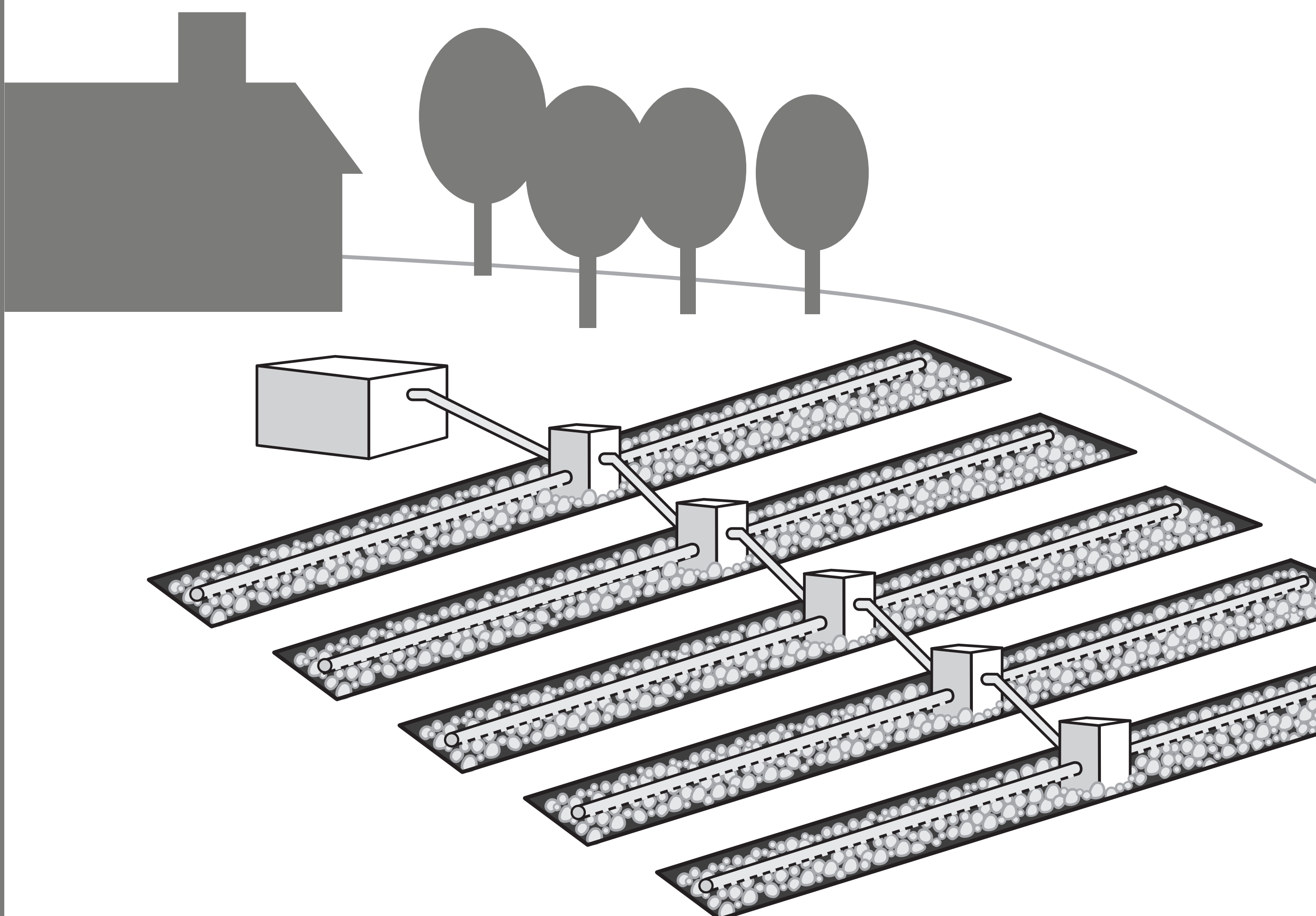
OHIO STATE UNIVERSITY EXTENSION

Bulletin 939

Septic Tank–Soil Treatment Systems

for Ohio Rural Homes



THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

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Septic Tank – Soil Treatment Systems For Ohio Rural Homes

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Protecting public health and water quality is the goal of an onsite wastewater treatment system. Many treatment technologies are available to meet this goal. The selection of an appropriate technology is dictated by the site and soil conditions

Natural soil is an ideal medium for treating wastewater. Pathogens, nutrients and organic matter all degrade water quality, but natural processes that occur in unsaturated soil remove or recycle these pollutants. Complete treatment of wastewater requires deep, permeable and unsaturated soil. Current Ohio regulations (OAC 3701-29) set minimum soil depth for onsite wastewater treatment.

This bulletin describes the design and maintenance of septic tank – soil treatment systems for individual homes. Permits for wastewater treatment systems serving 1, 2 or 3-family dwellings are issued by the local health department. Some health departments also issue permits for other systems that discharge up to 1000 gallons of wastewater per day.

Current Ohio regulations (OAC 3701-29) do permit septic tank – leach field systems to be installed on sites with very shallow soils to a limiting condition. It is important to note that while legally permitted in Ohio, systems constructed on shallow soils may provide some organic matter and bacteria removal, but they do not remove other pathogens, like viruses, and nutrients from wastewater.

For information on the soil's ability to treat wastewater and Ohio's soil depths check OSU Extension Bulletin "Suitability of Ohio Soils for Treating Wastewater" Bulletin 896. This bulletin is useful in planning for the use of onsite wastewater treatment systems. This and other publications on onsite wastewater treatment can be obtained through local OSU Extension offices or found at **http://setll.osu.edu**.

Where should a soil treatment system be used in Ohio?

Wastewater is treated as pollutants are removed when percolating through to a soil that is deep, permeable and unsaturated. A minimum soil depth from the trench bottom to a limiting layer is needed to ensure that the pollutants are removed. Some conditions in the soil, such as seasonal high water tables, dense, compacted layers, bedrock, sand and gravel limit treatment by preventing wastewater percolation or allow for it to move too quickly for adequate treatment. The distance from the trench bottom of a soil treatment system and the limiting condition is called the vertical separation distance (VSD) as shown in Figure 1. The minimum vertical separation distance between the trench bottom and a limiting condition is presented in Table 1 for different limiting conditions.

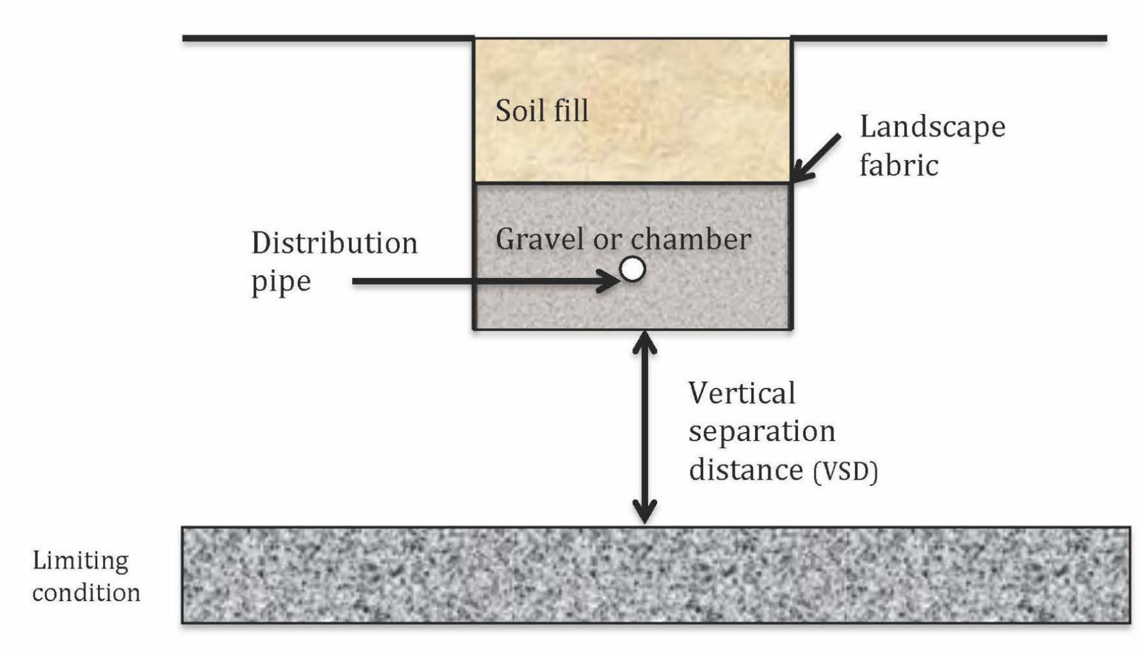

Figure 1. Cross-section of a septic tank – soil treatment system in relation to the limiting condition.

Table 1. Depth vertical separation distances (VSD) for septic tank – soil treatment systems.

Limiting Condition	Vertical Separation Distance (inches)
Fractured/Karst Bedrock	36
Ground water or aquifer	36
Seasonal water in highly weathered soils on the low lime till plains	24
Other limiting conditions	18
Perched seasonal water	12

* Note: VSD as shallow as 8 inches is permitted under the Ohio Household Sewage Treatment rules. However, OSU research shows pathogen removal requires at least 12 inches of unsaturated soil. Application of wastewater that has not been disinfected to very shallow soil is not recommended.

A soil treatment system must be positioned in the landscape along the land contour. Horizontal separation distance of 50 feet from drinking wells and of 10 feet from property lines are required for the treatment system. Soil treatment systems that are long and narrow ensure that water can infiltrate and move away from the site without backing up or ponding.

How do soil treatment systems work?

Soil treatment systems, described in this bulletin, accept septic tank effluent. In the septic tank solids settle out and are retained to minimize soil clogging. Research has shown that two tanks in series or one tank with two compartments retain a higher percentage of solids than a similarly sized single chambered tank. Septic tank effluent filters are required and enhances solids removal by the septic tank (Figure 2). Table 2 presents required septic tank size.

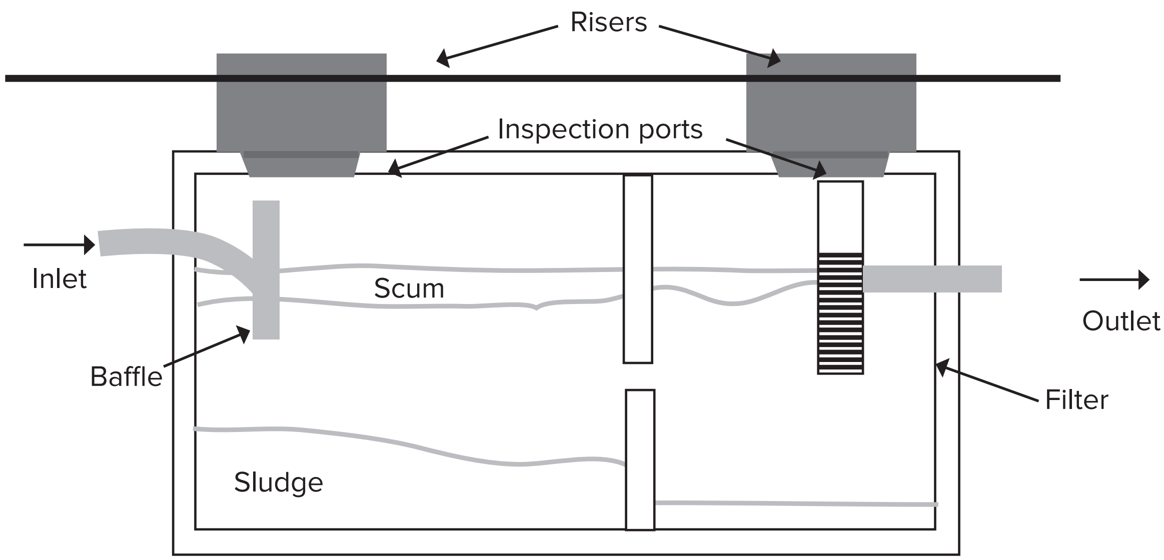

Figure 2. Septic tank cross section (not to scale).

The solids that accumulate in a septic tank must be pumped out to prevent them from flowing out and clogging the soil. Estimated septic tank pumping frequency based on tank and family size is presented in Table 3.

Septic tank effluent is distributed beneath the soil surface through a series of trenches. Soil treatment systems rely on gravity to distribute the wastewater. Wastewater quickly flows out of the pipes through a layer of gravel or a chamber to the bottom of the trench beneath the ground surface. The bottom of the trench actually distributes the wastewater, so the trench bottom must be level.

Table 2. Septic tank size. Tanks should have 2 chambers or use 2 tanks in series to achieve the required volume.

Number of Bedrooms	Gallons
1	1000
2	1000
3	1500
4	2000
5	2000
6 or more	2500 plus 250 gallons for each additional bedroom

Table 3. Estimated septic tank pumping frequency in years.

Tank Size (Gal)	Household Size (Number of People) 1	2	3	4	5	6	7	8	9	10
500	5.8	2.6	1.5	1.0	0.7	0.4	0.3	0.2	0.1	-
750	9.1	4.2	2.6	1.8	1.3	1.0	0.7	0.6	0.4	0.3
1000	12.4	5.9	3.7	2.6	2.0	1.5	1.2	1.0	0.8	0.7
1250	15.6	7.5	4.8	3.4	2.6	2.0	1.7	1.4	1.2	1.0
1500	18.9	9.1	5.9	4.2	3.3	2.6	2.1	1.8	1.5	1.3
1750	22.1	10.7	6.9	5.0	3.9	3.1	2.6	2.2	1.9	1.6
2000	25.4	12.4	8.0	5.9	4.5	3.7	3.1	2.6	2.2	2.0

Note: More frequent pumping needed if garbage disposal is used.

Since all of the wastewater is applied where the perforated pipe first enters a trench, a small area of the trench is used to accept and treat the wastewater. Eventually, the small area is overloaded and the soil clogs with solid particles and biological growth, sometimes called a biomat. The wastewater must then move along the trench to infiltrate. Over the years, wastewater continues to "creep" down the trench as illustrated in Figure 2.

Once a clogging layer covers the entire bottom of the trench, the entire trench will be utilized. A simple inspection port at the end of each trench enables an inspector to check for ponding. Without management, the wastewater will continue to pond in the trench and may begin to surface in the yard or back up in the house. A series of green stripes in a yard above the trenches is a sign that wastewater is ponding and action should be taken before the system completely fails.

Research conducted at Penn State University (1981) shows that by simply resting a clogged trench, the infiltration capacity can be restored in about 1 year. All soil treatment systems should be designed and installed with 3 features for maintenance.

1. Inspection ports at the end of each trench to check for ponding.
2. A device to divert wastewater away from a clogged trench to allow it to rest for at least 1 year.
3. Extra trenches to accept wastewater for at least 1 year while the clogged trenches are being restored.

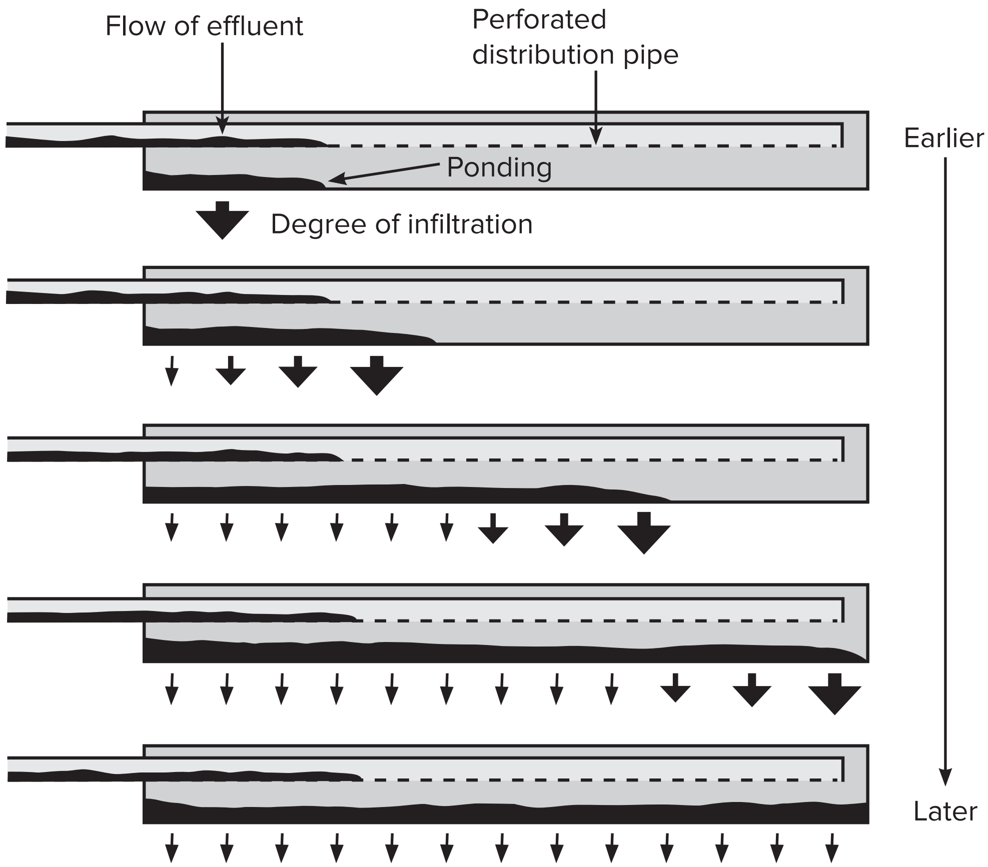

Figure 2. Progression of clogging along bottom in trench system. (After: Two Remedies for Failing Septic Systems. Penn State Extension Special Circular SC302.)

How are soil treatment systems designed?

Since the soil is treating the wastewater, designing a system relies on detailed information from a site and soil evaluation. Details on how evaluations are conducted are presented in Bulletin 905 Soil and Site Evaluation for Onsite Wastewater Treatment.

The following pages describe the design process and show an example for a 3-bedroom home.

Step 1. Evaluate site location for a soil treatment system.

A soil treatment system is proposed for a 3-bedroom residence. On a site with deep, permeable soil, locate the contour of the lot in the system area. Mark the horizontal separation distances to property lines, structures, wells and other important landscape features as shown in Figure 3. Also identify a replacement area to accommodate a new system in the future. The replacement area is subject to the same setback requirements.

Stake out and outline, with paint, the trench locations so that they run parallel to the contour. The trenches should be far enough apart to operate excavation equipment between the trenches. Six feet is a typical separation distance. The regulations require at least 4 feet from trench wall to an adjacent trench wall. Note that the distance between the trenches may vary as they are sited along the contour.

A summary of the soil and site information is given below. Confirm the soil and site description prior to designing a leaching trench system for the site.

1. Soil Profile

A 0-14 inches:	very dark brown (10YR 2/2) silt loam; moderate, fine granular structure; friable when moist, slightly acid.
B 14-66 inches	very dark grayish brown (10YR 3/2) silt loam; moderate, medium, subangular blocky structure, firm when moist; many coatings of organic matter on ped faces; slightly acid.
C 66 inches	brown (10 YR 5/3) gravel and sand; loose; calcareous.

2. Site slope is 0 – 4%
3. The area available is 160 feet along the contour and 50 feet along the slope. Three medium sized trees are in the proposed absorption area.
4. Depth to limiting condition is 66 inches due to sand and gravel layer.

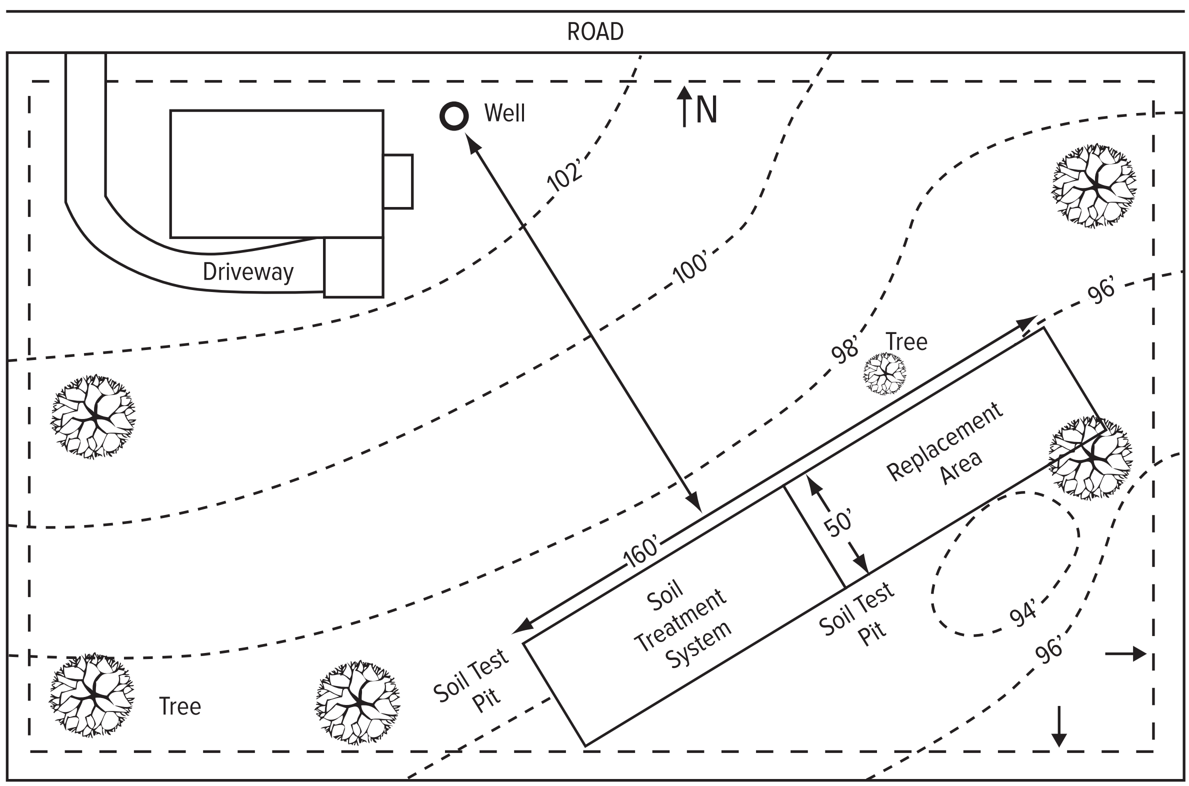

Figure 3. Draft of layout plan with site of proposed soil treatment system.

Step 2. Determine Design Wastewater Volume.

In Ohio, the daily wastewater design volume for single-family residences is 120 gallons/bedroom/day. Design volumes need to be adjusted for homes with extra water using fixtures or high water-consuming lifestyles.

Design wastewater volume:

For a 3-bedroom residence, design wastewater volume is
120 gallons/bedroom/day x 3 bedrooms = 360 gallons/day

Step 3. Select Linear Loading Rate.

Selection of the linear loading rate is a very important step in designing any soil treatment system. The linear loading rate estimates the contribution of water from the trenches to the landscape hydrology. In other words, the linear loading rate estimates how water will move from the trenches down-slope as it disperses into the soil profile. The nature of the limiting condition impacts how the water moves through the landscape and is identified as a part of the soil and site evaluation conducted by a qualified professional.

The linear loading rate is the volume of water the landscape can safely accept each day for each foot of trench length along the contour. It is presented as gallons per day per linear foot (gpd/lf). For positioning a trench in the landscape with a vertical separation distance of only 12 to 24 inches beneath the trench, use Table 4, to select the linear loading rate for the lot slope.

For sites where the limiting condition is fractured rock or sand and gravel, at least 36 inches vertical separation distance is required. Use Table 5 to select the linear loading rate for the lot slope.

For sites with deep soil over semi-permeable layers like, compacted, fractured till, use Table 6 to find the linear loading rate for the lot slope when the vertical separation distance is at least 24 inches.

For all other deep soils over seasonal water tables, solid rock or an impermeable soil layer use Table 7 to find the linear loading rate for the lot slope when the vertical separation distance is at least 24 inches.

Use the most limiting soil layer within six inches of the trench bottom.

Linear Loading Rate:

The soil evaluation revealed a limiting condition as a sand and gravel layer with a lot slope of 0-4% slope. The soil at the trench bottom is 18 inches beneath the surface putting it in the B horizon with silt loam; moderate, medium (grade 2), subangular blocky structure, firm. The corresponding linear loading rate from Table 5 is 6.3 gpd/lf.

Table 4. For 12-24 inches of infiltration distance to a limiting condition use the hydraulic linear loading rates to match the most restrictive soil in the profile for the given landscape slope.

SOIL CHARACTERISTICS			HYDRAULIC LINEAR LOADING RATE (GPD/FT)		
Texture	Structure		Infiltrative Distance (12–24 inches)		
	Shape	Grade*	Slope 0%–4%	Slope 5%–9%	Slope >10%
Coarse Sand, Sand, Loam Coarse Sand, Loam Sand (COS, S, LCOS, LS)	--	0SG	5.0	6.0	7.0
Fine Sand, Very Find Sand, Loam Find Sand, Loam Very Find Sand (FS, VFS, LFS, LVFS)	--	0SG	4.5	5.0	6.0
Clay Sandy Loam, Sandy Loam (CSL,SL)	--	0M	3.5	4.1	6.0
	Platy (PL)	1	3.5	4.1	5.0
		2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	4.5	5.0	6.0
		2,3	4.5	5.0	6.0
Fine Sandy Loam, Very Fine Sandy Loam (FSL, VFSL)	--	0M	2.3	2.7	3.2
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	3.5	3.8	4.1
		2,3	3.8	4.1	4.4
Loam (L)	--	0M	2.3	2.7	3.2
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	3.5	3.8	4.1
		2,3	3.8	4.1	4.4
Silt Loam (SIL)	--	0M	2.5	2.7	2.9
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	2.7	3.0	3.5
		2,3	3.0	3.5	3.8
Sandy Clay Loam, Clay Loam, Silty Clay Loam (SCL, CL, SICL)	--	0M			
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	2.5	2.7	2.9
		2,3	2.9	3.0	3.5
Sandy Clay, Clay, Silty Clay (SC, C, SIC)	--	0M			
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1			
		2,3	2.5	2.7	2.9

* Grade: 0 is structureless; 1 is weak; 2 is moderate; 3 is strong

Table 5. For fractured bedrock and sand and gravel layers* as a limiting condition greater than 24 inches beneath the infiltrative surface use the hydraulic linear loading rates to match the most restrictive soil in the profile at the landscape slope. The table was adjusted in accordance with OAC 3701-29-15(N)(2)(e)(ii).

SOIL CHARACTERISTICS			HYDRAULIC LINEAR LOADING RATE (GPD/FT)		
Texture	Structure		Infiltrative Distance (24–48 inches)		
	Shape	Grade**	Slope 0%–4%	Slope 5%–9%	Slope >10%
Coarse Sand, Sand, Loam Coarse Sand, Loam Sand (COS, S, LCOS, LS)	--	0SG	9.0	10.0	11.0
Fine Sand, Very Find Sand, Loam Find Sand, Loam Very Find Sand (FS, VFS, LFS, LVFS)	--	0SG	8.5	9.0	10.0
Clay Sandy Loam, Sandy Loam (CSL,SL)	--	0M	7.0	7.6	10.0
	Platy (PL)	1	7.0	7.6	9.0
		2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	8.5	9.0	10.0
		2,3	8.5	9.0	10.0
Fine Sandy Loam, Very Fine Sandy Loam (FSL, VFSL)	--	0M	5.6	6.0	6.7
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	7.0	7.3	7.6
		2,3	7.3	7.6	7.9
Loam (L)	--	0M	5.6	6.0	6.7
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	7.0	7.3	7.6
		2,3	7.3	7.6	7.9
Silt Loam (SIL)	--	0M	6.0	6.2	6.4
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	6.0	6.3	7.0
		2,3	6.3	7.0	7.3
Sandy Clay Loam, Clay Loam, Silty Clay Loam (SCL, CL, SICL)	--	0M			
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	6.0	6.2	6.4
		2,3	6.4	6.3	7.0
Sandy Clay, Clay, Silty Clay (SC, C, SIC)	--	0M			
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1			
		2,3	6.0	6.2	6.4

* Highly permeable material does not count as a part of the vertical separation distance.
** Grade: 0 is structureless; 1 is weak; 2 is moderate; 3 is strong

Table 6. For semi-permeable soil layers and fractured compacted till as a limiting conditions, greater than 24 inches beneath the infiltrative surface use the hydraulic linear loading rates to match the most restrictive soil in the profile at the landscape slope. The table was adjusted in accordance with OAC 3701-29-15(N)(2)(e)(i).

SOIL CHARACTERISTICS			HYDRAULIC LINEAR LOADING RATE (GPD/FT)		
Texture	Structure		Infiltrative Distance (>24inches)		
	Shape	Grade*	Slope 0%–4%	Slope 5%–9%	Slope >10%
Coarse Sand, Sand, Loam Coarse Sand, Loam Sand (COS, S, LCOS, LS)	--	0SG	8.0	9.0	10.0
Fine Sand, Very Find Sand, Loam Find Sand, Loam Very Find Sand (FS, VFS, LFS, LVFS)	--	0SG	7.5	8.0	9.0
Clay Sandy Loam, Sandy Loam (CSL,SL)	--	0M	6.0	6.6	9.0
	Platy (PL)	1	6.0	6.6	8.0
		2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	7.5	8.0	9.0
		2,3	7.5	8.0	9.0
Fine Sandy Loam, Very Fine Sandy Loam (FSL, VFSL)	--	0M	4.6	5.0	5.7
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	6.0	6.3	6.6
		2,3	6.3	6.6	6.9
Loam (L)	--	0M	4.6	5.0	5.7
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	6.0	6.3	6.6
		2,3	6.3	6.6	6.9
Silt Loam (SIL)	--	0M	5.0	5.2	5.4
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	5.0	5.3	6.0
		2,3	5.3	6.0	6.3
Sandy Clay Loam, Clay Loam, Silty Clay Loam (SCL, CL, SICL)	--	0M			
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	5.0	5.2	5.4
		2,3	5.4	5.3	6.0
Sandy Clay, Clay, Silty Clay (SC, C, SIC)	--	0M			
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1			
		2,3	5.0	5.2	5.4

* Grade: 0 is structureless; 1 is weak; 2 is moderate; 3 is strong

Table 7. For seasonal water table, solid rock, impermeable soil layers as limiting conditions, 24 – 48 inches beneath the infiltrative surface use the hydraulic linear loading rates to match the most restrictive soil in the profile at the landscape slope.

SOIL CHARACTERISTICS			HYDRAULIC LINEAR LOADING RATE (GPD/FT)		
Texture	Structure		Infiltrative Distance (24–48 inches)		
	Shape	Grade*	Slope 0%–4%	Slope 5%–9%	Slope >10%
Coarse Sand, Sand, Loam Coarse Sand, Loam Sand (COS, S, LCOS, LS)	--	0SG	6.0	7.0	8.0
Fine Sand, Very Find Sand, Loam Find Sand, Loam Very Find Sand (FS, VFS, LFS, LVFS)	--	0SG	5.5	6.0	7.0
Clay Sandy Loam, Sandy Loam (CSL,SL)	--	0M	4.0	4.6	7.0
	Platy (PL)	1	4.0	4.6	6.0
		2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	5.5	6.0	7.0
		2,3	5.5	6.0	7.0
Fine Sandy Loam, Very Fine Sandy Loam (FSL, VFSL)	--	0M	2.6	3.0	3.7
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	4.0	4.3	4.6
		2,3	4.3	4.6	4.9
Loam (L)	--	0M	2.6	3.0	3.7
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	4.0	4.3	4.6
		2,3	4.3	4.6	4.9
Silt Loam (SIL)	--	0M	3.0	3.2	3.4
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	3.0	3.3	4.0
		2,3	3.3	4.0	4.3
Sandy Clay Loam, Clay Loam, Silty Clay Loam (SCL, CL, SICL)	--	0M			
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1	3.0	3.2	3.4
		2,3	3.4	3.3	4.0
Sandy Clay, Clay, Silty Clay (SC, C, SIC)	--	0M			
	Platy (PL)	1,2,3			
	Prismatic/Blocky/Granular (PR/BK/GR)	1			
		2,3	3.0	3.2	3.4

* Grade: 0 is structureless; 1 is weak; 2 is moderate; 3 is strong

Step 4. Select the Soil Infiltration Area Loading Rate.

The wastewater moves down through the soil from the trench bottom by gravity. Therefore the soil infiltration area is the total area of the trench bottoms (trench length x trench width x number of trenches). The rate at which the daily application of wastewater safely infiltrates into the soil at the trench base is the soil infiltration area loading rate. It is estimated from the characteristics of the soil at the soil depth where the trench bottom will be located and is presented as gallons per day per square foot (gpd/ft^2).

Use the most limiting soil layer within six inches of the trench bottom.

Since the most permeable and well-aerated soil is near the surface, trenches should be as shallow as possible. Trench bottoms should be positioned at an 18-inch depth but can be as shallow as 2 inches into natural soil. They should never be deeper than 3 feet. Use Table 8 to select the soil infiltration loading rate.

Soil infiltration loading rate

The trenches for this proposed system will be 18 inches deep. The soil at that depth is silt loam texture; moderate (grade 2) subangular blocky structure; firm consistence. From Table 8 the soil infiltration area loading rate is 0.6 gpd/ft^2.

Table 8. Soil Infiltration loading rate

SOIL CHARACTERISTICS			SOIL INFILTRATION LOADING RATE (GPD/FT^2)
Texture	Structure		$CBOD_5$
	Shape	Grade*	>25mg/L (septic tank effluent)
Coarse Sand, Sand, Loam Coarse Sand, Loam Sand (COS, S, LCOS, LS)	--	0SG	0.8
Fine Sand, Very Find Sand, Loam Find Sand, Loam Very Find Sand (FS, VFS, LFS, LVFS)	--	0SG	0.4
Clay Sandy Loam, Sandy Loam (CSL,SL)	--	0M	0.2
	Platy (PL)	1	0.2
		2,3	0
	Prismatic/Blocky/Granular (PR/BK/GR)	1	0.4
		2,3	0.6
Fine Sandy Loam, Very Fine Sandy Loam (FSL, VFSL)	--	0M	0.2
	Platy (PL)	1,2,3	0
	Prismatic/Blocky/Granular (PR/BK/GR)	1	0.2
		2,3	0.4
Loam (L)	--	0M	0.2
	Platy (PL)	1,2,3	0
	Prismatic/Blocky/Granular (PR/BK/GR)	1	0.4
		2,3	0.6
Silt Loam (SIL)	--	0M	0
	Platy (PL)	1,2,3	0
	Prismatic/Blocky/Granular (PR/BK/GR)	1	0.4
		2,3	0.6
Sandy Clay Loam, Clay Loam, Silty Clay Loam (SCL, CL, SICL)	--	0M	0
	Platy (PL)	1,2,3	0
	Prismatic/Blocky/Granular (PR/BK/GR)	1	0.2
		2,3	0.4
Sandy Clay, Clay, Sandy Loam Clay (SC, C, SIC)	--	0M	0
	Platy (PL)	1,2,3	0
	Prismatic/Blocky/Granular (PR/BK/GR)	1	0
		2,3	0.2

* Grade: 0 is structureless; 1 is weak; 2 is moderate; 3 is strong

Step 5. Determine absorption area length.

Absorption area length = Design wastewater loading rate/Linear loading rate

Determine absorption area length.

Absorption area length = Design wastewater loading rate/Linear loading rate

Absorption area length = 360 gpd / 6.3 gpd/lf

Absorption area length = 57 feet

Step 6. Determine absorption area width

The absorption area width is the total width of the trench bases.
Absorption area width = Linear loading rate / soil infiltration area loading rate

Determine absorption area width:

Absorption area width = Linear loading rate / soil infiltration area loading rate

Absorption area width = 6.3 gpd/lf / 0.6 gpd/ft^2

Absorption area width = 10.5 feet

Step 7. Determine number of trenches.

Select a trench width that is convenient to install. Trenches on steeper slopes should be narrow to minimize the depth difference from one side of the trench to the other. A common trench width is 18 inches wide. Trenches should be 2 feet wide or less to maintain aerobic conditions.

Number of trenches = absorption area width / trench width

NOTE: This is the number of trenches needed for system operation. At least 25% as many additional trenches should be installed for system maintenance when clogging eventually occurs (Figure 4). Diversion devises redirecting the flow from each trench will also be needed. The extra trenches will receive wastewater for about 1 year, allowing the clogged trenches to rest and restore naturally. Following the rest period, wastewater is directed back into the original system.

Determine the number of trenches:

Select trench width of 1.5 feet wide, since the lot has little slope.

Number of trenches = absorption area width / trench width

Number of trenches = 10.5 feet / 1.5 feet
Number of trenches = 7 trenches

Overall system dimensions:
7 trenches, 1.5 feet wide, each at least 57 feet long.
Trenches are parallel to the contour and are 6 feet apart to allow for the easy movement of equipment during system construction.

Two to four additional trenches will be installed to allow for absorption area resting.

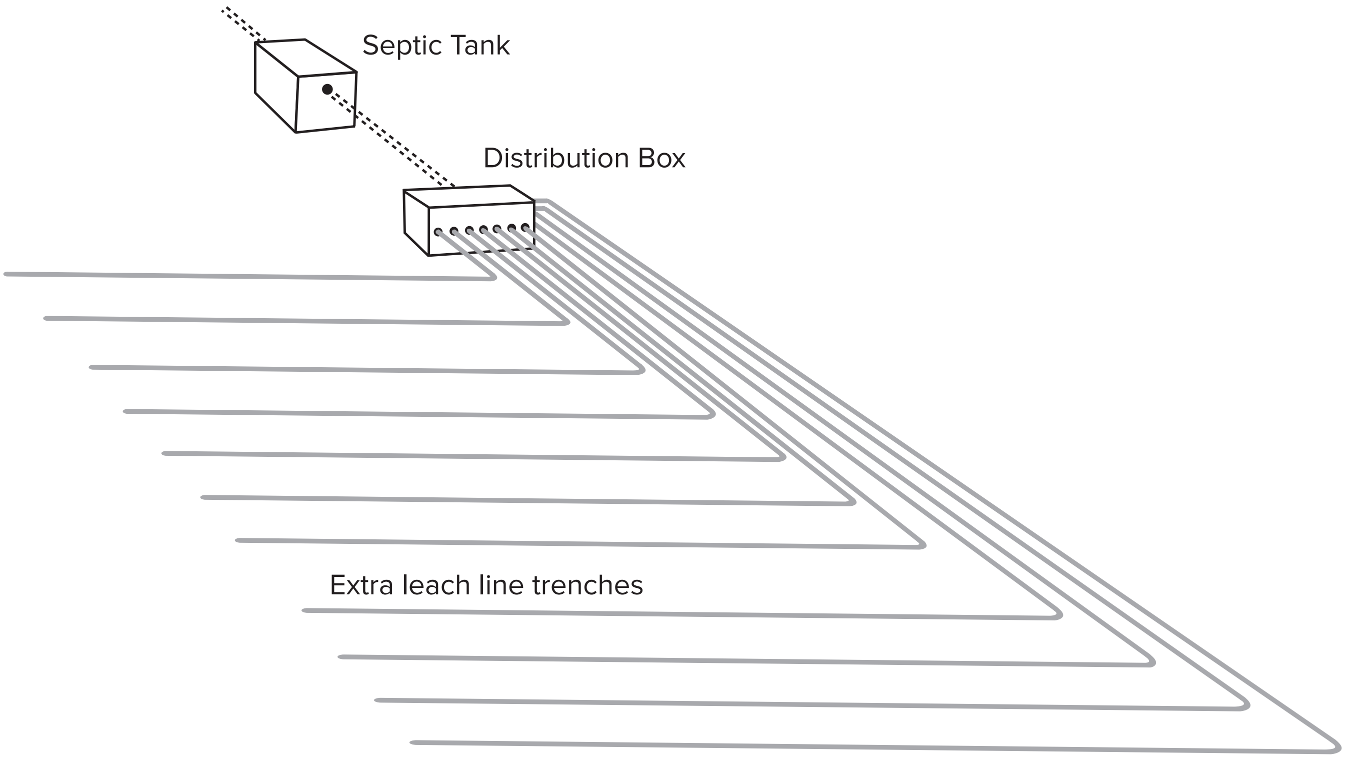

Figure 4. Soil treatment system layout with extra trenches for absorption area resting.

Check placement of trench system on lot

Note: since the area available for the system is 160 feet long along the contour the trenches can be longer, still leaving space for a replacement area.

An alternative design is with trenches 75 feet long and 2 feet wide. The longer trenches, in effect, lowers the design linear loading rate.

Design linear loading rate = wastewater design loading rate/system length
Design linear loading rate = 360 gpd/75 ft. = 4.8 gpd/ft

Absorption area width = Linear loading rate / soil absorption area loading rate
Absorption area width = 4.8 gpd/lf / 0.6 gpd/ft2 = 8 feet

Number of trenches = absorption area width / trench width

Number of trenches = 8 feet / 2 feet = 4 trenches
Remember 1 to 2 additional trenches will be needed with a diversion devise to allow for absorption area resting as shown in Figure 5.

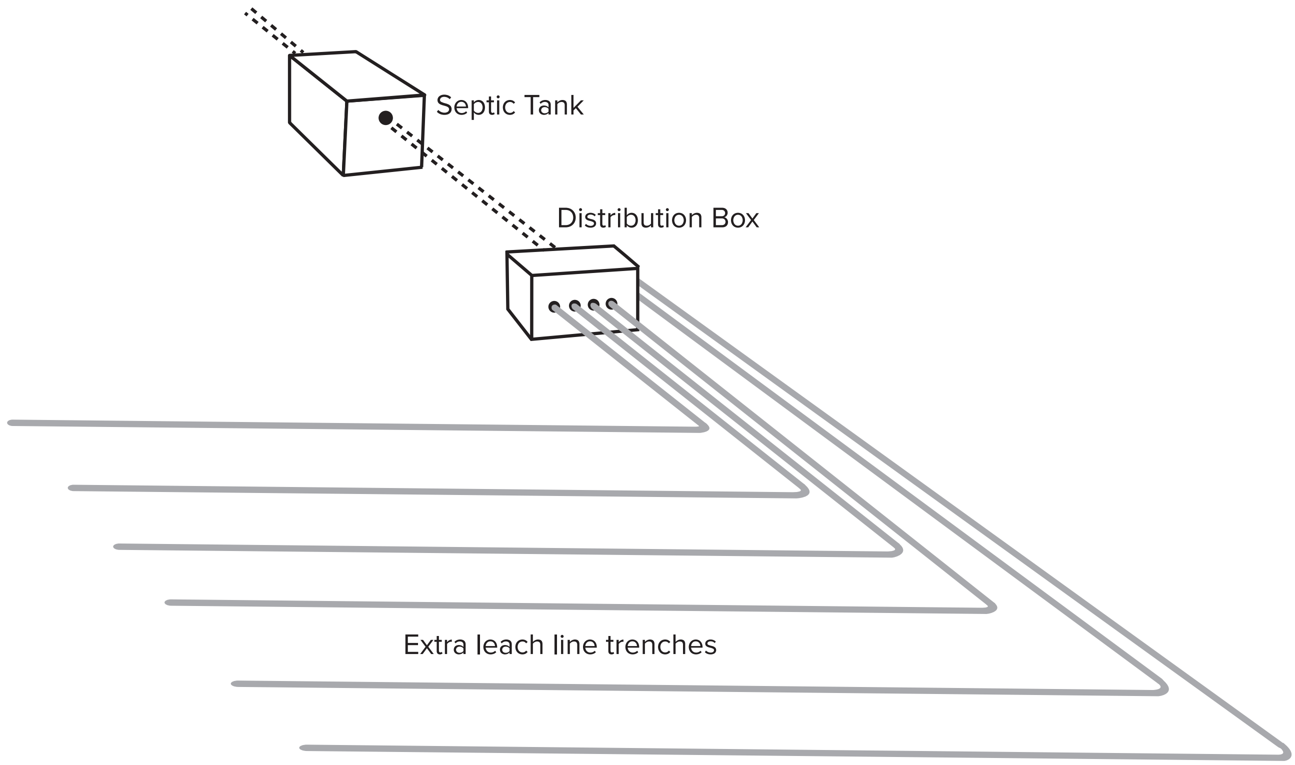

Figure 5. Layout of soil treatment system with longer lines and lower linear loading rate.

What about using drop boxes in soil treatment systems?

Another method of construction is to use drop boxes in every trench of a soil treatment system. Drop box systems use less pipe, since one pipe does not have to be installed and connected to the distribution box for each trench (Figures 7 and 8). This type of system is called sequential distribution. In this system style, the first trench is completely ponded before water overflows and flows down into the second drop box.

The drop box also acts as both an inspection port and a diversion valve (Figure 9). If ponding occurs in a trench, water will pond in the drop box. The outlets to the ponded trench can be capped off for one year to allow for resting and recovery.

Figure 7. Example of a drop box. Inlet (high) and outlet (low) are shown. Side is cut out at the appropriate elevation for the distribution pipe into trench.

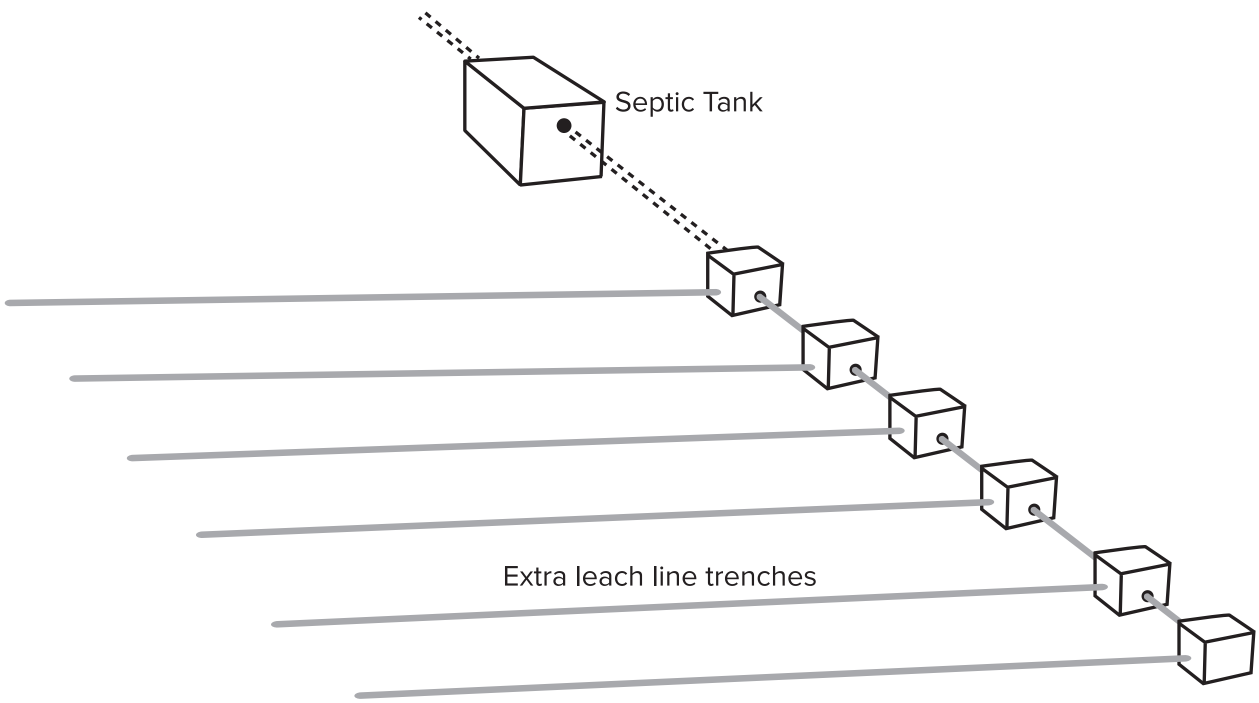

Figure 8. Layout of a sequential distribution system using drop boxes.

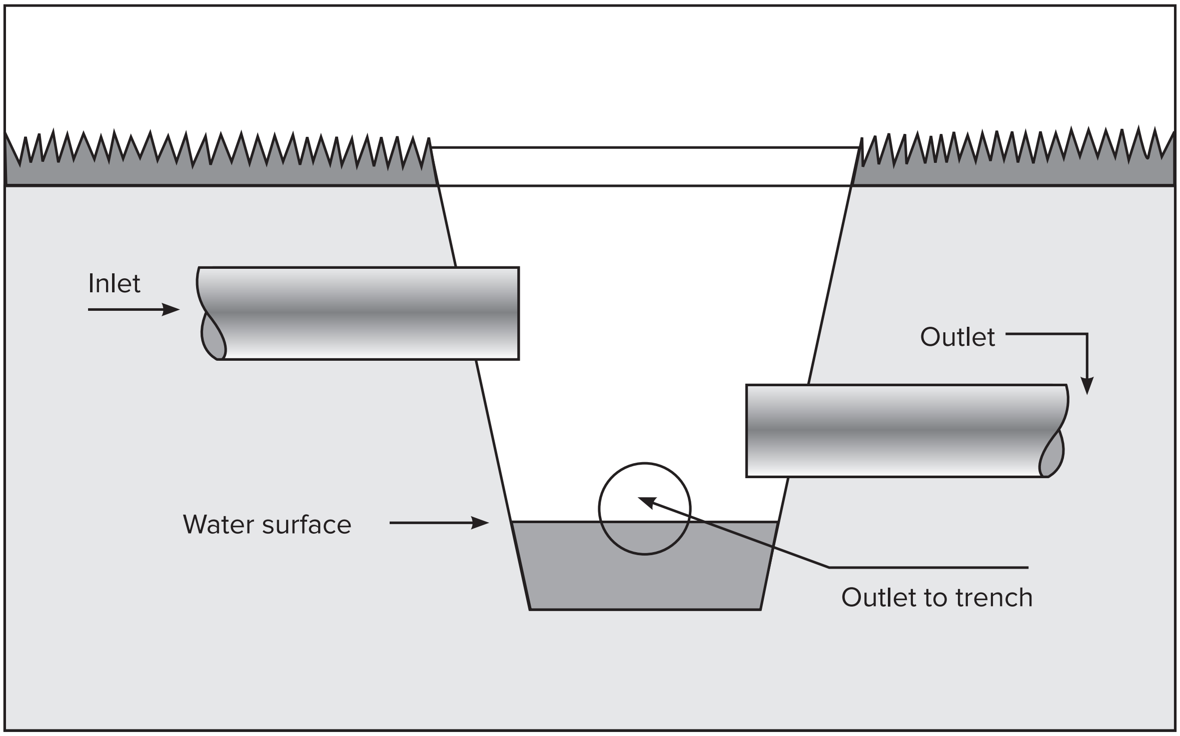

Figure 9. Example of a drop box. Inlet (high) and outlet (low) are shown. A hole is cut in the side at the appropriate elevation for the distribution pipe into trench. This illustrates ponding in the trench.

How should a soil treatment system be maintained?

Annual inspection and regular maintenance is all that is required for a septic tank – soil treatment system. The steps for regular maintenance include:

1. Check for landscape changes on the lot that could impact the soil treatment system. Make sure:
    a. No soil compaction has occurred in the area of or just down slope of the treatment system. Do not site structures, pave or park vehicles in the area.
    b. Excess water is diverted away from the soil treatment area. Watch for downspouts, roofing or paving that direct runoff onto the area of the treatment system. Never connect sump pumps, foundation or downspout drains to any septic system.

2. Locate inspection ports at end of each trench, uncover if necessary and cut away grass.
3. Open port at end of each line and check for ponding.
    a. First 10 years: Ponding is not expected in the first few years of operation. If ponding is present at the end of trenches – start checking water use amounts and patterns. The system may be receiving greater than design flows. Either institute water conservation or expand the system to match actual water use.
    b. After a decade or more of use, ponding is likely to occur in some or all of the trenches. Divert wastewater away from ponded trenches to reserve trenches for at least 1 year to restore their infiltration capacity.
4. Open up septic tank, check condition of baffles and clean off effluent filter.
5. Pump septic tank as needed. Regular pumping of a septic tank is required to restore the retention capacity of the septic tank to ensure proper functioning. Table 2 presents estimated septic tank pumping frequency.

In summary, septic tank - soil treatment systems can be simple to design and operate. In all cases, a qualified and registered contractor is needed for installation. These installers pay careful attention to layout surveys, good job control and excavation planning, and provide as-built documentation of the installed system.

When properly sited, designed, installed and operated, septic tank-soil treatment systems provide superior wastewater treatment at a low cost and eliminate the potential for wastewater discharge to streams. Unfortunately, in Ohio few lots are found to be naturally suited for soil treatment systems, so their use will be limited. Other onsite wastewater treatment technologies are available, however, to match Ohio's diverse soil natural resource.

To find out more about onsite wastewater treatment systems check the website for the Ohio State University Soil Environment Technology Learning Lab.
http://setll.osu.edu

Other References

Slater, B. and K. Mancl. 2005. *Soil and Site Evaluation for Onsite Wastewater Treatment. Extension Bulletin 905.* The Ohio State University.

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Ohio Administrative Code, Household Sewage Rules, Chapter 3701-29. Ohio Department of Health, January 2015.

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Soil Treatment System Inspection and Maintenance Record

Owner ____________________

Address ____________________

County ____________________

Permit No.		Site Plan
Permit Issued		
Date Installed		
Date Started		
Bedrooms		
Septic Tank Volume		
Number of Laterals		
Septic Tank Pumped Dates		

Inspection Date			
Inspector Name and Phone Number			
Lateral	Ponding/ Surfacing	Operating/ Resting	Inspection/ Port Cond.
1			
2			
3			
4			
5			
6			
Comments:			

Inspection Date			
Inspector Name and Phone Number			
Lateral	Ponding/ Surfacing	Operating/ Resting	Inspection/ Port Cond.
1			
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4			
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Comments:			

Inspection Date			
Inspector Name and Phone Number			
Lateral	Ponding/ Surfacing	Operating/ Resting	Inspection/ Port Cond.
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Comments:			

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