater is treated before it goes into the soil.

System location

You must know where the system is to take care of it. Since it is underground, finding it may be tough. If you do not know where your system is, a previous homeowner, county health department, or septic tank pumper's records may hold the answer.

To locate your septic tank yourself, look under your house for the sewer pipe and note which way it is going. Then, go outside and dig or probe in the ground for the tank about 10–20 feet away from the house in the direction the sewer line is going. The septic tank is usually within 2 feet of the ground surface. The distribution box and drainfield are usually downslope from the septic tank, but sometimes the wastewater is pumped to a drainfield uphill from the septic tank.

Once you've located the septic tank, mark it on your house and yard map that you made using HAPPI-Home

2. Note the distances from the septic tank opening to at least two permanent points such as the corner of the house foundation or survey stakes on the property line. If you can, show the location of the drainfield. Keep the map on file along with other maintenance records and pass it on to the next owner if you sell the house.

To reduce water pollution risks, the septic tank and drainfield should be as far as possible from streams, wetlands or the ocean. One hundred feet as a reasonable minimum distance. Hawaii state guidelines state that new drinking water wells must be located at least 1000 feet from septic tanks or cesspools.

If you have a private drinking water well, it is even more important to maintain your septic system. It is best if your septic system is downhill from the well, In addition, you should test your well water more often for nitrates and bacteria if your system is closer to your well than recommended or is uphill from your well. Refer to HAPPI-Home 9, *Drinking water wells*, for more information on how to keep your drinking water safe.

System design

Both the septic tank and drainfield should have adequate capacity to treat all the wastewater generated in your house, even at times of peak use. The system must be designed for the maximum occupancy of your home. Studies estimate that households generate 100–200 gallons of water per bedroom per day. So if you have a four bedroom house, you probably generate between 400 and 800 gallons of wastewater per day. It takes about two days for solids to settle out by gravity, so the septic tank should be large enough to hold two days' worth of wastewater. A three-bedroom home usually has a 1000-gallon tank. A two-compartment tank or a second tank in series can improve sludge and scum removal and help prevent drainfield clogging.

Using more water than the system can hold will stop it from working properly and lead to inadequate wastewater treatment or system failure. Conserving water, including installing low-flow toilets and water-saving faucets, or more frequent pumping may extend the life of the system. Adding space or a water-using appliance (such as a garbage disposal, jacuzzi, dishwasher, or water softener) to your home may require expanding your system. Using vacation homes a lot may overload existing systems. Teenagers or other heavy water users living in the home may also overload the system and cause problems.

Solids that do not settle out in the tank can be carried out of the tank and cause problems. Effluent filters on the outlet capture small particles. But, they must be cleaned regularly to keep them working well. Gas bubbles are produced by anaerobic bacteria slowly di-

Is your septic system's capacity adequate?

Water usage in the United States ranges from 50 to 100 gallons per day (gpd) per person. Estimate the wastewater load from your household using the equation below. Your septic tank should be able to hold two days' worth of wastewater.

_____ people in household x 75 gpd (average) =

_____ gpd x 2 days = _____ gallons

What is your septic tank capacity? _____ gallons

Based on your calculation above, is your tank capacity adeqaute for your present household size?

☐ Yes ☐ No

Calucalte the wastewater load from your home if each bedroom were occupied by two people:

_____ bedrooms x 150 gpd = _____ gpd x 2 days

= _____ gallons

This is the recommended tank size for your home if each bedroom were occupied by two people.

Would your septic tank be adequate if each bedroom were occupied by two people?

☐ Yes ☐ No

gesting wastes in the tank. A gas baffle near the outlet keeps the gas and sludge in the tank.

Septic systems can last a long time if they were appropriately designed for the site and are well maintained. But, if your septic tank is made of steel, it will rust and need replacement. If you have an older system, it may not meet the latest safety standards. Even a relatively new system can fail if it is located in poor soil, undersized, or not properly installed and maintained.

Maintenance

Keeping good records each time your septic system is pumped, inspected, or repaired is a good idea. You will know when your system needs regular maintenance. This information will also be valuable if you sell or transfer your property.

Regular pumping is the most important action you can take. As more solids build up, they are more likely to flow out of the tank and into the drainfield and cause problems. Pumping a septic tank or cesspool at a cost of $100–$250 is far less expensive than replacing a clogged drainfield at $2,000 to $8,000 or cleaning up the mess from an overflowed cesspool.

The best way to determine when to pump your tank is to have it inspected annually. Pumping as needed based on the results of periodic inspections will minimize your maintenance costs and maximize the system's longevity. Inspections can also identify problems with system components before they cause a backup or drainfield failure.

In general, a septic tank should be pumped by a licensed pumper every three to five years. The size of your tank, the amount of wastewater generated in your household, the amount of solids carried in the wastewater, and the age of the system, determine how often pumping is needed . Check your local yellow pages for the names and phone numbers of licensed septic tank pumpers and inspectors in your community.

After pumping, the tank should also be inspected by a professional for cracks and the condition of the baffles. Leaks should be repaired promptly. Never crawl inside or lean into a septic tank without proper ventilation and safety procedures-the gases inside the tank can be deadly!

The distribution box should be periodically checked to be sure that the distribution pipes are properly leveled. Solids building up in the distribution box indicate damaged baffles, the need to pump the tank, or the need for a bigger tank. If the system includes a pump, the pump should be checked along with the float switch, alarm, and air vents to the dosing tank.

Estimated number of years between septic tank pumpings

Tank size (gal)	Number of people in household					
	1	2	3	4	5	6
	Years between pumpings					
500	5.8	2.6	1.5	1.0	0.7	0 .4
1000	12.4	5.9	3.7	2.6	2.0	1.5
1500	18.9	9.1	5.9	4.2	3.3	2.6
2000	25.4	12.4	8.0	5.9	4.5	3.7

The drainfield is an important part of your system. Some tips for protecting the drainfield are

- Do not drive vehicles on the drainfield.
- Do not pave, build, pile logs or other heavy objects, or put a swimming pool over the drainfield.
- Divert roof runoff, footer drains, sump pumps, and other surface runoff away from the drainfield.
- Avoid planting trees and shrubs with deep roots over the drainfield. Grass is the best drainfield cover.
- Install an effluent filter or screen on the septic tank outlet.

Some typical signs of trouble with your system are

- Foul odors in your home or yard
- Slow or backed-up drains even after cleaning the pipes inside your house
- Wet, spongy ground or lush plant growth near the cesspool, septic tank, or drainfield.
- Repeated intestinal illnesses in your family.
- Algal blooms and excessive weed growth in nearby streams.

Proper use of your system

Your wastewater treatment system is not a substitute for the trash can or a compost pile. Dispose of tissues, diapers, baby wipes, sanitary napkins, tampons, condoms,

cigarette butts, and other solid waste with regular garbage and not down the toilet. Since these materials do not break down easily, they will cause your septic tank or cesspool to fill up faster.

Do not use a garbage grinder or garbage disposal in the kitchen sink; it adds more water and waste to the system. Excess grease, fats, and coffee grounds can clog your system. Consider composting food waste and even some paper wastes as an alternative. HAPPI-Home #3 provides information on trash disposal, recycling and composting.

Septic system and cesspools are not designed to neutralize the wide variety of common household chemicals. Paints, solvents, acids, drain cleaners, oils, and pesticides can pass untreated through your system and contaminate the groundwater and surface waters. Though generally safe when diluted, high concentrations or large volumes of water-soluble cleaners or bleach can harm septic tank microbes. See HAPPI-Home #4 on managing hazardous household products, for information on the proper disposal of hazardous chemicals.

Chemical products advertised to "sweeten" or improve your septic system and cesspool cannot replace routine pumping and may even be harmful. Buying and adding yeasts, bacteria, or enzymes is not necessary; plenty of the right microbes are already in your system. Additives containing solvents to unclog your system can kill the microbes and may contaminate groundwater and surface waters.

Assessing your risks

Complete the risk assessment table on pages 6–7 to determine your water pollution risks. Items with asterisks apply to septic tanks only, not cesspools. For each category, choose the set of practices that best fits your situation. Then, go to page 8 and develop an action plan to minimize water pollution hazards from your home's wastewater treatment system.

For more information . . .

. . . contact the Wastewater Branch of the Hawaii Department of Health by mail at 919 Ala Moana Blvd. Room 309, Honolulu, HI 96814; by e-mail at <wwb@eha.health.state.hi.us>; or by phone at 974-4000 ext. 64294 (island of Hawaii), 984-2400 ext. 64294 (Maui), 274-3141 ext. 64294 (Kauai), 1-800-468-4644 ext. 64294 (Molokai and Lanai), or 586-4294 (Oahu).

The National Small Flows Clearinghouse (NSFC) has several publications on septic system design and maintenance, as well as information about alternative systems. Look for these on the Web at <http://www.estd.wvu.edu/nsfc/NSFC_homepage.html>; or contact them by mail at NSFC, West Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064; or by phone at (800) 624-8301 to request their catalog.

Risk Assessment Table for Home Wastewater Treatment Systems

	Low risk	Moderate risk	High risk	Your risk
Capacity of system	Tank or cesspool is designed to handle more wastewater than required, based on the size of the home	Capacity just meets load requirements, but I watch out for factors indicating system overload and use water conservation measures	System does not meet current disposal needs, or new bathrooms or appliances were added without upgrading the system	❑ low ❑ moderate ❑ high
Maps and records	Have map of system location and keep good records of repairs and maintenance	Location of tank and date of last pumping are known but not recorded	Location of system is unknown; no record of pumping and repairs	❑ low ❑ moderate ❑ high
Separation distance	Septic tank, drainfield, and cesspool are at least 100 ft from any surface water and 1000 ft from wells	Septic tank, drainfield or cesspool is between 50 and 100 ft from surface water	Septic tank, drainfield, or cesspool is <50 ft from a well or surface water	❑ low ❑ moderate ❑ high
Age of system	System is 5 years old or less	System is between 6 and 20 years old	System is >20 years old	❑ low ❑ moderate ❑ high
Effluent filter *	An effluent filter is installed and cleaned regularly	An effluent filter is installed but only cleaned occasionally	There is no effluent filter installed on the septic tank outlet	❑ low ❑ moderate ❑ high
Tank pumping (including holding tanks and cesspools)	The septic tank or cesspool is pumped on a regular basis as determined by an annual inspection, or about every 3–5 years	The septic tank or cesspool is pumped, but not regularly	The septic tank or cesspool is not pumped	❑ low ❑ moderate ❑ high
Condition of tank and baffles *	The tank and baffles are inspected for cracks; repairs are made promptly		The condition of the tank and baffles is unknown	❑ low ❑ high
Drainfield protection *	Vehicles and other heavy objects or activities are kept from the drainfield area	Occasionally, the drainfield is compacted by heavy objects or activities	Vehicles and other heavy objects or activities are permitted in the drainfield area	❑ low ❑ moderate ❑ high
Diverting surface water	All surface runoff is diverted away from the drainfield or cesspool	Some surface water flows into the drainfield area or cesspool	Runoff from land, rooftops, driveways, etc. flows into the drainfield or cesspool	❑ low ❑ moderate ❑ high
Plantings over the drainfield *	Grass or other shallow-rooted plantings are over the drainfield		Trees and shrubs are growing on or near the drainfield	❑ low ❑ high

* Applies to septic tanks only, not to cesspools.

Risk Assessment Table for Home Wastewater Treatment Systems

	Low risk	Moderate risk	High risk	Your risk
Signs of trouble	Household drains flow freely; there are no sewage odors inside or outside; soil over the drainfield is firm and dry	Household drains run slowly; soil over the drainfield is sometimes wet	Household drains back up; sewage odors noticed in the house or yard; soil is wet or spongy in the drainfield area	❑ low ❑ moderate ❑ high
Solid wastes	There is no garbage grinder or garbage disposal in the kitchen; no grease or coffee grounds are put down the drain; only toilet tissue is put in the toilet	There is moderate use of a garbage grinder, and some solids are disposed of down the drain	There is heavy use of a garbage grinder, and many solids are disposed of down the drain; many paper products or plastics are flushed down the toilet	❑ low ❑ moderate ❑ high
Cleaners, solvents, and other chemicals	No solvents, fuels, or other hazardous chemicals are poured down the drain	Hazardous household chemicals are occasionally disposed of in the wastewater system	Hazardous household chemicals are regularly disposed of in the wastewater system	❑ low ❑ moderate ❑ high

Your action plan

Now that you have assessed your home's wastewater treatment system, you can take action to change practices that may be causing water pollution. For areas that you identified as high or moderate risk, decide what action you need to take and fill out the Action Plan below.

Write down your moderate-risk and high-risk activities below	What can you do to reduce the potential risk for water pollution?	Set a target date for action
Samples of action items:		
Low area over drainfield is always wet	*Have drainfield inspected for blockages, and clean as needed; divert runoff water*	*One week from today*

This HAPPI document was adapted by Michael Robotham, Carl Evensen, and Linda J. Cox from *Household wastewater—Septic systems and other treatment methods* by Barbara Kneen Avery, Chapter 4, pp. 33-46, in *Home•A•Syst: An environmental risk assessment guide for the home* developed by the National Farm•A•Syst / Home•A•Syst Program in cooperation with NRAES, the Northeast Regional Agricultural Engineering Service. Additional graphics are taken from *Protecting your resources through a farm and home assessment*. Permission to use these materials was granted by the National Farm•A•Syst/Home•A•Syst Office. HAPPI-Home materials are produced by the Hawaii's Pollution Prevention Information (HAPPI) project (Farm•A•Syst / Home•A•Syst for Hawaii) of the University of Hawaii College of Tropical Agriculture and Human Resources (UH-CTAHR) and the USDA Cooperative Extension Service (USDA-CES). Funding for the program is provided by a U.S. EPA 319(h) grant administered by the Hawaii State Department of Health.