United States Environmental Protection Agency | Office of Water Washington, D.C. | EPA 832-F-00-044 September 2000

Decentralized Systems Technology Fact Sheet
Septic Tank Leaching Chamber

DESCRIPTION

A leaching chamber is a wastewater treatment system consisting of trenches or beds, together with one or more distribution pipes or open-bottomed plastic chambers, installed in appropriate soils. These chambers receive wastewater flow from a septic tank or other treatment device and transmit it into soil for final treatment and disposal.

A typical septic tank system consists of a septic tank and a below-ground absorption field (also called a drainfield, leaching field, or nitrification field). Leaching chambers are drainfields used to dispose of previously treated effluent. The drainfield system typically consists of leaching chambers installed in trenches and connected to the septic tank via pipe. Effluent flows out of the septic tank and is distributed into the soil through the leaching chamber system. The soil below the drainfield provides final treatment and disposal of the septic tank effluent. After the effluent has passed into the soil, most of it percolates downward and outward, eventually entering the shallow groundwater. A small portion of the effluent is used by plants through their roots or evaporates from the soil. Figure 1 shows a typical leaching chamber.

Leaching chambers have two key functions: to dispose of effluent from the septic tanks and to distribute this effluent in a manner allowing adequate natural wastewater treatment in the soil before the effluent reaches the underlying groundwater aquifer. Although the septic tank removes some pollutants from wastewater, further treatment is required after the effluent leaves the tank. Nitrogen compounds, suspended solids, organic and inorganic materials,

Source: Infiltrator Systems Inc., 2000.

FIGURE 1 LEACHING CHAMBER

and bacteria and viruses must be reduced before the effluent is considered purified. These pollutants are reduced or completely removed from the wastewater by the soil into which the wastewater drains from the leaching chambers.

Depending on the drainfield size requirements, one or more chambers are typically connected to form an underground drainfield network. The leaching chambers are usually made of sturdy plastic and do not require gravel fill. The sides of each chamber have several openings to allow wastewater to seep into the surrounding soil.

A typical leaching chamber consists of several high-density polyethylene arch-shaped, injection-molded chamber segments. A typical chamber has an average inside width of 51 to 102 centimeters (20 to 40 inches) and an overall length of 1.8 to 2.4 meters (6 to 8 feet). The chamber segments are usually one-foot high, with wide slotted sidewalls, which are usually 20 degrees toward the chamber center or away from the trench sidewall. Each chamber segment is designed to mechanically interlock with the downstream chamber segment, forming a complete drainfield trench that consists of an inlet plate with a splash plate below the inlet on the trench bottom, and a solid-end plate at the distal end of the chamber drainfield line.

Common Modifications

Typical leaching chambers are gravelless systems, with drainfield chambers with no bottoms and plastic chamber sidewalls, available in a variety of shapes and sizes. Some gravelless drainfield systems use large diameter corrugated plastic tubing covered with permeable nylon filter fabric not surrounded by gravel or rock. The area of fabric in contact with the soil provides the surface for the septic tank effluent to infiltrate the soil. The pipe is a minimum of 25.4 to 30.5 centimeters (10 to 12 inches) in diameter covered with spun bonded nylon filter fabric to distribute water around the pipe. The pipe is placed in a 30.5 to 61 centimeter (12 to 24 inches) wide trench. These systems can be installed in areas with steep slopes with small equipment and in hand dug trenches where conventional gravel systems would not be possible.

Use of these systems decreases overall drainfield costs and may reduce the number of trees that must be removed from the drainfield lot. However, fabric-wrapped pipe cannot overcome unsuitable site conditions and should not be installed where gravel systems will not function properly or in fine sandy organic rich, coastal plain soils with shallow groundwater.

APPLICABILITY

Leaching chambers are widely used as drainfield systems for septic tank effluent discharge. Many leaching chambers have been installed in 50 states, Canada, and overseas over the last 15 years. Currently, a high percentage of new construction uses lightweight plastic leaching chambers for new septic tank systems in states such as Colorado.

Leaching chambers are an alternative to the conventional septic tank drainfield, which consists of several trenches with gravel beds and perforated plastic pipes. Leaching chambers allow more of the soil profile to be used since the septic tank effluent is distributed to the ground below and the soil surrounding the chamber. Therefore, leaching chambers are more effective than traditional gravel drainfields, especially when the drainfield must be located on a steep slope. Leaching chambers are suitable for lots with tight sizing constraints or where water tables or bedrock limit the depth of the drainfield. Some states offer up to 50 percent sizing reduction allowance when using leaching chambers instead of conventional septic tank gravel drainfields. Because they can be installed without heavy equipment, leaching chamber systems are easy to install and repair. These high-capacity open-bottom drainfield systems can provide greater storage and more time for proper infiltration than conventional gravel systems and, therefore, are also suitable for stormwater management.

Current Status

Septic tank system drainfields are usually classified as two types: gravel or gravelless systems. In gravel drainfield systems, the pipelines distributing septic tank wastewater are placed over a layer of gravel. Four inches of additional rock are then typically placed around the pipe and two inches above the pipe. Gravelless systems provide the same functions as gravel drainfields while overcoming the potentially damaging impacts of gravel such as compaction of moist soil during installation and reduction of infiltration by obstructing the soil. The leaching chambers create a larger contact area for effluent to infiltrate into the soil, providing efficient treatment.

Typically, leaching chambers consist of series of large, two to four foot wide modular plastic arch segments that snap together. These arch segments replace the perforated drainpipes used in gravel drainfields. The wide chambers are manifolded with conventional plastic pipe such as high-density polyethylene (HDPE).

ADVANTAGES AND DISADVANTAGES

Limitations

Leaching chamber application is limited under certain conditions. The main limitations for installation and normal operation are small lot sizes, inappropriate soils, and shallow water tables. Leaching chamber systems can be used only in areas with soils that have percolation rates of 0.2 to 2.4 minutes per millimeter (5 to 60 minutes per inch). Neglect of septic tank and leaching chamber maintenance can lead to drainfield failure and soil and groundwater contamination.

Reliability

Leaching chambers are reliable, do not have moving parts, and need little maintenance to function properly. They are usually made of plastic materials, with a useful life of 20 years or more in contrast to the average useful life of a drainfield of 15 years, with a maximum of 20 to 25 years.

Some systems can be combined with other drainfield systems such as mounds and pressure distribution systems. Some can also be used for stormwater applications. Leaching chambers do not require more maintenance than conventional drainfield systems.

Advantages

Key advantages of leaching chamber systems compared to gravel drainfields include:

- Easier and faster to install.
- Soil in the trenches is not as likely to be compacted.
- Less expensive in areas where gravel must be transported over a long distance, such as parts of eastern North Carolina, the Rocky Mountains, eastern Oregon, and Connecticut.
- Leaching chambers allow for lower intrusion of soil and silt into the drainfield and thereby extend the useful life of the drainfields.
- Some leaching chambers have greater storage volumes than gravel trenches or beds.
- Inspection of the chambers is easier.
- Eliminates the need for gravel.
- Leaching chambers require a smaller footprint. Some states allow up to a 50 percent reduction in drainfield size compared to conventional gravel drainfield systems.

The lightweight chamber segments available on the market stack together compactly for efficient transport. Some chambers interlock with ribs without fasteners, cutting installation time by more than 50 percent over conventional gravel/pipe systems. Such systems can be relocated if the site owner decides to build on the drainfield site. Leaching chamber systems can be installed below paved areas and areas of high traffic.

Disadvantages

A key disadvantage of leaching chambers compared to gravel drainfields is that they can be expensive if a low-cost source of gravel is readily available. Also, tests to assess the effectiveness of these drainfield systems have yielded mixed results. Direct effluent infiltration is advantageous in some soils yet detrimental in others. While open chambers can break up tight, clay soils and open up more airspace for biological treatment, they are less effective than gravel drainfields in preventing groundwater pollution. Because the open bottom allows septic tank effluent to infiltrate the soil unfiltered, high percolation rates (sandy soils) and groundwater levels must be carefully considered before installing such systems.

DESIGN CRITERIA

The size of a leaching chamber system is based on the wastewater flow and soil properties. For a three bedroom home, the area needed for a leaching chamber system could range from 18.6 sq. meters (200 square feet) for a coarse-textured soil up to 185.8 sq. meters (2,000 square feet) for a fine-textured soil. When the total drainfield area is estimated, setbacks from the house and property lines must be provided. These are usually state-regulated and vary from state to state. Table 1 recommended setback distances.

TABLE 1 SETBACK DISTANCES FROM LEACHING CHAMBER DISPOSAL AREAS

Item	Minimum Distance, ft
Private Water Supply Well	100
Public Water Supply Well	300
Leak or Impoundment	50
Stream or Open Ditch	25
Property Lines	10
Water Line Under Pressure	10
Sewer Interceptor Drain	25

Source: Schultheis, 1999.

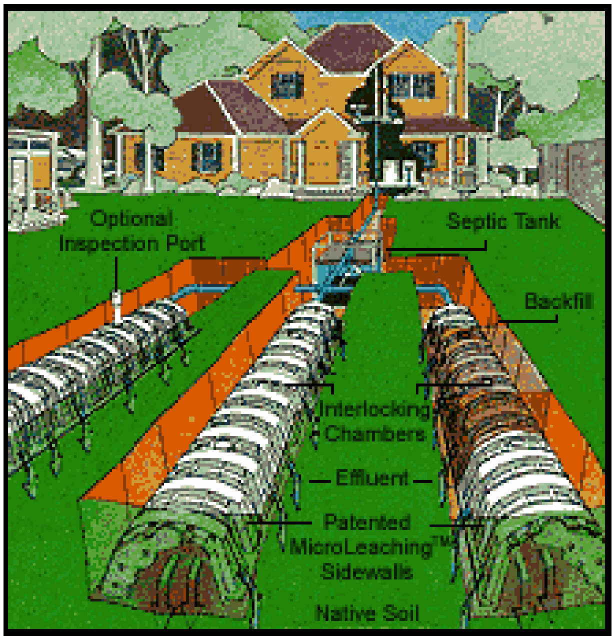
The key design parameter for leaching chambers is the maximum long-term acceptance rate (LTAR), which depends on the type of drainfield soils. Table 2 presents recommended LTARs for leaching chamber sizing.

The design LTAR should be based on the most hydraulically limiting naturally occurring soil horizon within three feet of the ground surface or to a depth of one foot below trench bottom, whichever is deeper. To determine the total trench bottom area required, the design daily wastewater flow should be divided by the applicable LTAR. The minimum linear footage of the leaching chamber system should be determined by dividing the total trench bottom area by 1.2 meters (4 feet), when used in a conventional drainfield trench. No reduction area is allowed for leaching chamber systems installed in bed or fill systems. In addition to the area needed for the leach field, space should be reserved for possible expansion (for example, a 50 percent expansion area is required in New York State; a 100 percent repair area is required in North Carolina).

Leaching chamber systems in septic tank drainfields are typically installed in three foot wide trenches, separated by at least nine feet, edge to edge. Soil backfill is placed along the chamber sidewall area to a minimum compacted (walked-in) height of eight inches above the trench bottom. Additional backfill is placed to a minimum compacted height of 30.5 centimeters (12 inches) above the chamber. The leaching chamber trench bottom is usually at least 61 centimeters (24 inches) below finished grade, and the inlet invert is approximately 20.3 centimeters (8 inches) above the trench bottom, and at least 43.2 centimeters (17 inches) below the finished grade. Most health codes limit the length of individual trenches to 18.3 meters (60 feet). A leaching chamber system should have at least two trenches. Figure 2 shows a schematic of a leaching chamber trench.

TABLE 2 LEACHING CHAMBER LONG-TERM ACCEPTANCE RATE

Soil Type	Long-Term Acceptance Rate (gpd/ft./yr)	
	Natural Soil	Saprolite
Sands	0.8 – 1.0	0.4 – 0.6
Coarse Loams	0.6 – 0.8	0.1 – 0.4
Fine Loams	0.3 – 0.6	-
Clays	0.1 – 0.4	-



Source: Infiltrator Systems Inc., 2000.

Individual chamber trenches should be leveled in all directions and follow the contour of the ground surface elevation without any dams or other water stops. Leaching systems installed on sloping sites may use distribution devices or step-downs when necessary to channel the level of the leaching chamber segments from upper to lower elevations. The manufacturer's installation instructions should be followed and systems should be installed by an authorized contractor.

PERFORMANCE

The performance of leaching chamber systems is determined by the characteristics of the soil, available slope, space, soil depth over the groundwater table, and other site-specific factors. The overall performance of leaching chambers is highly dependent on the performance of the connected septic tanks.

OPERATION AND MAINTENANCE

Septic tank/leaching chamber systems can operate independently and require little day-to-day maintenance. Proper maintenance of the septic tank includes inspection to determine the rate of sludge and scum accumulation in the tank every three to five years. Under normal conditions, the septic tank should be pumped every five to eight years.

Materials that do not readily decompose (grease and cooking oil, coffee grounds, disposable diapers, tampons, cigarette butts, condoms, plastics, etc.) should not be flushed into septic tanks because they may clog the tank inlet and/or outlet and cause the leaching chambers to fail. Harmful chemicals, such as pesticides, herbicides, gasoline, oil, paint and paint thinners should not be discharged to sanitary drains because they may harm soil microorganisms in the drainfield which provide natural wastewater treatment. Excessive use of chlorine-based cleaners can harm the normal operation of leaching chambers because they may cause soil dispersion and sealing, reducing soil treatment capabilities.

COSTS

Leaching chamber costs depend on many factors, including:

1. Soil type.

2. Cost of land.

3. Site topography.

4. Groundwater level.

These site and system specific factors must be examined and incorporated when preparing a leaching chamber cost estimate.

Construction Costs

Even with favorable soil conditions, a leaching chamber system is more expensive then a conventional gravel-pipe drainfield. The cost of a standardized, 2.13 meter (seven foot) leaching chamber segment ranges from $50 to $150. While drainage pipe is less expensive per foot, a larger drainfield footprint is needed for conventional gravel drainfields. The cost for a single-family septic tank leaching chamber drainfield typically ranges between $2,000 and $5,000 in 1993 dollars. If the site is inadequate for a new drainfield and the field must be removed and replaced with a new one, the cost of a new leaching chamber system may exceed $10,000.

Operation and Maintenance Costs

Operation and maintenance costs for these systems are minimal. Key costs associated with the proper functioning of the drainfield systems include septic tank cleaning, which typically ranges between $500 to $1,500 per cleaning.

REFERENCES

Other Related Fact Sheets

Septic System Tank
EPA 832-F-00-040
September 2000

Septage Treatment/Disposal
EPA 832-F-99-068
September 1999

Septic Tank-Soil Absorption Systems
EPA 832-F-99-075
September 1999

Other EPA Fact Sheets can be found at the following web address:
http://www.epa.gov/owmitnet/mtbfact.htm

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