

Alternative Technologies for On-Lot Septic Systems

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On-Lot Septic Systems

- Regulations established in PA Code under the Clean Streams Law

PENNSYLVANIA SEWAGE FACILITIES ACT

Cl. 35 Act of Jan. 24, (1966) 1965, P.L. 1535, No. 537

AN ACT

Providing for the planning and regulation of community sewage systems and individual sewage systems; requiring municipalities to submit plans for systems in their jurisdiction; authorizing grants; requiring permits for persons installing such systems; requiring disclosure statements in certain land sale contracts; authorizing the Department of Environmental Resources to adopt and administer rules, regulations, standards and procedures; creating an advisory committee; providing remedies and prescribing penalties.

(Title amended Dec. 2, 1976, P.L. 1264, No. 280)

Chapter 73- Septic System Testing & Design

- Chapter 73 applies to sewage enforcement officers administering the act, as well as to persons installing onlot sewage systems

<https://www.pacodeandbulletin.gov/Display/pacode?file=/secure/pacode/data/025/chapter73/chap73toc.html>

- Establishes the grounds for approval of sites (i.e. types of septic systems)
- Dictates limitations (both in soils and location on lots)

Site Limitations

- The slope of the proposed absorption area is less than 25%.
- The area is identified outside completed Federal Flood Insurance mapping as a floodway. Where there is no flood mapping, a floodway extends 50 feet from the top of the stream bank as determined by the local agency.
- No rock outcrops exist within the proposed absorption area.
- In areas underlain by limestone, no depressions left by earlier sinkholes within the proposed absorption area or spray field.
- Absorption areas (drain fields) may not be placed in or on fill unless the fill has remained in place for a minimum of 4 years & shall be composed of clean mineral soil and passes testing established in § 73.14.
- Absorption areas shall be sited only in or on undisturbed soils.

Separation Distances

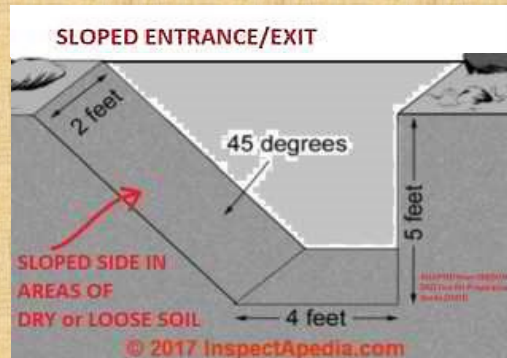
The following minimum horizontal distances shall be maintained between the features named and the perimeter of the absorption area:

- An individual water supply or water supply system suction line 100 feet
- Streams, water courses, lakes, ponds or other surface water - 50 feet
(wetlands are not surface water)
- A cistern used as a water supply 25 feet
- Mine subsidence areas, mine bore holes or sink holes 100 feet
- Property line, easement or right-of-way 10 feet
- Occupied buildings, swimming pools and driveways 10 feet
- Water supply line under pressure 10 feet
- Surface drainageways (swales) 10 feet
- Rock outcrop or identified shallow pinnacle 10 feet
- Natural or manmade slope greater than 25% 10 feet
- Detention basins, retention basins and stormwater seepage beds 10 feet
- Other active onlot systems 5 feet

Testing – two parts: Part 1 – Visual Evaluation of the Soil determines System TYPE

- Soil profile excavations shall be conducted within 10 feet of the proposed drain field. A description of the soil profile shall be recorded on the site investigation form.
- When the examination of the soil profile reveals a limiting zone within 20 inches of the mineral soil surface, percolation tests may not be conducted.

Excavated test pit



https://inspectapedia.com/septic/Soil_Perc_Test_Hole_Specifications.php

Limiting Zone

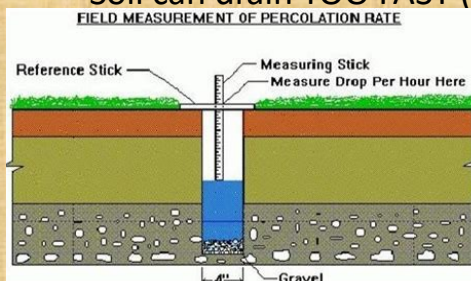
- There are **three types of limiting zone** (soil conditions from which drainfields must have separation):
 - high **watertable**, whether perched or regional;
 - **rock formation**/other stratum or as **masses of loose rock fragments** / gravel with **insufficient fine soil** to fill the voids between the fragments
 - soil condition which is so **slowly permeable** that it effectively limits downward passage of effluent.

Sometimes inspectors will use the term “seasonal high watertable” to indicate seasonal wetness/saturation which would qualify as limiting zone 3 but isn’t wet enough to qualify as a watertable according to a geologist or driller.

Testing: Part 2 – Percolation Testing

If soils are suitable ...percolation testing determines septic system **SIZE!**

- The faster the soil drains, the smaller the septic bed needs to be
- Soil can drain **TOO FAST** (most common in shaly soils)



<https://theconstructor.org/geotechnical/percolationtest-soil-absorption-capacity/8714/>

Soil Testing to Determine System Type

- If the limiting zone is less than 20" deep, there ARE alternatives:
 - Spray Irrigation (requires ½ acre of drainfield
 - Defined in Chapter 73.
 - Alternate Systems established by DEP
 - Chapter 73.76

BUT...

Limits to Alternate Systems

- No soil-based on-lot wastewater system can be installed on sites where there is a high water-table/restricted drainage limiting zone closer to the soil surface than 10 inches ...
or
- where there is a rock limiting zone closer to the soil surface than 16 inches.

On-lot Alternate Technology Listings

Last Revised: July 2022

AdvanTex Treatment System	(04/2022)	Orenco System, Inc.
Alternate Aggregates	(02/2014)	Generic
At-Grade Absorption Area	(03/2016)	Generic
Drip Distribution PERC-RITE micromound	(03/2012)	American Manufacturing Co. Inc.
Drip Distribution PERC-RITE primary effluent	(03/2012)	American Manufacturing Co. Inc.
Drip Distribution PERC-RITE secondary effluent	(02/2014)	American Manufacturing Co. Inc.
Drip Distribution (SAS primary effluent)	(03/2012)	JNM Technologies, Inc.
Drip Distribution (SAS secondary effluent)	(02/2015)	JNM Technologies, Inc.
Drip Distribution (SAS mound drip)	(03/2012)	JNM Technologies, Inc.
Ecoflo Biofilter	(07/2022)	Premier Tech Water and Environment

On-lot Alternate Technology Listings (cont.)

Last Revised: July 2022

• Ecoflo EC7 Biofilter	(07/22)	Premier Tech Water and Environment
• Eljen Geotextile Sand Filters	(06/15)	Eljen Corporation
• Floating Outlet (Flout) Siphon	(09/09)	Rissy Plastics, Inc.
• Flow Equalization	(02/14)	Generic
• Greywater	(02/14)	Generic
• Leaching Chambers	(02/14)	Infiltrator Systems, Inc.
• Modified Subsurface Sand Filter	(02/14)	Generic
• Puraflo Peat Biofilter	(02/14)	Anua
• Shallow Limiting Zone At-Grade Absorption Area	(03/16)	Generic
• Shallow Placement Pressure Dosed System	(02/14)	Generic
• Singular-Hydro-Kinetic Combo	(12/15)	Norweco, Inc.
• Soil Air Treatment & Rejuvenation System	(01/10)	Soil Air Systems/Geomatrix, LLC
• Steep Slope Elevated Sand Mound	(02/14)	Generic
• Sundrive Biovaporator	(02/14)	Sundrive, Inc.
• UV Disinfection Unit	(02/14)	Generic

Types of Alternate Sewage Systems in PA

“Generic” adjust already established parameters

Dosing reduce the volume ~ spread out the flow!

Filter Physical filtration

Aeration Biochemical alteration (change from anaerobic bacteria to Oxygen-loving bacteria)

Technology Description - PERC-RITE

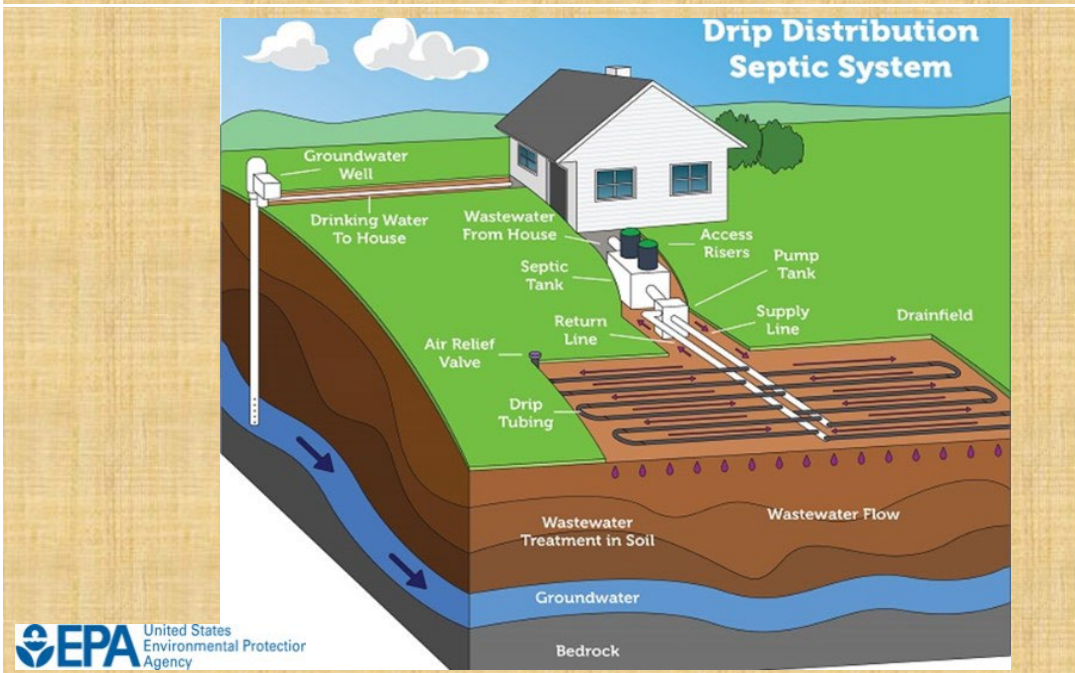
•
Drip irrigation (PERC-RITE) is the technology by which effluent at either the primary treatment level or the secondary treatment level is **distributed** to the drainfield slowly using a **network of flexible drip emitter tubing**.

- Distribution of sewage, network forward **flushing**, and for **backflushing** of filter wash solids to the pretreatment train are activated by a controller.

Drip Irrigation

- Through drip irrigation, wastewater is distributed in small doses over an infiltration field to aid in maintaining the aerobic environment in the soil for biochemical treatment of the wastewater.
- Final discharge for distributing sewage will be to a drip irrigation absorption area involving high-pressure/slow-release tubing.

Drip Tubing

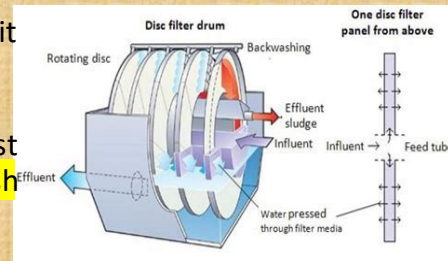


Technology Description - PERC-RITE

- The drip irrigation system shall accurately **calculate flows**, pump cycle counter, pump elapsed time, counts of automated flushing events and alarm events. This requirement is to be accomplished by having **a flow meter and a control unit** that performs these functions.
- A **programmable timer control panel** shall be employed to regulate dosing frequency, volume, and other pertinent information. The control panel is to provide manual capability to operationally **verify** filter flushing, dosing, and flushing.

Technology Description - PERC-RITE

- Final filtration must be provided by a hydraulic unit fitted with **disk filters** to remove suspended solids
- The hydraulic headworks and control system must include a mechanism to automatically **backflush** the filters independently before each dose.
- The filters are to be **backwashed** at the manufacturer specified minimum requirements.
- The hydraulic unit must be protected from freezing temperatures in accordance with the manufacturer's specifications.



Technology Description - PERC-RITE micromound

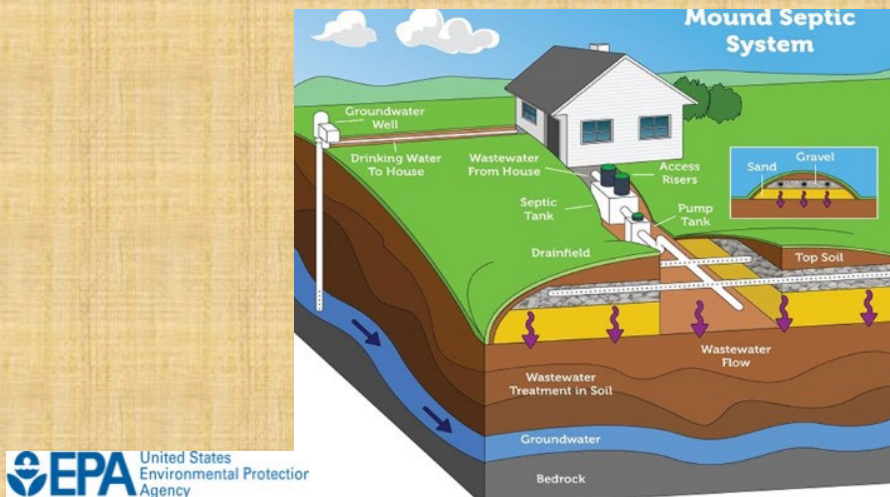
- The minimum **soils drainage class** morphology must be at least somewhat poorly drained as **determined by a soil scientist** who is a professional member of the Pennsylvania Association of Professional Soil Scientists (PAPSS) or is a **qualified soil scientist** as defined in Section 73.1.
- A minimum of **four** soil profile test pits shall be evaluated to verify the morphology of the proposed absorption site. In cases where the calculated area length exceeds 100 feet, additional soil profile evaluations are required to verify the soil morphology.

Technology Description - PERC-RITE micromound

- Treatment and distribution configuration is based on the basal loading rate and the horizontal linear loading rate derived from the soil morphological analysis and the Hydraulic Linear Loading Rate (HLLR) described by Tyler.
- The drip & drip micromounds must follow the contour of the land.

Drip Micromound similar to Sand Mound

...except longer, lower in height, and skinnier



DEP Alternate Classification Listing

American PERC-RITE micromound

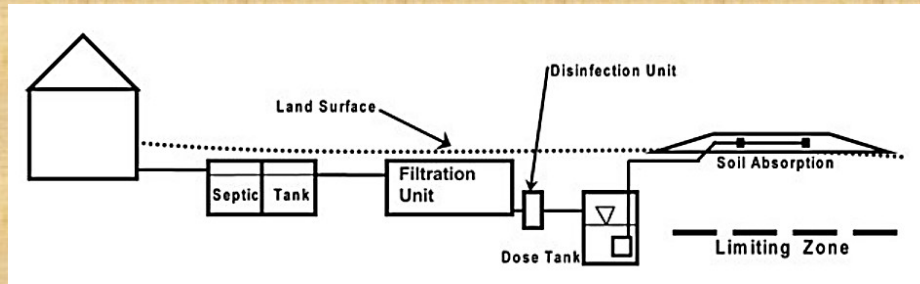
Classification Date: March 1, 2012

Most soil in PA

Classification Date: 1/1/2014				Classification Date: 1/1/2014	
USDA Texture Group	Texture	Basal Loading (gal/ ft ² /day) ^a	Limitation Depth (inches) ^b	Horizontal Linear Load in gal/linear ft./day (g/lf/d) ^c SLOPES	
I Sands	Sand, Loamy Sand	≤ .6	≥ 10" to seasonal high water table ≥ 16" to rock	≤ 5 g/lf/d Slope ≤ 15%	
II Coarse Loams	IIa Sandy Loam IIb Loam				
III Fine Loams	IIIa Sandy Clay Loam, Silt Loam IIIb Clay Loam, Silty Clay Loam	≤ .4		≤ 4 g/lf/d Slope ≤ 15%	
	IVa Sandy Clay, Silty Clay, Clay				≤ .2
IV Clays	IVb	Special Considerations ^d		≤ 2 - 3 g/lf/d Slope ≤ 15% Slope > 5%	

Shallow Limiting Zone At-Grade

- The at-grade system was developed and can be designed for sites with restrictive soil conditions, especially limiting zones at less than 48 inches. Thus, the at-grade systems may serve as an alternative to placing an elevated sand mound on some sites.



<https://extension.psu.edu/atgrade-and-shallow-at-grade-on-lot-systems>

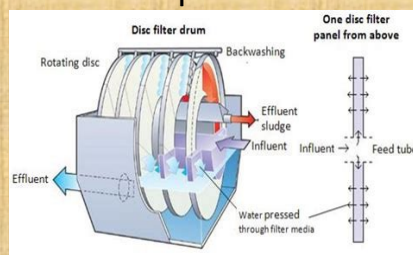
Shallow Limiting Zone At-Grade

- The wastewater flowing from the home first enters a **two-chamber septic tank**. Septic tanks allow the heavier solids to settle to the bottom of the tank and the lighter scum to float to the surface. A baffle keeps the scum in the tank to be digested by bacteria.
- The liquid is discharged to an **aerobic treatment** tank where a stream of air (oxygen) is forced through the wastewater encouraging the biological breakdown of the organics in the wastewater.

<https://extension.psu.edu/atgrade-and-shallow-at-grade-on-lot-systems>

Filtration

- The filtration or advanced treatment requirements are dependent on the depth to the site's **limiting zone**.

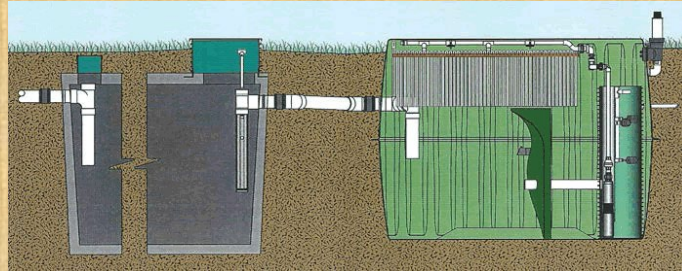


- Wastewater is conveyed to a filtration or advanced treatment unit where the wastewater is filtered to remove and biodegrade a large portion of the wastewater's organic components.

<https://extension.psu.edu/atgrade-and-shallow-at-grade-on-lot-systems>

Orenco AdvanTex

- The approved filtration or advanced treatment units for sites with limiting zones at depths less than 48 inches below the land surface are the Orenco AdvanTex Unit or one of the Peat or Coco Fiber Filters.



Orenco AdvanTex

Peat or Coco Fiber Filters

A peat or coco filter is a large tank, filled mostly with peat or coco (coir) fiber, into which the septic tank effluent is pumped. The wastewater percolates slowly down through the fibers, where the biological treatment occurs. The treated wastewater is collected at the bottom and piped to the dose tank and on to the absorption area.



Advantages & Disadvantages of At-Grade On-Lot Systems

- The at-grade on-lot wastewater disposal system can be used as an alternative to full-height elevated sand mounds on some sites having a limiting zone between 20 and 48 inches.
- The at-grade mound has a lower profile and is less intrusive than the standard elevated sand mound. The at-grade system also yields better quality effluent.
- The disadvantage of an at-grade system is that you need to include a filtration or advanced treatment unit between the septic tank and the absorption area and regular maintenance is required.

Existing vs. New lots

- Alternate Technology systems are reserved for use in replacement of **existing** failing septic systems and for **vacant lots** of record (lots existing before 1972 or subdivided since with DEP approval...which they (DEP) can't always find!) .
- The soil requirements are vastly different between an existing lot of record (with paperwork from DEP) and a new land subdivision
- The subdivision of land into new individual parcels is a time-consuming, paperwork-intense process. (Lots of parties involved ~ +/- 18 months needed)
- The biggest challenge is to find soil depths that would support Conventional Septic Systems for all proposed lots.

Soil as a Filter

Soils act as a natural three-stage filter

- Physical filter –
 - soils 'catch' solid materials that don't settle in the septic tank
- Chemical filter –
 - soil have ion exchange capacity (fertility) that trade "good" chemicals (K, Ca, Na) for "bad" chemicals (Pb, Hg, Zn etc.)
- Biological filter-
 - "good" bacteria eat harmful bacteria
 - Not all bacteria are BAD!

Evaluating Septic System Failure

- Septic system failure is referred to as a "malfunction"
- There are three basic types of malfunction:
 1. soil no longer takes water at the rate it's coming out of the house/tank & comes to the surface (yeah...it's smelly, disgusting, and potentially will make you sick!)
 2. soil no longer takes water at the rate it's coming out of the house/tank & backs up into the house
 3. soil takes only some of the water (dry seasons) and fails a septic inspection (conducted at the time home sale). This circumstance is not generally recognized by DEP as a "regulatory malfunction" so repair/replacement options are sometimes more limited ~ depending on your local inspector!

PA Sewage Management Assoc. Inspection

- Slow wastewater infiltration causes a problem & is often not classified as a regulatory 'Malfunction'.
- When the crushed stone/aggregate is full of liquid and sludge, it is only a matter of time until the liquid will discharge on the surface or create a backup.
- If you are anticipating a real estate transaction with an existing home, it is to your advantage to have the on-lot sewage system inspected.
- Qualified inspectors are certified by PSMA



PA Sewage Management Assoc. Inspection

Assuming there is no surface malfunction...

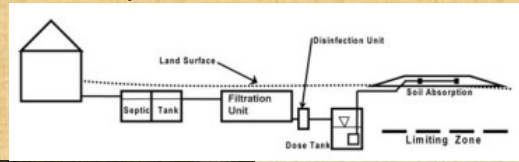
& that water isn't backing up into the house...

- 1. Find (the drainfield)
- 2. Probe check for water in the suspected/identified drainfield
- 3. Load depending on depth of dry stone in the drainfield
 - Add 400 gallons two days in a row
 - The drainfield must dry out both days

PA Sewage Management Assoc. Inspection

Several factors may constitute an unsatisfactory condition which will influence whether a repair is needed:

- over-saturated drainfield
- clogged/broken pipes
- damaged tanks
- dysfunctional d-box →
- faulty pumps or floats



A PSMA Inspection does not provide assurance that the soil is adequately treating sewage or that it will continue to do so in the future