SEO

FIELD MANUAL

Field Manual

For Pennsylvania Sewage

Enforcement Officers

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Clean Water

6/2021

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For Pennsylvania

Sewage Enforcement Officers

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

Prepared by

The Pennsylvania State Association of
Township Supervisors

for

The Department of Environmental Protection

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Acknowledgments

The Department of Environmental Protection would like to thank the SEOs and soil scientists who contributed to the development of the field manual.

Forward

Purpose: The field manual has diagrams, instructions, and procedures to help assist SEOs in performing their duties in the field. The manual also serves as a resource to help others understand what the SEO must do to follow the Sewage Facilities Act (Act537) and the Pennsylvania Code Title 25, Environmental Protection Chapters 71, 72, and 73 regulations.

Disclaimer: The information found in this manual is intended to provide general guidance to SEOs in performing of their duties. It should not be considered a substitute for the Sewage Facilities Act (Act 537) or the Pennsylvania Code Title 25, Environmental Protection Chapters 71, 72, and 73 regulations. Therefore, SEOs are advised to always consult these documents prior to taking any action.

Sources: Several primary sources were used to develop the field manual: The Sewage Facilities Act (Act 537), the Pennsylvania Code Title 25, Environmental Protection Chapters 71, 72, and 73, the *USDA Soil Survey Manual*, and the *Field Book for Describing and Sampling Soils* (Version 1.1, National Soil Survey Center, Natural Resources Conservation Service and the U.S. Department of Agriculture, Lincoln, Nebraska).

Key

Pennsylvania Code Title 25, Environmental Protection Chapters 71, 72, and 73 Regulations: Regulatory items in the field manual are noted with their section number next to the graphic .

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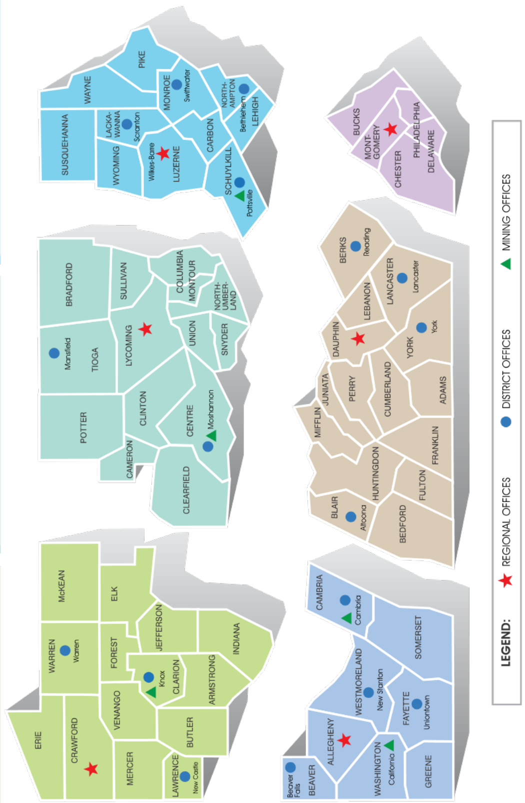

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"**Note:** Go to the **office locations** section of the DEP website at www.dep.pa.gov for more information on the regional offices."

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SITE TESTING

Before investing in a lot for a home or business, the applicant needs to be sure that the site can qualify for an onlot permit. The site must be evaluated and tested to determine if it is suitable. When evaluating the suitability of a site for an onlot sewage disposal system, the SEO must consider the following major factors:

- Slope
- Isolation distances
- Soil suitability
- Sewage flows
- Percolation testing

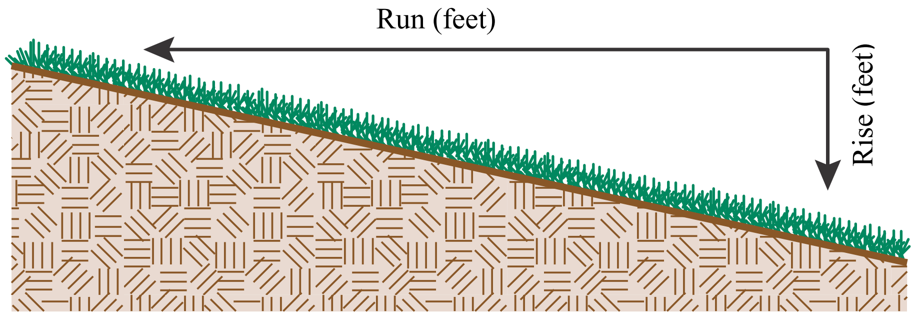
Slope

Certain absorption areas cannot properly function or be installed on excessively steep slopes. Chapter 73 of the regulations specifies the maximum slope on which a system can be installed. The maximum slopes are established to allow the system to function as intended, thereby protecting the public health.

CALCULATING SLOPE

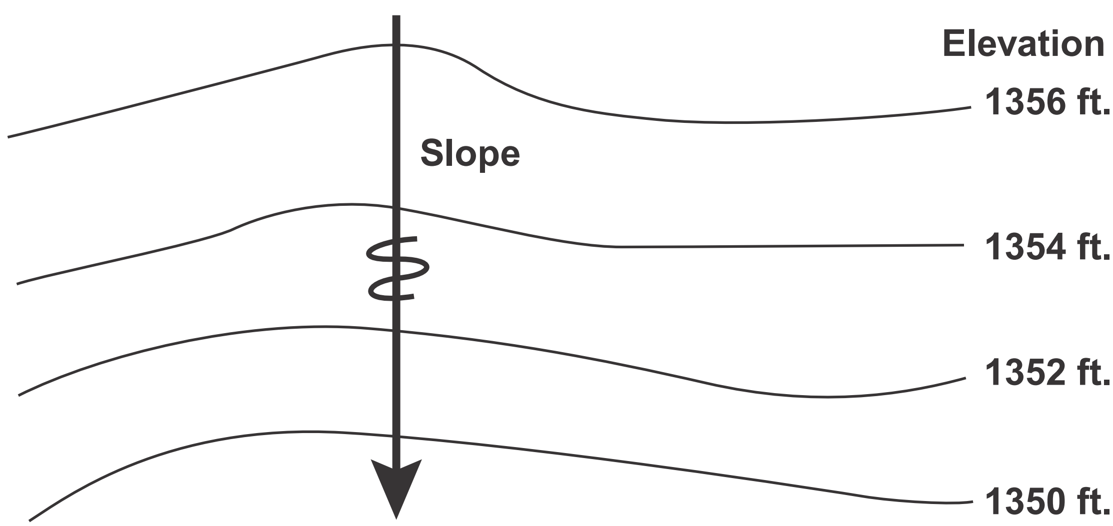
Slope is the change in elevation, measured in consistent units, form one point to another.

$$\text{Percent slope} = \frac{\text{rise}}{\text{run}} \times 100$$



MEASURING SLOPE

Slope must be measured ***perpendicular*** to the contours of the land. Contours are lines of equal elevation



SLOPE REQUIREMENTS FOR CONVENTIONAL SYSTEMS

In-Ground Systems

Sections 73.52 and 73.54

- In-ground trench absorption area: 0-25%
- Subsurface sand filter trench absorption area: 0-25%

Sections 73.53 and 73.54

- In-ground bed absorption area: 0-8%
- Subsurface sand filter bed absorption area: 0-8%

Elevated Systems

Section 73.55

- Bed absorption area: 0-12%
- Trench absorption area: 0-12%

IRSIS (Individual Residential Spray Irrigation System)

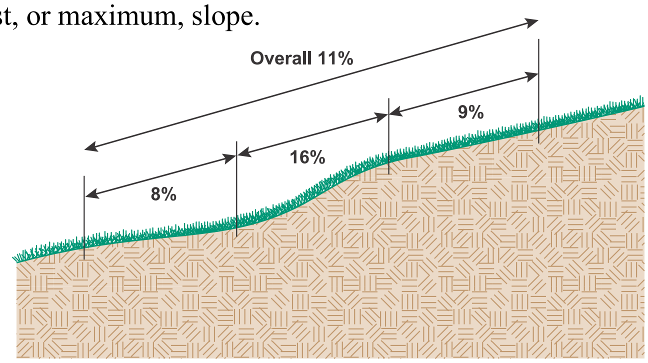
Section 73.163

- Nonfood-producing agricultural areas: 0-4%
- Open, grassed areas: 0-12%
- Forested areas (closed canopy): 0-25%

Refer to DEP's Onlot Alternate Technology Listings for the slope requirements for alternate systems. The listings can be found on the DEP website at www.dep.state.pa.us.

MEASURE THE STEEPEST SLOPE ON A PROPOSED DISPOSAL AREA

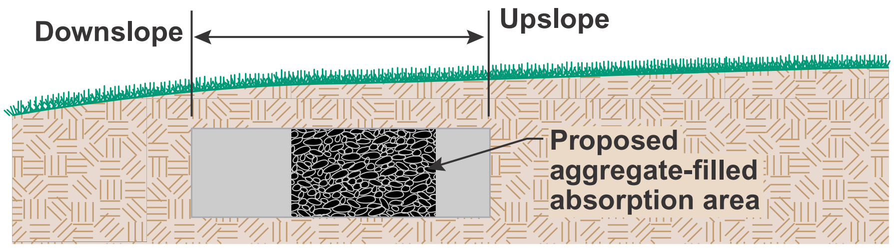
If the slope varies, differs, or changes over a large portion of the area being measured, then the steepest, or maximum, slope must be used. For example, in the diagram below, 16% is the slope used, because it is the steepest, or maximum, slope.



WHERE TO MEASURE SLOPE

Proposed In-Ground System

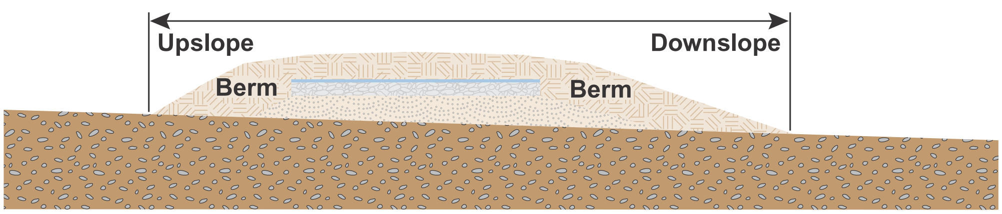
For an in-ground system, slope is measured from extremity of aggregate on the upslope side to the extremity of aggregate on the downslope side.



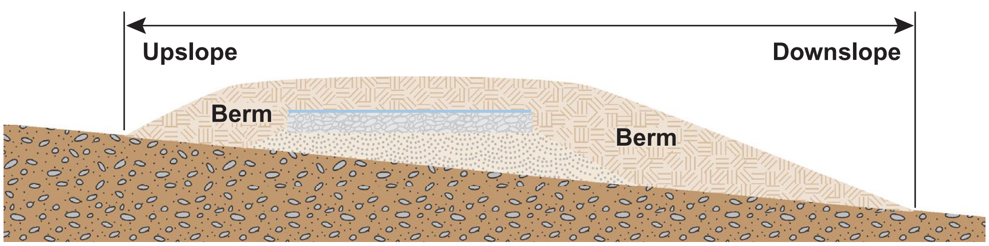
Proposed Elevated System

For an elevated system, slope is measured from extremity of the berm on the upslope side to extremity of the berm on the downslope side. The steeper the slope, generally the larger the berm.

GRADUAL SLOPES:



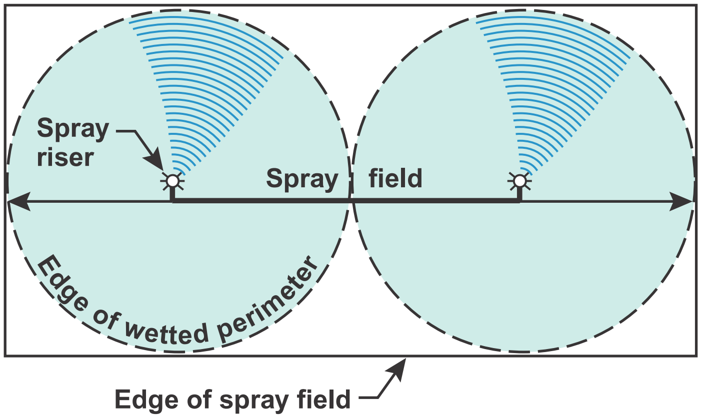
STEEP SLOPES:



Individual Residential Spray Irrigation System (IRSIS)

For an IRSIS, slope is measured within the edges of the spray field. The steepest slope within the spray field must be used to site the system.

Top View



SLOPE INSTRUMENTS

On the next few pages, some of the common instruments that may be used to measure slope are shown. Other instruments may also be used. Refer to the manufacturer's instructions for more detailed directions on how to use the slope-measuring instruments explained in the field manual.

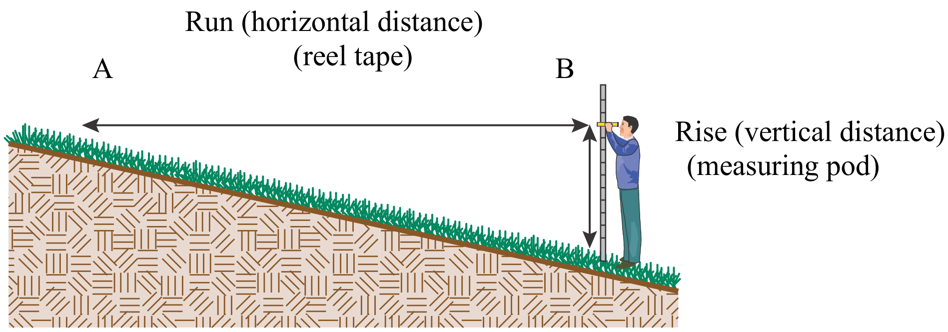
Calibrate the Slope-Measuring Instrument

- Periodically check your slope-measuring instrument to ensure that it is measuring slope accurately.
- Check the manufacturer's instructions on how to calibrate the instrument.
- Set up a known slope somewhere, such as your home or office, to frequently check the accuracy of your instrument.

How to Measure Slope
Using a Lock Level

TOOLS:

A) Reel tape measure of 100 ft. or greater
B) Measuring rod or pocket tape measure
C) Screwdriver, chaining pin, or large spike



SAMPLE PROCEDURE:

<u>Measure the Run</u>

1) Measure the distance between A and B; this will give you the run (horizontal distance). This distance should be the approximate width of the absorption area for an in-ground system or the distance from toe of berm to toe of berm for an elevated system. For an IRSIS, the slope is measured at the maximum slope within the projected limits of the spray field. To accurately measure the run, the reel tape must be pulled level as shown in the drawing. A screwdriver, chaining pin, or large spike can be used to hold the reel tape to the ground on the upslope side.

<u>Measure the Rise</u>

1) Standing at point B, line up the leveling bubble on the cross hair in the lock level. Slide the lock level up or down the measuring rod until the crosshair is lined up on point A.

2) Once this position is achieved, read the number on the measuring rod. This is the rise (vertical distance).

<u>Calculate the Percent Slope</u>

1) Divide the rise (vertical distance) by the run (horizontal distance) and multiply by 100.

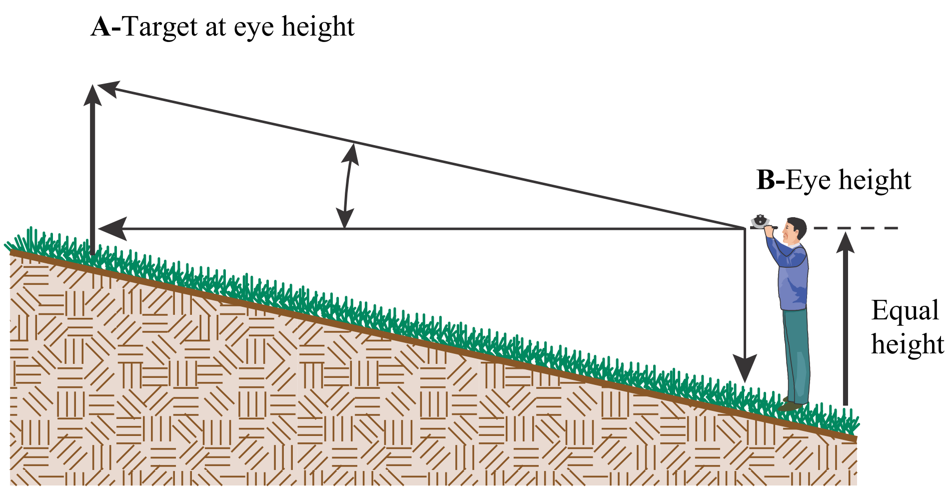
<u>Example:</u>
Rise (vertical distance) = 3 ft.
Run (horizontal distance) = 30 ft.

$$\frac{3 \text{ ft.}}{30 \text{ ft.}} \text{ X } 100 = 10\%$$

How to Measure Slope Using an Abney Level

TOOL:

A) A target at the same vertical distance above grade as your eye height. For example, a measuring rod or tape around an object such as a tree or stake.



PROCEDURE:

1) Set up your target at point A.

2) Anticipate the approximate width of the absorption area for an in-ground system or the distance from toe of berm to toe of berm for an elevated system (A to B). For an IRSIS, the slope is measured at the maximum slope within the projected limits of the spray field (A to B).

3) Standing at B, look through the eyepiece of the Abney level and sight the target at point A. Slope can be measured up or down hill with an Abney level.

4) Line up the crosshair on the target, and turn the thumb screw on the Abney level until the bubble lines up with the crosshair.

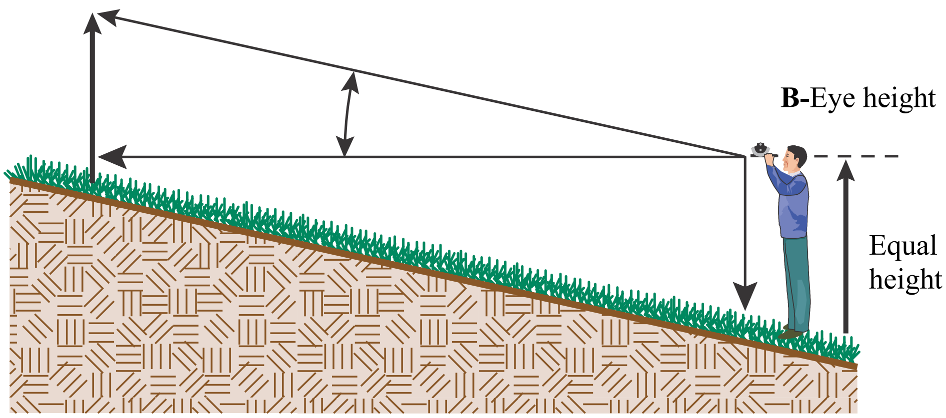
5) Read the percent slope directly off the dial indicator.

How to Measure Slope Using a Clinometer

Note: The Abney level and Clinometer work on the same principle of measuring the angle.

TOOL:

A) A target at the same vertical distance above grade as your eye height. For example, a measuring rod or tape around an object such as a tree or stake.



PROCEDURE:

1) Set up your target at point A.

2) Anticipate the approximate width of the absorption area for an in-ground system or the distance from toe of berm to toe of berm for an elevated system (A to B). For an IRSIS, the slope is measured at the maximum slope within the limits of the spray field (A to B).

3) Standing at the other end of the slope (B), look into the eyepiece of the Clinometer with one eye, and look at the target with the other eye. Both eyes must be open for the Clinometer to work. Sight (either upslope or downslope) on the target at point A.

4) While looking into the eyepiece, line up the crosshair with the target and read the percent slope directly from the scale in the Clinometer.

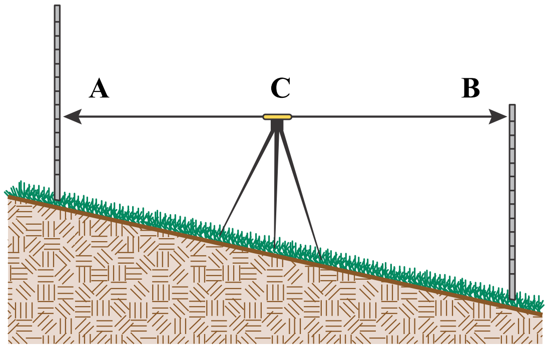
How to Measure Slope
Using a Laser Level or Transit

Note: The laser level measures the exact elevation change. The vertical and horizontal distances are used to calculate slope.
Warning: *Never look directly into the laser light as doing so could cause permanent eye damage or blindness.*

TOOLS:

A) Measuring rod with target (purchase as part of package with laser)

B) Reel tape measure of 100 ft. or greater



PROCEDURE:

1) Set up the laser level at a location (C) close to the proposed absorption area where you have unobstructed sight to points A and B.

2) Pull the tape measure level, as you would with the lock level, to measure the run (horizontal distance) between A and B. This distance between A and B would be the width of the absorption area for an in-ground system or the distance from toe of berm to toe of berm for an elevated system. For an IRSIS, the slope is measured at the maximum slope within the projected limits of the spray field (A to B).

3) Walk to the highest vertical point of the absorption area (A). Hold the rod exactly vertical, or plumb, at A, and move the sighting target up or down on the rod until the laser beam strikes the target at A, creating an audible sound. Record the elevation measured.

4) Walk to the lowest part of the absorption area (B). Hold the rod exactly vertical, or plumb, at B, and move the sighting target up or down on the rod until the laser beam strikes the target at B, creating an audible sound. Record the elevation measured.

5) Subtract the elevation measured at A from the elevation measured at B. The difference between these two elevations is the rise (vertical distance).

6) To calculate percent slope, divide the rise (vertical distance) by the run (horizontal distance) and multiply by 100.

Example:
Rise (vertical distance) = 3 ft.
Run (horizontal distance) = 30 ft.

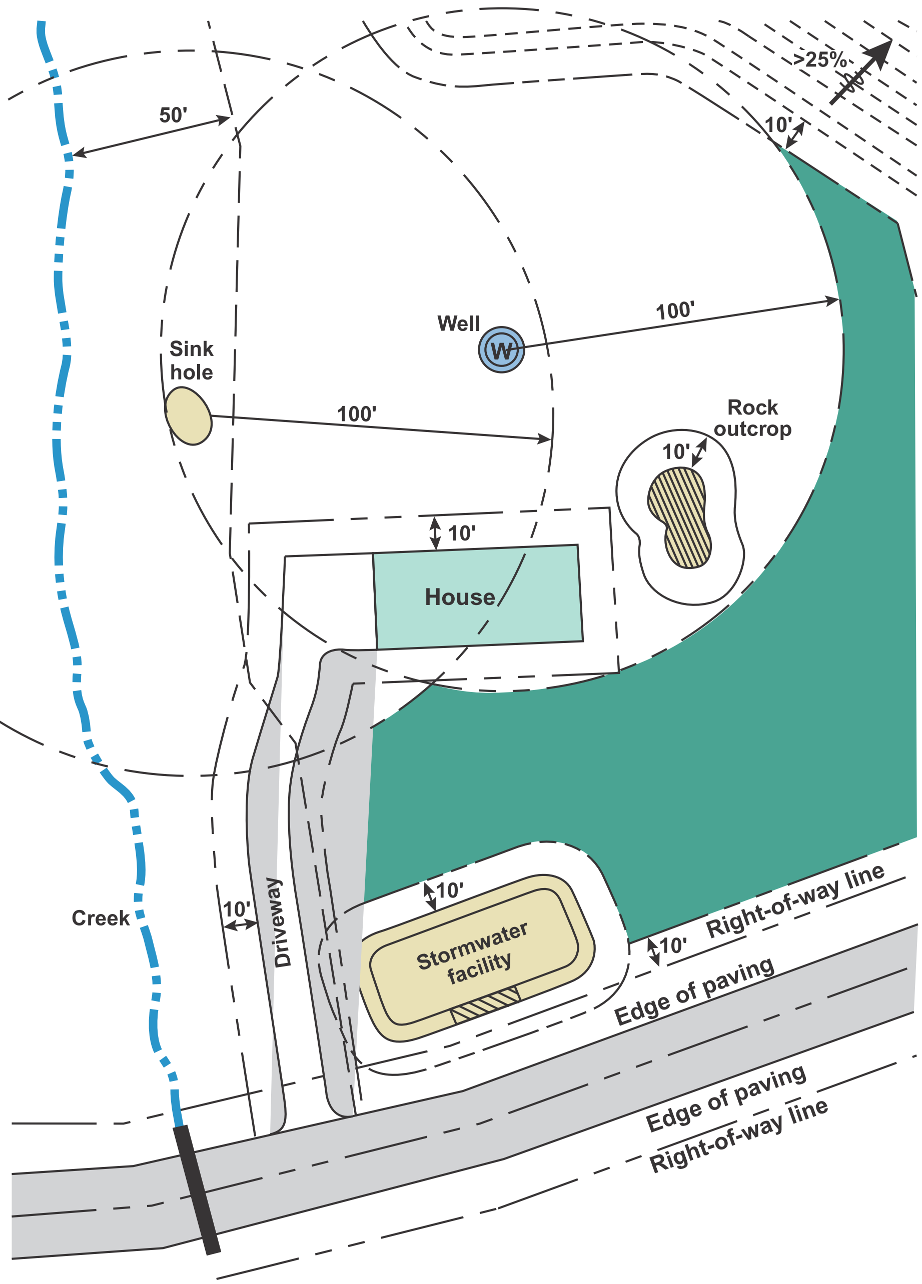
$$\frac{3 \text{ ft.}}{30 \text{ ft.}} \text{ X } 100 = 10\%$$

Isolation Distances

An isolation distance is the minimum required horizontal distance that the closet point of a feature is allowed to be to a component of the onlot sewage disposal system. To protect the system from damage and to protect public health, Chapter 73 of the regulations identified all the required isolation distances that must be met.

The next two pages present all the regulatory isolation distances associated with conventional onlot sewage disposal systems.

The diagram below shows a plan view of some common isolation distances from an absorption area. The shaded area represents the available area to locate an onlot sewage disposal area.



MINIMUM HORIZONTAL ISOLATION DISTANCES

Section 73.13

Minimum horizontal distances shown in Section 73.13 must be maintained between the onlot sewage disposal system and the features itemized except as provided by Section 72.33 (relating to the well isolation distance exemption). If conditions warrant, greater isolation distances may be required.

A) The minimum horizontal isolation distances between the features named and **treatment tanks, dosing tanks, lift pump tanks, filter tanks, and chlorine contact/storage tanks must comply with the following:**

1) Property line, easement, or right-of-way – 10 feet

2) Occupied buildings, swimming pools, and driveways – 10 feet

3) An individual water supply or water supply system suction line – 50 feet

4) Water supply line under pressure – 10 feet

5) Streams, lakes, or other surface waters – 25 feet

6) A cistern used as a water supply – 25 feet

B) The following minimum horizontal isolation distances must be maintained between the features named and the **perimeter of the aggregate in the absorption area:**

1) Property line, easement, or right-of-way – 10 feet

2) Occupied buildings, swimming pools, and driveways – 10 feet

3) An individual water supply or water supply system suction line – 100 feet

4) Water supply line under pressure – 10 feet

5) Streams, watercourses, lakes, ponds, or other surface water – 50 feet *(For the purposes of Chapter 73 of the regulations, wetlands are not surface waters.)*

6) Other active onlot sewage disposal systems – 5 feet

7) Surface drainageways – 10 feet

8) Mine subsidence areas, mine boreholes, or sinkholes – 100 feet

9) Rock outcrop or identified shallow pinnacle – 10 feet

10) Natural or manmade slope greater than 25% -- 10 feet

11) A cistern used as a water supply – 25 feet

12) Detention basins, retention basins, and stormwater seepage beds – 10 feet

C) The following minimum horizontal isolation distances must be maintained between the features named and the **wetted perimeter of the spray field:**

1) Property lines, easements, or right-of-ways – 25 feet
2) Occupied buildings and swimming pools – 100 feet
3) An individual water supply or water supply suction line – 100 feet
4) A cistern used as a water supply – 25 feet
5) Water supply line under pressure – 10 feet
6) Streams, watercourses, lakes, ponds, or other surface waters – 50 feet *(For the purposes of Chapter 73 of the regulations, wetlands are not surface waters.)*
7) Mine subsidence, boreholes, or sinkholes – 100 feet
8) Roads or driveways – 25 feet
9) Unoccupied buildings – 25 feet
10) Rock outcrop – 25 feet

D) The area within the wetted perimeter of the spray field may not be sited over an unsuitable soil profile.

Soil

- Soil plays multiple roles in the operation of an onlot sewage disposal system. It absorbs, disperses, and renovates sewage effluent.
- Renovation occurs through physical filtering, chemical reactions, and microbial activity within soils. This treatment by the soil prevents ground and surface water pollution and protects the public health.

THE SEO’S ROLE IN THE SOIL PROBE EVALUATION

The state’s regulations regarding onlot sewage disposal systems require SEOs to write the soil profile description or verify the soil profile written by a consultant. The SEO must be present during the soil prove evaluation, or observe the profile before the probe is closed, to verify that the results of the evaluation are correct.

When writing or verifying the soil profile description, the SEO must make sure the following items are included:

- Name of the individual providing the soil description.
- Date of the evaluation.
- Soil profile description for each horizon, including:
  - Depth of horizon from the mineral soil surface
  - The presence and depth of any seeps or standing water
  - Description of color, texture, structure, mottling (redoximorphic features), consistence, and percentage of rock fragments
- The depth to limiting zone in inches. If no limiting zone was observed in the excavation, indicate that the limiting zone was greater than the depth of the probe. For example, more than 84” or 84” +.
- The type of limiting zone.

Note: Master horizons, subordinate distinctions, and horizon boundary descriptions are helpful items to note on the soil profile description; however, they are not required by the DEP.

Reasons for a Complete Soil Profile Description

The soil profile description is the only documentation of the existing soil condition that remains after the probe is closed. It should support why a site either passed or failed. If the description is not complete and questions arise, a new test may be needed.

Under some soil conditions, onlot sewage disposal systems may not properly function. Therefore, the SEO must know enough about soil science to recognize the soil characteristics necessary for an onlot sewage disposal system.

Below is an example of what information should be recorded on a soil profile description.

Sample Soil Profile Description of Two Horizons

Depth	To	Depth	Horizon	Color; Rock Fragment Modifier and Texture; Mottling (redoximorphic features, if observed); Structure; Consistence; Boundary
0	To	6”	A	Dark brown (7.5YR 3/2); silt loam; weak very fine granular structure; friable; abrupt smooth boundary
6”	To	14”	Btg	Light brownish gray (10YR 6/2); channery silty clay loam; many coarse distinct dark yellowish brown (10YR 4/6) mottles; moderate subangular blocky structure; friable; clear wavy boundary

RECOMMENDED PROCEDURES FOR CONDUCTING THE SOIL PROFILE EVALUATION

Items to Do Prior to Excavating the Probe

1) An SEO should find the proposed site in a soil survey to become familiar with soil conditions that may be present at the site. Soil surveys are available for each county; contact the local USDA Natural Resources Conservation Service (NRCS) office.

   Soil surveys are completed and published on a continuing schedule. To order or obtain information on reference copies, contact:

   State Soil Scientist
   1 Credit Union Place, Suite 340
   Harrisburg, PA 17110-2993
   www.pa.nrcs.usda.gov

2) An SEO should check the proposed area for obvious unsuitable surface features, including:

   - Standing water
   - Rock outcrops
   - Extreme slopes
   - Sinkholes
   - Isolation distance encroachments
   - Insufficient suitable areas

Section 72.42

3) The law requires that a PA One-Call System serial number be obtained prior to soil testing by the permit applicant or the contractor retained by the applicant to perform the test excavation. This notification must take place no less than three and no more than ten working days prior to the excavation. The PA One-Call phone number is (800) 242-1776.

4) The SEO should be present on the site when the soil probe(s) is excavated. This allows for the most efficient use of time and excavation equipment. It is recommended that the property owner also be present at the time of the site and soil evaluation. At this time, the SEO may point out and explain the basis for decisions regarding the site.

5) The SEO may assist the applicant and/or consultant in selecting potential absorption area sites and designating general probe locations.

Where to Place the Probe(s)

Soil probes must be seven feet deep or to a depth that sufficiently exposes the limiting zone, whichever is less. Probes used to characterize the suitability of a system must be dug within ten feet of the proposed absorption area.

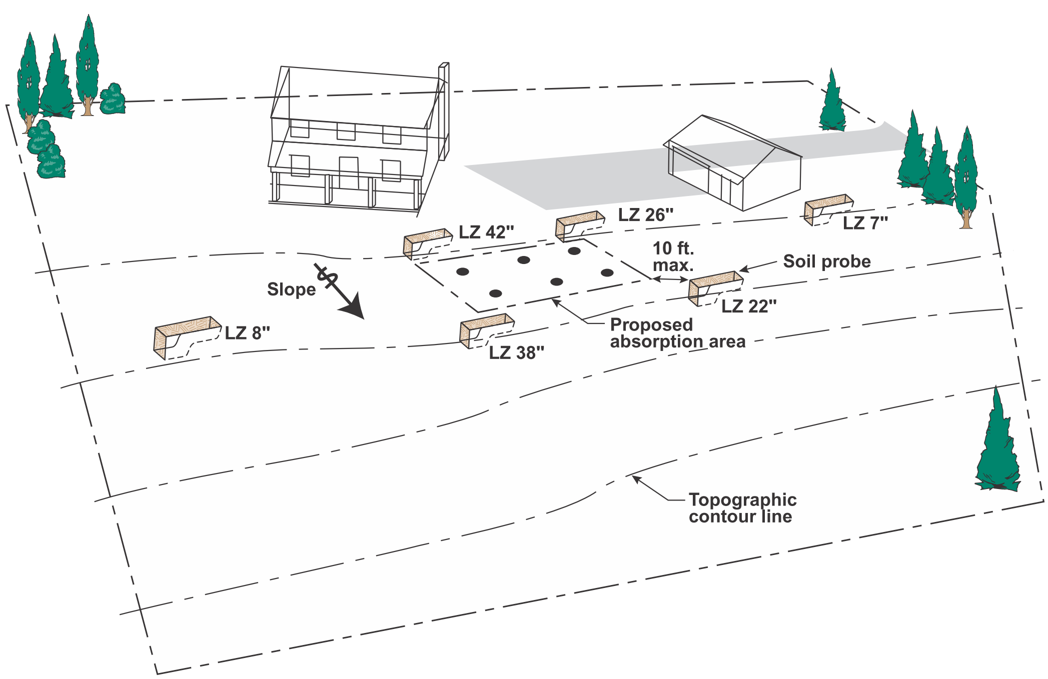
Probe(s) to Determine Site Suitability

On all sites where the installation of an onlot sewage disposal system is proposed, at least one test probe must be excavated to determine whether sufficient suitable soils are present. However, soil variability may necessitate the excavation of additional probes. Enough probes must be evaluated to adequately verify the suitability of the entire proposed disposal site.

In limestone areas or where soil depths vary significantly in short distances, it is recommended to evaluate multiple probes. This is necessary to ensure that the area of suitable soil is large enough to accommodate the installation of the system while still maintaining the necessary vertical isolation distance to a limiting zone. One good probe immediately adjacent to one or more unsuitable probes is not sufficient evidence to determine if a site is suitable.

Note: Refer to the IRSIS section (VII) of the field manual for specific probe requirements for an IRSIS.

The illustration below shows four probes around a proposed disposal site. Because probes with 7- and 8-inch limiting zones were also found in the general vicinity, four probes were dug to ensure there were sufficient suitable soils throughout the entire proposed disposal area. In this case, a 22-inch limiting zone would be used for design purposes, because it is the most limiting probe in the proposed absorption area.



Make Sure the Probe is Safe to Enter

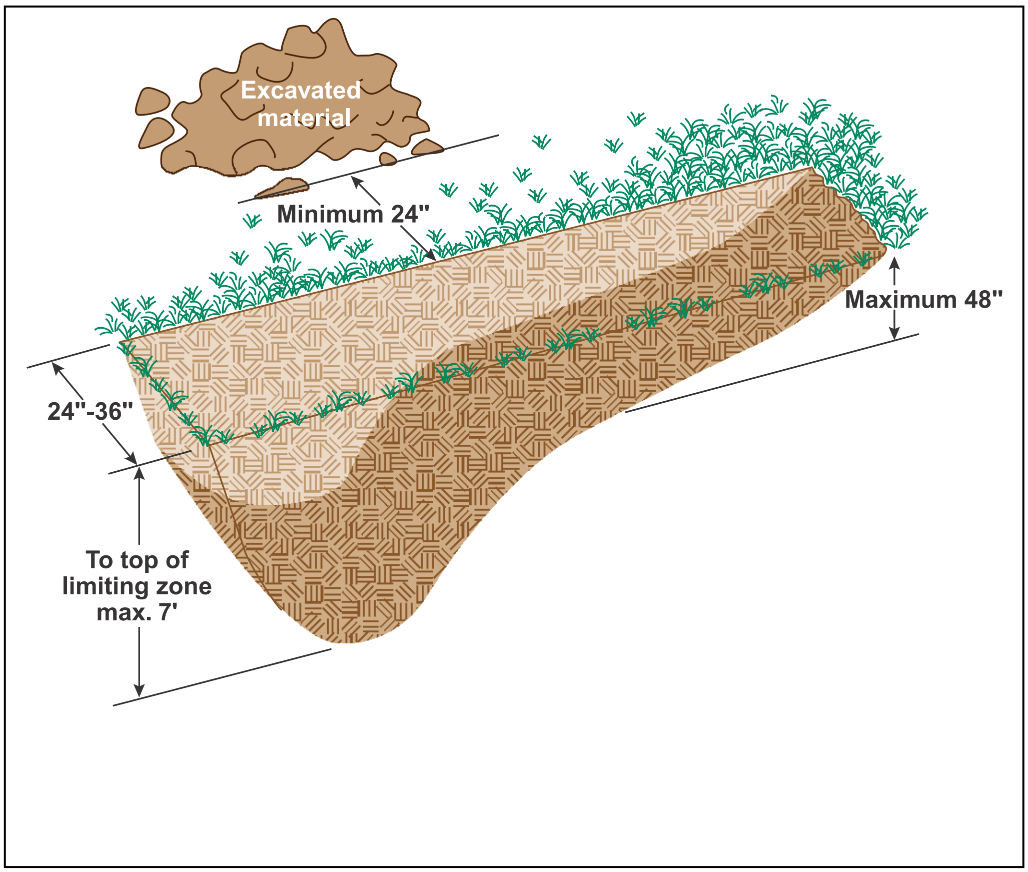
- Before actually examining the soil profile, make sure that the probe is safe to enter. Check to be sure that the probe is excavated properly to allow safe entry **and** exit. There should be no sidewall slumps and no potential for a "cave-in." Be sure that no heavy pieces of equipment or large objects, such as rocks or boulders, are resting on the surface immediately adjacent to the probe sidewalls. Before entering the probe, confirm that no appreciable soil or rock debris will topple into the probe. This material should be placed far enough away from the test probe to prevent roll-in or slumping. Be especially wary of cave-ins in sandy, gravelly, or wet soil conditions.

- If the excavating equipment is present on the site, be sure that the engine is off and the bucket is resting on the ground. Operational machinery may pose a serious safety hazard if a hose suddenly ruptures or if the operator accidentally bumps a lever. To prevent cave-ins, equipment should not be parked near the pit while an SEO is evaluating a probe.

- Before entering a pit, make sure there are others in the immediate area who are aware of your location and are able to hear if you call for help.

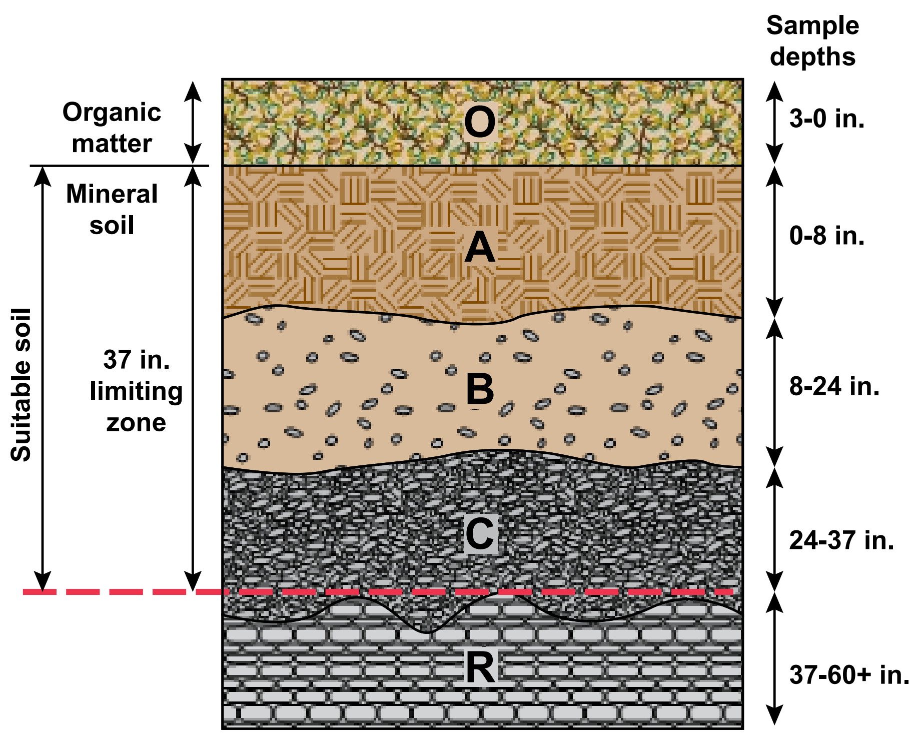
The illustration below shows the typical dimensions associated with the excavation of a soil probe for an SEO evaluation.

Soil Probe for an SEO Soil Evaluation



Recommended Procedures for Examining the Soil Profile

- Evaluate the entire probe to determine if a limiting zone is present.
- If a limiting zone is present, use the shallowest indication of the limiting condition as the depth of suitable soil in the soil profile description.
- Choose the soil profile within the excavation with the shallowest limiting zone. Using a picking tool, prepare the sidewalls from top to bottom by exposing a fresh soil surface. This will remove soil smearing caused by the excavator's bucket. Using the prepared section of the probe, identify the individual soil horizons and measure the depth of each horizon.
- Record the characteristics of individual horizons on a field sheet to prepare a soil profile description using the state's Appendix A form.
- Remember that changes in color (including redoximorphic features), texture (including rock fragment modifiers), structure, or other soil variable are reasons for a horizon break. The limiting zone depth must always correspond to a horizon break.
- When a limiting zone is identified, measure the depth from the mineral soil surface to the uppermost indication of a limiting condition. ***(See diagram below.)***
- If an organic horizon is present, record it as part of the soil description. However, all soil horizon depths must be measured from the top of the mineral soil surface. ***(See diagram below.)*** The organic horizon cannot be included in the suitable soil depth to the limiting zone.



LIMITING ZONES

Suitable soil depth is limited by the three following limiting zones as established in the Pennsylvania Code Title 25, Environmental Protection Chapter 71 regulations.

i) **A seasonal high water table**, whether perched or regional, determined by direct observation of the water table or indicated by soil mottling (redoximorphic features).

ii) **A rock with open joints**, fracture or solution channels, or masses of loose rock fragments, including gravel, with insufficient fine soil to fill the voids between the fragments.

iii) **A rock formation**, other stratum, or **soil condition** which is so slowly permeable that if effectively limits downward passage of effluent.

COLOR

- Color is a significant descriptive feature of the soil. Changes in color may often provide important information about a particular soil horizon.
- Soil color should be documented using the Munsell color charts. The predominant color (matrix color) of each horizon should be described. Non-uniform color variations, such as mottles (redoximorphic features), manganese coatings, organic staining, and color variations inherited from weathered parent material, should also be described. The color and color patterns in soil are indicators of the drainage characteristics of the soil.

How to Use the Munsell Color Book

When using the Munsell color charts to determine color, hold the soil sample and book so the sun shines over your shoulder. Match the soil color with the closest color chip and record the hue, value, chroma, and the corresponding color name.

Usually, soil color is described in a moist condition. If the soil is dry, apply water with a spray bottle to observe the colors when moist. Allow the soil to absorb the sprayed water into the soil ped before matching the soil color with a color chip. When the soil color is described in a wet or dry condition, the condition should be indicated after the color notation: for example, 7.5YR 3/2(dry).

Hue, Value, and Chroma

Hue, value, and chroma are used to describe the color of the soil.

Hue is the color--red, yellowish red, and yellow.

Value is the degree of lightness or darkness of the color.

Chroma describes the strength of the color.

The Munsell system is based on principal **hues,** such as red (R), yellowish red (YR), and yellow (Y). These are colors that you would typically encounter in Pennsylvania.

Value indicates the degree of lightness or darkness of a color in relation to neutral gray scale. On a neutral gray (achromatic) scale, value extends from pure black (0/) to pure white (10/). The value notation is a measure of the amount of light that reaches the eye under standard lighting conditions. Gray is perceived as about halfway between black and white and has a value notion of 5/.

Chroma is the relative purity of strength of the spectral color. Chroma indicates the degree of saturation of neutral gray by the spectral color. The scales of chroma for soil extend from /0 for neutral colors to a chroma of /8 as the strongest expression of color used for soils.

MOTTLING

Mottling, which is a type of redoximorphic feature, is a soil characteristic associated with wetness. It results from the reduction and oxidation of iron and manganese compounds in the soil. This splotchy appearance indicates intermittent saturation and desaturation.

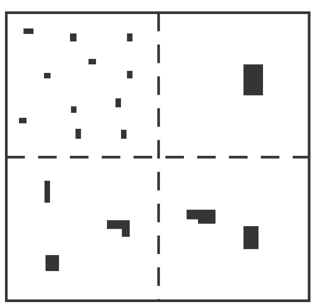
- Mottles are indicators that saturation occurs during certain times of the year, when water is present in soil pores.
- This seasonal saturation is commonly referred to as a seasonal high water table.
- A seasonal high water table is a limiting zone.

Mottles are described using the following characteristics:

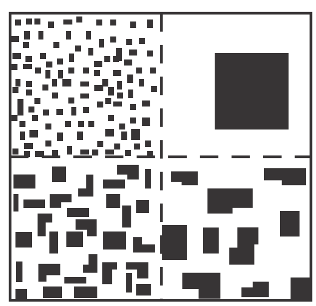
- Abundance
- Size
- Contrast

Abundance—How many mottles?

Few	<2% surface area
Common	2-20% surface area
Many	>20% surface area

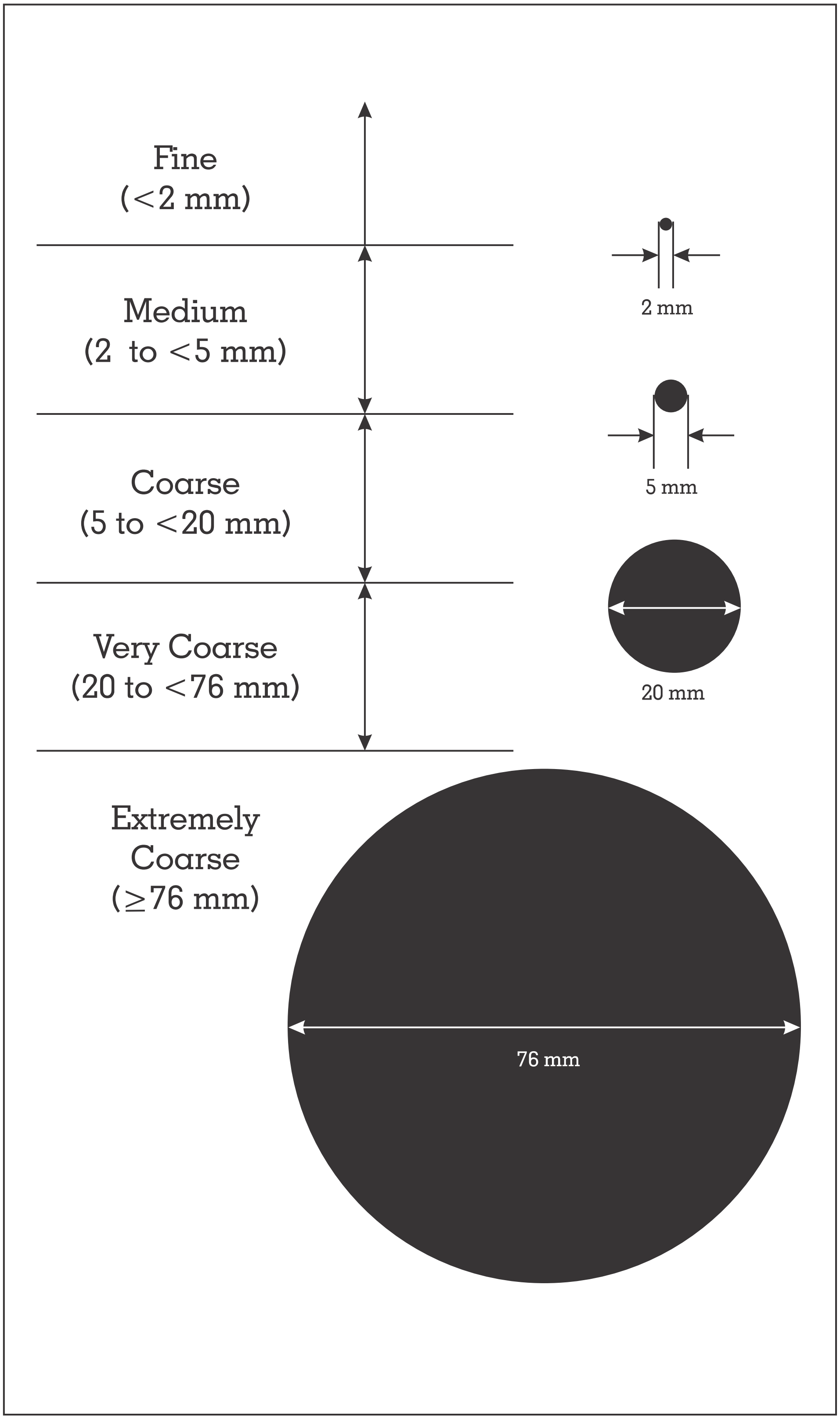


2% Mottles



20% Mottles

Size—How large are the mottles?



Note: The above measurements are **not** to scale.

Contrast—How easy is it to see the mottles?

Faint----------------- Hard to see in profile.

Distinct ------------- Easy to see in profile.

Prominent---------- Easy to see from outside of profile.

Contrast Class	Code	Difference in Color Between Matrix and Mottle			
		Hue[1]	Value		Chroma
Faint[2]	F	same page	0 to ≤2	and	≤1
Distinct	D	same page	>2 to <4	and	<4
				or	
			<4	and	>1 to <4
		1 page	≤2	or	≤1
Prominent	P	same page	≥4	or	≥4
		1 page	>2	or	>1
		≥2 pages	≥0	or	≥0

[1]*One Munsell Color Book page = 2.5 hue units.*

[2]*Faint also includes mottles (redoximorphic features) that are similar in color to the matrix that have both low (e.g., <3) value and chroma and differ by up to 2.5 units (one page) of hue.*

Reference: *Field Book for Describing and Sampling Soils Version 1.1*; National Soil Survey Center, Natural Resources Conservation Service, U.S. Department of Agriculture, Lincoln, Nebraska.

Sample Description of Mottling (Redoximorphic Features)

Yellowish brown (10YR 5/6) matrix
Light gray (10YR 7/1) splotches
30% surface area
4 mm in diameter
Easy to see from outside of profile

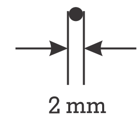
Abundance	Size	Contrast	Color
Many	Medium	Prominent	10YR 7/1

TEXTURE

Soil texture refers to the weight proportion of the sand, silt, and clay particles that are 2 mm and less.

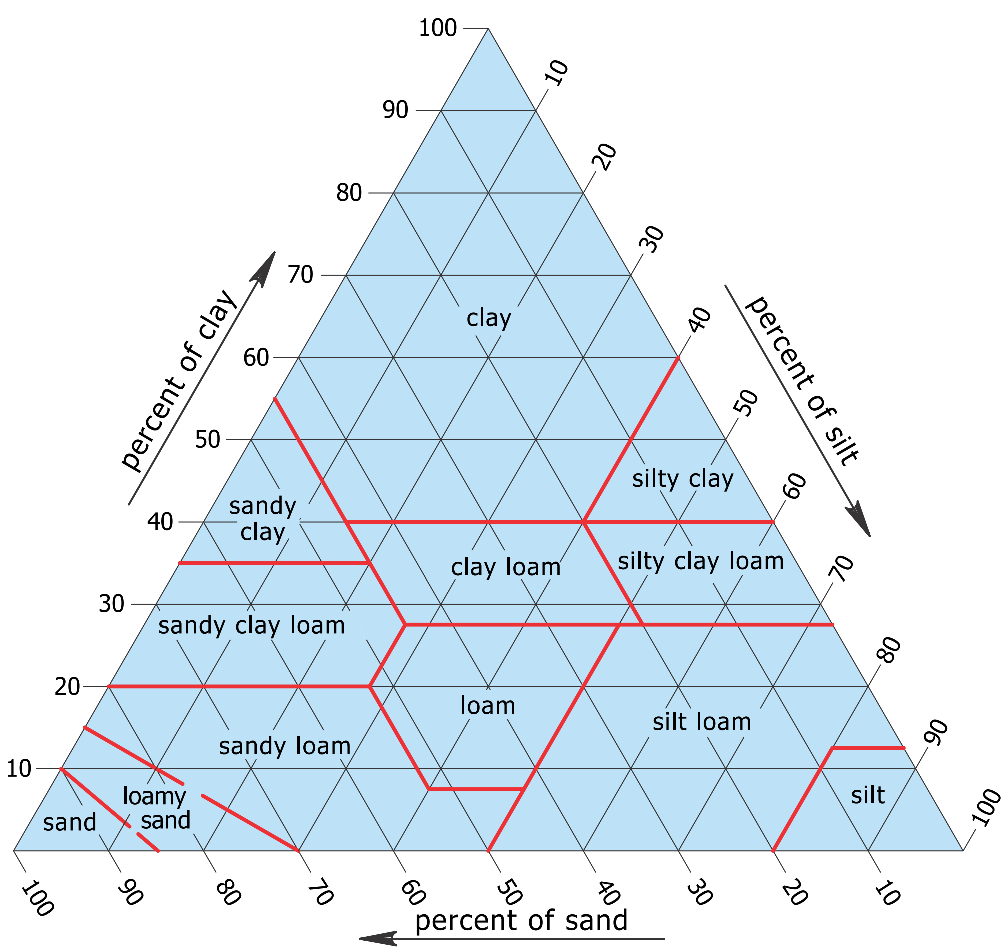
Soil Mineral Particles

1) Sand 2.0-0.05 mm
2) Silt 0.05-0.002 mm
3) Clay <0.002 mm



The percentage of these mineral particles determines the texture of the soil. Textures have been grouped into 12 textural classes. The soil textural triangle below is used to determine the textural class by estimating the percentages of sand, silt, and clay.

Example: 40% sand
40% silt
20% clay
Soil texture—loam



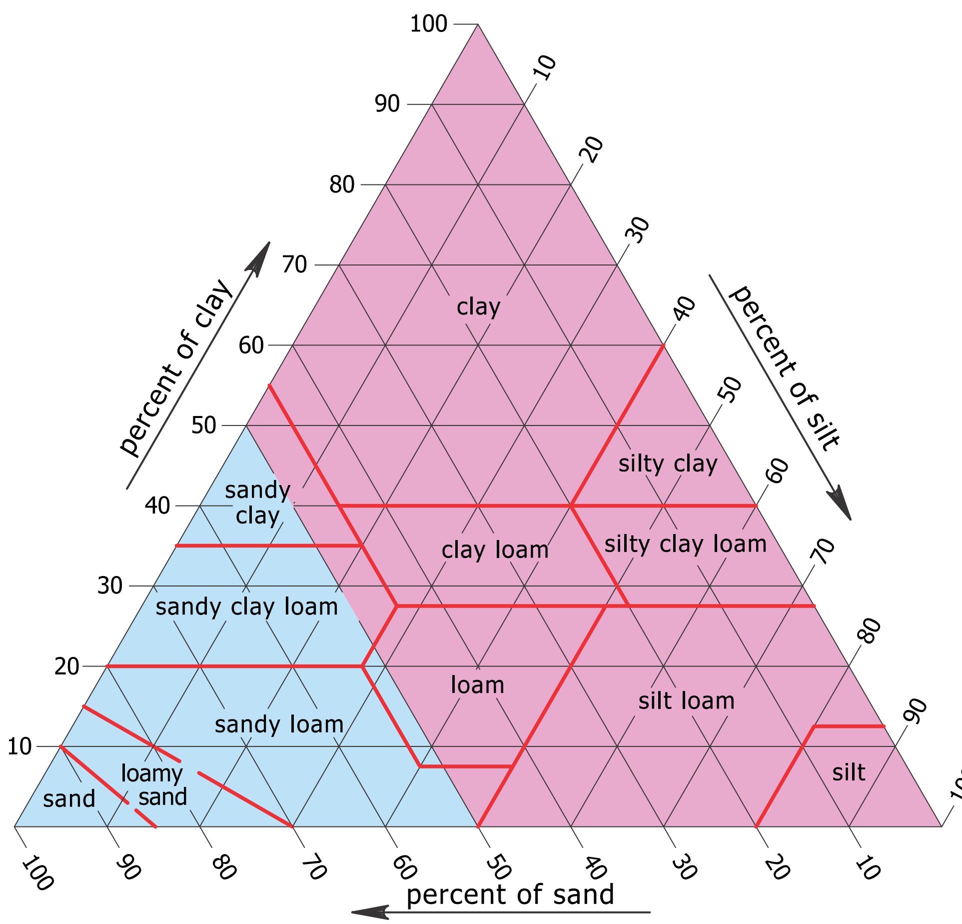
Procedure for Estimating Percentage of Sand and Clay

PREPARE SAMPLE

1) Fill the palm of your hand with soil.
2) If the soil is dry, moisten it enough so that it sticks together. Don't saturate it to a runny mud. If sample becomes too moist, discard sample and begin the process again.
3) Knead the soil between your thumb and fingers. Take out the coarse fragments and crush all the soil aggregates. You may need to add a little more water.
4) Continue working the soil until you crush all the aggregates and the soil feels uniform.

ESTIMATE SAND

1) Estimate the sand content by the amount of textural grittiness you feel.
   a) More than 50% sand—Sand dominates, and the textural name usually contains the term sand or sandy.
   b) Less than 50% sand—The textural name typically does not contain the term sand or sandy.



>50% sand or <50% sand

ESTIMATE CLAY

1) Estimate the clay content by pushing the sample up between your thumb and index finger to form a ribbon.

    a) Less than 27% clay—The ribbon is less than 1 inch long. The textural class name typically does not include the term clay.

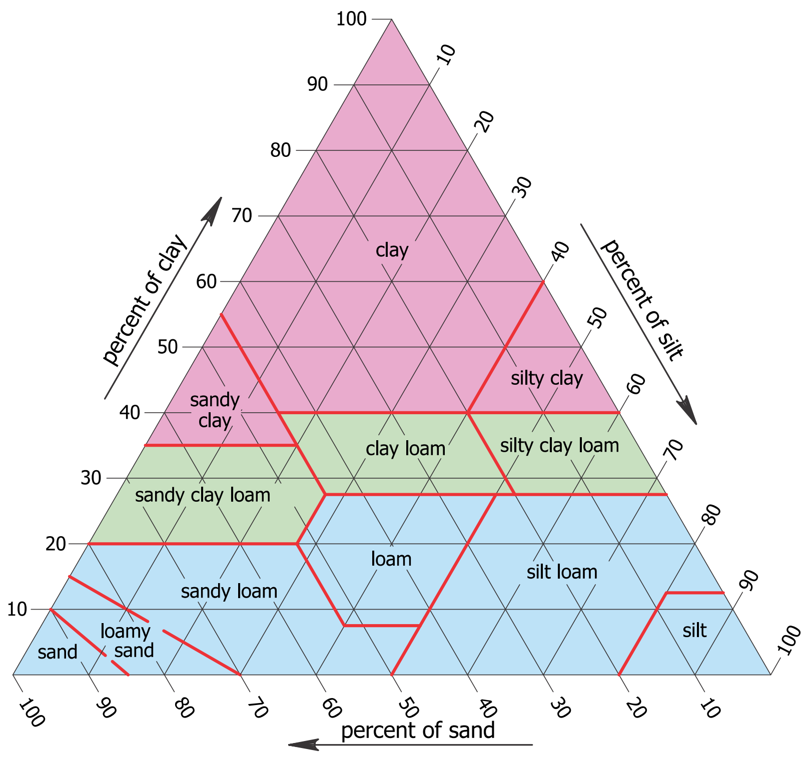
    b) 27 to 40% clay—The ribbon is 1 to 2 ½ inches long. The textural class name probably uses the term clay as a first or middle name in the textural class.

    c) More than 40% clay—The ribbon is more than 2 ½ inches long. Clay dominates the sample. The Textural class name contains the term clay as a last name in the textural class.

Percent of Clay	Length of Ribbon	Textural Class Name
<27%	**<1”**	**Clay is not in the name.**
27-40%	**1-2 ½”**	**Clay is the first or middle name.**
>40%	**>2 1/2”**	**Clay is the last name.**

DETERMINE TEXTURAL CLASS

1) Use your estimated percentages of sand and clay to establish the resultant percentage of silt, and then determine the textural class using the soil textural triangle below.



The pictures on the following pages visually demonstrate the procedure for estimating the percentage of clay.

Estimating Percentage of Clay

Fill the palm with soil. A moist sample is easiest to work with.

Work the soil in the hand. If necessary, add water to the soil to give it a cohesive consistence.

Manipulate the soil sample between the thumb and forefinger to create a ribbon. The ribbon should be about ¼ to 1/8 inch thick and about ½ inch wide. **The ribbon must support its own weight; it cannot be supported by fingers or other objects.**

Less than 27% Clay
The ribbon is less than 1 inch long. The textural name does not include the term clay in the textural class.

27 to 40% Clay
The ribbon is 1 to 2 ½ inches long. The textural name uses the term clay as a first or middle name in the textural class.

More than 40% Clay
The ribbon is more than 2 ½ inches long. Clay dominates the sample. The textural name contains the term clay as the last name in the textural class.

The Feel Method of Determining Textural Classes

1) Sand
   a) Moist sand sample collapses after squeezing; non-sticky
   b) Hand stays clean while working the sample
   c) Feels gritty

2) Loamy Sand
   a) Sample has very little body; non-sticky
   b) Moist soil barely stays together after squeezing
   c) Just enough silt to dirty your hands
   d) Will not form ribbon

3) Sandy Loam
   a) Sand noticeably evident; non-sticky
   b) Moist soil stays together after squeezing
   c) Enough silt and clay to give body
   d) Barely forms a ribbon

4) Sandy Clay Loam
   a) Moist sample feels gritty and somewhat sticky
   b) Forms ribbon 1-2 inches long

5) Sandy Clay
   a) Can feel sand in sample; stains fingers; sticky
   b) Forms ribbon 2-3 inches long

6) Loam
   a) Sand noticeable but not dominant; non-sticky
   b) Sample works easily between thumb and forefinger
   c) Contains enough silt and clay to give sample good body
   d) Forms only short, broken ribbons.

7) Silt Loam
   a) Feels smooth like flour or cornstarch with grains of sand noticeable
   b) Tends to be non-sticky
   c) Forms only short, broken ribbons

8) Silt

   a) Feels like flour or cornstarch
   b) Tends to be non-sticky, smooth
   c) Forms ribbon less than 1 inch long

9) Clay Loam

   a) Noticeably gritty, but sand does not dominate
   b) Noticeably sticky
   c) Harder to work between thumb and forefinger; stains fingers
   d) Forms gritty ribbon 1-2 ½ inches long

10) Silty Clay Loam
   a) Feels smooth and slightly sticky
   b) Contains very little sand; stains fingers
   c) Forms ribbon 1-2 ½ inches long

11) Silty Clay
   a) Dry sample absorbs a lot of water before it is moist enough to work; slightly sticky
   b) Sample hard to work between thumb and forefinger; stains fingers
   c) Forms ribbon 2 ½-4 inches long

12) Clay
   a) Dry sample absorbs a lot of water before it is moist enough to work; very sticky
   b) Sample hard to work between thumb and forefinger; stains fingers; smooth satiny feel
   c) Forms flexible ribbon 2½-4 inches long

ROCK FRAGMENTS

Rock fragment modifiers are used to describe the percentage of rock fragments in the horizon, and are presented in association with soil textural class names.

Fragment Content (% by volume)	Rock Fragment Modifier Usage
<15	No texture adjective is used; e.g., *loam*.
15 to <35	Use adjectives for appropriate size; e.g., *gravelly loam*.
35 to <60	Use "very" with the appropriate size adjective; e.g., *very gravelly loam*.
60 to <90	Use "extremely" with the appropriate size adjective; e.g., *extremely gravelly loam*.
≥90	No adjective or modifier is used. If ≤10% fine earth, use the appropriate noun for the dominant size class; e.g., *gravel*.

Size Classes

ROUNDED, SPHERICAL, OR CUBELIKE

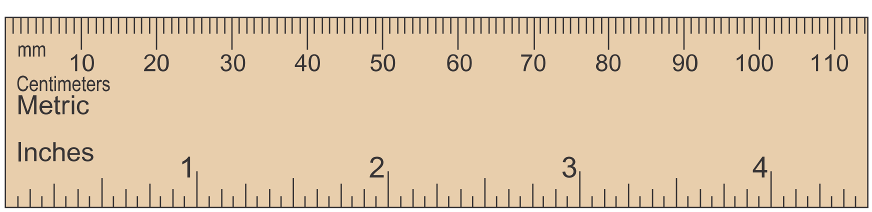
(The measurement represents the diameter of the rock.)

Size	Noun	Adjective
>2-75 mm/0-3 in.	gravel	gravelly
>75-250 mm/3-10 in.	cobbles	cobbly
>250-600 mm/10-24 in.	stones	stony
>600 mm/>24 in.	boulders	bouldery

FLAT

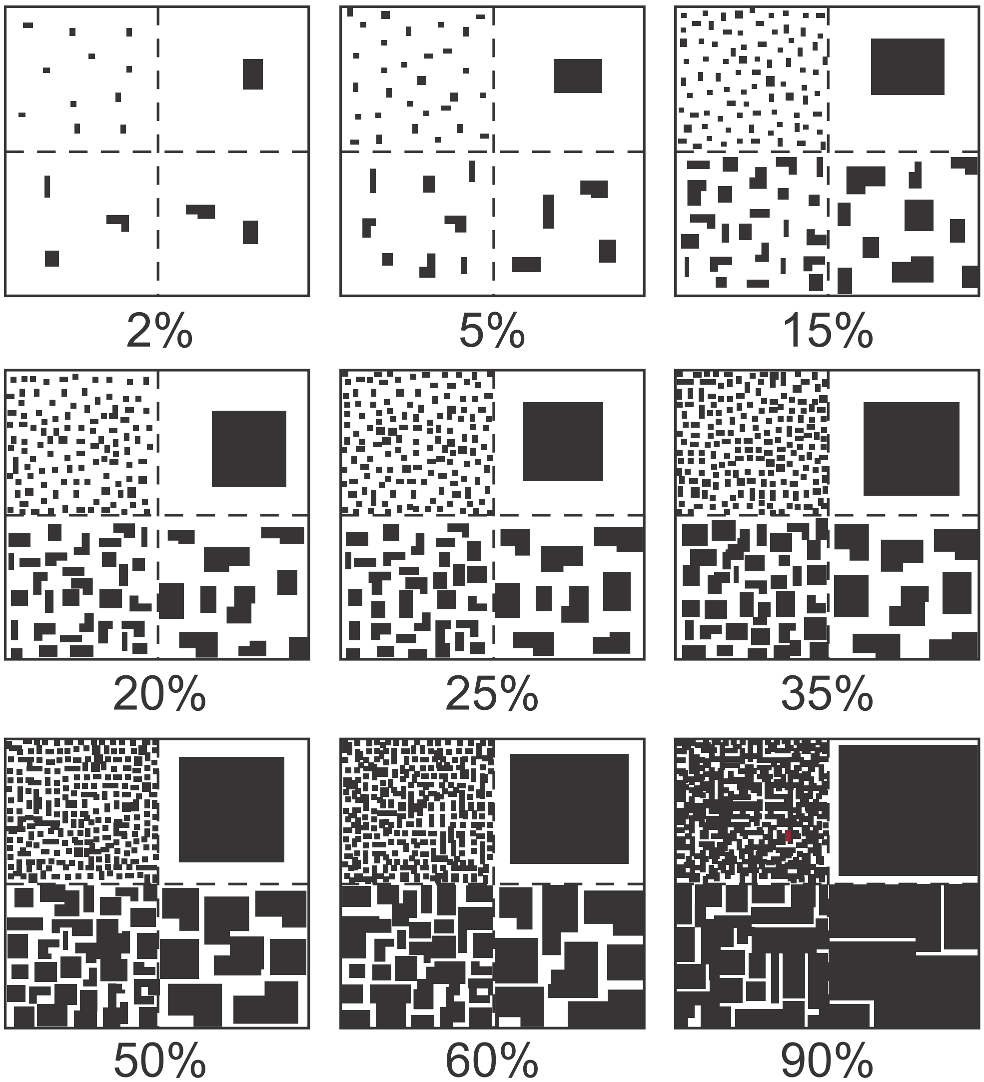
(The measurement represents the longest axis of the rock.)

Size	Noun	Adjective
>2-150 mm/0-6 in.	channers	channery
>150-380 mm/6-15 in.	flagstones	flaggy
>380-600 mm/15-24 in.	stones	stony
>600 mm/>24 in.	boulders	bouldery



Estimating the Percentage of Rock Fragments

The illustration below shows how the distribution and size of rock fragments may vary within the same percentage. Within any given box, each quadrant contains the same total area cover, just different sized objects.



STRUCTURE

Structure is the shape of a unit of soil as it is naturally bound together. These units, called peds, are like pieces of a puzzle that fit together.

Note: If more than one structure exists, use the dominant one to characterize that horizon.

Structureless

Structureless soils have no noticeable peds.

1) **Massive**—large solid mass of material that is bound together
2) **Single grain**—single grains of sand

Note: Massive structures may restrict the flow of liquid, and single grains of sand may let the effluent infiltrate too fast for proper renovation.

Structure

In soils that have structure, each of these conditions should be described:

1) Type
2) Grade
3) Size

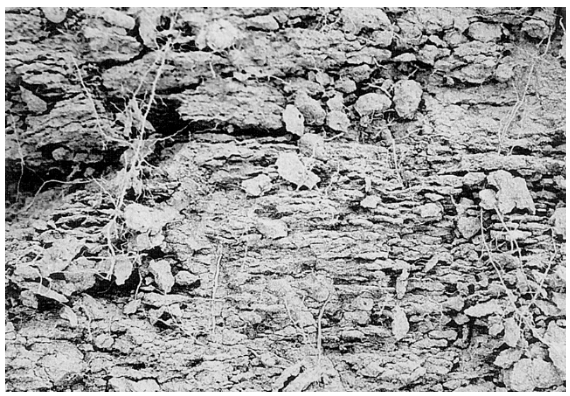
1) TYPE OR SHAPE OF STRUCTURE

The following terms describe the basic shapes and related arrangements.

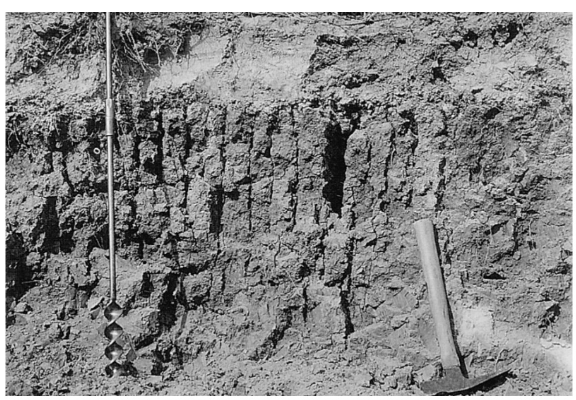
Granular: The units are approximately spherical and are bounded by curved or very irregular faces.

Blocky: The units are block-like. The structure is described as angular blocky it the faces intersect at very sharp angles (like shattered glass), and as subangular blocky if the faces are a mixture of rounded plan faces and the corners are mostly rounded. ***(A subangular blocky structure is shown below.)***

Platy: The units are flat and plate-like, oriented horizontally.



Prismatic: Units are distinctly longer vertically. The tops of the prisms are somewhat indistinct and normally flat.



2) GRADE OF STRUCTRUE

The grade of structure describes the distinctness of the structural units. The criteria are based on the structure's ease of separation into discrete units and the proportion of units that hold together when the soil is handled.

Classes of Grade:

Weak: Units are barely observable in places. When gently disturbed, the soil material parts into a mixture of whole and broken units and most of the material exhibits no planes of weakness.

Moderate: Units are well formed and evident in undisturbed soil. When disturbed, the soil material parts into a mixture of mostly whole units, some broken units, and some material that is not in units.

Strong: Units are distinct in undisturbed soil. They separate cleanly when the soil is disturbed. When removed, the soil material separates mainly into whole units.

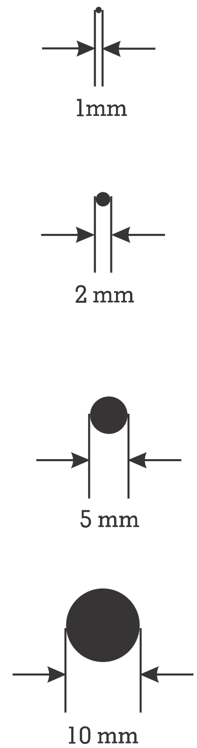
3) SIZE CLASSIFICATION OF STRUCTURAL TYPES

The following pages identify the separate size classifications of four structural shapes.

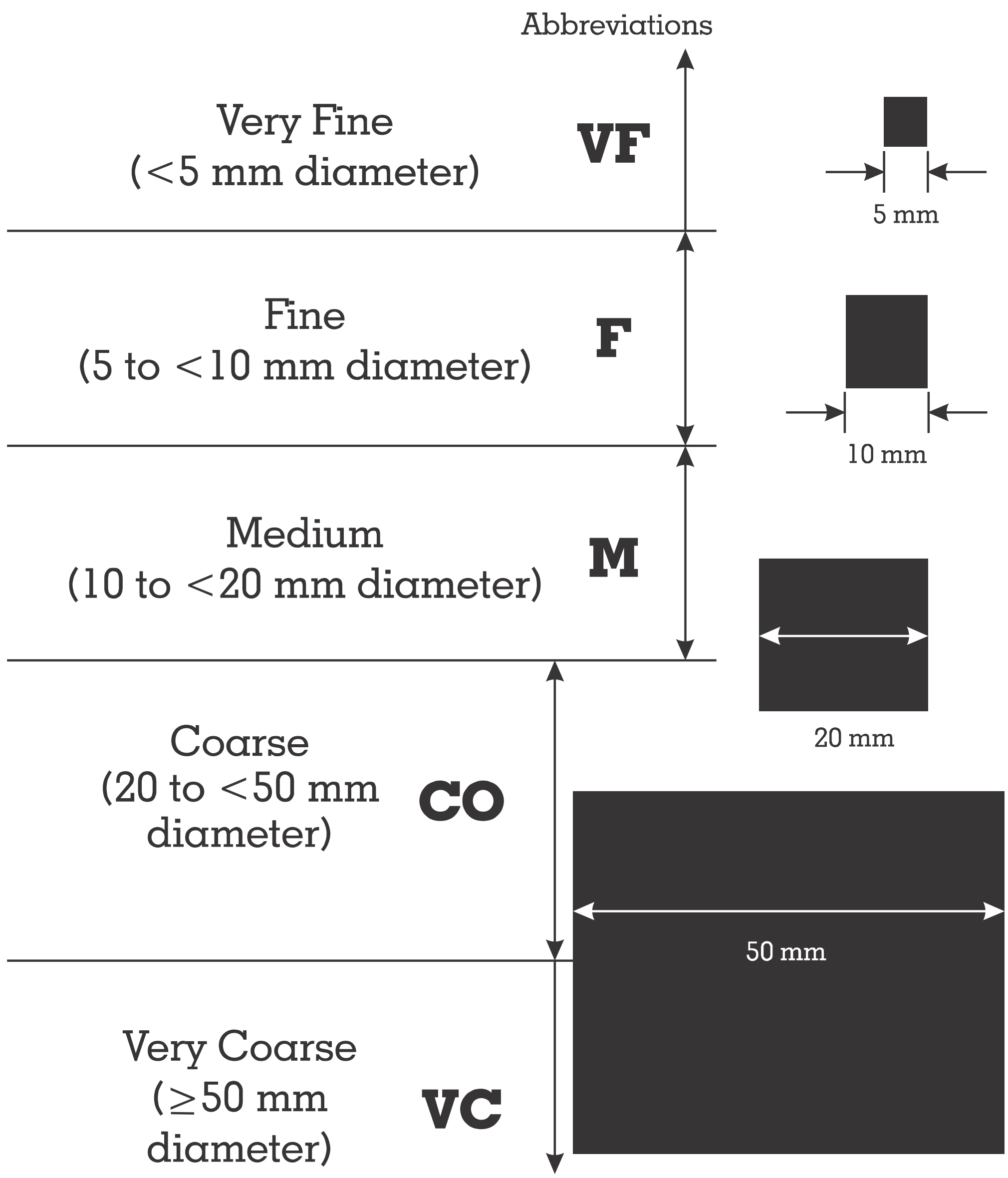
Note: The following four diagrams are **not** shown to scale.

Granular

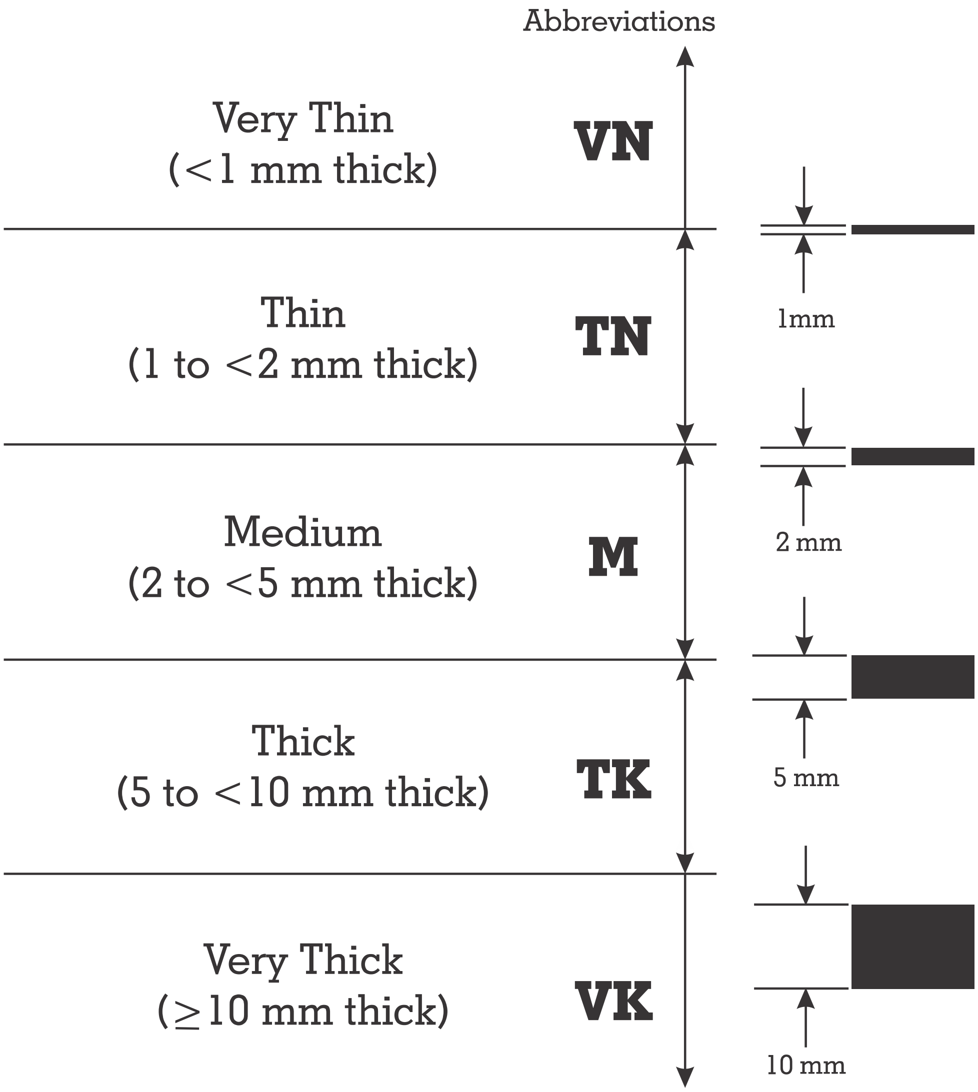
	Abbreviations
Very Fine (<1 mm diameter)	**VF**
Fine (1 to <2 mm diameter)	**F**
Medium (2 to <5 mm diameter)	**M**
Coarse (5 to <10 mm diameter)	**CO**
Very Coarse (≥10 mm diameter)	**VC**



Angular & Subangular Blocky



Platy



Abbreviations
Very Thin
(<1 mm thick)
VN
Thin
(1 to <2 mm thick)
TN
Medium
(2 to <5 mm thick)
M
Thick
(5 to <10 mm thick)
TK
Very Thick
(≥10 mm thick)
VK
1mm
2 mm
5 mm
10 mm

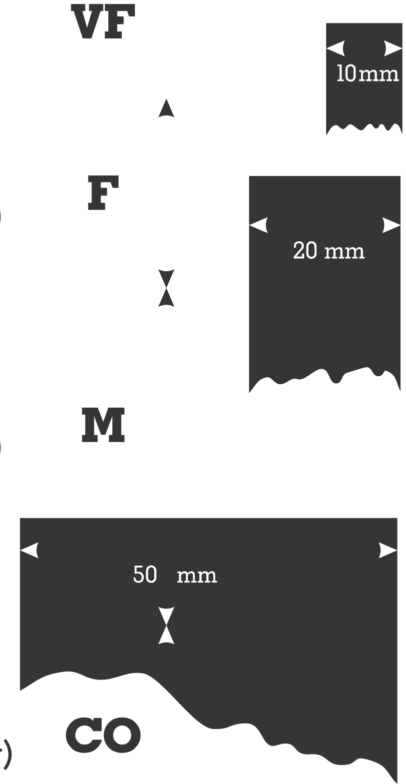
Prismatic & Columnar

Abbreviations

Very Fine (<10 mm diameter) — **VF**

Fine (10 to <20 mm diameter) — **F**

Medium (20 to <50 mm diameter) — **M**



Coarse (50 to <100 mm diameter) — **CO**

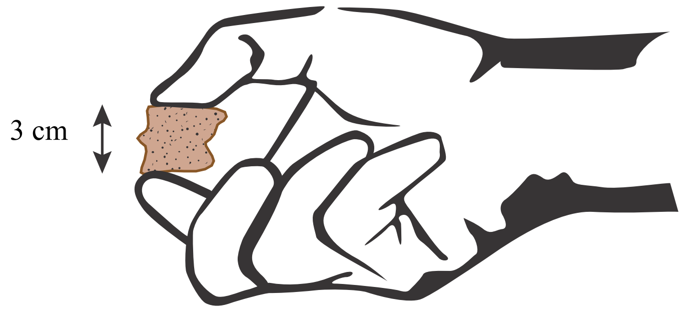
Very Coarse (100 to <500 mm diameter) — **VC** [100 mm not shown]

Extremely Coarse (>500 mm diameter) — **EC** [500 mm not shown]

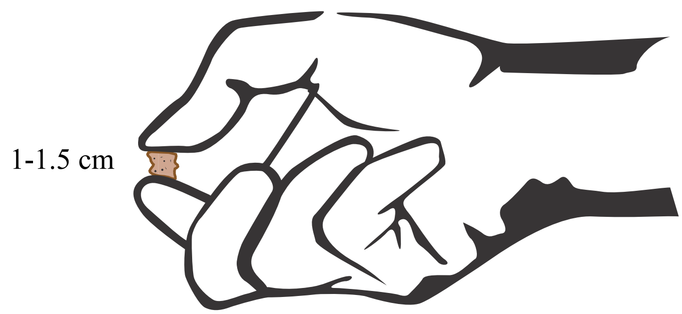
CONSISTENCE

- Soil consistence is the resistance of a soil structural unit to deformation at various moisture contents.
- Consistence may be a good indicator of liquid penetration.

With block-shaped specimens, the sample should be approximately 3 cm across to determine consistence.



With plate-shaped specimens, the sample should be approximately 1-1.5 cm across to determine consistence.



When the soil is in a moist state, terminology associated with moist soil conditions is used. In most cases, moist soil conditions are noted.

<u>Consistence</u>

MOIST SOIL CONDITION:	SPECIMEN BREAKS APART WITH:
Loose	Intact specimen not obtainable
Very friable	Very slight force between fingers
Friable	Slight force between fingers
Firm	Moderate force between fingers
Very firm	Strong force between fingers
Extremely firm	Moderate force between hands

Dry and Wet Consistence Terminology

When the soil is in a dry state, terminology associated with dry soil conditions is used.

Consistence

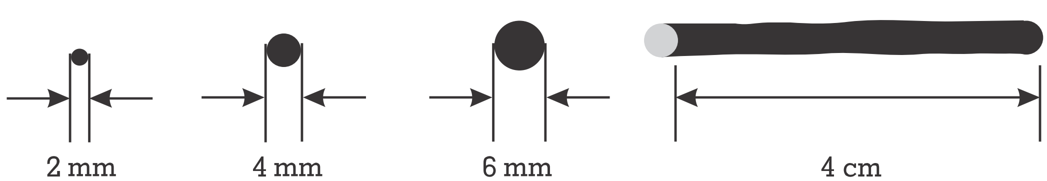
DRY SOIL CONDITION:	SPECIMEN BREAKS APART WITH:
Loose	Intact specimen not obtainable
Soft	Very slight force between fingers
Slightly hard	Slight force between fingers
Moderately hard	Moderate force between fingers
Hard	Strong force between fingers
Very hard	Moderate force between hands
Extremely hard	Foot pressure by full body weight

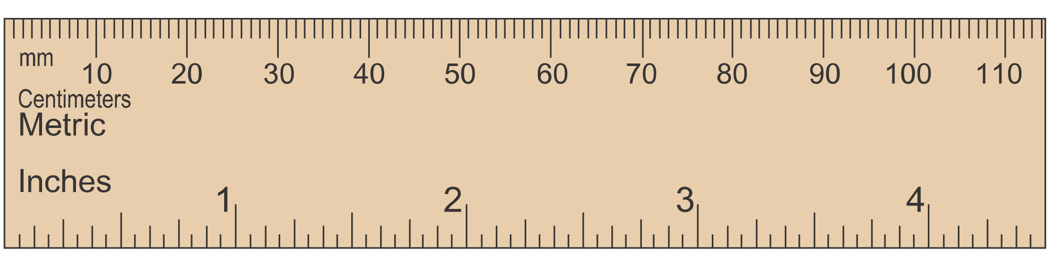
When the soil is in a wet state, stickiness and plasticity is used to describe soil consistence.

Wet Soil Condition:	**Criteria:**
STICKINESS CLASS	**WORK MOISTENED SOIL BETWEEN THUMB AND FOREFINGER. . .**
Non-sticky	Little or no soil adheres to fingers after release of pressure.
Slightly sticky	Soil adheres to both fingers after release of pressure. Soil stretches little on separation of fingers.
Moderately sticky	Soil adheres to both fingers after release of pressure. Soil stretches some on separation of fingers.
Very sticky	Soil adheres firmly to both fingers after release of pressure. Soil stretches greatly upon separation of fingers.

Wet Soil Condition:	**Criteria:**
PLASTICITY CLASS	**MAKE A ROLL OF SOIL 4 CM LONG . . .**
Non-plastic	Will not form a 6 mm diameter roll or, if formed, can't support itself if held on end.
Slightly plastic	6 mm diameter roll supports itself; 4 mm diameter roll does not.
Moderately plastic	4 mm diameter roll supports itself; 2 mm diameter roll does not.
Very plastic	2 mm diameter roll supports its weight.

Note: The diagram and ruler below are **not** shown to scale.





SOIL HORIZONS

A soil horizon is a layer in the soil profile, roughly parallel to the surface, that differs in characteristics from adjacent layers. Usually this a result of several soil-forming processes. Horizons are given a standard designation based on their characteristics and relation to adjacent horizons. Horizon designation can be thought of as a three-step process:

1) Recognize the characteristics that distinguish the horizons;
2) Describe the characteristics of each horizon; and
3) Name or designate the horizons based on their descriptions.

Recognizing Horizons

Horizon separations are generally based on differences in **color, texture,** and/or s**tructure**. Other soil features may also be used for a horizon break. Identify the approximate boundaries between the horizons based on these differences.

To identify these horizons, examine the soil profile by moving from the surface downward, looking for changes in soil properties. Compare material near the top and the bottom of what you believe to be one horizon. Soils are rarely uniform throughout, so use your judgment (and experience) to decide whether the soil materials are sufficiently different to warrant further subdivision.

Do not confine your examination to a narrow section of the soil probe; look at the entire exposed soil area. When the soil properties change, a horizon break must be indicated. Some horizons will have variations within the horizon, which should be noted.

Describing Horizon Characteristics

Once satisfied with your horizon breaks, you may begin describing the characteristics of the horizons. Describe the basic soil characteristics first before deciding on a designation. This minimizes any unintentional bias that may result from trying to tailor the description to fit the horizon designation.

Describe the basic soil characteristics for each horizon. While some prefer to describe all of the features for one horizon before moving to the next, others may describe the same property for each horizon before moving on to the next property. This latter method allows for easier recognition of changes in properties from one horizon to the next and is useful in comparing adjacent horizons.

Characteristics of the Master Soil Horizons

MASTER HORIZON	CHARACTERISTICS
Organic Horizon	
O	Horizon or layer dominated by fresh and/or decomposed organic material.
Mineral Horizons	
A	Mineral horizon formed at the surface or below an “O” horizon. “A” horizons exhibit one or both of the following: 1) An accumulation of humified organic matter mixed with the mineral fraction, not dominated by properties of the “E” and “B” horizons (described below). 2) Properties resulting from cultivation, pasturing, or other disturbances.
E	Mineral horizon in which the dominant feature is the eluvial loss of clay, iron, aluminum, organic matter, or a combination of these elements. These losses result in a concentration of sand and silt particles and lighter colors. All or much of the original parent material structure is obliterated.
B	Mineral horizons in which all or much of the parent material structure is obliterated. “B” horizons exhibit one or more of the following properties: 1) Illuvial concentrations of clay, iron, aluminum, organic matter, or a combination of them. 2) A redder and often darker soil. 3) Color change (redder hue, lower value, or higher chroma) in relation to overlying and underlying horizons. 4) Alteration of original material to form clay and/or release oxides and form granular, blocky, or prismatic structure.
C	Mineral horizons or layers, excluding “R” horizons, that are relatively unaffected by soil-forming processes. Properties are dominated by the parent material. Unconsolidated with low to moderate excavation difficulty, this horizon is still considered soil.
R	Hard bedrock that is difficult to excavate. Cracks, if present, are too few or too small to allow root penetration.

Subordinate Horizon Designations Common to Pennsylvania

SUBORDINATE DESIGNATION	CHARACTERISTICS
Mineral Horizons	
b	Buried genetic horizon (A, E, or B); features formed before burial.
c	Concentrations or nodules of iron, manganese, or aluminum in significant accumulation (O, A, E, B, or C).
d	Dense, root-restricting layer (B or C; not with fragipan).
g	Strong gleying; matrix chromas generally ≤ 2, resulting from saturation and reduction (A, E, B, or C).
h	Illuvial accumulation of organic matter (B only).
p	Plowing or other disturbance (O or A only).
r	Weathered or soft bedrock; root-restricting layer that can be excavated with a shovel (C only).
s	Illuvial accumulation of sesquioxides (oxides and hydroxides of iron and aluminum) and organic matter (B only).
t	Accumulation of clay by illuviation or concentration (usually B; may be used in C or R).
w	Development of color and structure with little or no illuvial accumulation (B only).
x	Fragipan character as indicated by genetically developed firmness, brittleness, and high bulk density that restricts root penetration (B or C).

Horizon Boundaries

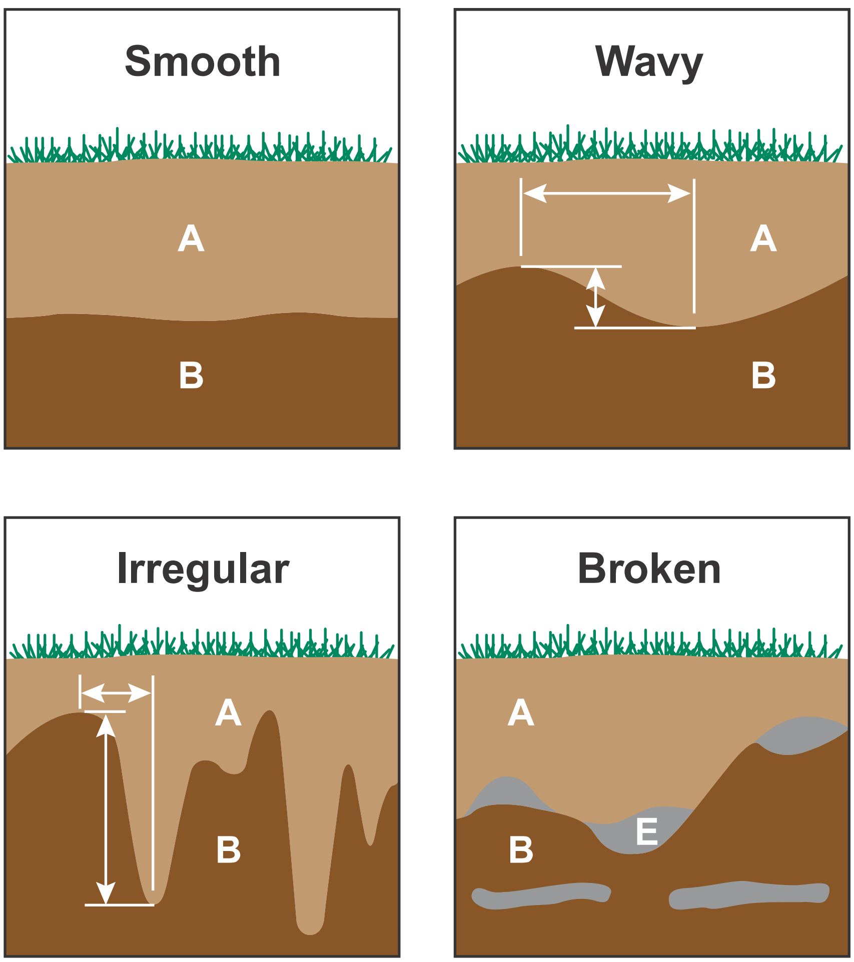
- A soil boundary is a transitional layer between two adjoining horizons.
- Each boundary is characterized by describing its distinctness and topography.

DISTINCTNESS

Class	Horizon Transition Thickness
Abrupt	<3/4"
Clear	3/4-2"
Gradual	>2-6"
Diffuse	>6"

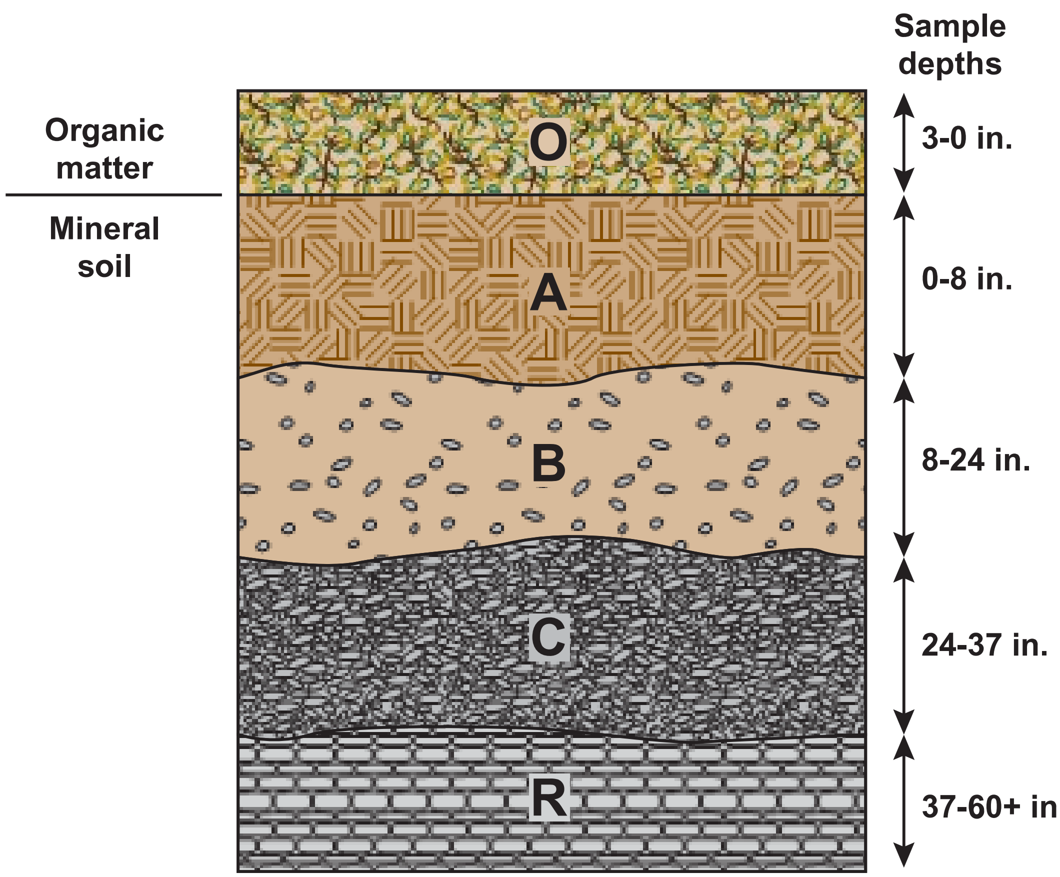
TOPOGRAPHY

The illustrations below show the different kinds of topography for soil horizon boundaries.



Measuring the Depth of the Horizons

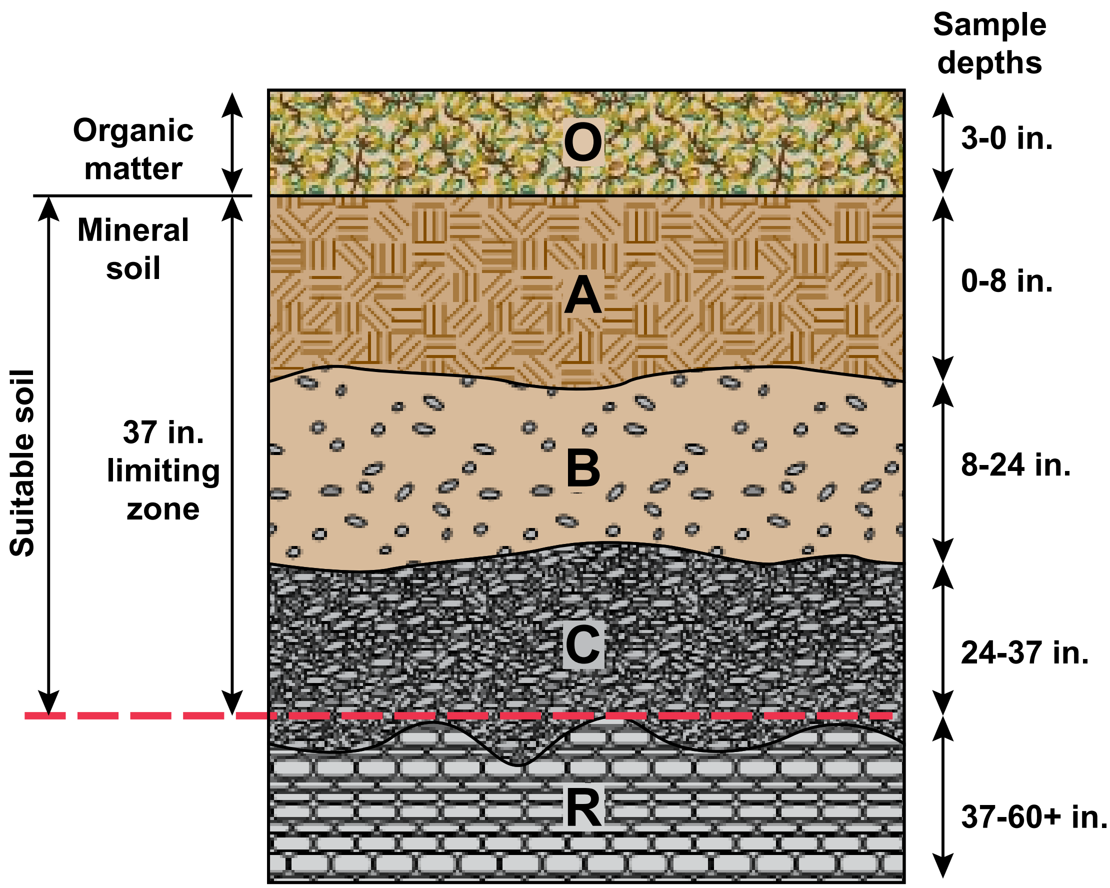
The organic horizon is measured from the top of the mineral soil surface to the top of the organic matter, and the mineral horizons are measured from the top of each horizon to the bottom of that horizon. ***(See diagram below.)***



MEASURING THE DEPTH TO THE LIMITING ZONE

The limiting zone is measured at the shallowest depth of the limiting zone to the mineral surface. ***(See diagram below.)***

Note: The depth of organic matter **must not** be included in the depth of suitable soil. The depth of suitable soil begins at the top of a mineral soil.



SOIL ABBREVIATIONS

ROCK FRAGMENT MODIFIER

Gravelly – GR	Very gravelly – VGR	Extremely gravelly – EGR
Cobbly – CB	Very cobbly – VCB	Extremely cobbly – ECB
Channery – CH	Very channery – VCH	Extremely channery – ECH
Flaggy – FL	Very flaggy – VFL	Extremely flaggy – EFL
Stony – ST	Very stony – VST	Extremely stony – EST
Bouldery – BD	Very Bouldery – VBD	Extremely bouldery - EBD

TEXTURAL CLASS

Sand – S	Loamy sand – LS	Sandy loam – SL
Loam – L	Silt loam – SIL	Silt – SI
Sandy clay loam – SCL	Clay loam – CL	Silty clay loam – SICL
Sandy clay – SC	Silty clay – SIC	Clay - C

STRUCTURE

Grade: Structureless – 0
Weak – 1
Moderate – 2
Strong – 3

Shape: Granular- GR
Platy – PL
Subangular blocky - SBK
Angular blocky - ABK
Prismatic – PR
Massive – MA
Single grain - SG

Size: Refer to pages I-C-25 to I-C-28.

MOIST CONSISTENCE

Loose – LO
Friable – FR
Very friable – VFR
Firm – FI
Very firm – VFI
Extremely firm - EFI

REDOXIMORPHIC FEATURES

Abundance: Few – F
Common – C
Many – M

Size: Fine – 1
Medium – 2
Coarse – 3
Very coarse – 4
Extremely coarse – 5

Contrast: Faint – F
Distinct – D
Prominent – P

BOUNDARY DISTINCTNESS

Abrupt – A	Clear – C	Gradual – G	Diffuse – D
Smooth – S	Wavy – W	Irregular – I	Broken – B

Sewage Flows

SEWAGE FLOWS IN THE REGULATIONS

Sections 73.16 and 73.17

- Absorption areas and spray fields for single-family dwellings not served by a community sewage system must be designed based on a minimum flow of 400 gallons per day (gpd) for all dwellings having three bedrooms or less. The minimum flow of 400 gpd is increased by 100 gpd for each bedroom over three.
- The flow figures in Section 73.17 of the regulations are peak daily flows for the design of community onlot sewage disposal systems. The sewage flow from single-family dwellings served by a community onlot sewage disposal system or from apartments, rooming houses, hotels, and motels served by an individual or community onlot sewage disposal system must be determined from the following table:

Residential Establishment

	Gallons/unit/day	
	Gallons/unit	BOD/unit
Hotels and motels	100	.30
Multiple-family dwellings and apartments, including townhouses, duplexes, and condominiums	400	1.13
Rooming houses (per unit)	200	.60
Single-family residences	400*	.90

**For units of three bedrooms or less. For each bedroom over three, add 100 gallons.*

Commercial Establishment

- The sewage flow, which excludes any industrial waste, for nonresidential establishments served by an individual or community onlot sewage disposal system must be determined from the following table:

Note: 200 gallons per day is the minimum flow for a commercial establishment.

	Gallons/day	BOD/day
Airline catering (per meal served)	3	.03
Airports (per passenger—not including food)	5	.02
Airports (per employee)	10	.06
Beauty shops—one licensed operator	200	—
Bus service areas, not including food (per patron and employee)	5	.02
Country clubs, not including food (per patron and employee)	30	.02
Drive-in theaters (not including food—per space	10	.06
Factories and plants exclusive of industrial wastes (per employee)	10	.06
Laundries, self-service (gallons/washer)	400	2.00
Mobile home parks, independent (per space)	400	1.00
Movie theaters (not including food, per auditorium seat)	5	.03
Offices (per employee)	10	.06
Restaurants (toilet and kitchen wastes per patron)	10	.06
(additional for bars and cocktail lounges)	2	.02
Restaurants (kitchen and toilet wastes, single-service utensils/person)	8.5	.03
Restaurants (kitchen waste only, single-service utensils/patron	3	.01
Stores (per public toilet)	400	2.00
Warehouses (per employee)	35	—
Work or construction camps (semipermanent) with flush toilets (per employee)	50	.17
Work or construction camps (semipermanent) without flush toilets (per employee)	35	.02

Institutional Establishment

Note: 200 gallons per day is the minimum flow for a commercial establishment.

	Gallons/day	BOD/day
Churches (per seat)	3	—
Churches (additional kitchen waste per meal served	3	—
Churches (additional with paper service per meal served	1.5	—
Hospitals (per bed space, with laundry)	300	.20
Hospitals (per bed space, without laundry)	220	—
Institutional food service (per meal)	20	—
Institutions other than hospitals (per bed space)	125	.17
Schools, boarding (per resident)	100	.17
Schools, day (without cafeterias, gyms, or showers per student and employee)	15	.04
Schools, day (with cafeterias, but no gyms or showers per student and employee	20	.08
Schools, day (with cafeterias, gyms, and showers per student and employee)	25	.10

Recreational and Seasonal

Note: 200 gallons per day is the minimum flow for a recreational or seasonal facility.

	Gallons/day	BOD/day
Camps, day (no meals served)	10	.12
Camps, hunting, and summer residential (night and day) with limited plumbing including water-carried toilet wastes (per person)	50	.12
Campgrounds, with individual sewer and water hookup (per person)	100	.50
Campgrounds with water hookup only and/or central comfort station which includes water-carried toilet waste (per space)	50	.50
Fairgrounds and parks, picnic—with bathhouses, showers, and flush toilets (per person)	15	.06
Fairgrounds and parks, picnic (toilet wastes only, per person)	5	.06
Swimming pools and bathhouses (per person)	10	.06

CALCULATING A SEWAGE FLOW FOR NONRESIDENTIAL ESTABLISHMENT

Sections 73.17

Actual Peak Flow

This section allows a nonresidential establishment to measure the actual peak daily flow for an existing or a new establishment to determine the sewage flow to size an absorption area.

Existing nonresidential establishment: For example, a school may take daily flow measurements for a year to establish a peak daily flow. If the school is proposing to add 100 students, it can use this actual peak daily flow rather than the number in the regulations. The actual measured peak daily flow may be used to size or expand the existing onlot sewage disposal system.

New nonresidential establishment: For example, a store could take daily flow measurements for a year from a similar existing store and use the actual peak daily flow to size its onlot sewage disposal system.

Calculating Peak Flow

- If a nonresidential establishment does not want to take flow readings every day to determine the peak daily sewage flow, the total flow could be measured for a year and then divided by the days of operation in a year.
- If the average actual daily flow is used, the peak daily flow must be calculated by multiplying the average daily flow by two.
- Care must be exercised when dealing with a facility that has irregular sewage flows.

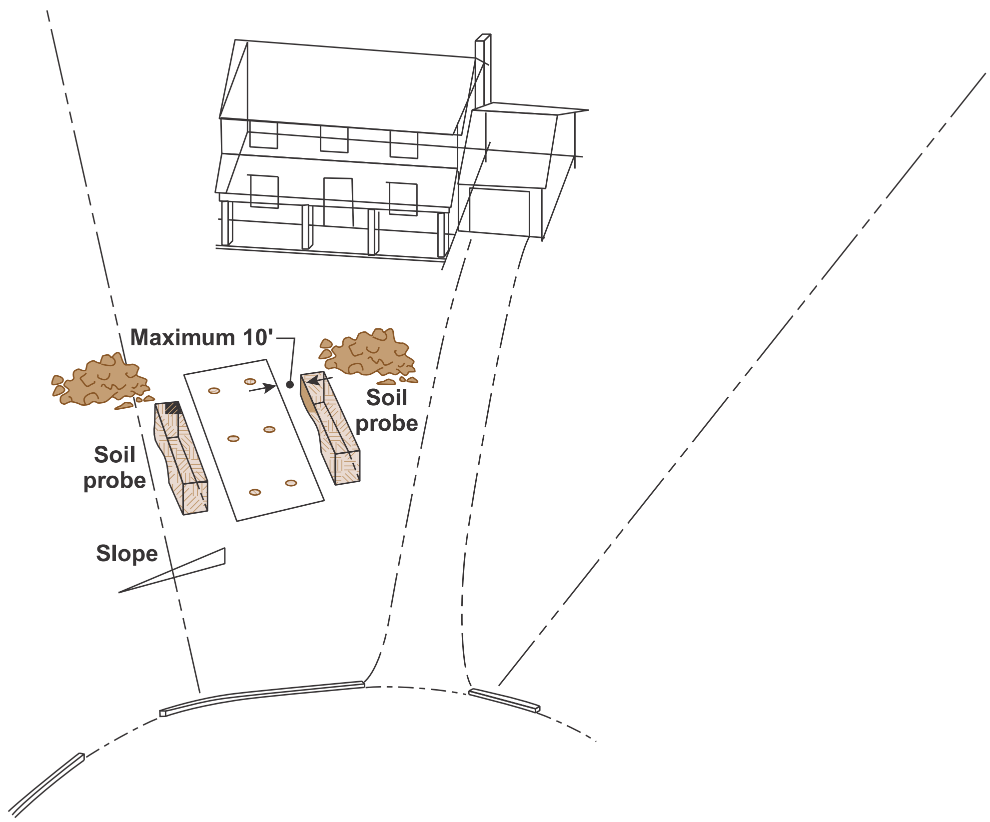
INDUSTRIAL WASTE

Contact the DEP regional office if you are dealing with an industrial waste.

Some examples of industrial waste may be:

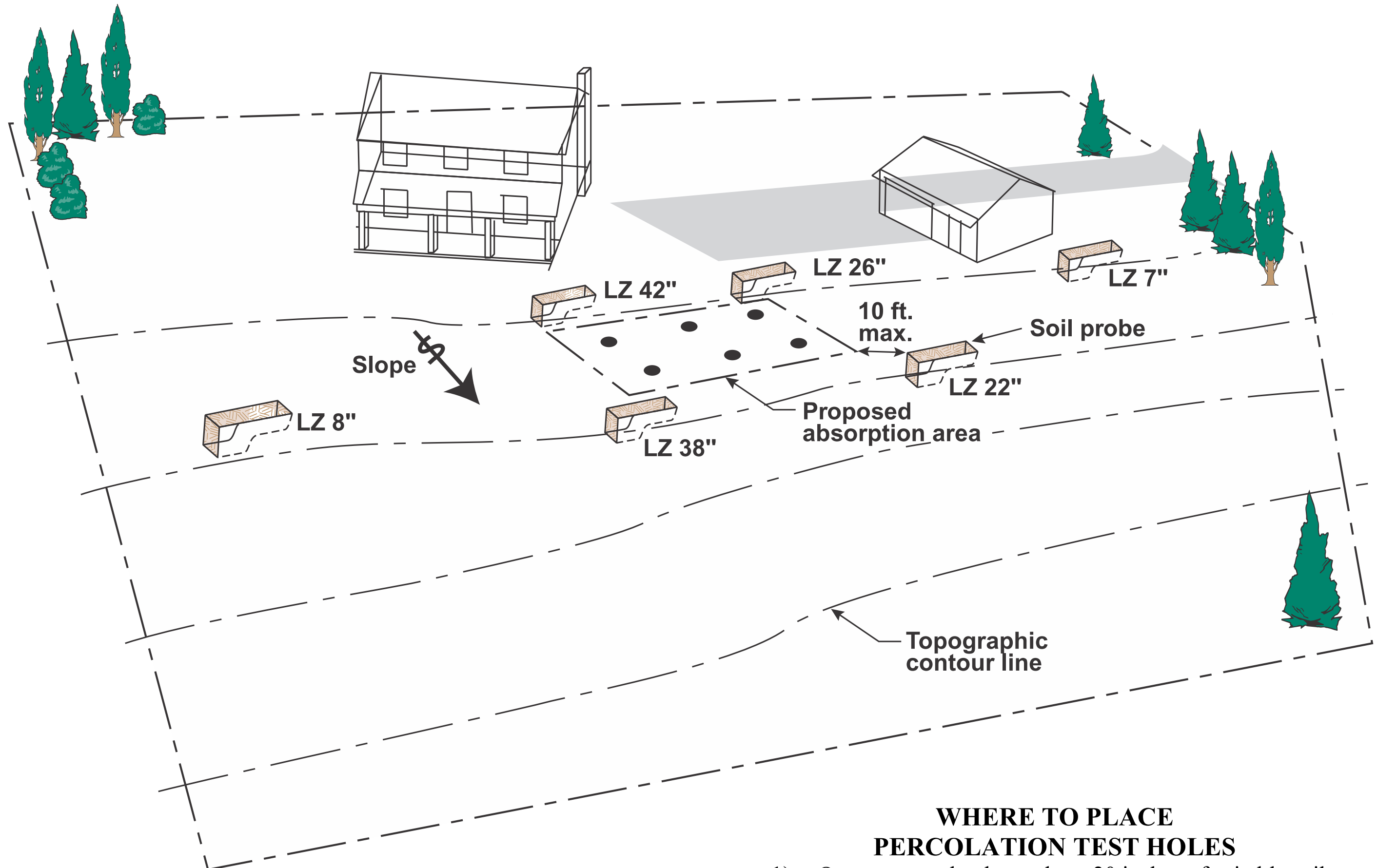
- Slaughterhouses
- Funeral homes
- Pharmacies
- Beauty salons (more than one operator)
- Car washes
- Pet kennels

Percolation Test



The illustration above shows a proposed absorption area with six percolation test holes.

- The percolation test determines the rate at which sewage effluent can be expected to move through the soil.
- The percolation rate determines the size of the absorption area and may also determine the type of absorption area, the method of distribution, or the suitability of the site.



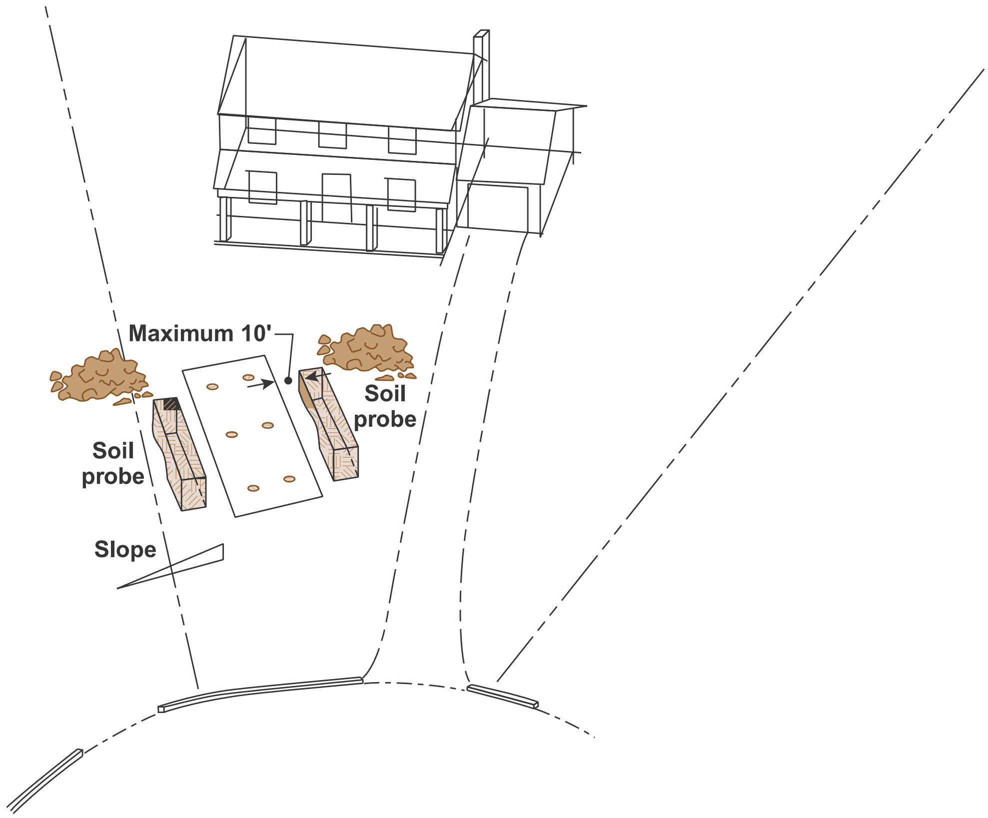
WHERE TO PLACE
PERCOLATION TEST HOLES

1) Over an area that has at least 20 inches of suitable soil
2) Along ground surface contours
3) Spaced uniformly over the proposed absorption area

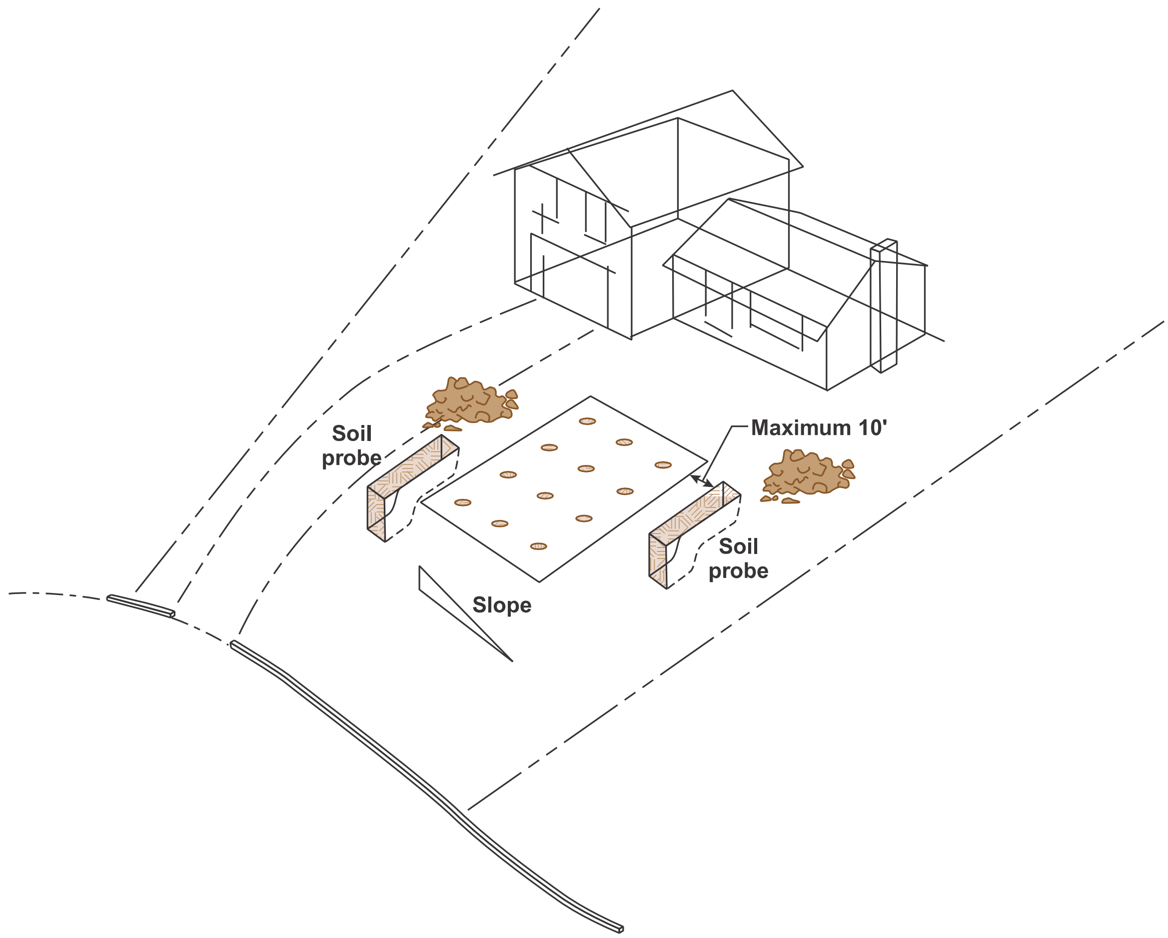
MINIMUM NUMBER OF PERCOLATION TEST HOLES

Section 73.15

- A minimum of six percolation test holes must be spaced uniformly throughout the proposed absorption area site.
- Sufficient holes must be tested to adequately cover the proposed absorption area.



MINIMUM RECOMMENDED NUMBER OF PERCOLATION HOLES FOR LARGER SYSTEMS



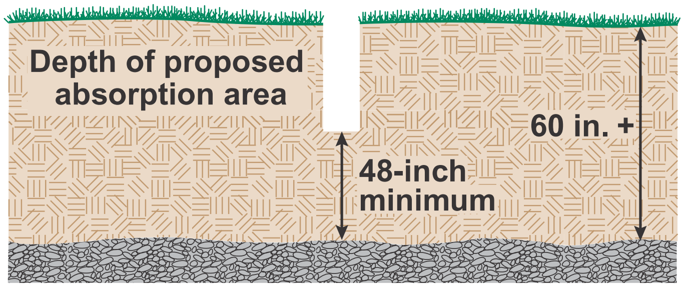
1) **Projected absorption area size** — **Minimum number of test holes**
   - 3,000 sq. ft. —— 12 holes
   - 4,000 sq. ft. —— 15 holes
   - 5.000 sq. ft. —— 18 holes
2) Place holes along contours
3) Space holes uniformly throughout the proposed absorption area

Note: Sufficient percolation holes must be tested to adequately cover the proposed absorption area. At any given site, you may need more test holes.

DEPTH OF PERCOLATION TEST HOLES

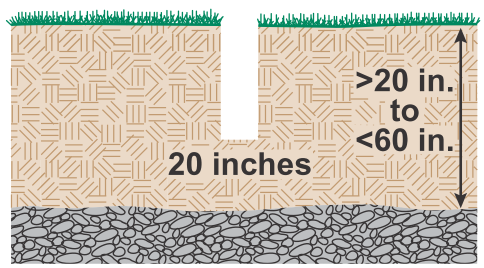
Limiting Zone at 60 Inches or More

Percolation holes must be dug to the depth of the proposed absorption area, where the limiting zone is 60 inches or more from the mineral soil surface. In all cases, a minimum 48-inch vertical separation must be maintained between the bottom of the proposed absorption area aggregate and the soil limiting conditions.



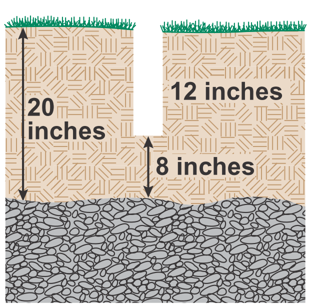
Limiting Zone of Seasonal High Water Table, Rock Formation, or Slowly Permeable Soil Condition

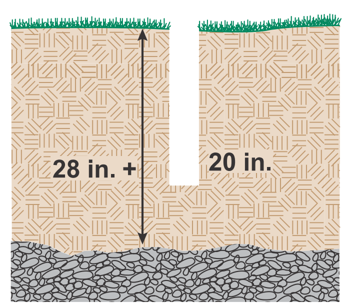
Percolation holes must be dug to a depth of 20 inches if the limiting zone occurs at less than 60 inches from the mineral soil surface and is identified as a seasonal high water table, whether perched or regional; rock formation; other stratum; or other soil condition which is so slowly permeable that it effectively limits downward passage of effluent.



Limiting Zone of Rock with Open Joints

Percolation holes must be dug to a depth of 8 inches above the limiting zone or 20 inches, whichever is less, if the limiting zone occurs at less than 60 inches from the mineral soil surface and is identified as rock with open joints, or with fractures or solution channels, or as masses of loose rock fragments, including gravel with insufficient fine soil to fill the voids between the fragments.





PREPARATION OF PERCOLATION TEST HOLES

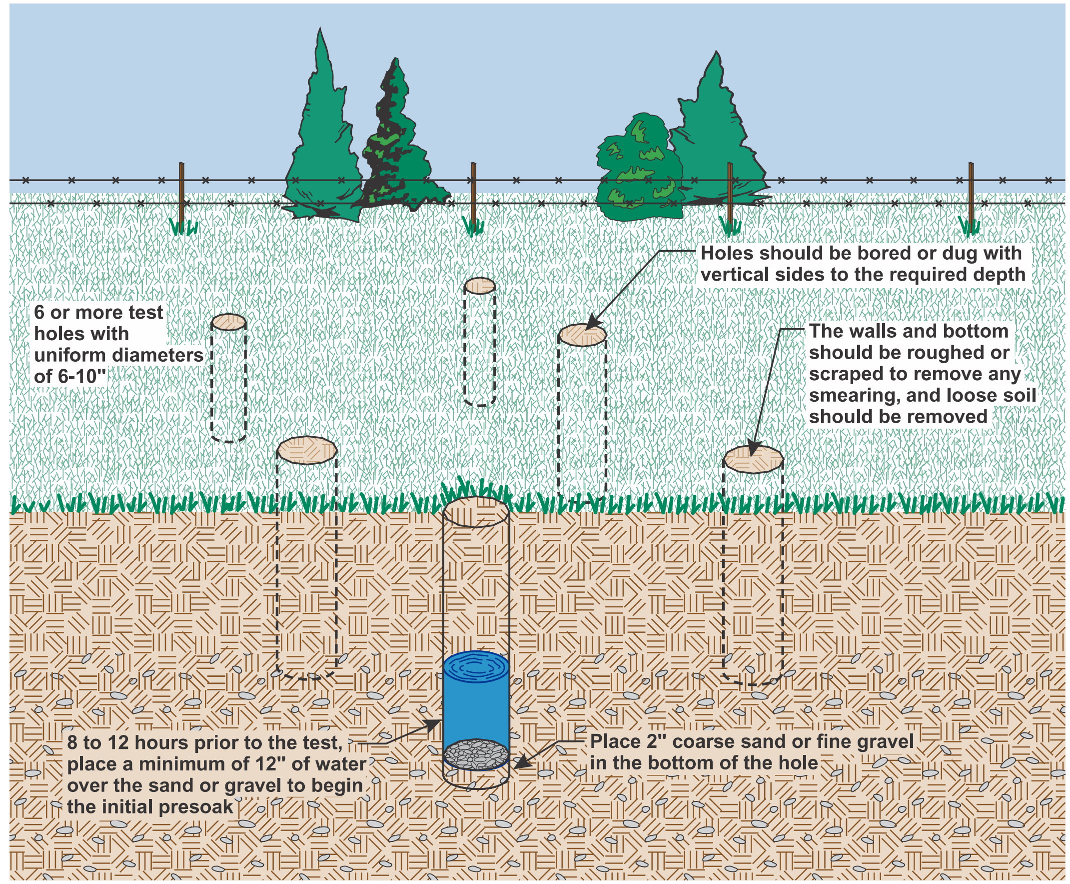
1) Must have six or more test holes with uniform diameters of 6-10 inches.

2) Holes should be bored or dug with vertical sides to the required depth.

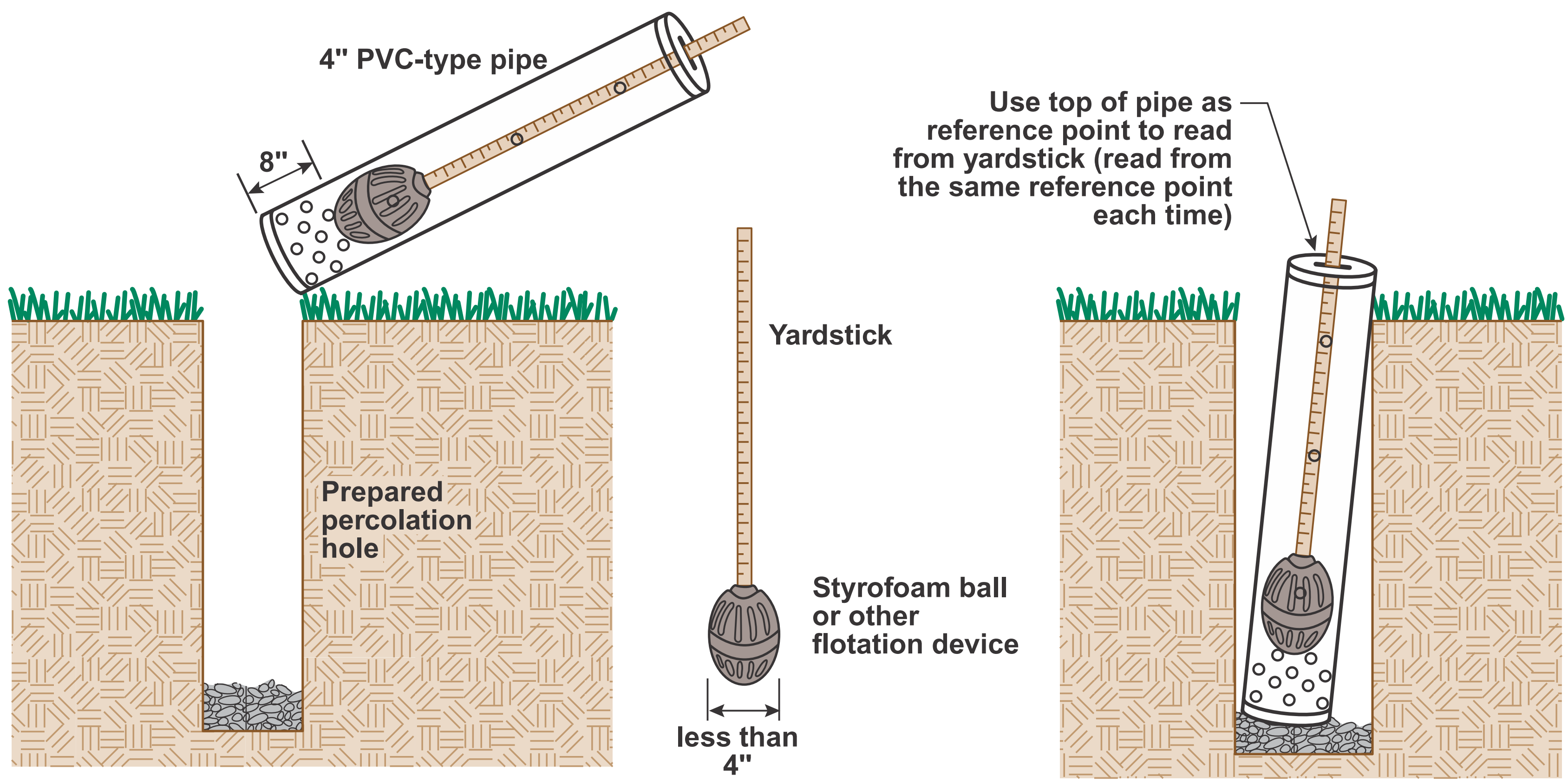
3) The walls and bottom of the holes should be roughed or scraped to remove any smearing, and loose soil should be removed.

4) Place 2 inches of coarse sand or fine gravel in the bottom of the hole.

5) Place a minimum of 12 inches of water over the sand or gravel to begin the initial presoak 8 to 24 hours prior to the test.

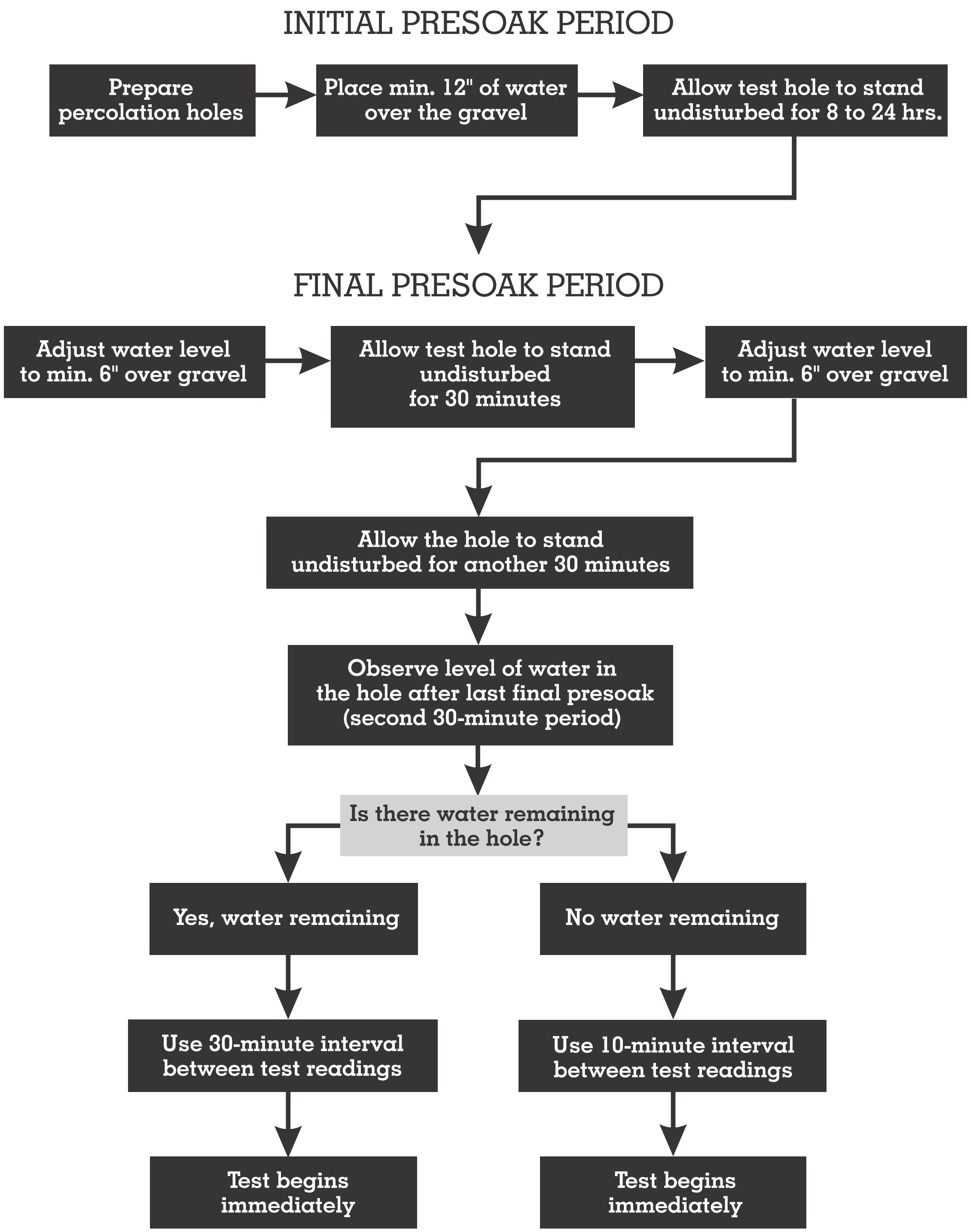


RECOMMENDED PERCOLATION TEST EQUIPMENT



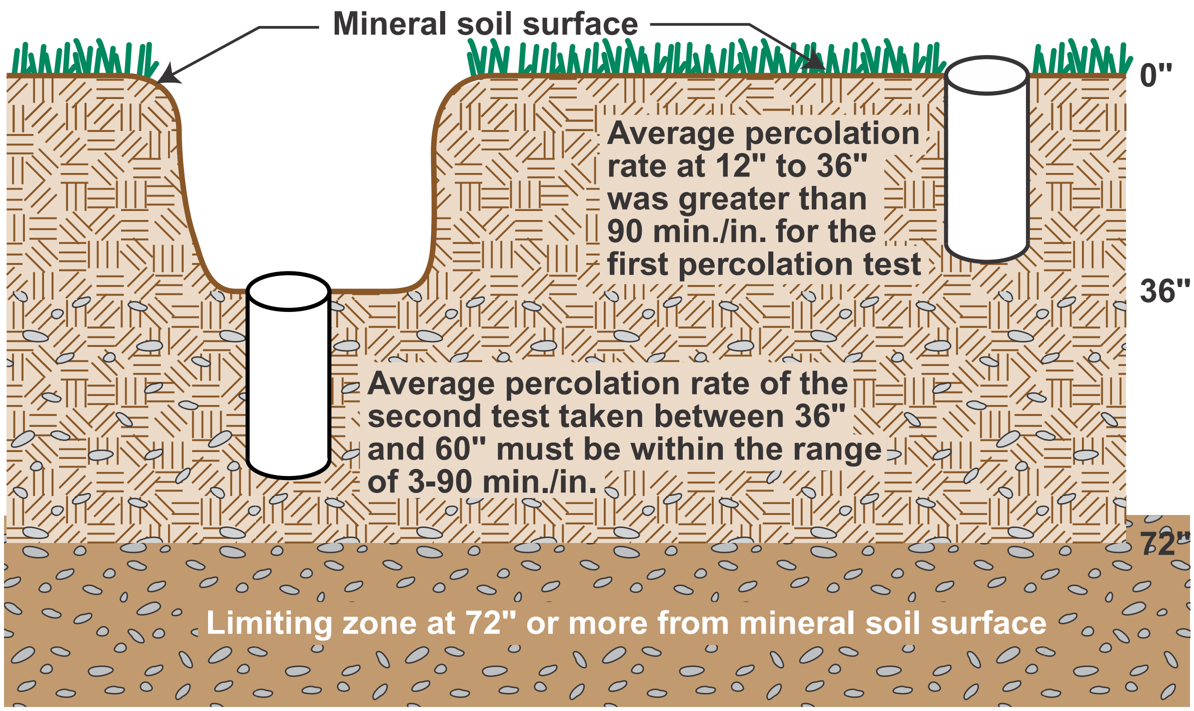
PERCOLATION TEST PRESOAKS

The percolation test needs to be done under conditions that approximate saturated soil conditions. The initial and final presoaks simulate this conditions.



SUBSURFACE SAND FILTER PERCOLATION TEST

If the first percolation test result is more than 90 minutes per inch, it failed for an in-ground system at the original proposed depth. If the limiting zone is greater than or equal to 72 inches, a second test may be conducted at a greater depth to determine the site suitability for a subsurface sand filter.



Note: The bottom of the percolation hole must be at the depth of the proposed absorption area.

CONVERSION TABLE FOR DROP OF WATER LEVEL IN STANDARD PERCOLATION TEST HOLES

Drop in 1/8" Increments	Equivalent in inches	30-Minute Interval Between Readings	10-Minute Interval Between Readings
Less than 1/8	0.000	240	*
1/8	0.125	240	*
1/4	0.25	120	*
3/8	0.375	80	26.7
1/2	0.5	60	20
5/8	0.625	48	16
3/4	0.75	40	13.3
7/8	0.875	34.3	11.4
1	1.0	30	10
1 1/8	1.125	26.7	8.9
1 1/4	1.25	24	8.0
1 3/8	1.375	21.8	7.3
1 1/2	1.5	20	6.7
1 5/8	1.625	18.5	6.2
1 3/4	1.75	17.1	5.7
1 7/8	1.875	16	5.3
2	2.0	15	5
2 1/8	2.125	14	4.7
2 1/4	2.25	13.3	4.4
2 3/8	2.375	12.6	4.2
2 1/2	2.5	12	4
2 5/8	2.625	11.4	3.8
2 3/4	2.75	10.9	3.6
2 7/8	2.875	10.4	3.5
3	3.0	10	3.3
3 1/8	3.125	9.6	3.2
3 1/4	3.25	9.2	3.1
3 3/8	3.375	8.9	3.0
3 1/2	3.5	8.6	2.9
3 5/8	3.625	8.3	2.8
3 3/4	3.75	8.0	2.7
3 7/8	3.875	7.7	2.6
4	4.0	7.5	2.5
4 1/8	4.125	7.3	2.4
4 1/4	4.25	7.1	2.4
4 3/8	4.375	6.9	2.3
4 1/2	4.5	6.7	2.2
4 5/8	4.625	6.5	2.2
4 3/4	4.75	6.3	2.1
4 7/8	4.875	6.2	2.1
5	5.0	6.0	2.0
5 1/8	5.125	5.9	2.0
5 1/4	5.25	5.7	1.9
5 3/8	5.375	5.6	1.9
5 1/2	5.5	5.5	1.8
5 5/8	5.625	5.3	1.8
5 3/4	5.75	5.2	1.7
5 7/8	5.875	5.1	1.7
6	6.0	Use 10-min. interval	1.7

*Use 30-minute interval for accuracy.

Section 73.16 Table A

SIZE OF SYSTEM CALCULATION

TABLE A

With the results of the percolation test and the sewage flow, the size of the absorption area can be calculated using Table A.

Average Percolation Rate Expressed as Minutes Per Inch	*Square Feet of Aggregate Area Per Gallon Per Day*	
	All Systems Except Elevated Sand Mounds And Subsurface Sand Filters	**Subsurface Sand Filters and Elevated Sand Mounds**
Less than 3.0[D]	Unsuitable	Unsuitable
3-5[C]	Unsuitable	1.50[AB]
6-15[C]	1.19[B]	1.50[AB]
16-30[C]	(Avg. Perc Rate – 15) x (0.040) + 1.19[B]	1.50[AB]
31-45[C]	(Avg. Perc Rate – 30) x (0.030) + 1.79[B]	(Avg. Perc Rate – 30) x (0.026) + 1.50[AB]
46-60[C]	(Avg. Perc Rate – 45) x (0.028) + 2.24[B]	(Avg. Perc Rate – 45) x (0.022) + 1.89[A]
6-90[C]	(Avg. Perc Rate – 60) x (0.023) + 2.66[A]	(Avg. Perc Rate – 60) x (0.020) + 2.22[A]
91-120[ACD]	Unsuitable	(Avg. Perc Rate – 90) x (0.017) + 2.82[A]
121-150[CD]	Unsuitable	(Avg. Perc Rate – 120) x (0.015) + 3.33)] (1.05)[A]
151-180[CD]	Unsuitable	(Avg. Perc Rate – 150) x (0.014) + 3.78)] (1.10)[A]
Greater than 181[CD]	Unsuitable	Unsuitable

[A] Pressure dosing required.

[B] One-third reduction may be permitted for use of an aerobic tank.

[C] May be considered for experimental or alternate proposals.

[D] Unsuitable for subsurface sand filters.

Note: A percolation test is not required for an IRSIS. See page VII-8 for sizing information.

DISPOSAL AREA OPTIONS

CONVENTIONAL SYSTEMS

The various disposal area options available for conventional onlot sewage disposal systems are explained in this section of the field manual. They can also be found on the system matrix, which is in the front pocket of the field manual.

ALTERNATE AND EXPERIMENTAL SYSTEMS

The disposal area options available for alternate and experimental systems are explained in DEP's alternate and experimental systems guidance. They can also be found on the system matrix, which is in the front pocket of the field manual.

Alternate and Experimental System Components

The alternate and experimental system components are explained in DEP's alternate and experimental systems guidance. Refer to this guidance document for the specifications for these components, which are not included in this field manual. The guidance document can be found on the DEP website at www.dep.pa.gov .

IN-GROUND ABSORPTION AREA
(Excluding Subsurface Sand Filter Absorption Area)

SLOPE

- Bed--0-8%
- Trenches—0.25%

ISOLATION DISTANCES

- Refer to Section I-B for the isolation distance requirements.

SOIL EVALUATION

Section 73.51

- By regulation, **a minimum of 60 inches of suitable soil** is required to use an in-ground absorption area.
- A 48-inch separation must be maintained between the bottom of the absorption area aggregate and the limiting zone.

PERCOLATION RATE/DISTRIBUTION METHOD

If: **Percolation Rate**	**And:** **Size of Absorption Area**	**Then:** **Distribution Method**
6 to 60 min./in.	≤2,500 sq. ft.	gravity flow or pressure dosed
6 to 60 min./in.	≥2,500 sq. ft.	pressure dosed
>60 to 90 min./in.	any size	pressure dosed

SEWAGE FLOW

- 200 to ≤10,000 gpd

SIZE OF ABSORPTION AREA

- Refer to page I-E-11 to size the absorption area.
- Refer to page II-4 to calculate the width of a bed or trench.

Subsurface Sand Filter Absorption Area

SLOPE

- Bed--0-8%
- Trenches—0.25%

ISOLATION DISTANCES

- Refer to Section I-B for the isolation distance requirements.

SOIL EVALUATION

Section 73.51 and 73.54

- By regulation, **a minimum of 72 inches of suitable soil** is required to use a subsurface sand filter absorption area.
- A 48-inch separation must be maintained between the bottom of the absorption area aggregate and the limiting zone.

PERCOLATION TEST/SYSTEM TYPE

If: **Test**	**And:** **Percolation Test Results and Depth**	**Then:** **Type of System**
1st test	>90 min./in. at 12 to 36 inches	Test unsuitable for other in-ground systems
2nd test	3 to 90 min./in. between 36 to 60 inches	pressure dosed subsurface sand filter
3rd test	<3 min./in. between 36 to 60 inches >90 min./in. between 36 to 60 inches	unsuitable for a subsurface sand filter

SEWAGE FLOW

- 200 to ≤10,000 gpd

SIZE OF ABSORPTION AREA

- Refer to page I-E-11 to size the absorption area.
- Refer to page II-4 to calculate the width of a bed or trench.

Calculating Width of Bed or Trench for an In-Ground System

$$\frac{[LZ - (ID + 48)] \times 8.3}{\text{Slope (\%)}} = \text{maximum width of in-ground bed or trench in feet}$$

- LZ = depth of limiting zone in inches
- ID = minimum installation depth in inches to the bottom of the absorption area aggregate in inches
- 48 = the minimum regulatory separation in inches between the bottom of aggregate and the top of the limiting zone
- 8.3 = conversion factor for this formula
- Slope = steepest percent slope over absorption area (The percent slope is expressed as a whole number. Example: 3% = 3)

Example:

- LZ = 78 in.
- ID = 12 in.
- Slope = 3%
- Absorption area length will be installed along contours

$$\frac{[78 \text{ in.} - (12 \text{ in.} + 48)] \times 8.3}{3} = 49.8 \text{ ft. maximum width}$$

Note: By regulation, the maximum width for a trench is 6 feet; therefore, this example would be for a bed absorption area.

ELEVATED SAND MOUND ABSORPTION AREA

SLOPE

- Bed--0-12%
- Trench—0-12%

ISOLATION DISTANCES

- Refer to Section I-B for the isolation distance requirements.

SOIL EVALUATION

Section 73.51 and 73.55

- By regulation, **a minimum of 20 inches of suitable soil** is required to use a conventional elevated absorption area.
- A 48-inch separation must be maintained between the bottom of the absorption area aggregate and the limiting zone. The additional material needed to meet the 48-inch separation for an elevated system must be approved sand or other approved materials.

PERCOLATION TEST

- 3 to 180 min./in. – pressure dosed

SEWAGE FLOW

- 200 to ≤10,000 gpd

SIZE OF ABSORPTION AREA

- Refer to page I-E-11 to size the absorption area.
- Refer to page II-9 to calculate the berm footprint of the bed.

Note: On slopes >8 to 12%, the length to width ratio of the bed must be 4 to 1.

Calculating the Minimum Sand Footprint for an Elevated System

SAND is placed between the original grade and the aggregate in an elevated system to maintain the 48-inch separation between the aggregate bottom and the limiting zone.

ABSORPTION AREA WIDTH

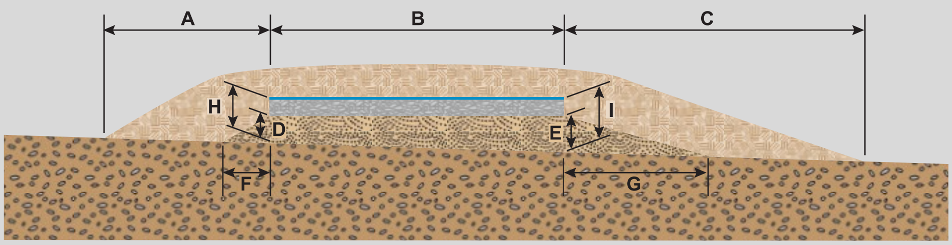
To calculate the minimum sand footprint, use the actual width of the absorption area aggregate.

SAND FOOTPRINT

To calculate the sand footprint, the following information is needed:

- Absorption area aggregate width (B)
- Original grade slope
- Upslope sand height (D)
- Downslope sand height (E2)
- Sand slope not directly beneath the aggregate area
- Limiting zone depth

Calculating Sand Footprint



1) Upslope Sand Width (F)

upslope sand height (D)
+ (sand slope + original grade slope)
= **upslope sand width (F)** (convert answer into feet)

2) Absorption Area Aggregate Width (B)

3) Downslope Sand Width (G)

downslope sand height (E)
+ (sand slope - original grade slope)
= **downslope sand width (G)** (convert answer into feet)

Sand Footprint

Upslope Sand Width (F)
+ Absorption Area Aggregate Width (B)
+ Downslope Sand Width (G)
= **Width of sand footprint**

CALCULATING UPSLOPE AND DOWNSLOPE SAND HEIGHT

Upslope Sand Height (D)

48 in. separation between the aggregate bottom and the limiting zone
\- Limiting zone for proposed absorption area
= **Upslope sand height (D)**

Note: A minimum of 12 inches of sand must be used for any elevated system.

Example Information:

- Original grade slope = 10% (or .10)
- Limiting zone = 36 in.
- Absorption area aggregate width = 10 ft. (B)

Upslope Sand Height-Example:

48 in. separation between the aggregate bottom and limiting zone
\- 36 in. limiting zone
= 12 in. **upslope sand height (D)**

Downslope Sand Height (E)

Absorption area aggregate width (B)
x Original grade slope
= ***Downslope extra sand height***

Upslope sand height (D)
\+ Downslope extra sand height
= **Downslope sand height (E)**
Convert answer into inches.

Downslope Sand Height--Example:

10 ft. absorption area aggregate width (B)
x .10 original grade slope
= 1 ft. downslope extra sand height

Convert to inches: $\frac{1 \text{ ft.} \times 12 \text{ in.}}{1 \text{ ft.}} = 12$ in.

12 in. upslope sand height (D)
\+ 12 in. downslope extra sand height
= 24 in. downslope sand height (E)

CALCULATING SAND FOOTPRINT—EXAMPLE:

- Absorption area aggregate width = 10 ft. (B)
- Original grade slope = 10% (or .10)
- Upslope sand height = 12 in. (D)
- Downslope sand height = 24 in. (E)
- Sand slope = 2-to-1 ratio, 50%, or .50
- Limiting zone = 36 in.

1) Upslope Sand Width (F)

12 in. upslope sand height (D)
+ (.50 sand slope + .10 original grade slope)
= 20 in. upslope sand width (F)

Convert to feet: $\frac{20 \text{ in.} \times 1 \text{ ft.}}{12 \text{ in.}}$ = **1.7 ft. (F)** (always round up to the nearest foot)

2) Absorption Area Aggregate Width (B)

10 ft. (B)

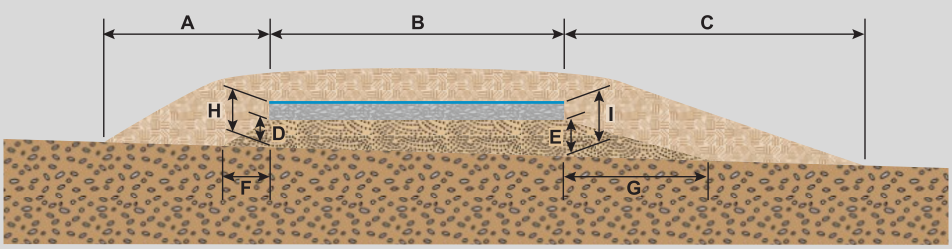
3) Downslope Sand Width (G)

24 in. downslope sand height (E)
+ (.50 sand slope - .10 original grade slope)
= 60 in. downslope sand width (G)

Convert to feet: $\frac{60 \text{ in.} \times 1 \text{ ft.}}{12 \text{ in.}}$ = **5 ft. (G)**

Sand Footprint Width

2 ft. (F) + 10 ft. (B) + 5 ft. (G) = **17 ft.**



Calculating the Minimum Berm Footprint for an Elevated System

The **BERM** is the cover material that protects and supports the absorption area. This material must provide an environment for vegetative cover to grow to protect the absorption area against erosion.

ABSORPTION AREA WIDTH

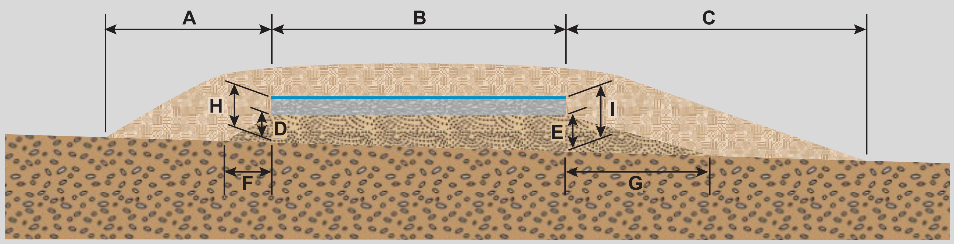
To calculate the minimum berm footprint, use the actual width of the absorption area aggregate.

BERM FOOTPRINT

To calculate the sand footprint, the following information is needed:

- Absorption area aggregate width (B)
- Original grade slope
- Upslope absorption area top of aggregate height (H)
- Downslope absorption area top of aggregate height (I)
- Upslope soil berm slope
- Downslope soil berm slope

Calculating Berm Footprint



1) Total Upslope Berm Width (A)

Upslope absorption area top of aggregate height (H)
+ (berm slope + original grade slope)
= ***Upslope berm width***
+ 3 ft. regulatory min. horizontal cover
= *Total upslope berm width (A)*

2) Total Downslope Berm Width (C)

Downslope absorption area top of aggregate height (I)
+ (berm slope - original grade slope)
= ***Downslope berm width***
+ 3 ft. regulatory min. horizontal cover
= *Total downslope berm width (C)*

Total Berm Footprint Width

Total upslope berm width (A)
+ Absorption area aggregate width (B)
+ Total downslope berm width (C)
= **Berm footprint width**

CALCULATING UPSLOPE AND DOWNSLOPE TOP OF AGGREGATE HEIGHT

Upslope

Upslope sand height (D)
+ Aggregate (usually 10 in.)
= **Upslope absorption area top of aggregate height (H)**

Downslope

Downslope sand height (E)
+ Aggregate (usually 10 in.)
= **Downslope absorption area top of aggregate height (I)**

Note: Refer to the sand height calculations on page II-7 to calculate the upslope or downslope sand height.

Example Information:

- Upslope sand height = 12 in. (D)
- Downslope sand height = 24 in. (E)

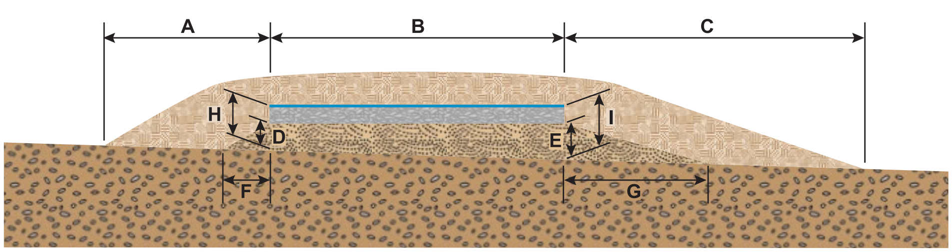
Absorption Area Top of Aggregate Height-Example:

Upslope

12 in. upslope sand height (D)
+ 10 in. aggregate
= 22 in. upslope absorption area top of aggregate height (H)

Downslope

24 in. downslope sand height (E)
+ 10 in. aggregate
= 34 in. downslope absorption area top of aggregate height (I)



CALCULATING BERM FOOTPRINT—EXAMPLE:

- Absorption area aggregate width = 10 ft. (B)
- Original grade slope = 10% (or .10)
- Upslope top of aggregate height = 22 in. (H)
- Downslope top of aggregate height = 34 in. (I)
- Upslope soil berm slope = 3-to-1 ratio, 33%, or .33
- Downslope soil berm slope = 3-to-1 ratio, 33%, or .33
- Limiting zone = 36 in.

1) Total Upslope Berm Width (A)

22 in. upslope absorption area top of aggregate height (H)
+ (.33 berm slope + .10 original grade slope)
= 51.2 in. upslope berm width

Convert to feet: $\frac{51.2 \text{ in.} \times 1 \text{ ft.}}{12 \text{ in.}}$ = **4.3 ft.** (always round up to the nearest foot)

Add 3 feet regulatory minimum horizontal cover:

5 ft. upslope berm width
+ 3 ft. min. horizontal cover beyond the edge of the aggregate
= 8 ft. total upslope berm width (A)

2) Absorption Area Aggregate Width (B)

10 ft. (B)

3) Total Downslope Berm Width (C)

34 in. downslope absorption area top of aggregate height (I)
+ (.33 berm slope - .10 original grade slope)
= 147.8 in. downslope berm width

Convert to feet: $\frac{147.8 \text{ in.} \times 1 \text{ ft.}}{12 \text{ in.}}$ = **12.3 ft.** (always round up to the nearest foot)

Add 3 feet regulatory minimum horizontal cover:

13 ft. downslope berm width
+ 3 ft. min. horizontal cover beyond the edge of the aggregate
= 16 ft. total downslope berm width (C)

Berm Footprint Width

8 ft. (A) + 10 ft. (B) + 16 ft. (C) = **34 ft.**

INDIVIDUAL RESIDENTIAL SPRAY IRRIGATION SYSTEM (IRSIS)

SLOPE

- Forested areas (covered canopy)--0-25%
- Grassed areas--0-12%
- Agricultural areas—0-4%

ISOLATION DISTANCES

- Refer to Section I-B for the isolation distance requirements.

SOIL EVALUATION

Section 73.163

- By regulation, **a minimum of 16 inches of suitable soil** is needed to a **rock** limiting zone.
- By regulation, **a minimum of 10 inches of suitable soil** is needed to a **seasonal high water table** limiting zone.

PERCOLATION TEST

- Not required

SEWAGE FLOW

- 400 gpd for a 1- to 3-bedroom single-family home.
- Add 100 gpd for each additional bedroom over 3 bedrooms.

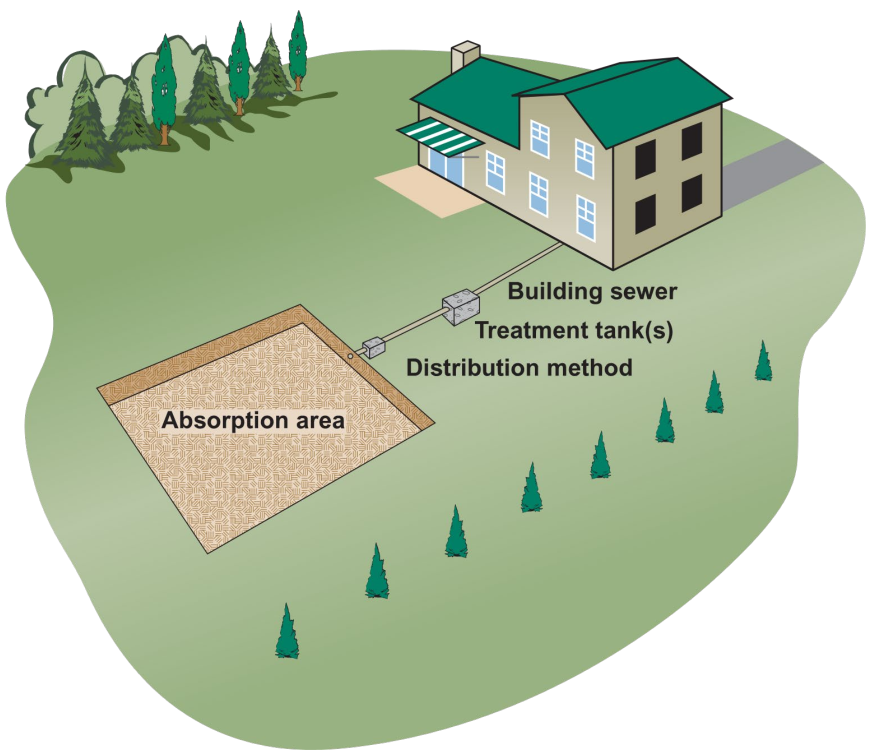
SIZE OF SPRAY FIELD

- Refer to Section VII for spray field sizing.

SYSTEM COMPONENTS

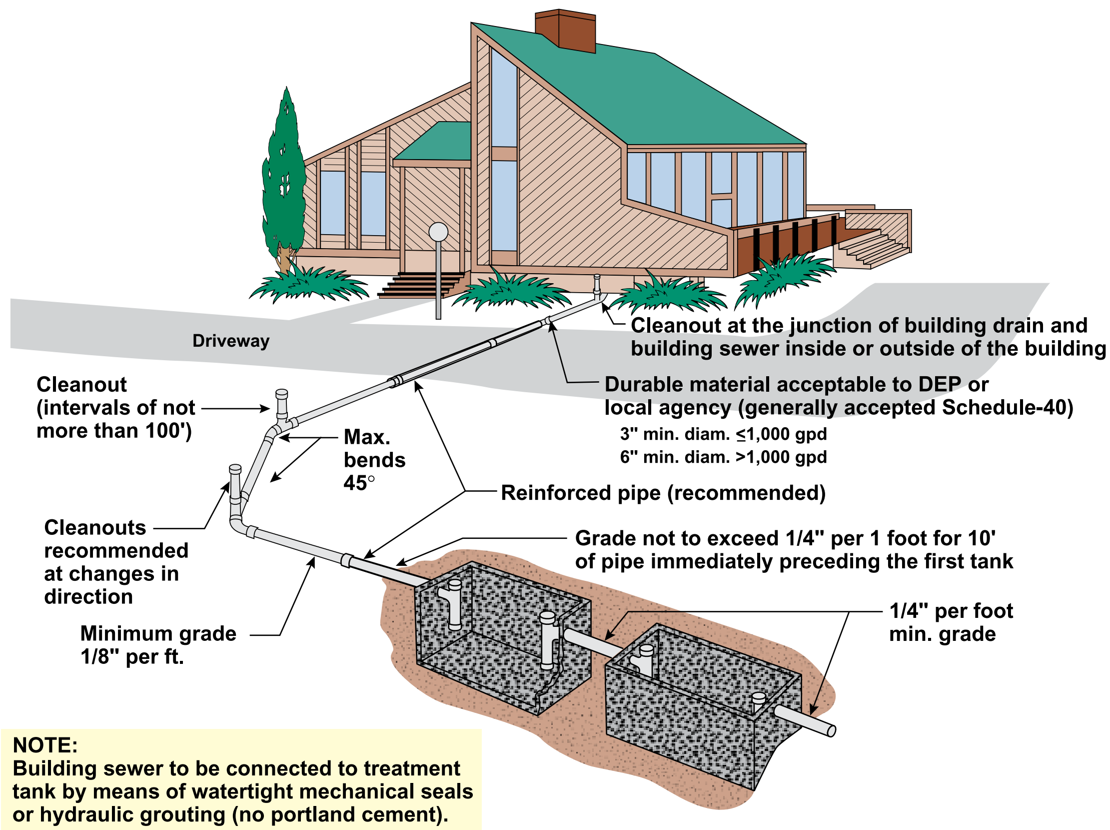
An onlot sewage disposal system is comprised of the components listed below:

- Building sewer
- Treatment tank(s)
- Distribution method
- Absorption area



Section 73.21

Building Sewer



Treatment Tanks

SEPTIC TANKS

Sections 73.31

Minimum Septic Tank Capacity

The minimum septic tank capacity must be calculated from the following table, using estimated sewage flows from Sections 73.16 and 73.17 of the regulations relating to sewage flows:

Design flow ***(gallons per day)***	***Tank capacity*** ***(gallons)***
0-500	(3.5 x flow exceeding 400 gpd) + (900)
500-5,000	(1.50 x flow exceeding 500 gpd) + (1,250)
5,000-7.500	(1.45 x flow exceeding 5,000 gpd) + (8,000)
7,500-10,000	(1.35 x flow exceeding 7,500 gpd) + (11,625)
over 10,000	(1.50 x the daily flow)

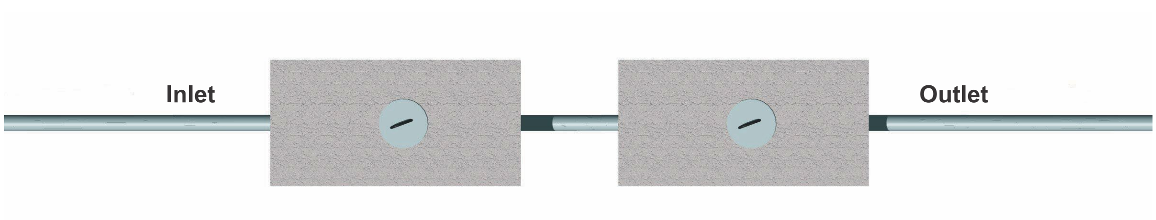
Note: 900 gallons is the minimum liquid capacity for any septic tank installation.

Options for Septic Tanks

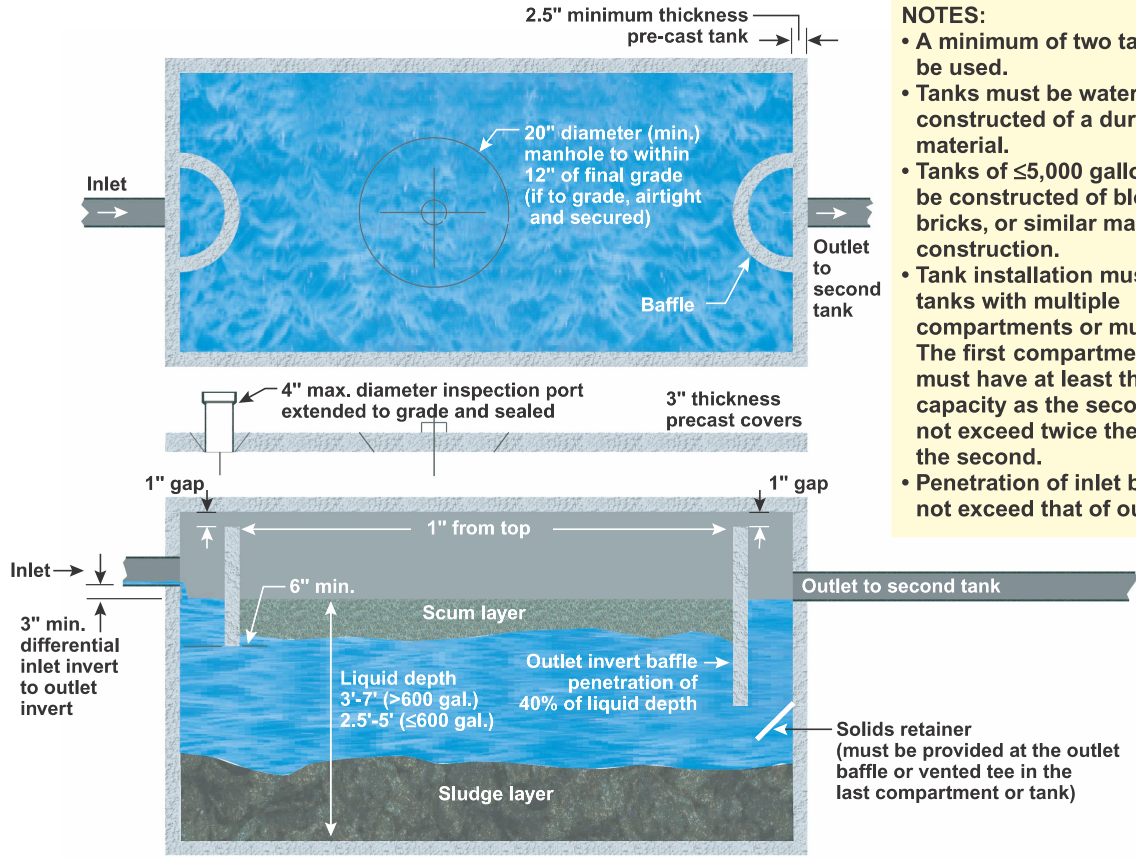
- Single-compartment tanks – A minimum of two tanks must be used.
- Multiple-compartment tanks

Septic Tanks in Series

Multiple tanks or compartments must be placed in a series and may not exceed four in number for any installation.



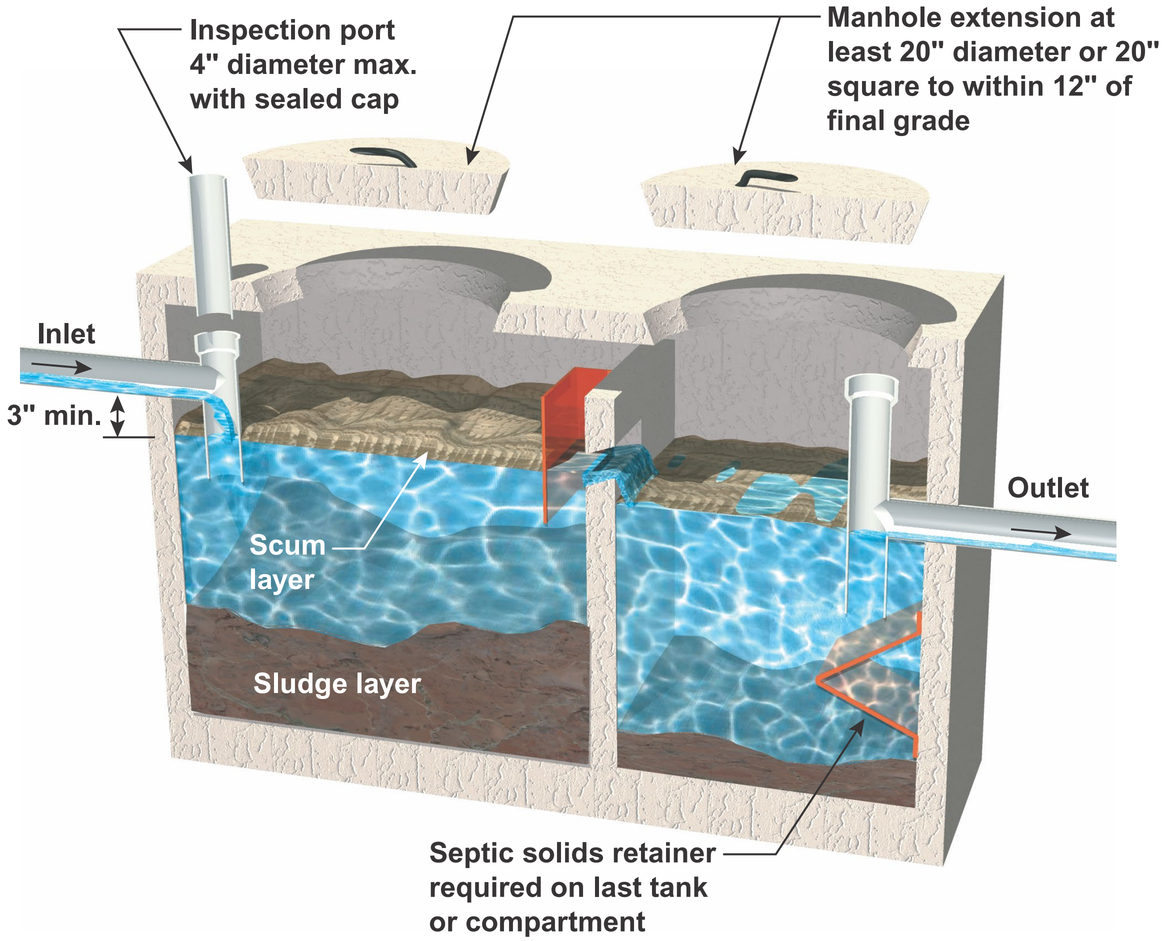
Regulations for a Precast Single-Compartment Septic Tank



NOTES:

- A minimum of two tanks must be used.
- Tanks must be watertight and constructed of a durable material.
- Tanks of ≤5,000 gallons cannot be constructed of blocks, bricks, or similar masonry construction.
- Tank installation must consist of tanks with multiple compartments or multiple tanks. The first compartment or tank must have at least the same capacity as the second but may not exceed twice the capacity of the second.
- Penetration of inlet baffle may not exceed that of outlet baffle.

Regulations for a Multiple-Compartment Septic Tank



NOTES:

- If the manhole is extended to grade, it must be airtight and secured by bolts or locking mechanisms, or it must have sufficient weight to prevent unauthorized access.
- If the manhole is extended to grade, the ground must slope away from access.
- The first compartment must have at least the same capacity as the second but may not exceed twice the capacity of the second.

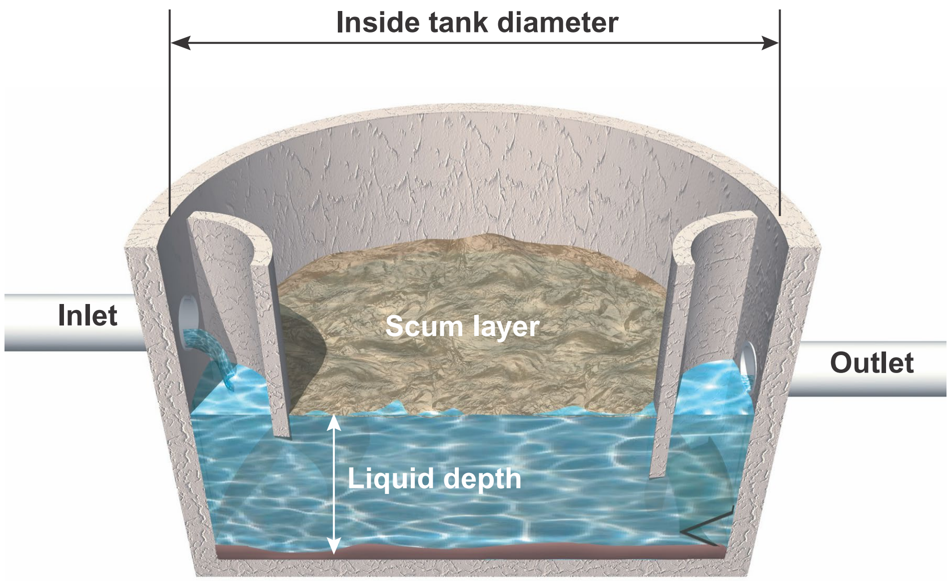
Calculating the Liquid Capacity of a Round Tank

$\pi = 3.14$

Inside radius = ½ of the inside diameter

$$\frac{\pi \text{ x inside radius (inches) x inside radius (inches)}}{\text{231 cubic in./gallon}} = \text{gallons/vertical inch of tank depth}$$

$$\left(\begin{array}{c}\text{gallons/vertical}\\ \text{inch of tank depth}\end{array}\right) \times \left(\begin{array}{c}\text{liquid depth (from}\\ \text{bottom of outlet to}\\ \text{inside bottom of tank)}\end{array}\right) = \textbf{LIQUID CAPACITY OF A ROUND TANK}$$

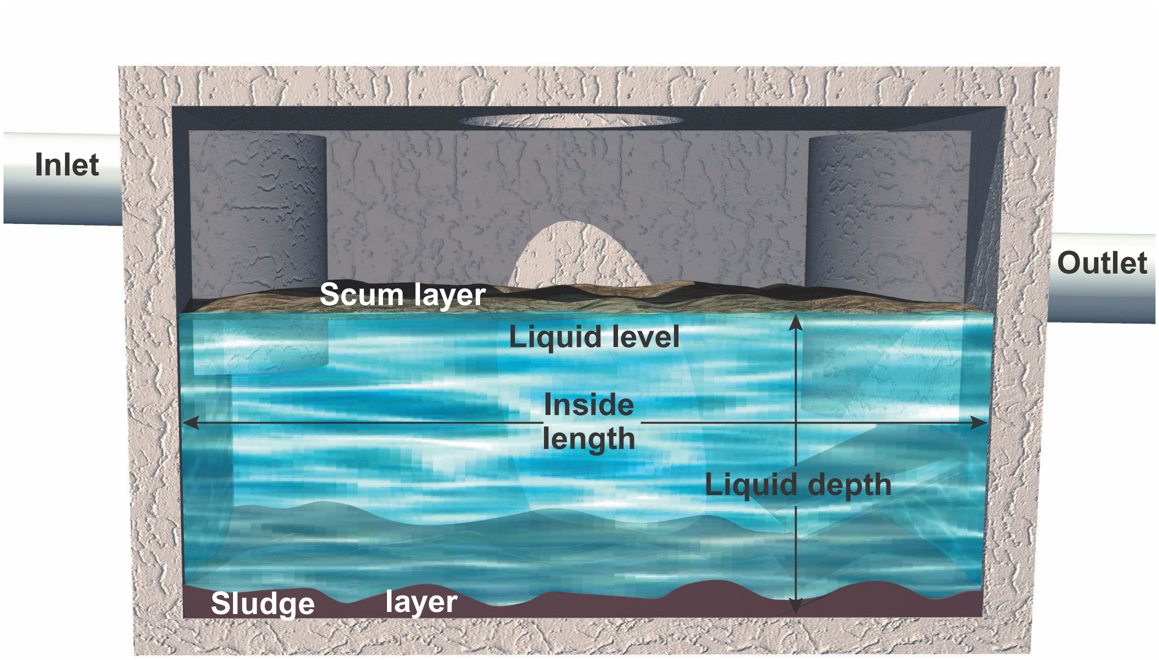


NOTE: No tank or compartment may have an inside horizontal dimension less than 36 inches.

Calculating the Liquid Capacity of a Rectangular Tank

$$\frac{\text{inside width (inches)} \times \text{inside length (inches)}}{\text{231 cubic in./gallon}} = \text{gallons/vertical inch of tank depth}$$

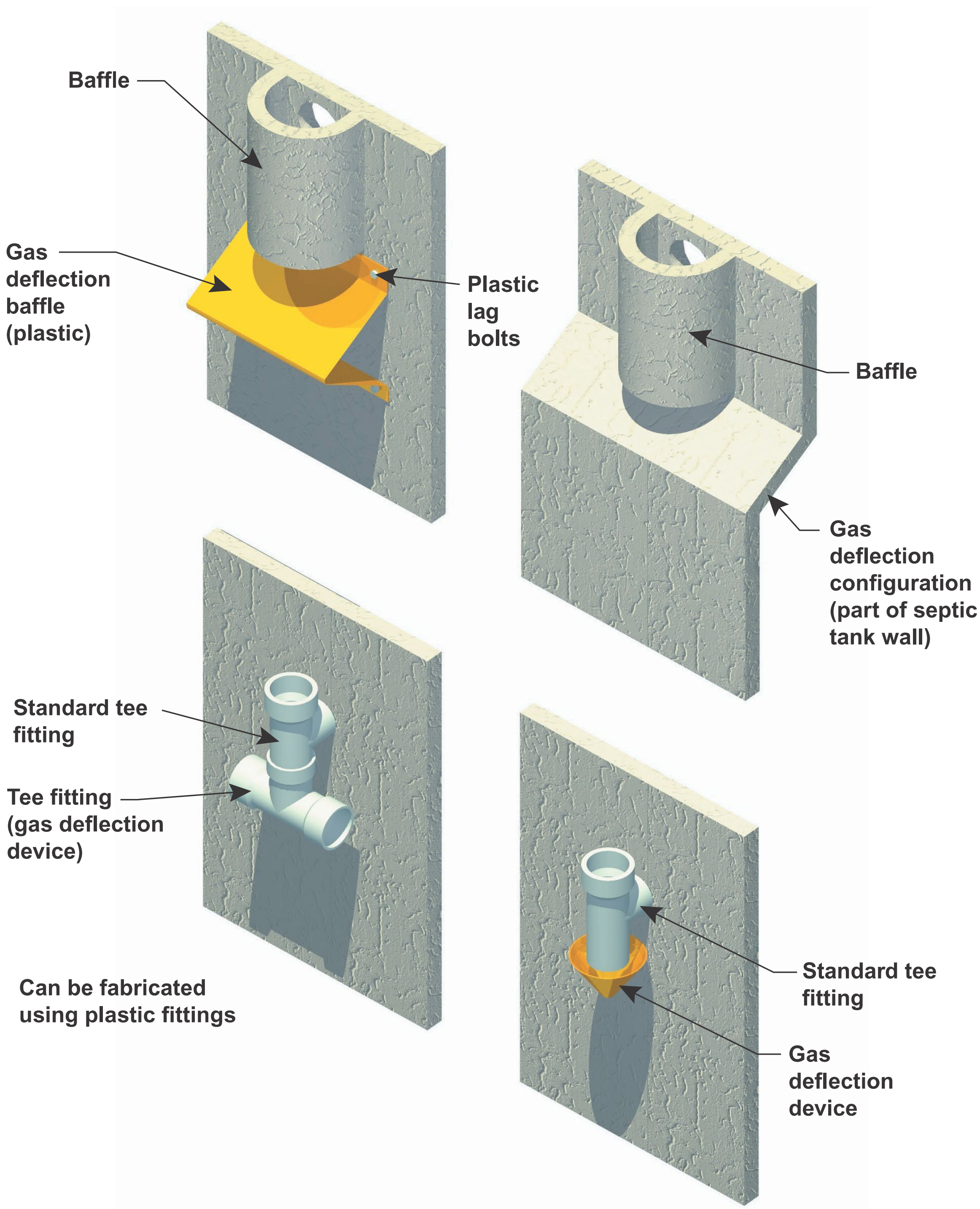
$$\left(\text{gallons/vertical inch of tank depth}\right) \times \left(\text{liquid depth (from bottom of outlet to inside bottom of tank)}\right) = \text{LIQUID CAPACITY OF A RECTANGULAR TANK}$$



Common Septic Solids Retainers

Sections 73.31

Below are some options for septic solids retainers, which must be placed in the last compartment or tank at the outlet baffle or vented tee.



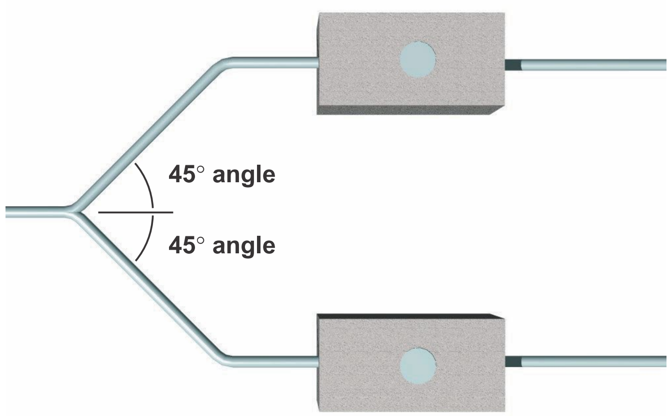
AEROBIC TREATMENT TANKS

Sections 73.32

Minimum Tank Capacity

- The rated capacity of the unit must equal or exceed the daily sewage flows.
- See manufacturer specifications.

Aerobic Treatment Tanks in Parallel



NOTES:
- **Tanks must have equal capacity and receive equal loading.**
- **Multiple aerobic tanks are only permitted where the tanks are connected in parallel.**
- **There must be a flow diverter or equalizer before the pipes split to the tanks.**

Approved Tanks

≤1,500 gallons-per-day flow—The tank must meet NSF* Standard 40.

>1,500 gallons-per-day flow—The tank must meet NSF* Criteria C-9.

**NSF-National Sanitation Foundation*

- Contact DEP for approved aerobic tanks.
- To contact NSF, call 1-800-NSF-MARK or visit its Web page www.NSF.org .

Sections 73.32

The aerobic tank must have a visual and audible alarm which must be designed to respond to any electrical failure or malfunction of the tank or any component thereof.

RETAINING TANKS

Sections 73.61

- Retaining tanks are individual sewage systems that require permits.
- Planning requirements must be met before issuing a permit for a retaining tank.

Holding Tanks

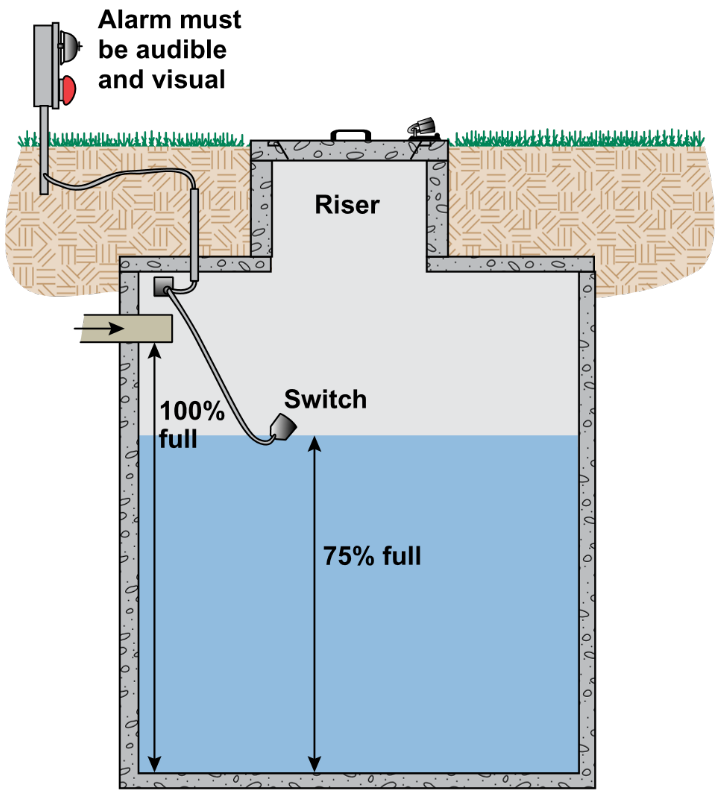
Sections 73.62

MINIMUM CAPACITY

Use the larger capacity of the two listed below:

- 1,000 gallons, or
- Equal to the quantity of waste generated in three days.

The illustration below shows some of the regulatory requirements for a holding tank.

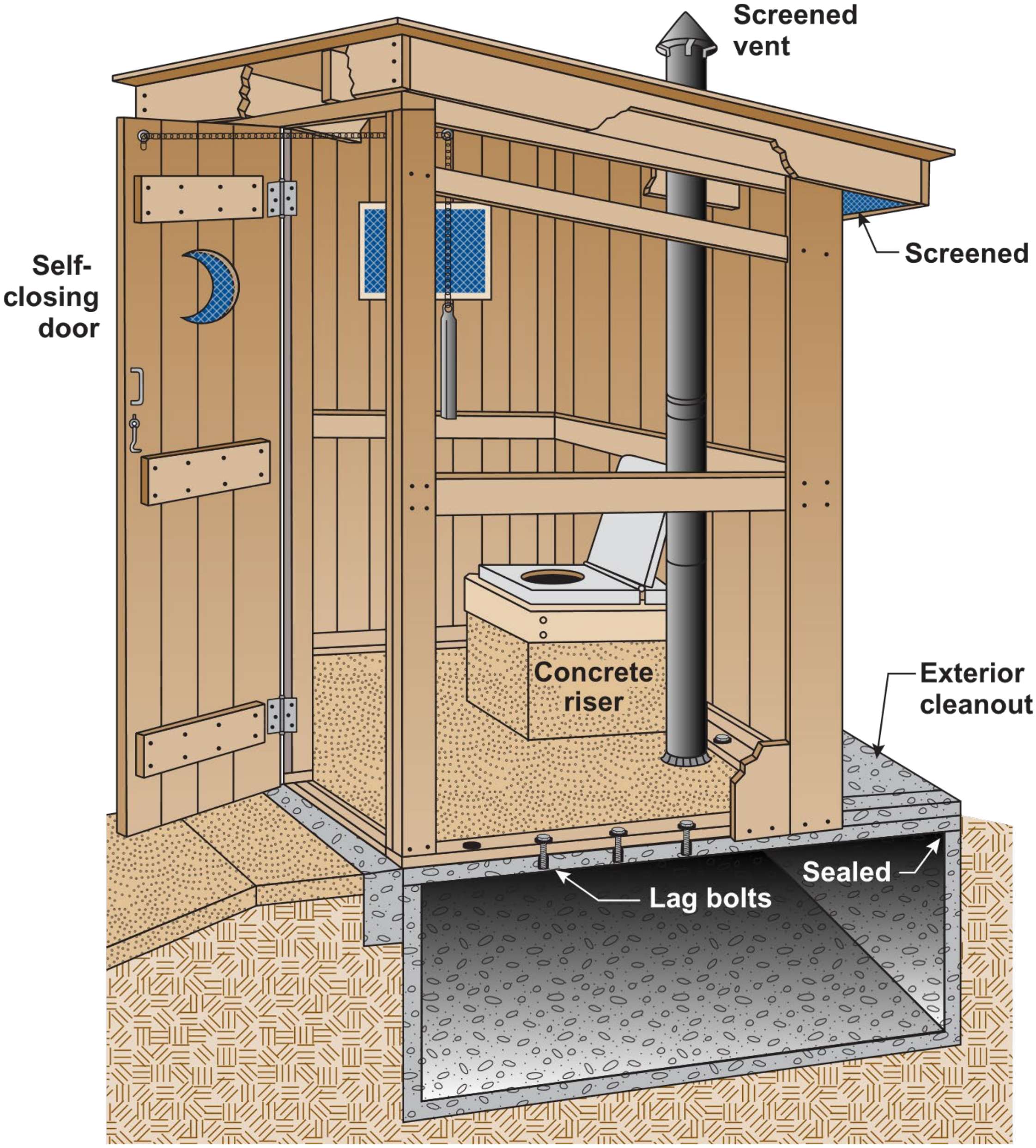


Privies

Section 73.63

- The privy must be located to minimize any danger of contaminating the water supplies. When possible, the privy must downgrade from any source of water supply.
- The privy must be 50 feet from any water supply.
- The privy must be a minimum of 50 feet from any building served.
- The vault must be large enough to hold several years of use.
- An earth mound must be placed around the privy, or a surface water diversion must be constructed to keep surface water from flooding the vault.

The illustration below shows some of the regulatory requirements for a privy.



Chemical Toilets or Other Portable Toilets

Section 73.64

EXEMPT FROM PERMITTING

These toilets are exempt from permitting at the discretion of the local agency when they are used at:

- Temporary constructions sites
- Facilities providing temporary recreational or sporting activities
- Temporary seasonal facilities other than those intended for human habitation

MULTIPLE TOILETS

One permit must be used when multiple toilets are used at temporary:

- Construction sites
- Recreational activities
- Seasonal facilities

Note: Check the local agency ordinances on chemical and portable toilets before issuing or exempting a permit.

Recycling Toilets, Incinerating Toilets, or Composting Toilets

Section 73.65

- The toilet must bear the seal of the NSF* indicating testing and approval by the agency under Standard No. 41.
- The device must be installed according to the manufacturer's specifications.

**NSF-National Sanitation Foundation*

To contact NSG, call 1-800-NSF-MARK or visit its Web page at www.NSF.org.

Distribution Methods

Effluent from the treatment tank(s) may be distributed by gravity flow or pressure distribution to the absorption area. The diagrams in this section will explain some of the regulatory requirements for the two methods of distributing effluent to the absorption area.

Gravity flow uses either a:

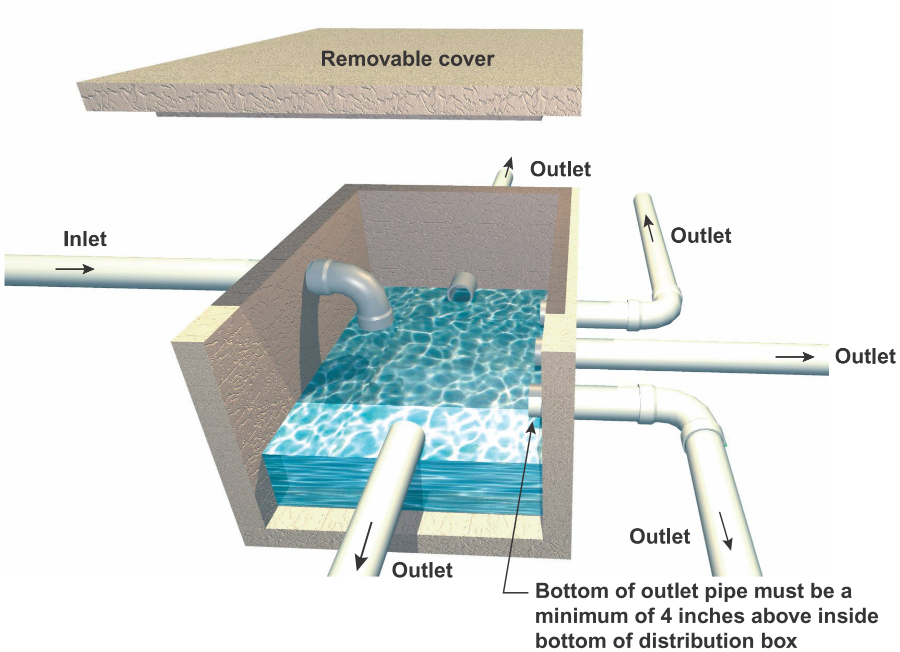
- Distribution box, or
- Header pipe

Pressure distribution uses either a:

- Pump, or
- Siphon

GRAVITY FLOW DISTRIBUTION BOX

This illustration shows some of the regulatory requirements of the distribution box used in a gravity flow system.

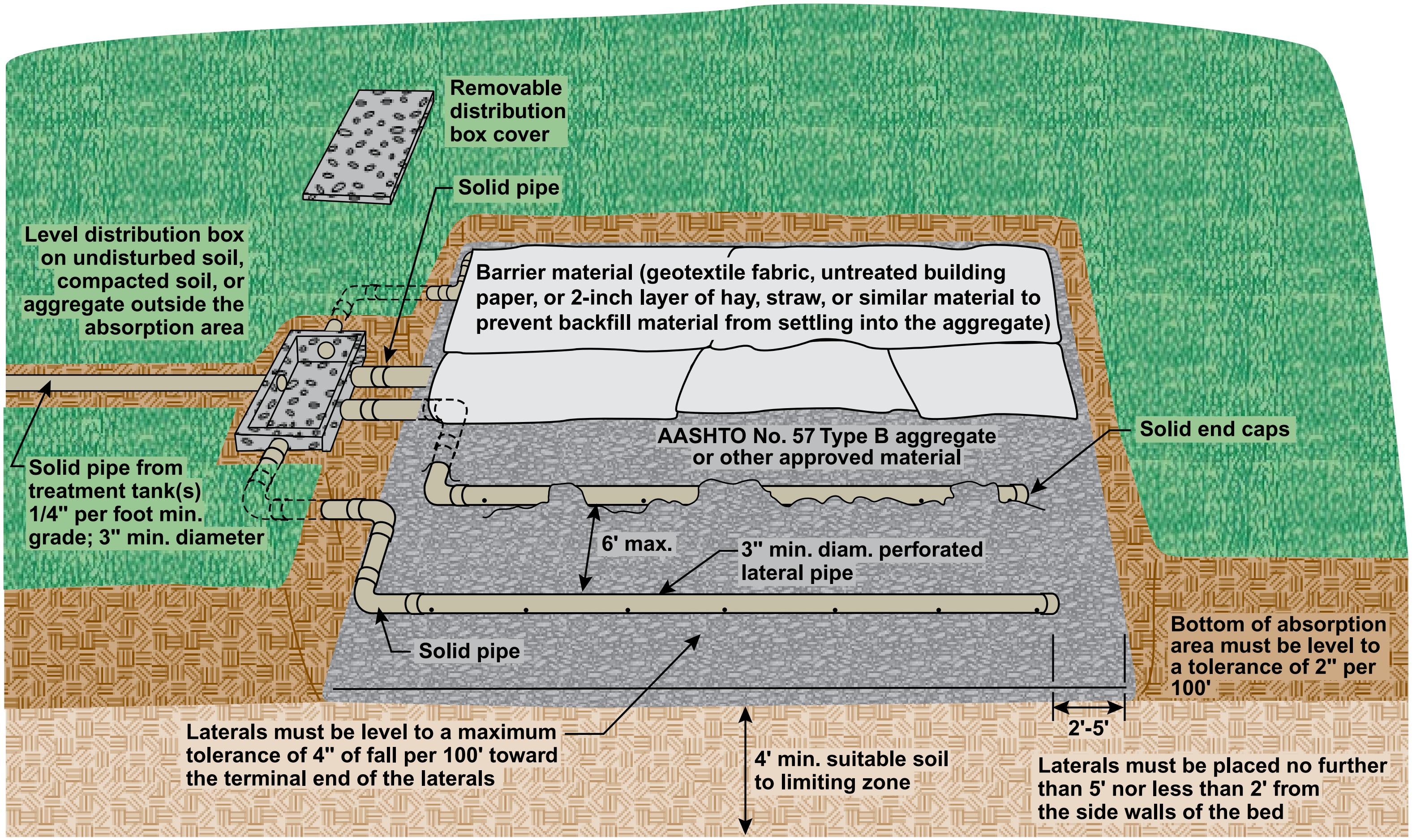


NOTES:

- **Bottom of inlet pipe must be a minimum of 1 inch higher than bottom of outlet pipes.**
- **Each lateral must be connected separately and not subdivided. Bottom of oulet pipes must be level.**
- **If the distribution box receives effluent under pressure, a down-turn elbow or other baffle must be placed on the inlet.**
- **If the distribution box receives effluent by gravity flow, it is recommended to use a down-turn elbow or other baffle placed on the inlet.**
- **Distribution box must be installed on an adequate base of undisturbed or properly compacted earth or aggregate outside of the absorption area.**
- **Equal distribution of effluent must be maintained between individual laterals.**

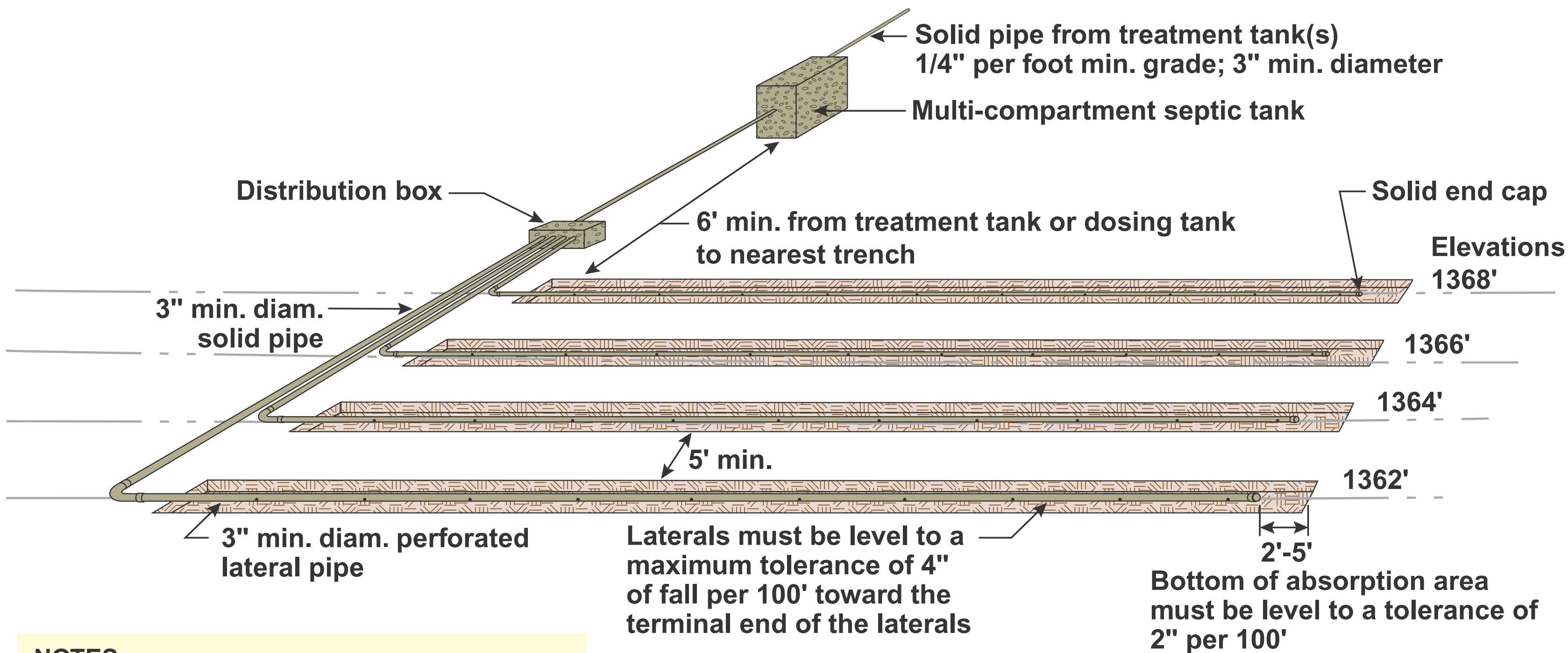
GRAVITY FLOW BED WITH A DISTRIBUTION BOX

This illustration shows some of the regulatory requirements for a gravity flow bed with a distribution box.



GRAVITY FLOW TRENCH WITH A DISTRIBUTION BOX

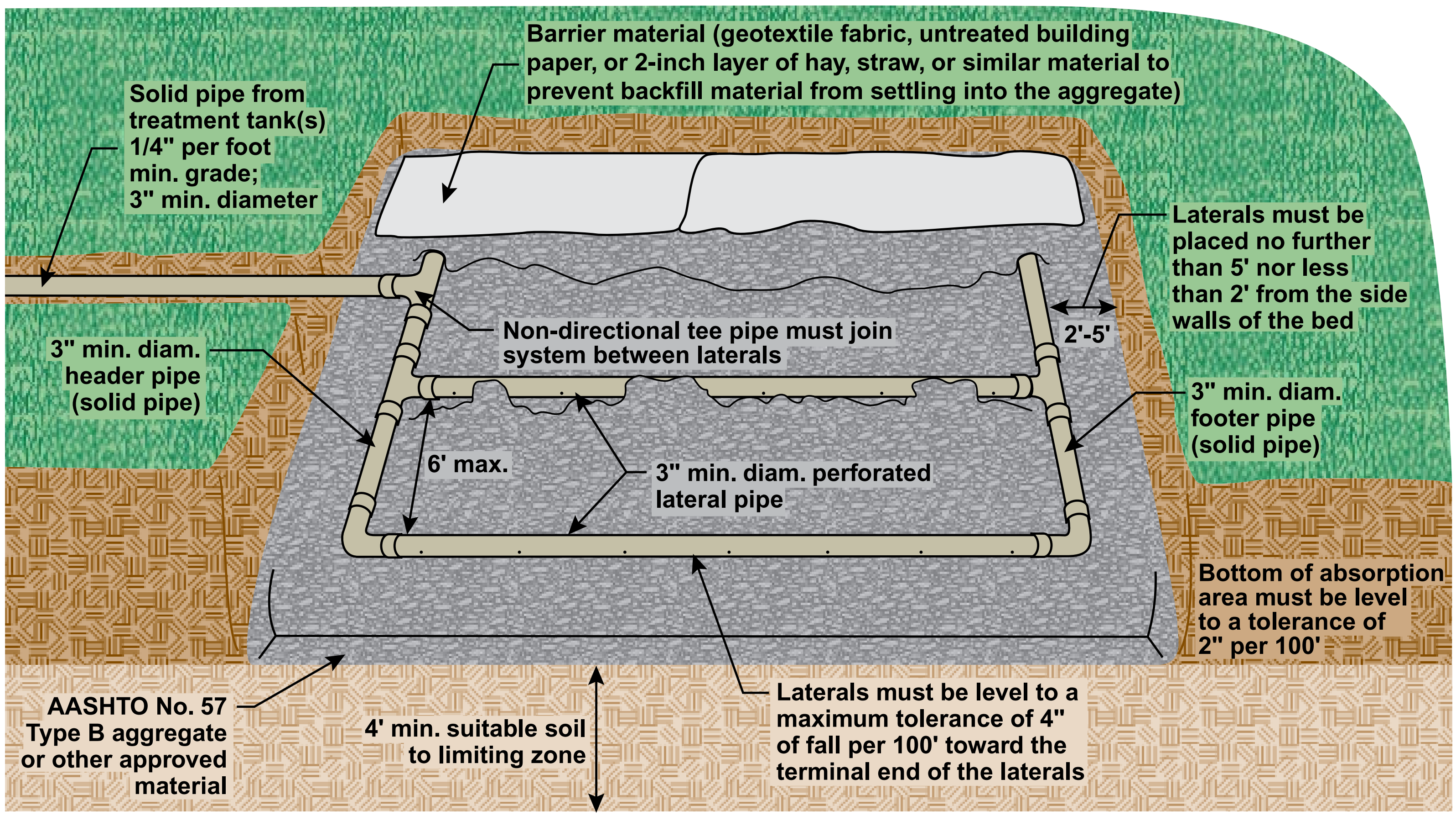
This illustration shows some of the regulatory requirements for a gravity flow bed trench system..



NOTES:
- Trenches must be constructed on contour.
- Maximum lateral length is 100 feet.

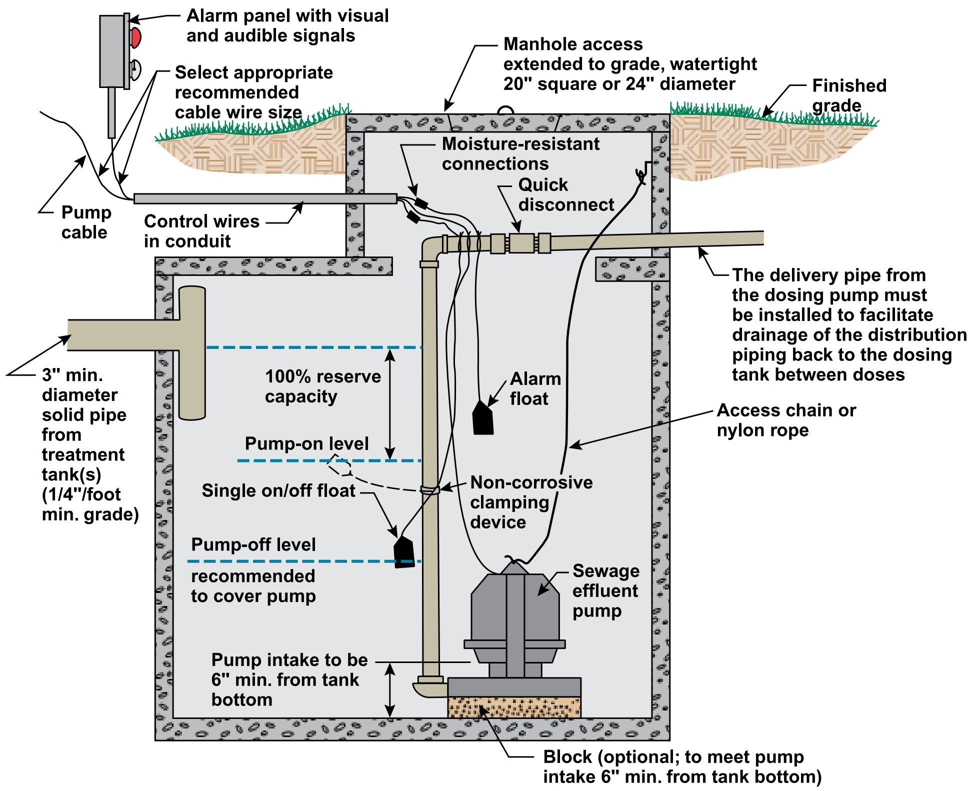
GRAVITY FLOW BED WITH A HEADER PIPE

This illustration shows some of the regulatory requirements for a gravity flow bed using a header pipe.



PRESSURE DISTRIBUTION USING A PUMP

This illustration shows some of the regulatory requirements of a pressure distribution system that uses a pump.



NOTES:

- **Dosing tank must have a minimum liquid capacity equal to or greater than two times the designed dose volume.**
- **Double on/off floats may be used in lieu of single on/off float.**
- **Quick disconnect must be located for ease of pump removal.**
- **Pump and alarm must be on separate breakers.**

Submersible Pump Cable Selection

This chart shows how to select the appropriate cable wire size for a submersible pump.

Single-Phase Motor Maximum Cable Length in Feet Measured Between the Motor to Service Entrance [1]

Motor Rating		Copper Wire Size [2]								
Volts	HP	14	12	10	8	6	4	2	0	00
		Maximum Cable Length in Feet								
115	1/3	130	210	340	540	840	1300	1960	2910	3540
	½	100	160	250	390	620	960	1460	2160	2630
230	1/3	550	880	1390	2190	3400	5250	7960	11770	
	½	400	650	1020	1610	2510	3880	5880	8720	
	¾	300	480	760	1200	1870	2890	4370	6470	7870
	1	250	400	630	990	1540	2380	3610	5360	6520
	1 ½	190	310	480	770	1200	1870	2850	4280	5240
	2	150	250	390	620	970	1530	2360	3620	4480
	3	120	190	300	470	750	1190	1850	2890	3610
	5	0	110	180	280	450	710	1110	1740	2170
	7 ½	0	0	120	200	310	490	750	1140	1410
	10	0	0	0	160	250	390	600	930	1160
	15	0	0	0	0	170	270	430	660	820

Note: This chart is from the U.S. National Electrical Code (NEC).

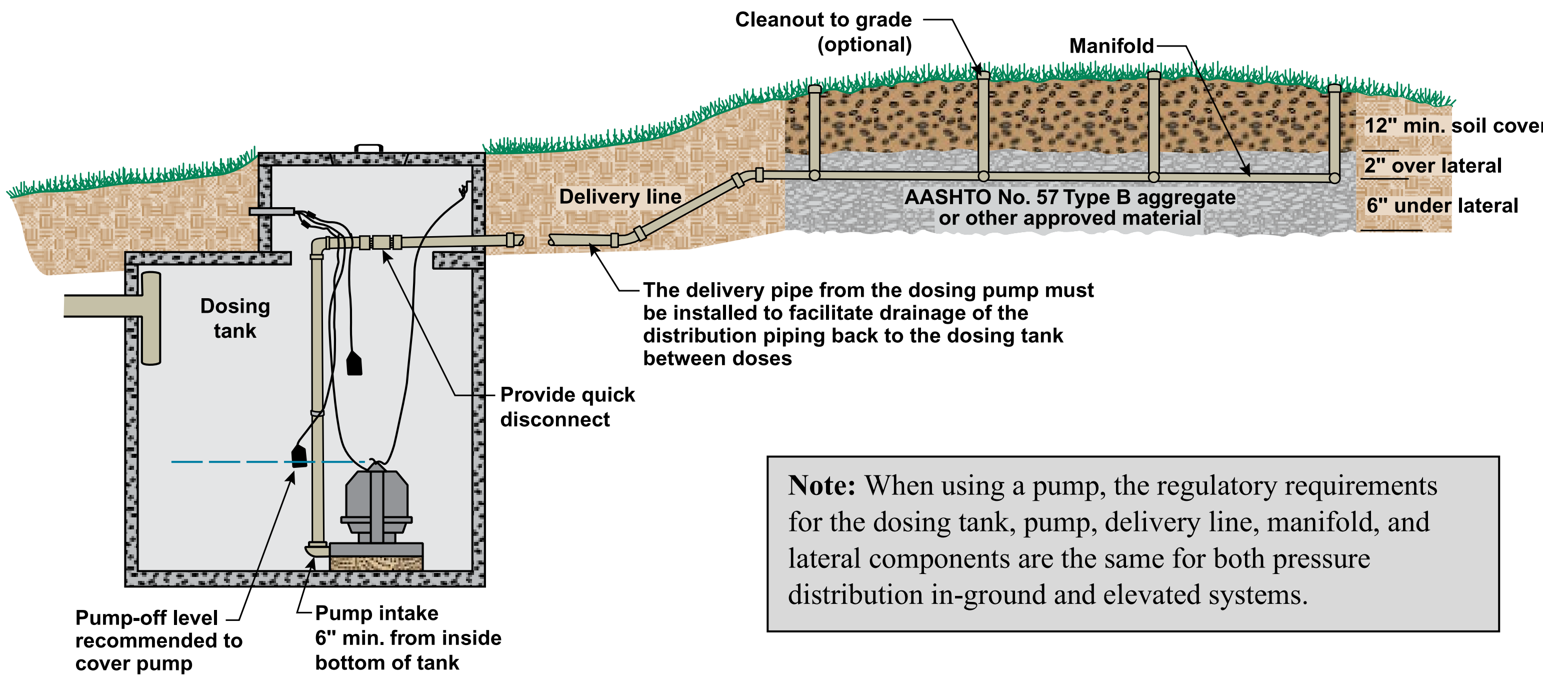
Example: If you were using a 1/3-horsepower pump with 115 volts and a copper wire size of 12, the maximum length the cable could be is 210 feet.

(1) *Single-phase control boxes may be connected at any point of the total cable length.*

(2) *This table is based on copper wire. If aluminum is used, it must be two sizes larger. Example: When the table calls for #12 copper wire, you would use #10 aluminum wire.*

PRESSURE DISTRIBUTION TO AN IN-GROUND BED ABSORPTION AREA USING A PUMP

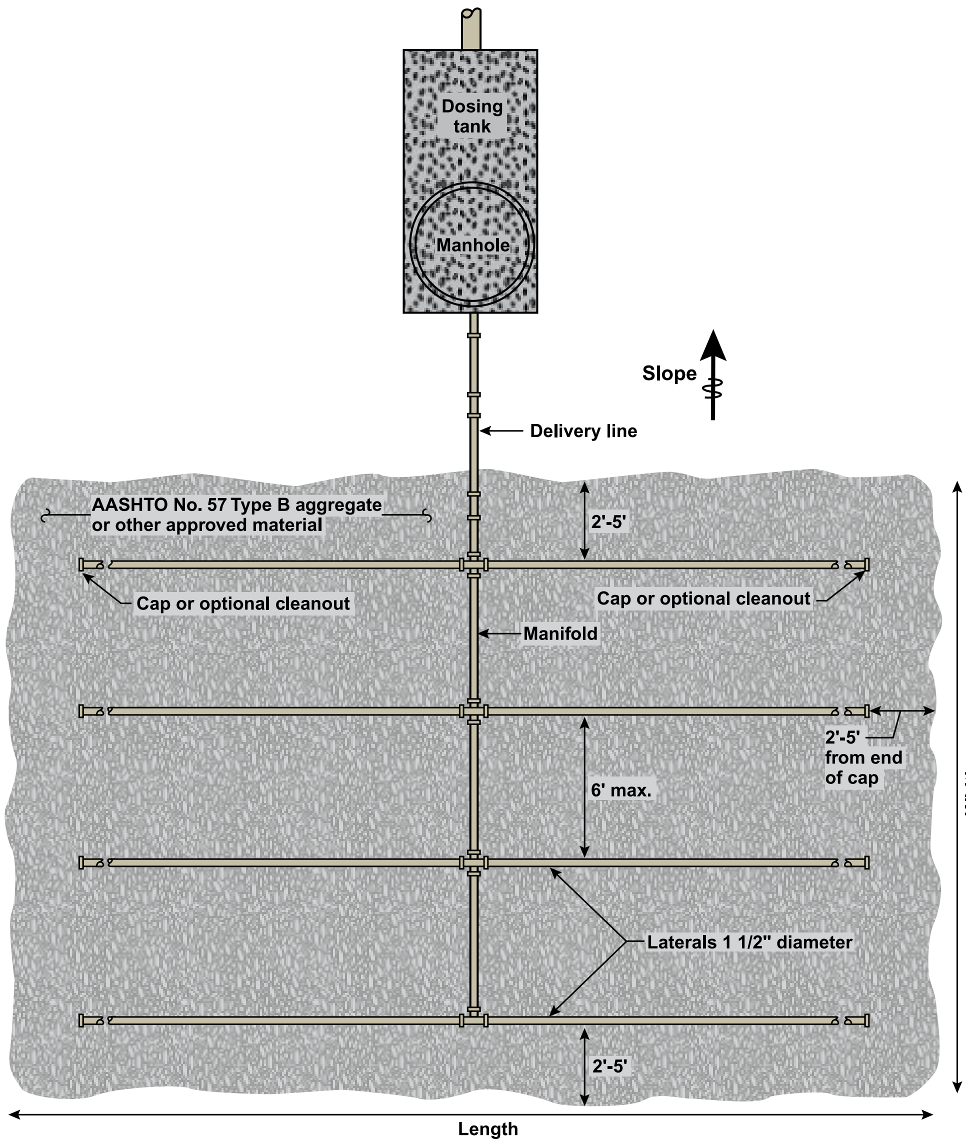
This illustration shows some of the regulatory requirements for a pressure distribution system that pumps effluent to an in-ground bed absorption area.



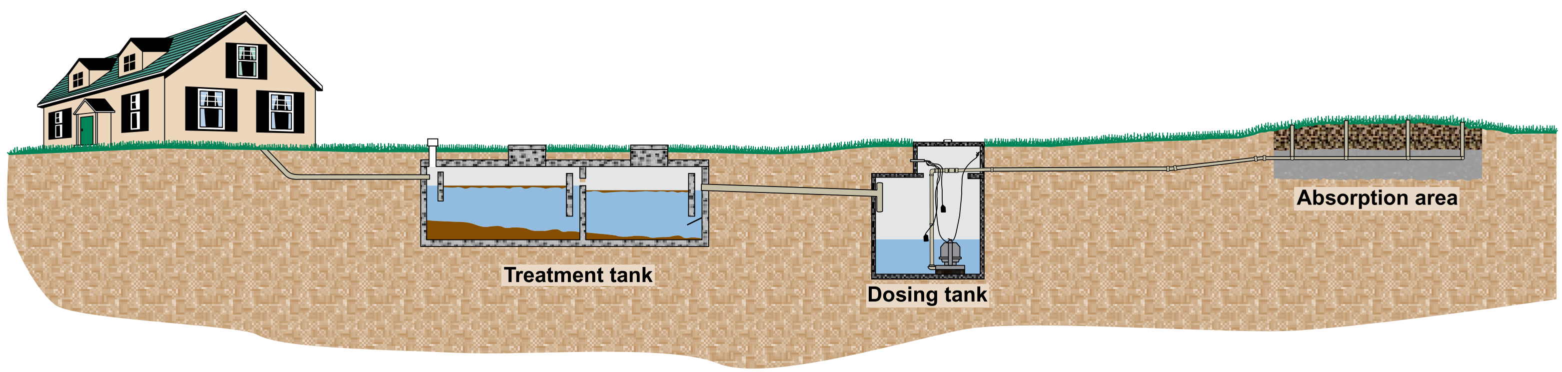
Note: When using a pump, the regulatory requirements for the dosing tank, pump, delivery line, manifold, and lateral components are the same for both pressure distribution in-ground and elevated systems.

Pressure Distribution to an In-Ground Bed Absorption Area ≤2,500 Square Feet Using a Pump

Note: For 200 to 1,199 square feet of absorption area, use a minimum manifold diameter of 1 ½ inches. For 1,200 to 2,500 square feet of absorption area, use a minimum manifold diameter of 2 inches.

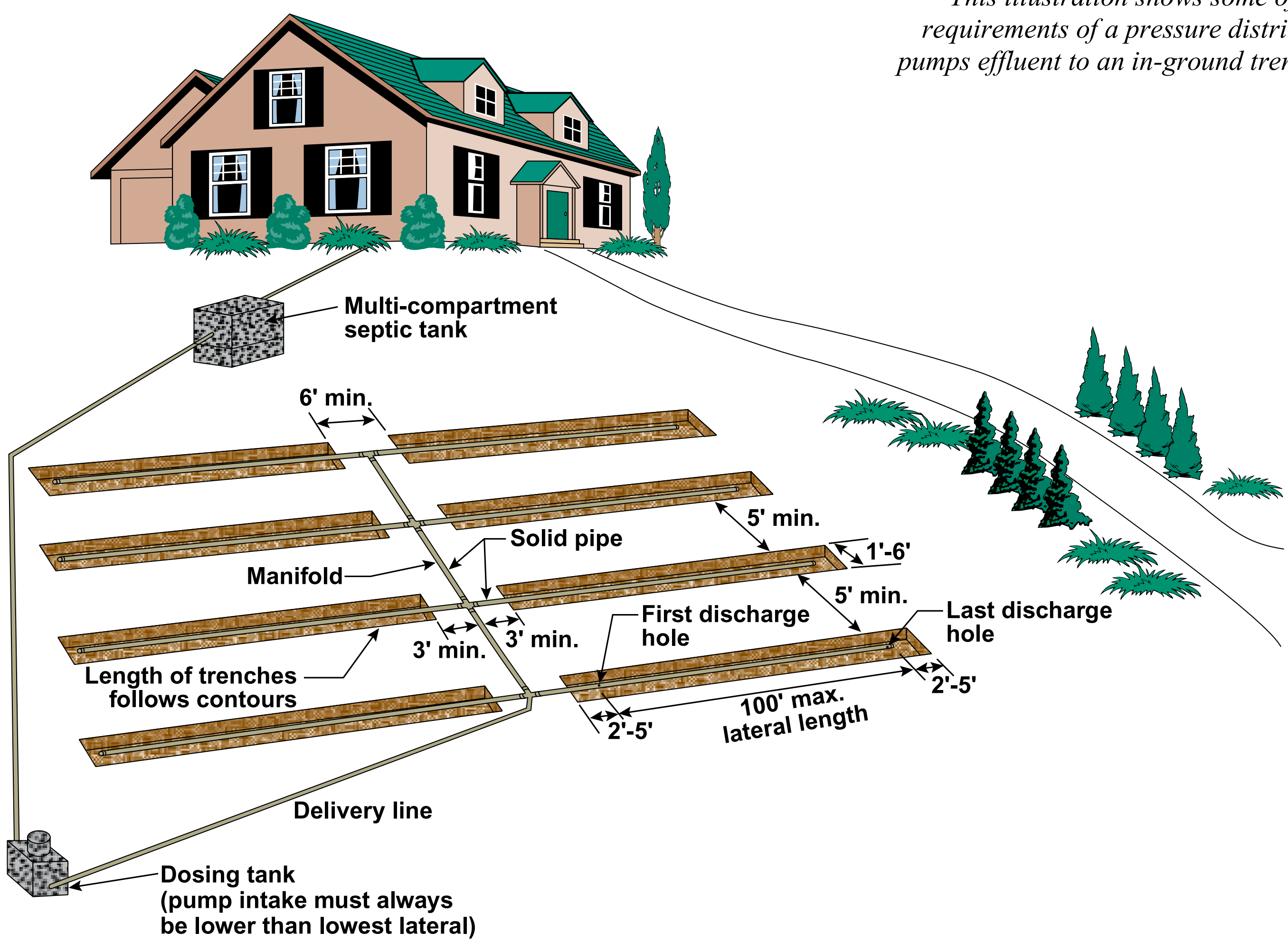


A Typical Hydraulic Profile of a Pressure Distribution System to an In-Ground Bed Absorption Area Using a Pump



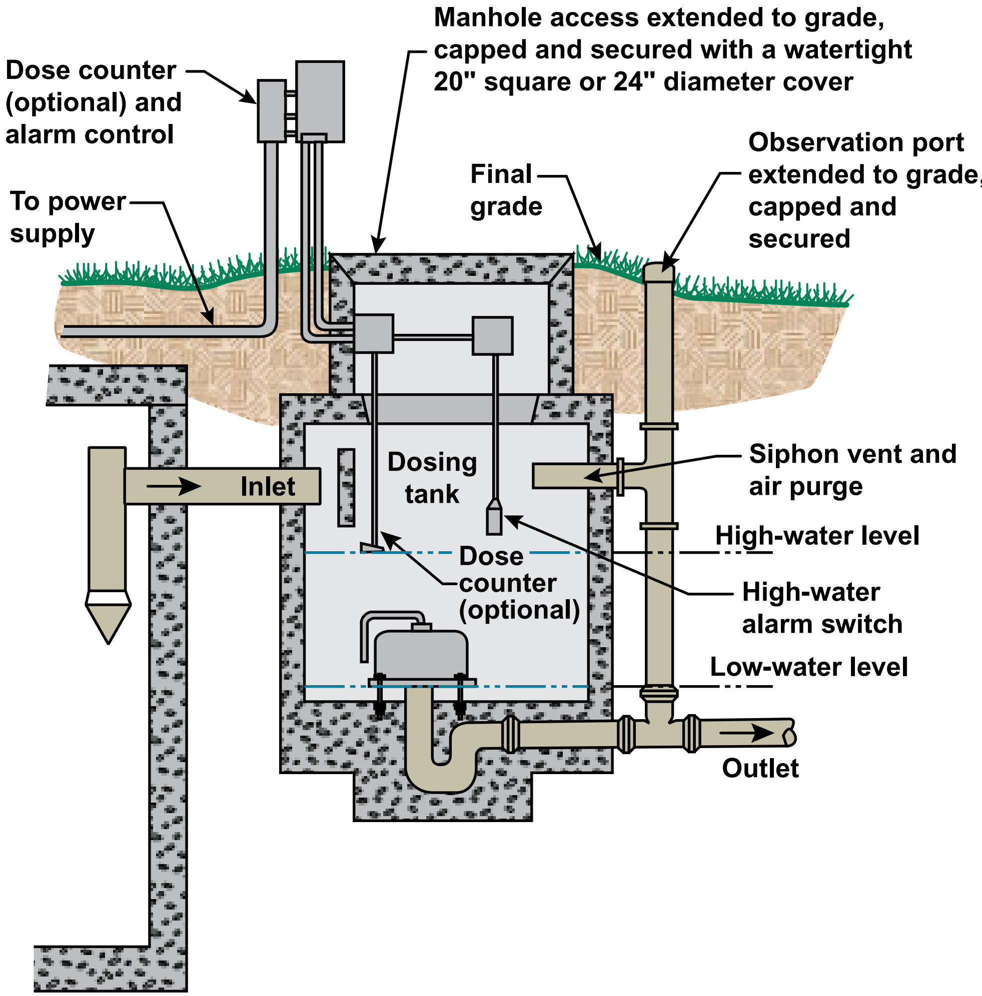
PRESSURE DISTRIBUTION TO AN IN-GROUND TRENCH ABSORPTION AREA USING A PUMP

This illustration shows some of the regulatory requirements of a pressure distribution system that pumps effluent to an in-ground trench absorption area.



PRESSURE DISTRIBUTION USING A SIPHON

This illustration shows some of the regulatory requirements for the dosing tank of a pressure distribution system that uses a siphon.



NOTES:

- **The siphon tank must be set level on undisturbed soil, compacted soil, or modified aggregate.**
- **The siphon trap must be filled with water prior to operation.**
- **Delivery pipe must be connected directly to the end of the manifold.**
- **Laterals must be designed so that total hole discharge in GPM does not vary by more than 20% of the average siphon discharge in GPM.**
- **Total hole discharge rate may not be less than minimum siphon discharge rate in GPM.**
- **Minimum hole size is 5/16".**

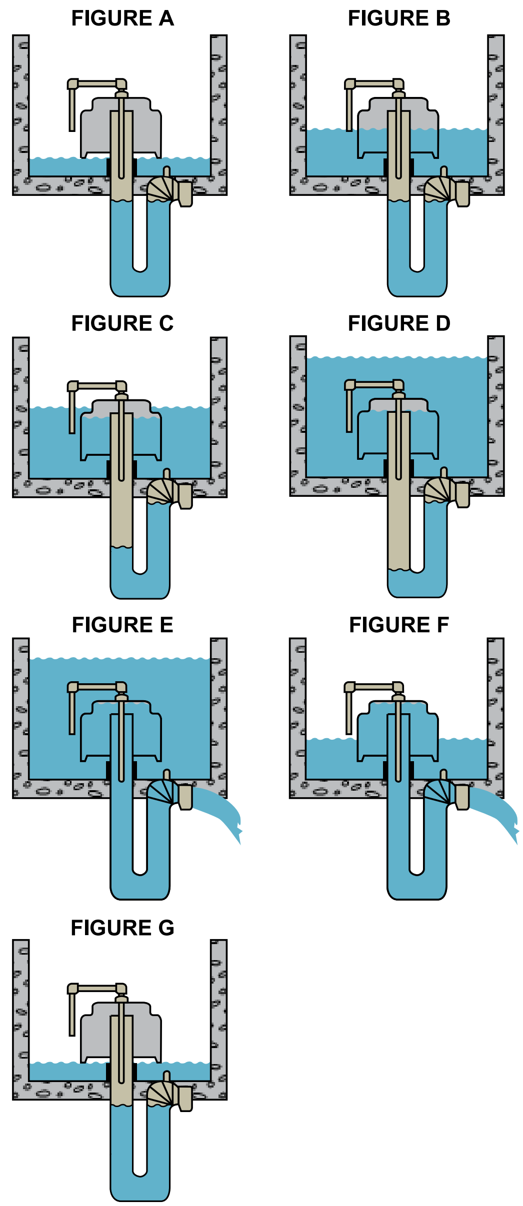
1) As liquid fills the dosing tank, the level of liquid in the tank and inside the siphon bell rises at the same rate. (The siphon bell is open at the bottom.) The siphon is vented to the atmosphere through the vent piping. The rising action continues until the level of the liquid reaches the open end of the outside vent pipe (*see Figures A and B*).

2) Once the liquid reaches the outside vent pipe, it creates an air seal. As the level of liquid continues to rise in the tank, the liquid level in the bell continues to rise but at a much slower rate (*see Figures C and D*). At the same time, the head of water in the tank exerts pressure on the air trapped in the top of the bell and the long leg of the trap. The air in the long leg of the trap is forced towards the invert of the trap (*see Figures C and D*).

3) As the liquid in the tank approaches the high water line (*see Figure D*), the liquid in the bell will have risen to level just short of the top of the trap, and the air in the long leg of the trap will have descended to the invert of the trap.

4) As the liquid in the tank reaches the high water line, a volume of air is forced around the invert of the trap and out through the discharge leg of the siphon. The escaping air relieves the back pressure within the siphon, and the liquid inside of the bell will rush up and fill the siphon trap, thereby starting the siphon action (*see Figure E*).

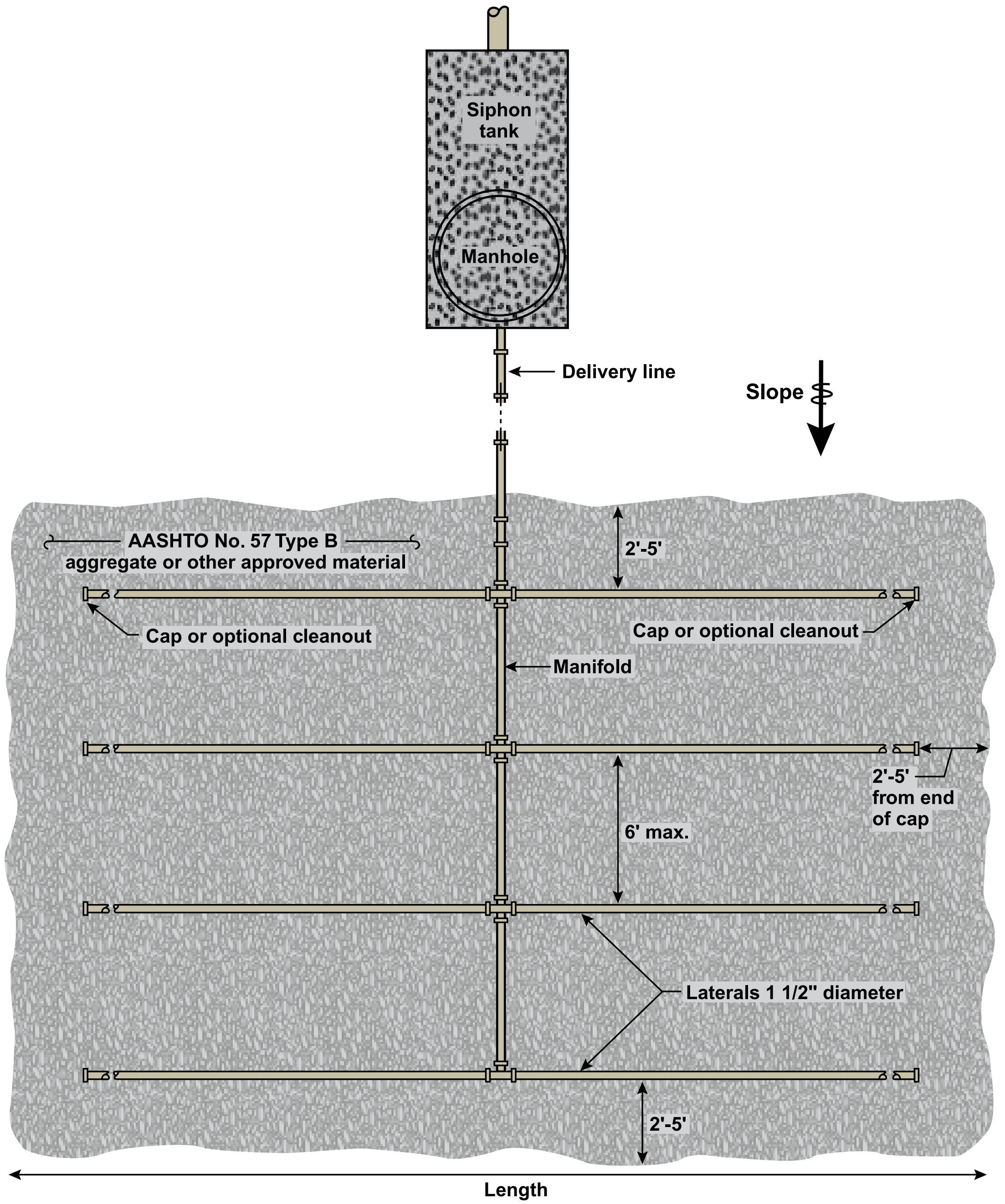
How a Siphon Works



5) The liquid is drawn out of the tank through the discharge leg (*see Figures E and F*) until the liquid in the tank reaches the bottom of the bell. Then the siphon draws air, and the siphon action is stopped (*see Figure G*) until the process repeats itself.

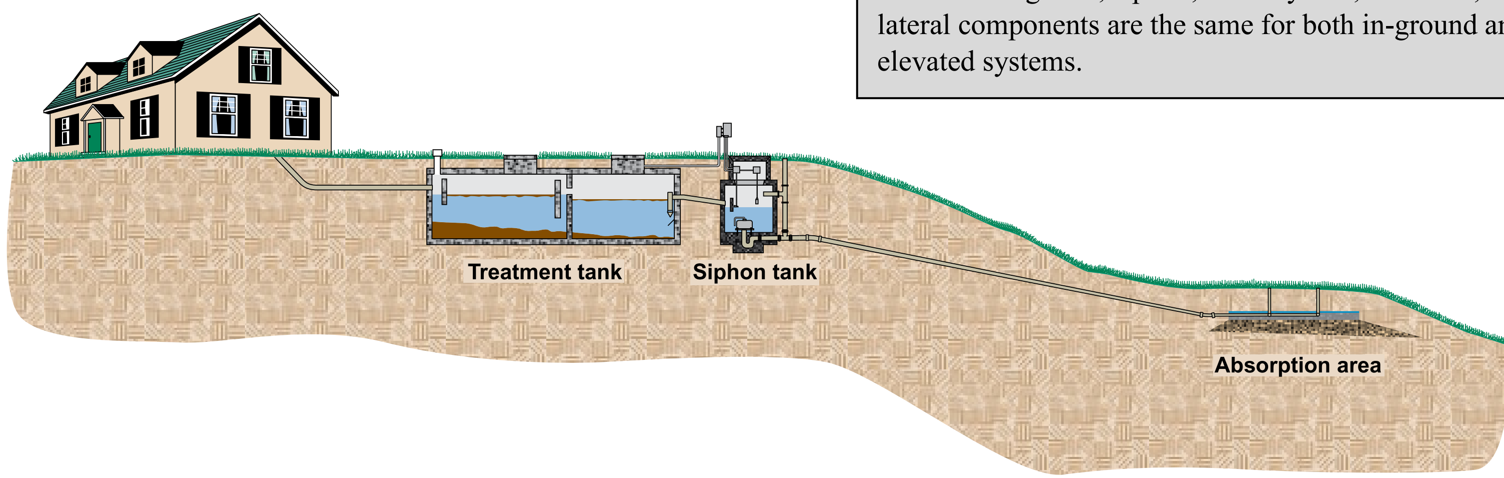
Pressure Distribution to an In-Ground Bed Absorption Area ≤2,500 Square Feet Using a Siphon

Note: It is recommended that the delivery line be the same size or larger than the siphon per manufacturer's specifications.



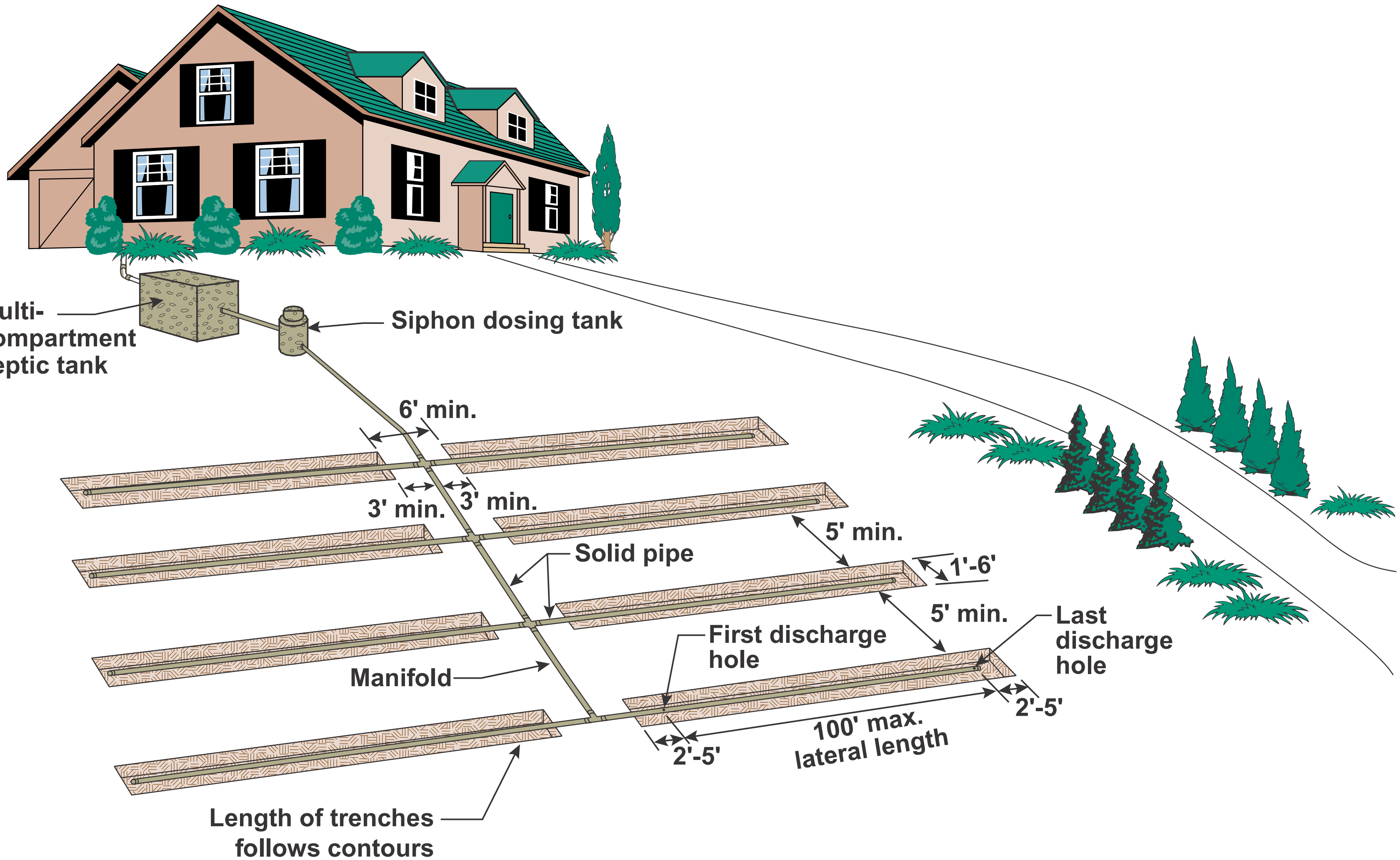
A Typical Hydraulic Profile of a Pressure Distribution System to an Elevated Sand Mound Absorption Area Using a Siphon

Note: When using a siphon, the regulatory requirements for the dosing tank, siphon, delivery line, manifold, and lateral components are the same for both in-ground and elevated systems.



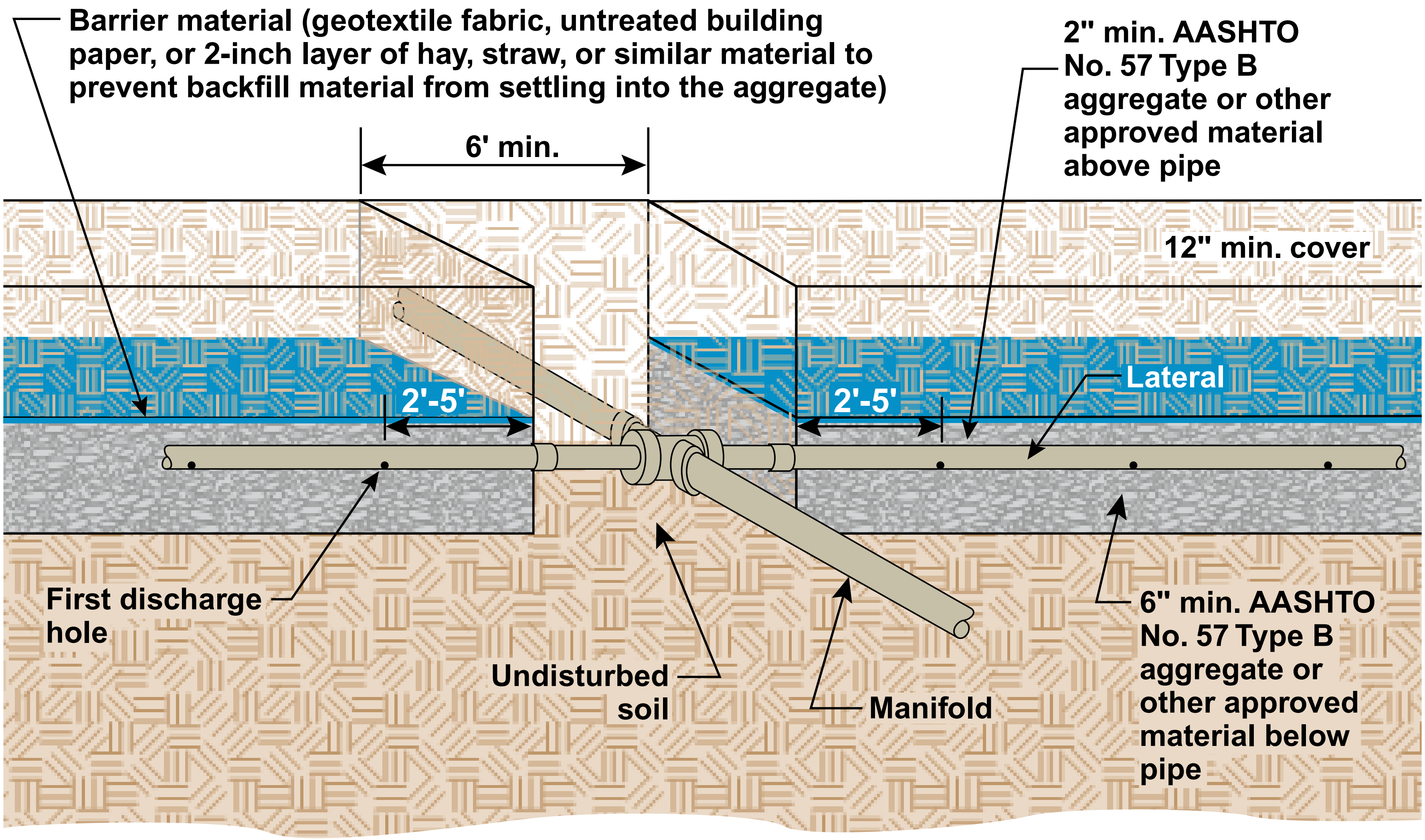
PRESSURE DISTRIBUTION TO AN IN-GROUND TRENCH ABSORPTION AREA USING A SIPHON

This illustration shows some of the regulatory requirements for the absorption area of a pressure distribution system to in-ground trenches.



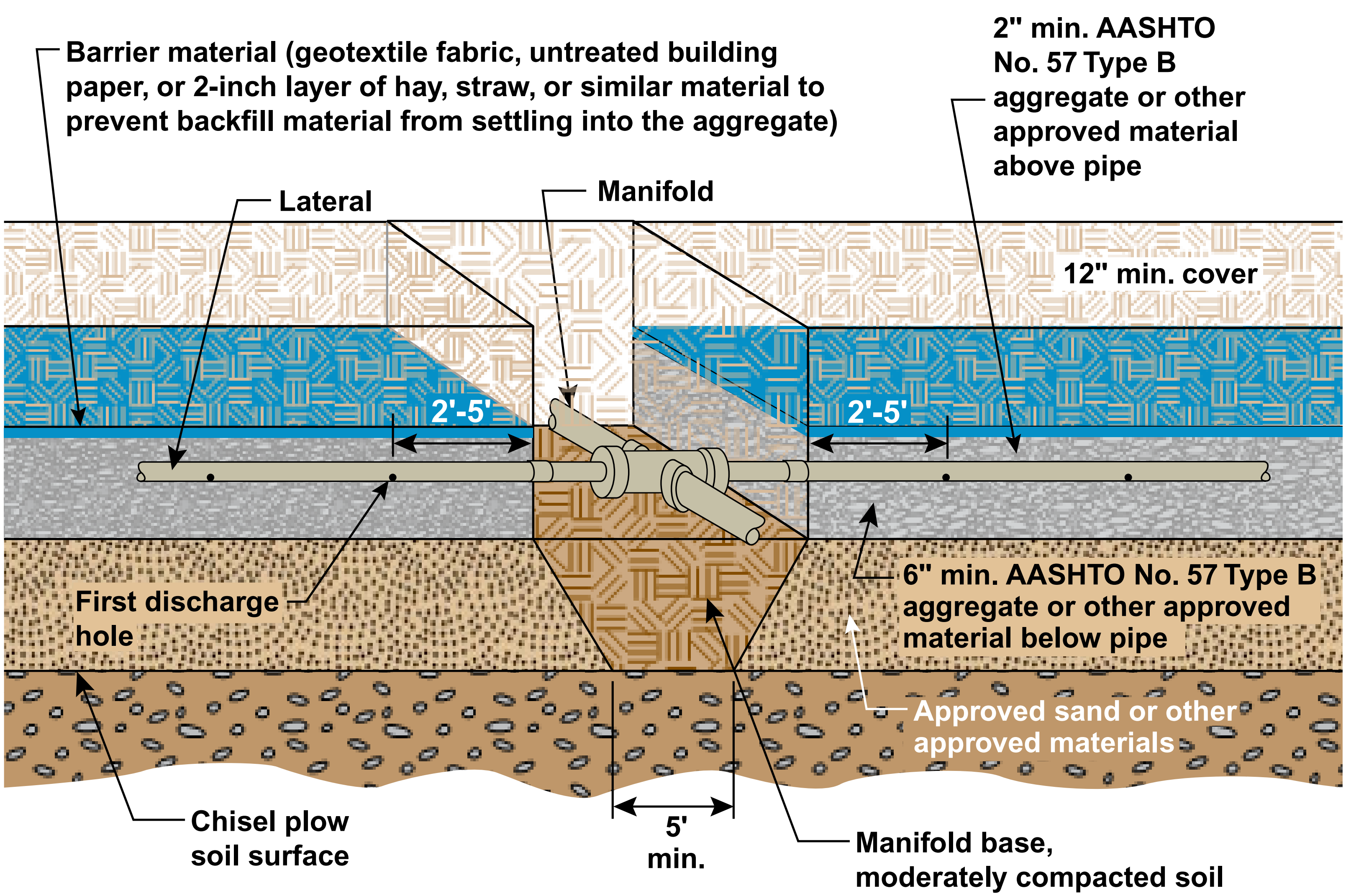
In-Ground Trenches for a Pressure Distribution System Using a Pump

This illustration shows in greater detail some of the regulatory requirements of the in-ground trenches used with a pressure distribution system.

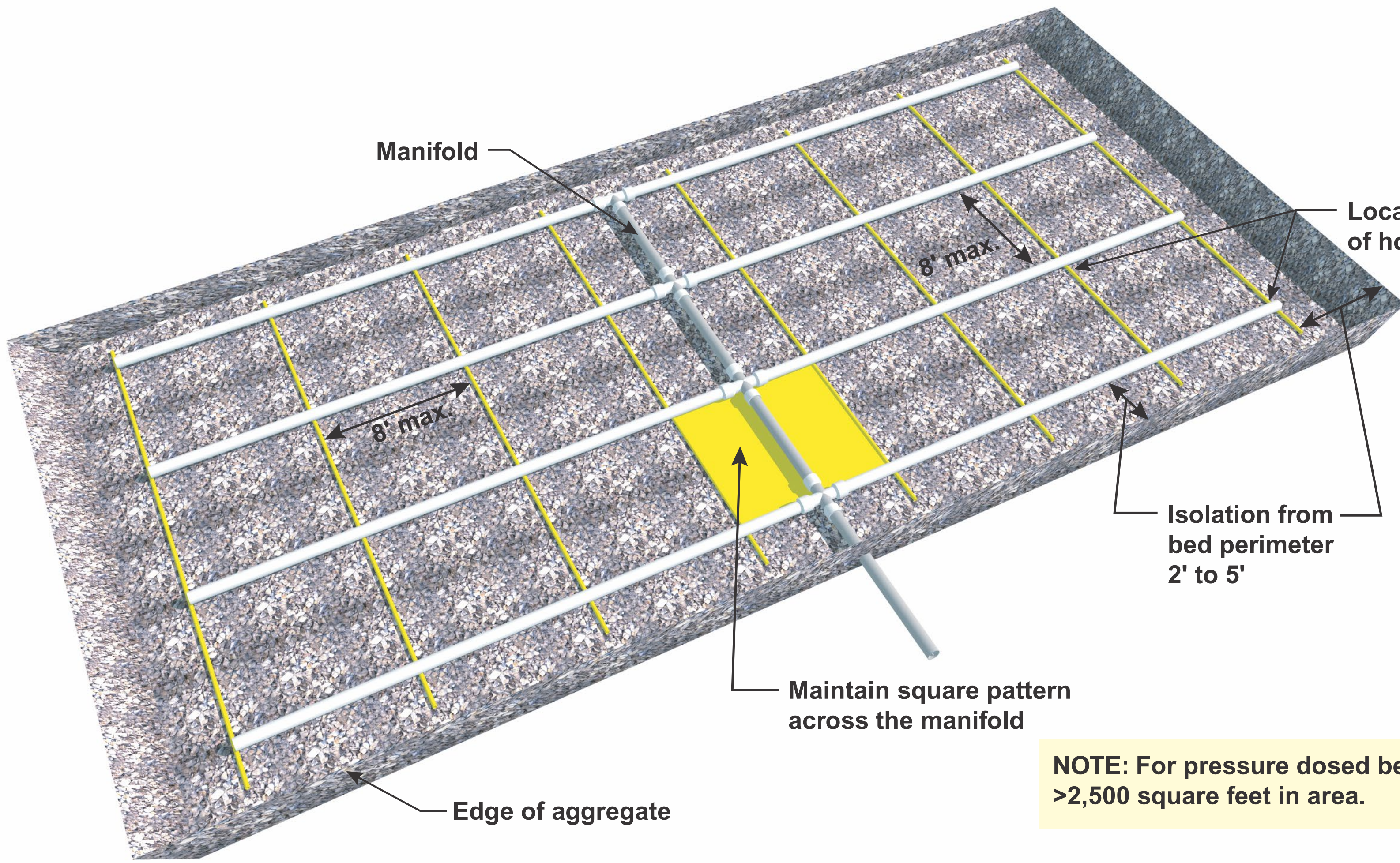


Elevated Sand Mound Trenches for a Pressure Distribution System Using a Pump or Siphon

This illustration shows in greater detail some of the regulatory requirements of elevated sand mound trenches used with a pressure distribution system.

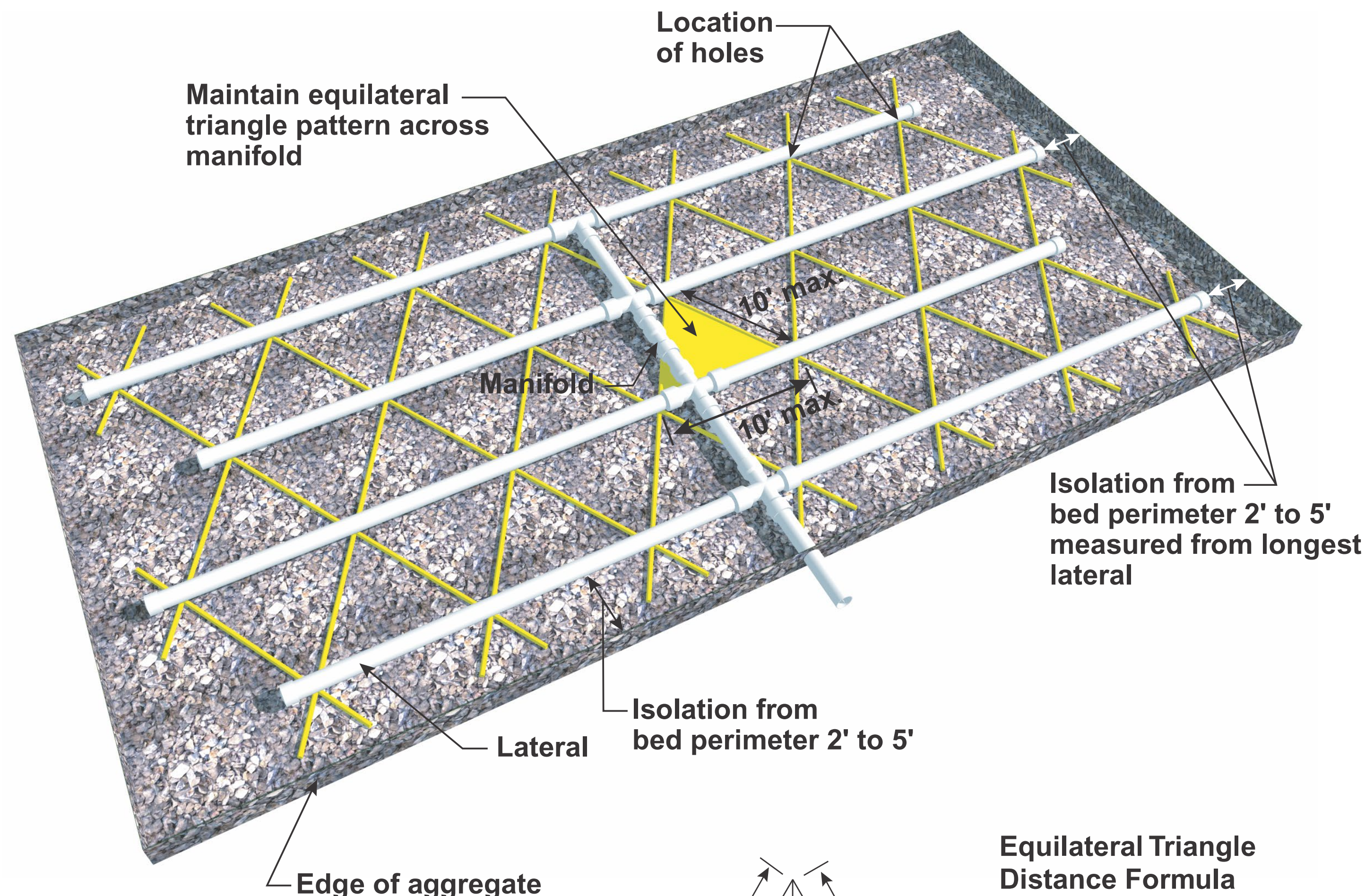


PRESSURE DISTRIBUTION BED:
8-FOOT LAYOUT

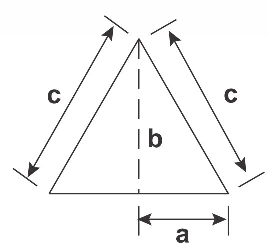


NOTE: For pressure dosed beds >2,500 square feet in area.

PRESSURE DISTRIBUTION BED: 10-FOOT LAYOUT



NOTE: For pressure dosed beds >2,500 square feet in area.



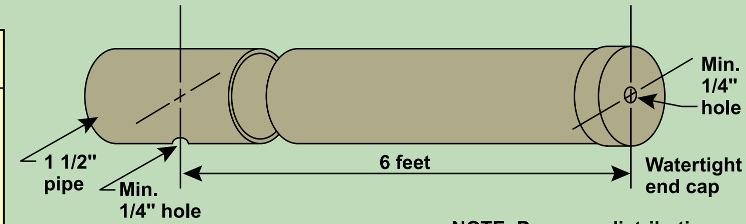
Equilateral Triangle Distance Formula

$b = \sqrt{c^2 - a^2}$

a = 1/2 distance of c
b = distance between laterals
c = space between holes

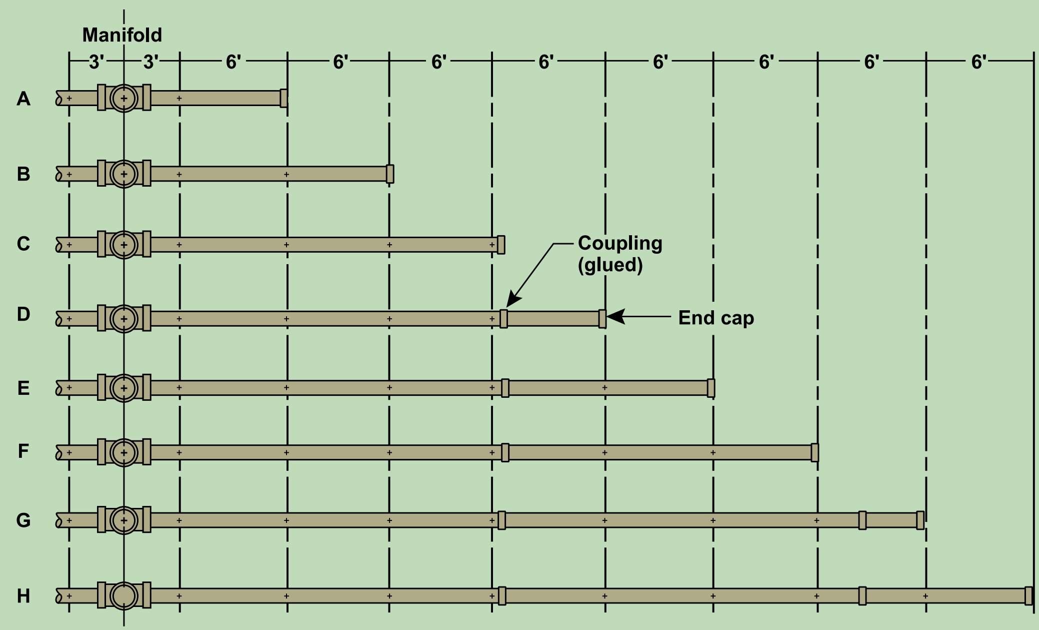
LATERAL LENGTHS FOR A PRESSURE DISTRIBUTION BED ≤2,500 SQUARE FEET

Lateral Type	No. of Holes Per Lateral	Minimum and Maximum Bed Length Manifold to Perimeter
A	2	11-14 feet
B	3	17-20 feet
C	4	23-26 feet
D	5	29-32 feet
E	6	35-38 feet
F	7	41-44 feet
G	8	47-50 feet
H	9	53-56 feet



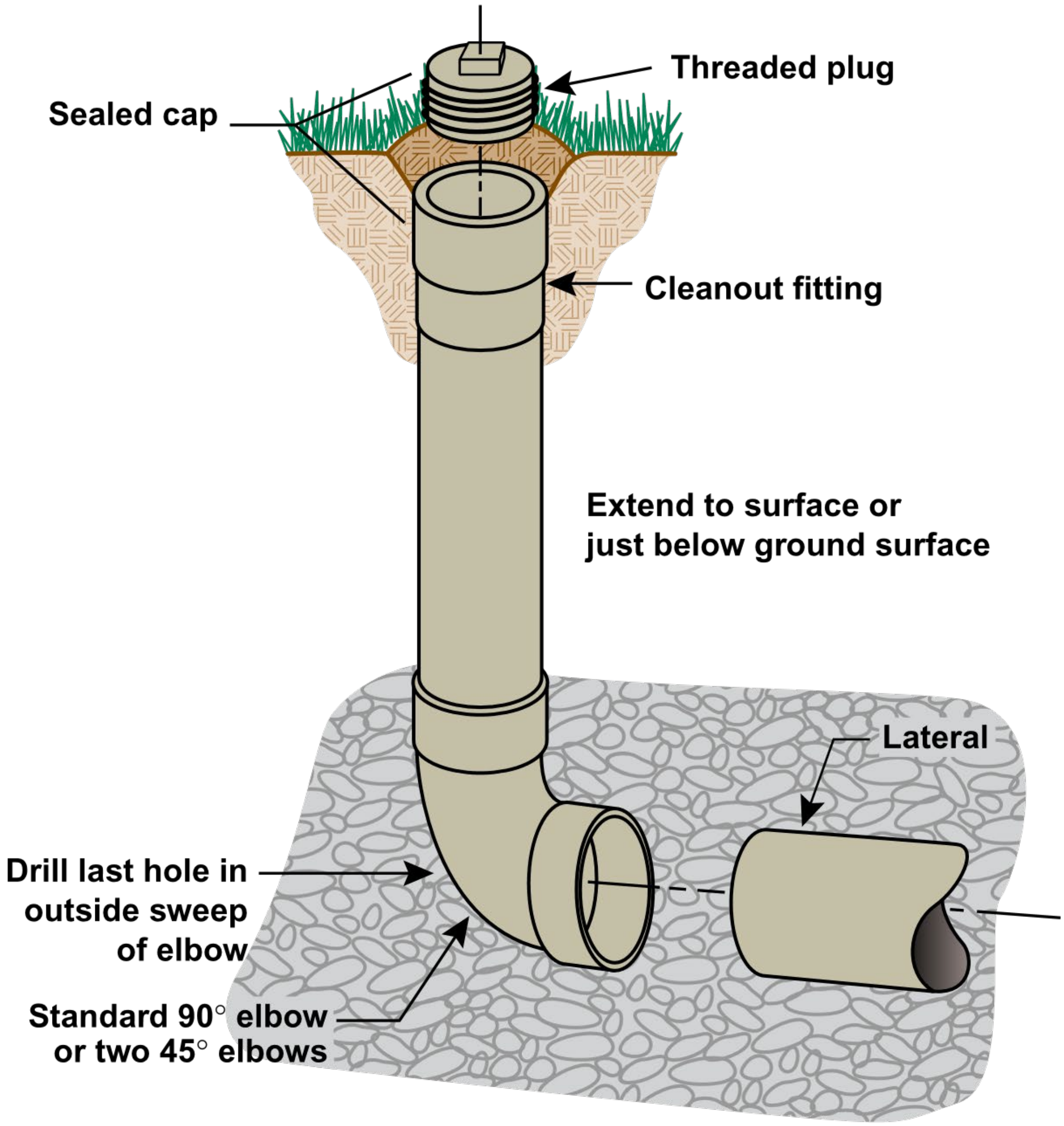
NOTE: Pressure distribution siphon min. hole size is 5/16"

1 1/2" pipe is available in 20' sections



PRESSURE DISTRIBUTION LATERAL CLEANOUT
(Optional)

If a system is malfunctioning, the cleanouts are easily accessible to investigate whether solids are entering the drainfield.



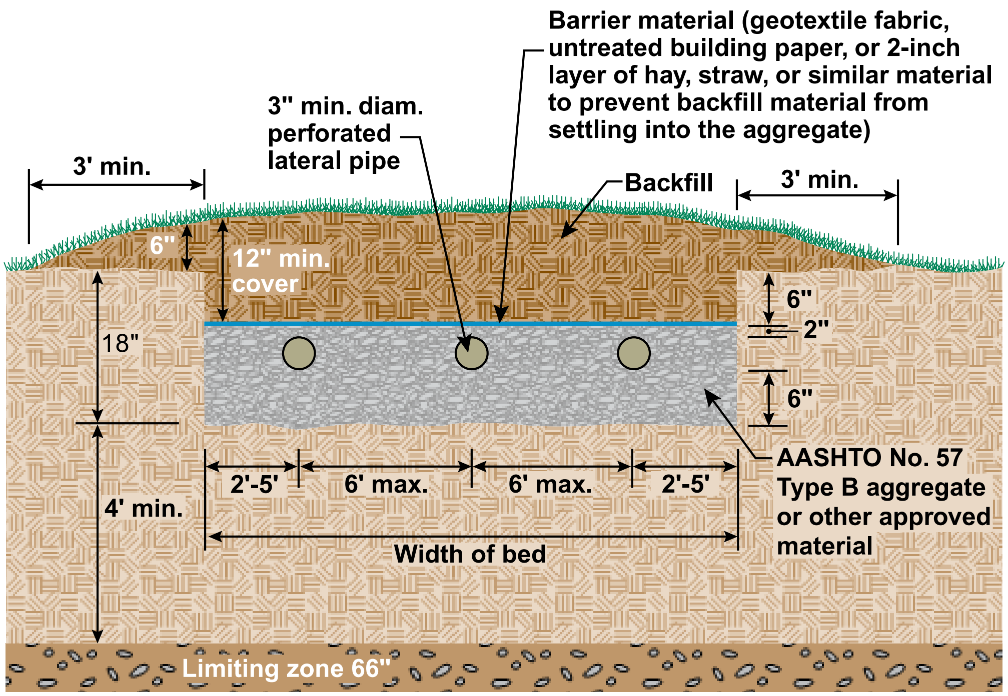
All PVC lateral piping 1 1/2" diameter (absorption area ≤2,500 sq. ft.)

If lateral cleanout is not used, drill last hole in lateral end cap

Absorption Areas

GRAVITY FLOW IN-GROUND SEEPAGE BED ON A LEVEL SITE

This illustration shows some of the regulatory requirements for a gravity flow in-ground seepage bed placed on a level site With a 66-inch limiting zone.

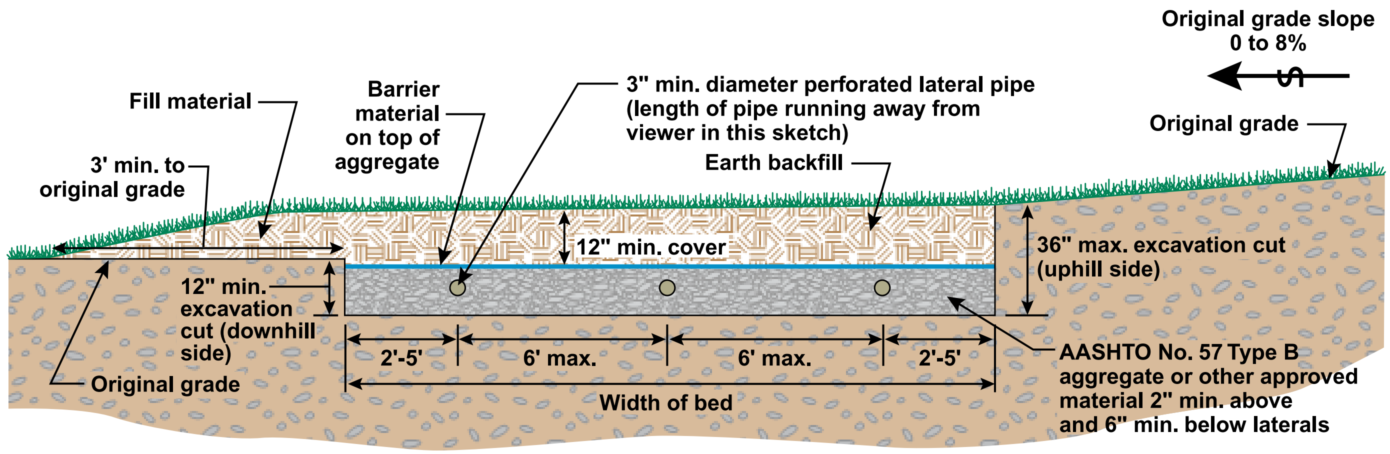


NOTES:

- **Bottom of bed excavation must be level to a tolerance of 2 inches per 100 feet.**
- **Laterals must be level to a maximum tolerance of 4 inches of fall per 100 feet toward the terminal end of the lateral.**
- **AASHTO No. 57 Type B aggregate or other approved material must be installed at a uniform depth throughout.**
- **Topsoil must not be stripped prior to installation.**
- **A minimum 12-inch cover must be provided from the top of aggregate to final grade. Where the top of aggregate is less than 12 inches from the undisturbed soil surface, fill material must be provided and extend beyond the sides of the bed by at least 3 feet.**

GRAVITY FLOW IN-GROUND SEEPAGE BED ON A SLOPE

This illustration shows some of the regulatory requirements for a gravity flow in-ground seepage bed placed on a slope of 8 percent or less.

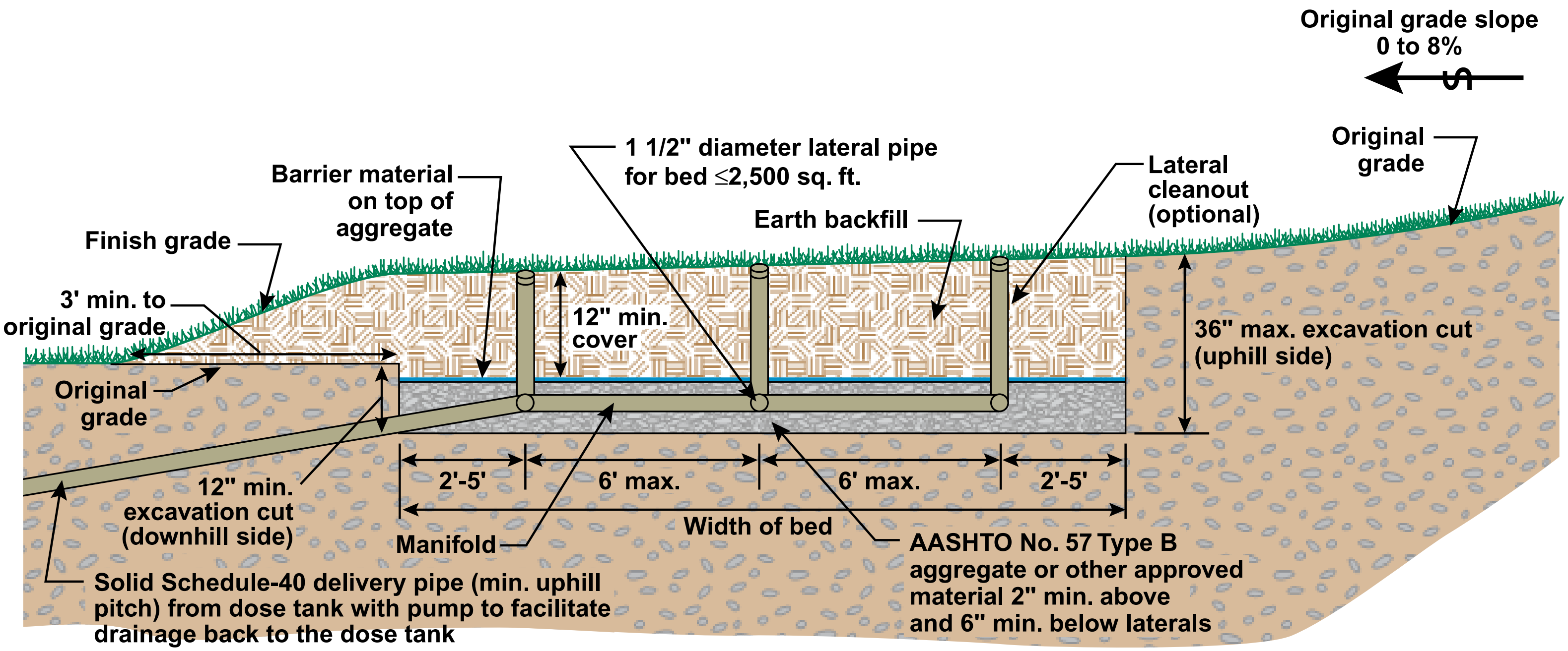


NOTES:

- **Bottom of bed excavation must be level to a tolerance of 2 inches per 100 feet.**
- **Laterals must be level to a maximum tolerance of 4 inches of fall per 100 feet toward the terminal end of the lateral.**
- **AASHTO No. 57 Type B aggregate or other approved material must be installed at a uniform depth throughout.**
- **Topsoil must not be stripped prior to installation.**
- **A minimum 12-inch cover must be provided from the top of aggregate to final grade. Where the top of aggregate is less than 12 inches from the undisturbed soil surface, fill material must be provided and extend beyond the sides of the bed by at least 3 feet.**
- **It is recommended that the bed be installed on contours.**

PRESSURE DISTRIBUTION IN-GROUND SEEPAGE BED ON A SLOPE

This illustration shows some of the regulatory requirements for a pressure distribution in-ground seepage bed placed on a slope of 8 percent or less.

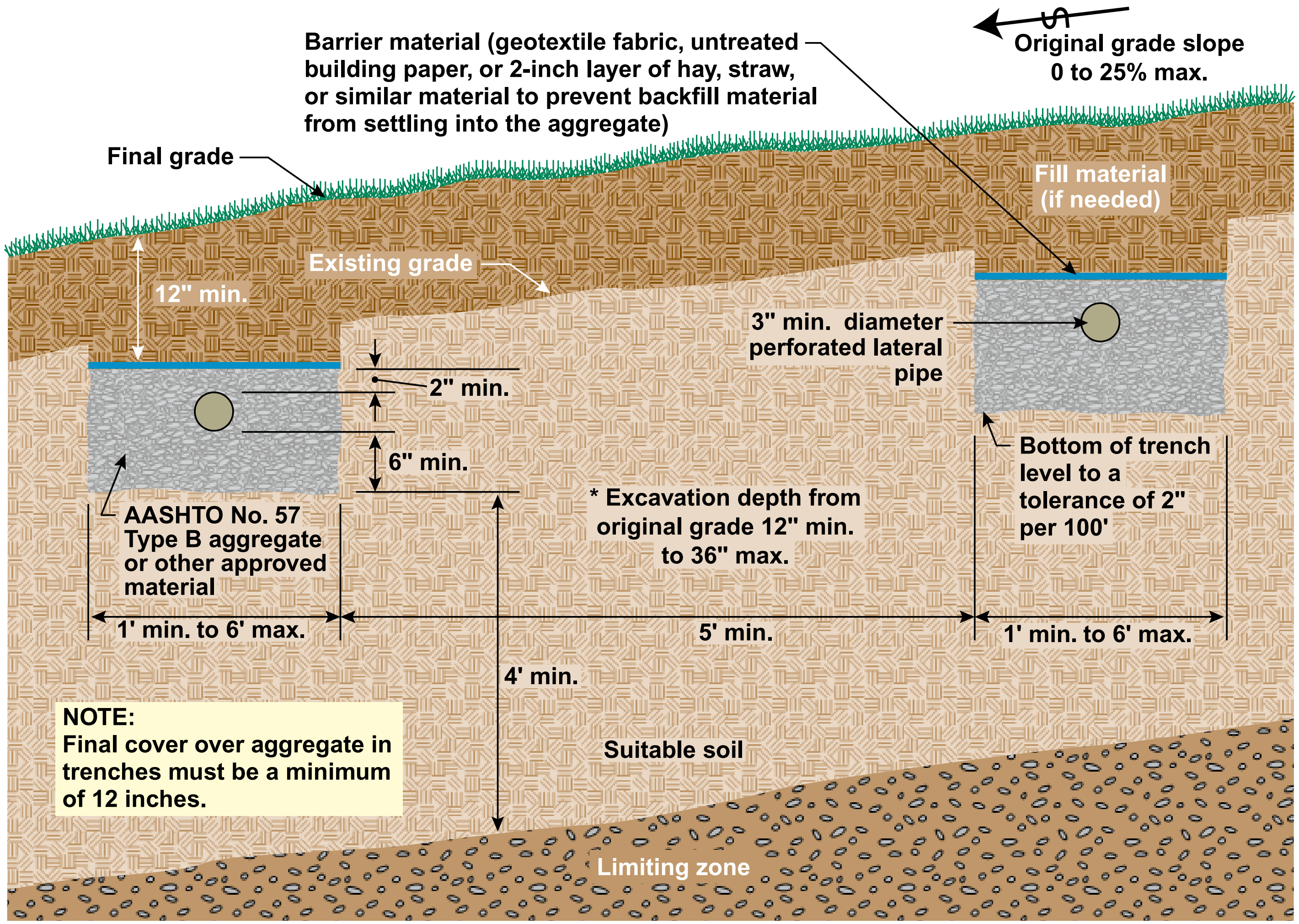


NOTES:

- **Bottom of bed excavation must be level to a tolerance of 2 inches per 100 feet.**
- **Laterals must be level to a maximum tolerance of 4 inches of fall per 100 feet toward the terminal end of the lateral.**
- **All joints must be watertight.**
- **AASHTO No. 57 Type B aggregate or other approved material must be installed at a uniform depth throughout.**
- **Topsoil must not be stripped prior to installation.**
- **A minimum 12-inch cover must be provided from the top of aggregate to final grade. Where the top of aggregate is less than 12 inches from the undisturbed soil surface, fill material must be provided and extend beyond the sides of the bed by at least 3 feet.**
- **It is recommended that the bed be installed on contours.**

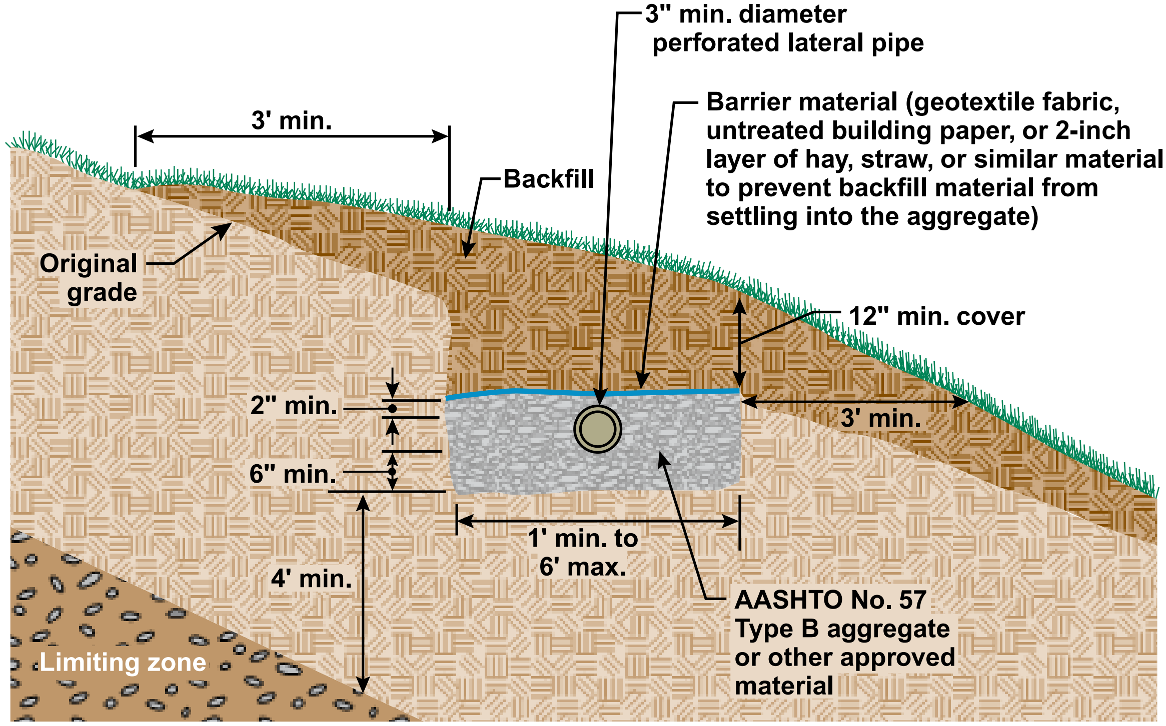
GRAVITY FLOW IN-GROUND TRENCH

This illustration shows some of the regulatory requirements for a gravity flow in-ground trench system.



Individual Gravity Flow In-Ground Trench

This illustration shows some of the regulator requirements for an individual for a gravity flow in-ground trench. (All trench systems must have a minimum of two trenches.)

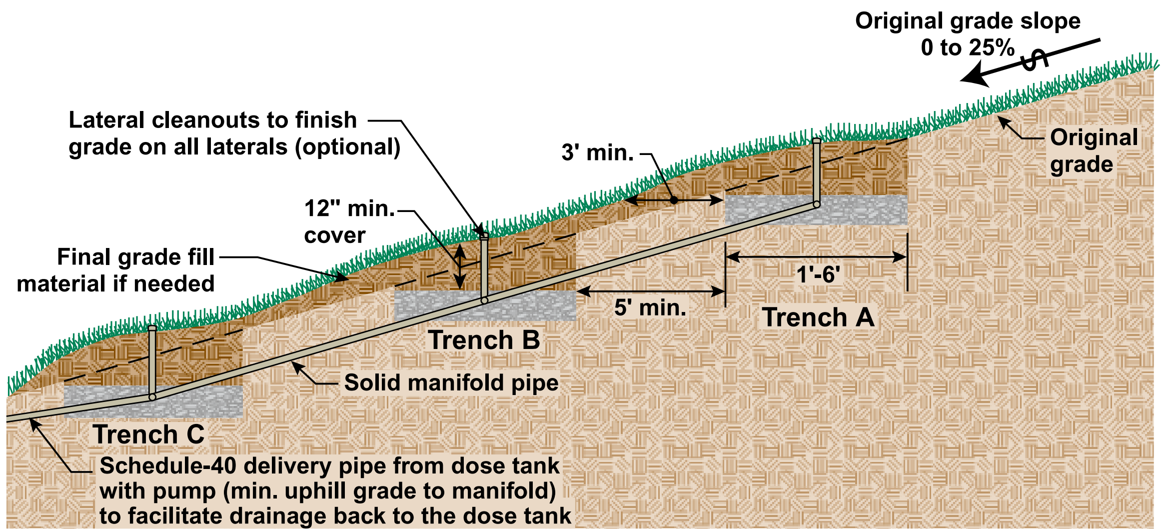


NOTES:

- **Trench bottom must be level to a tolerance of 2 inches per 100 feet.**
- **Laterals must be level to a maximum tolerance of 4 inches of fall per 100 feet toward the terminal end of the lateral.**
- **Excavation depth from original grade must be a minimum of 12 inches to a maximum of 36 inches.**

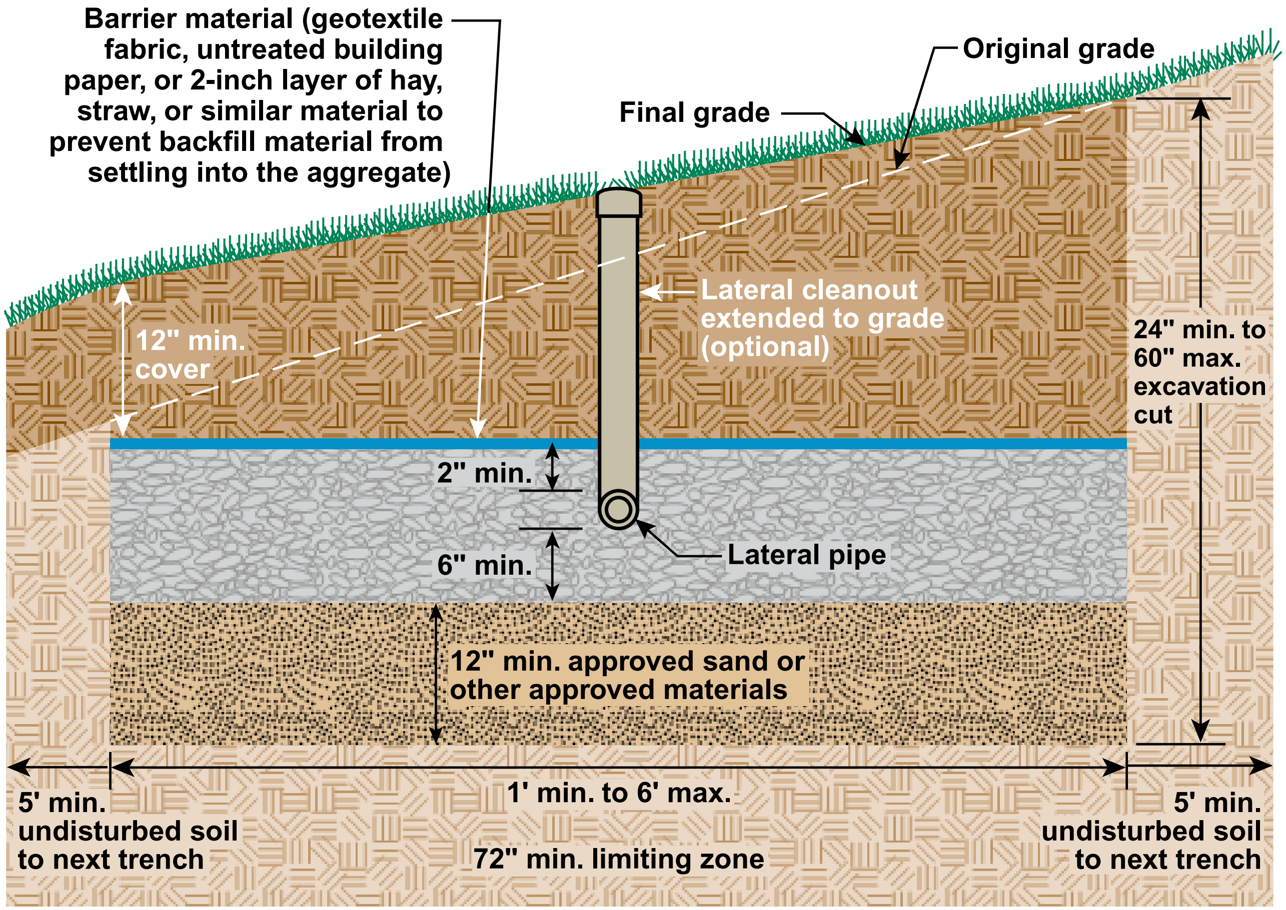
PRESSURE DISTRIBUTION IN-GROUND TRENCHES USING A PUMP

This illustration shows some of the regulatory requirements for pressure distribution in-ground trenches in a system that uses a pump to move the effluent.



NOTES:

- **Aggregate in trenches must meet AASHTO No. 57 Type B aggregate or other approved material requirements; 6-inch minimum aggregate under laterals and 2-inch minimum aggregate must be placed over laterals.**
- **Barrier material (geotextile fabric, untreated building paper, or 2-inch layer of hay, straw, or similar material to prevent backfill material from settling into the aggregate) must be used.**
- **Trench bottom must be level to a tolerance of 2 inches per 100 feet.**
- **Laterals must be level to a maximum tolerance of 4 inches of fall per 100 feet toward the terminal end of the lateral.**
- **A minimum 12-inch cover must be provided from the top of aggregate to final grade. Where the top of aggregate is less than 12 inches from the undisturbed soil surface, fill material must be provided and extend beyond the sides of the trench by at least 3 feet.**
- **From original grade, maximum depth of cut is 36 inches (uphill side of trench). Minimum depth of cut is 12 inches (downhill side of trench).**
- **All joints must be watertight.**
- **Topsoil must not be stripped prior to installation.**
- **Trenches must be installed on contours.**



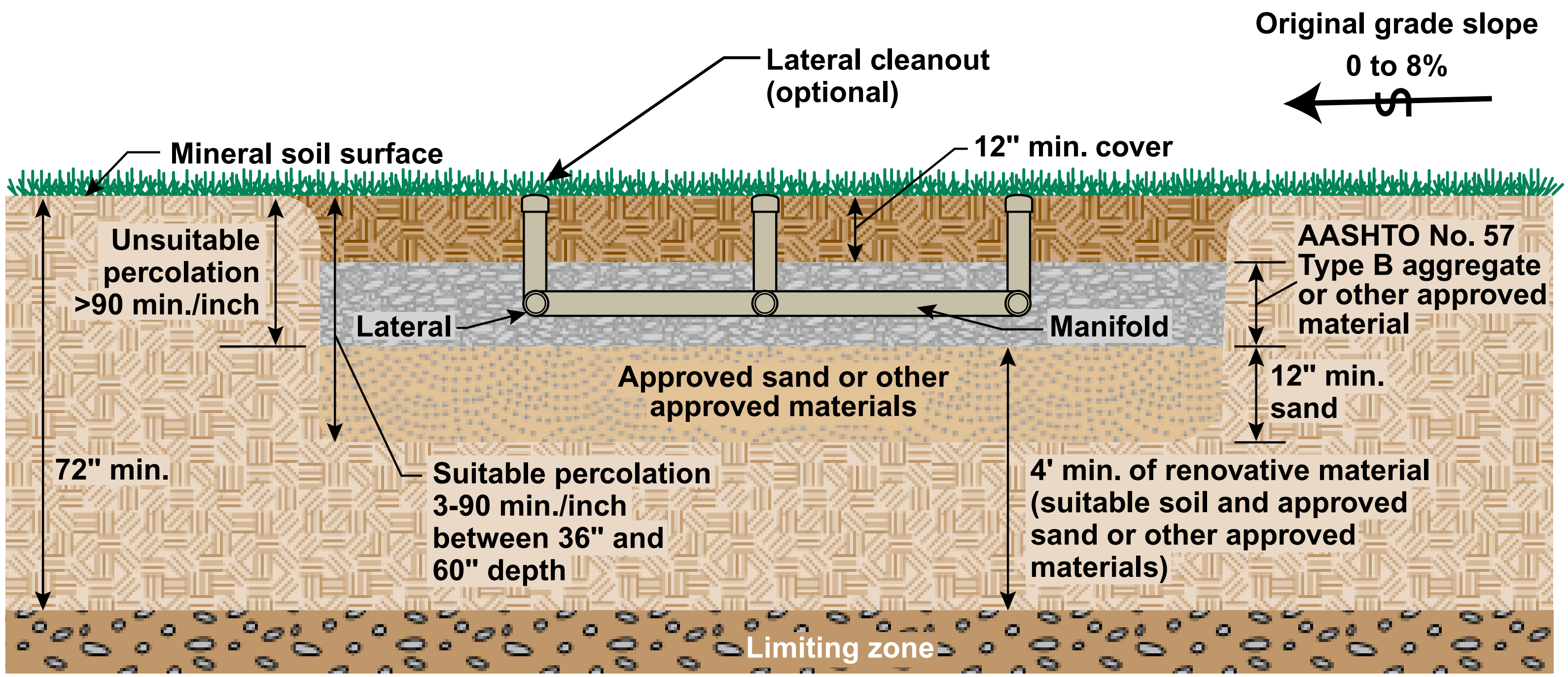
Individual Pressure Distribution In-Ground Trench Using a Pump or Siphon

This illustration shows some of the regulatory requirements for an individual pressure distribution in-ground trench in a system that uses a pump or siphon to move the effluent. (All trench systems must have a minimum of two trenches.)

NOTES:
- **Trench bottom must be level to a tolerance of 2 inches per 100 feet.**
- **Laterals must be level to a maximum tolerance of 4 inches of fall per 100 feet toward the terminal end of the lateral.**
- **Solid manifold pipe (not shown) connects all trenches.**

PRESSURE DISTRIBUTION SUBSURFACE SAND FILTER BED

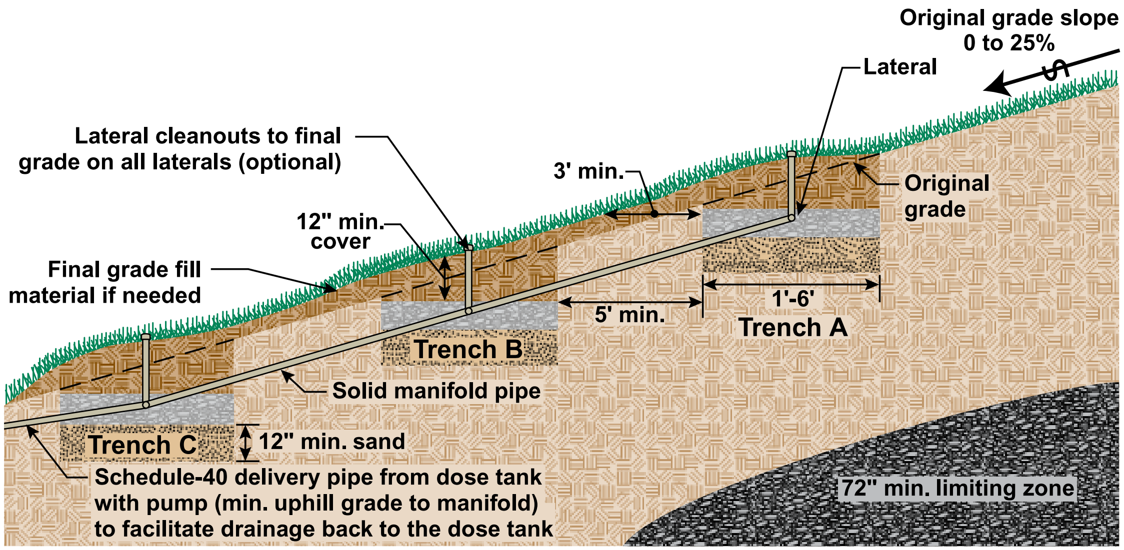
This illustration shows some of the regulatory requirements for a pressure distribution subsurface sand filter bed.



NOTE: From original grade, maximum depth of cut is 60 inches.

PRESSURE DISTRIBUTION SUBSURFACE SAND FILTER TRENCHES USING A PUMP

This illustration shows some of the regulatory requirements for pressure distribution subsurface sand filter trenches in a system that uses a pump to move the effluent.

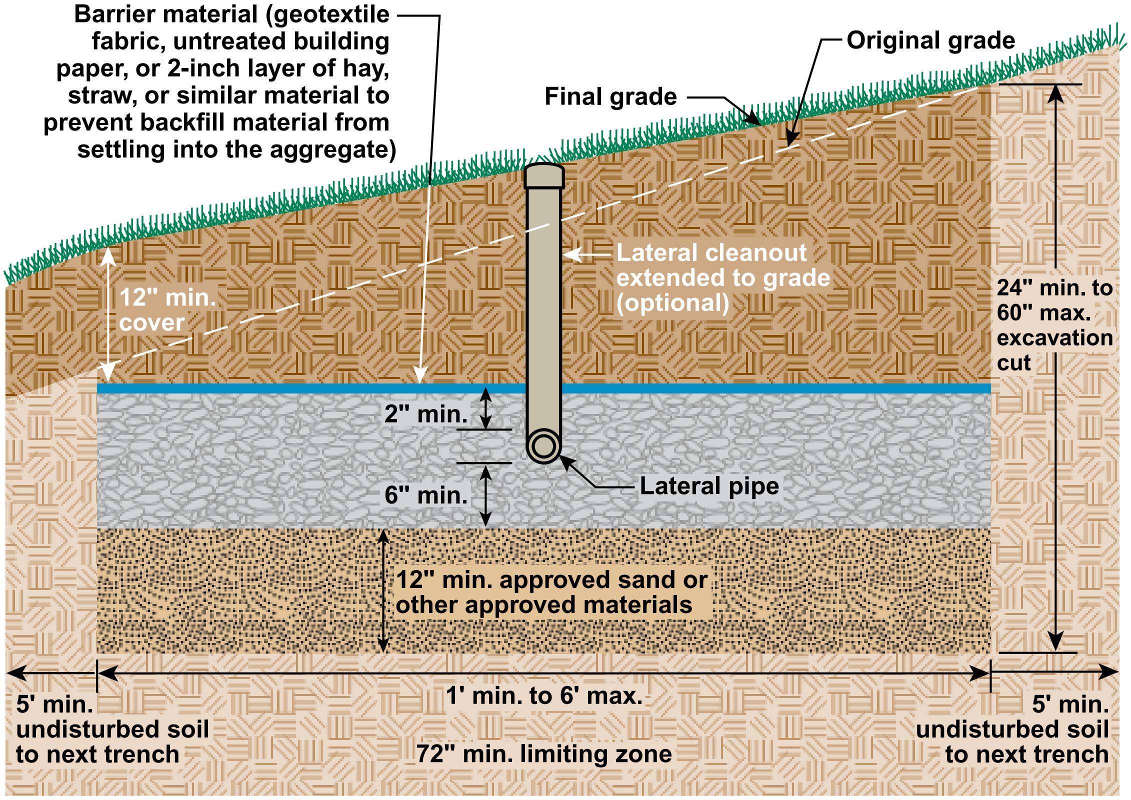


NOTES:

- Aggregate in trenches must meet AASHTO No. 57 Type B aggregate or other approved material requirements; 6-inch minimum aggregate under laterals and 2-inch minimum aggregate over laterals.
- Barrier material (geotextile fabric, untreated building paper, or 2-inch layer of hay, straw, or similar material to prevent backfill material from settling into the aggregate) must be used.
- Trench bottom must be level to a tolerance of 2 inches per 100 feet.
- Laterals must be level to a maximum tolerance of 4 inches of fall per 100 feet toward the terminal end of the lateral.
- A minimum 12-inch cover must be provided from the top of aggregate to final grade. Where the top of aggregate is less than 12 inches from the undisturbed soil surface, fill material must be provided and extend beyond the sides of the trench by at least 3 feet.
- From original grade, maximum depth of cut is 60 inches (uphill side of trench).
- All joints must be watertight.
- Topsoil must not be stripped prior to installation.
- Trenches must be installed on contours.

Individual Pressure Distribution Subsurface Sand Filter Trench Using a Pump or Siphon

This illustration shows some of the regulatory requirements for an individual pressure distribution subsurface sand filter trench. (All trench systems must have a minimum of two trenches.)



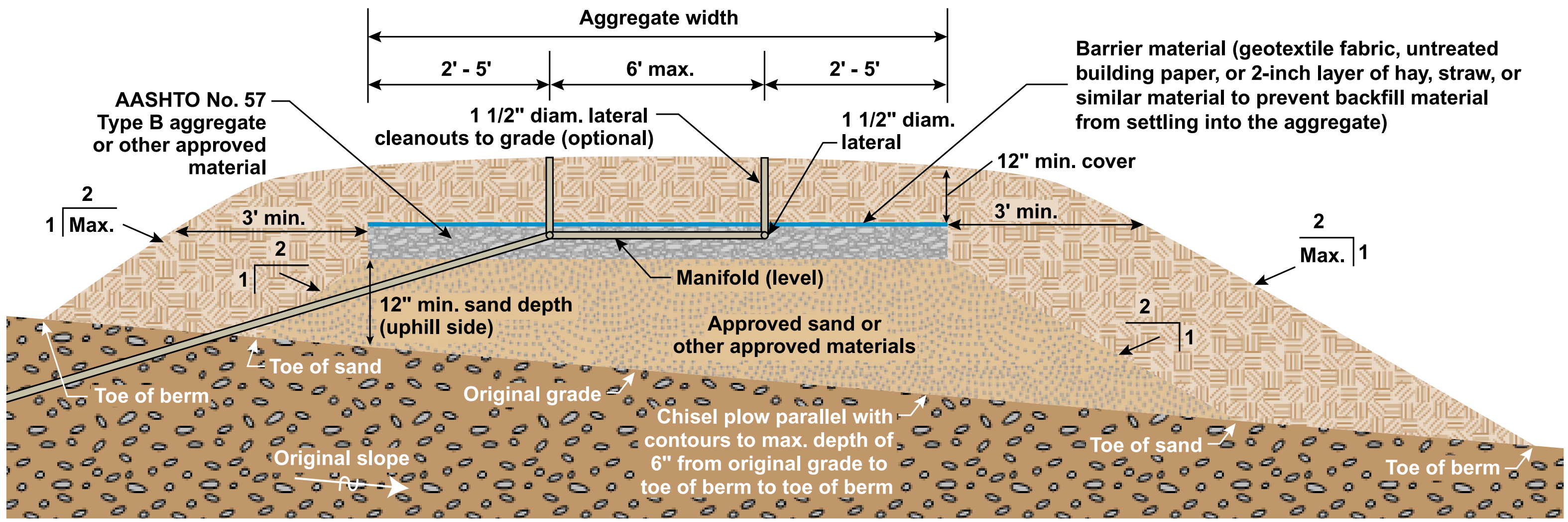
NOTES:

- **Trench bottom must be level to a tolerance of 2 inches per 100 feet.**
- **Laterals must be level to a maximum tolerance of 4 inches of fall per 100 feet toward the terminal end of the lateral.**
- **Solid manifold pipe (not shown) connects all trenches.**

PRESSURE DISTRIBUTION ELEVATED SAND MOUND BED ON SLOPES 0 TO 8%

(Side View)

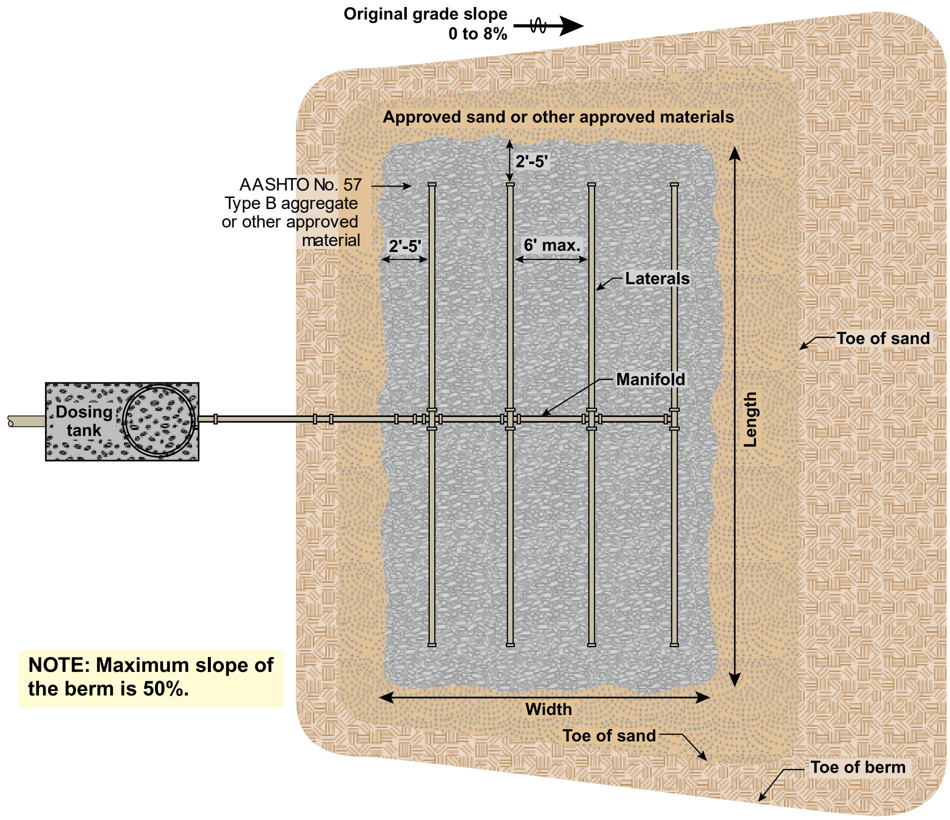
This illustration shows some of the regulatory requirements for a pressure distribution elevated sand mound bed placed on a slope of 8 percent or less.



NOTES:
- **All joints to be watertight.**
- **Top of aggregate, sand, manifold, and laterals to be level.**
- **Required: 2 inches of aggregate above laterals and 6 inches of aggregate below laterals.**
- **For slopes of 0-8 percent.**
- **Recommended to be installed on contours.**

Pressure Distribution Elevated Sand Mound Bed on Slopes 0 to 8%
(Top View)

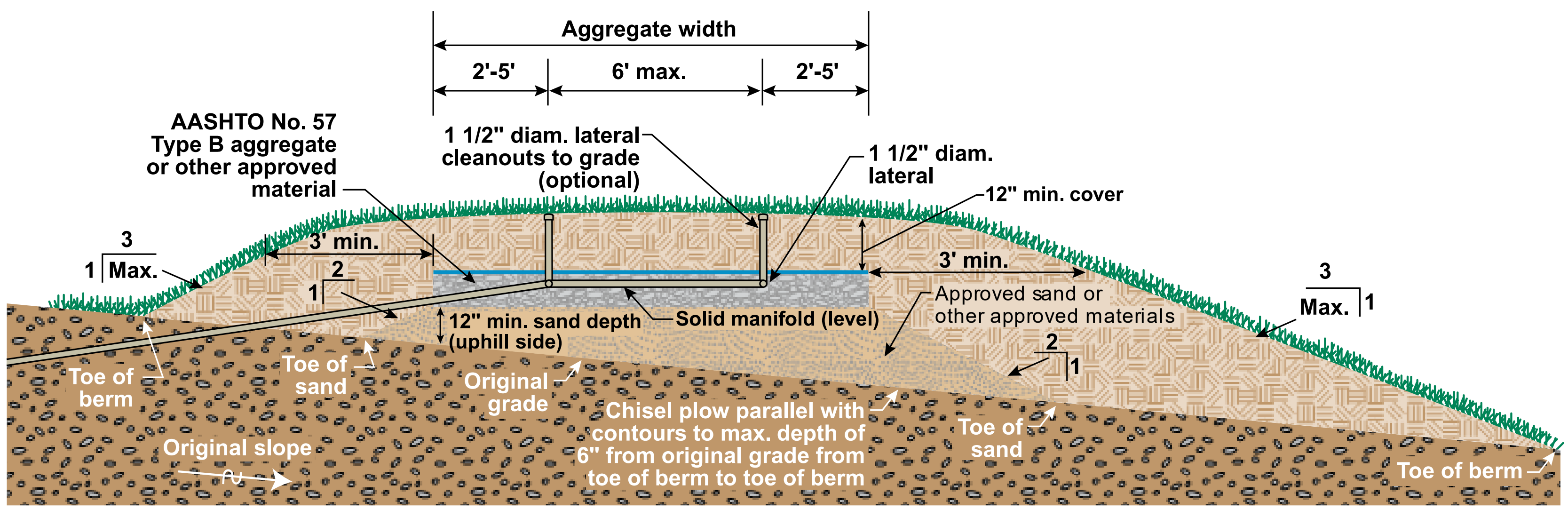
This illustration shows some of the regulatory requirements for a pressure distribution elevated sand mound bed placed on a slope of 8 percent or less.



PRESSURE DISTRIBUTION ELEVATED SAND MOUND BED ON SLOPES >8 TO 12%

(Side View)

This illustration shows some of the regulatory requirements for a pressure distribution elevated sand mound bed placed on a slope greater than 8 to 12 percent.



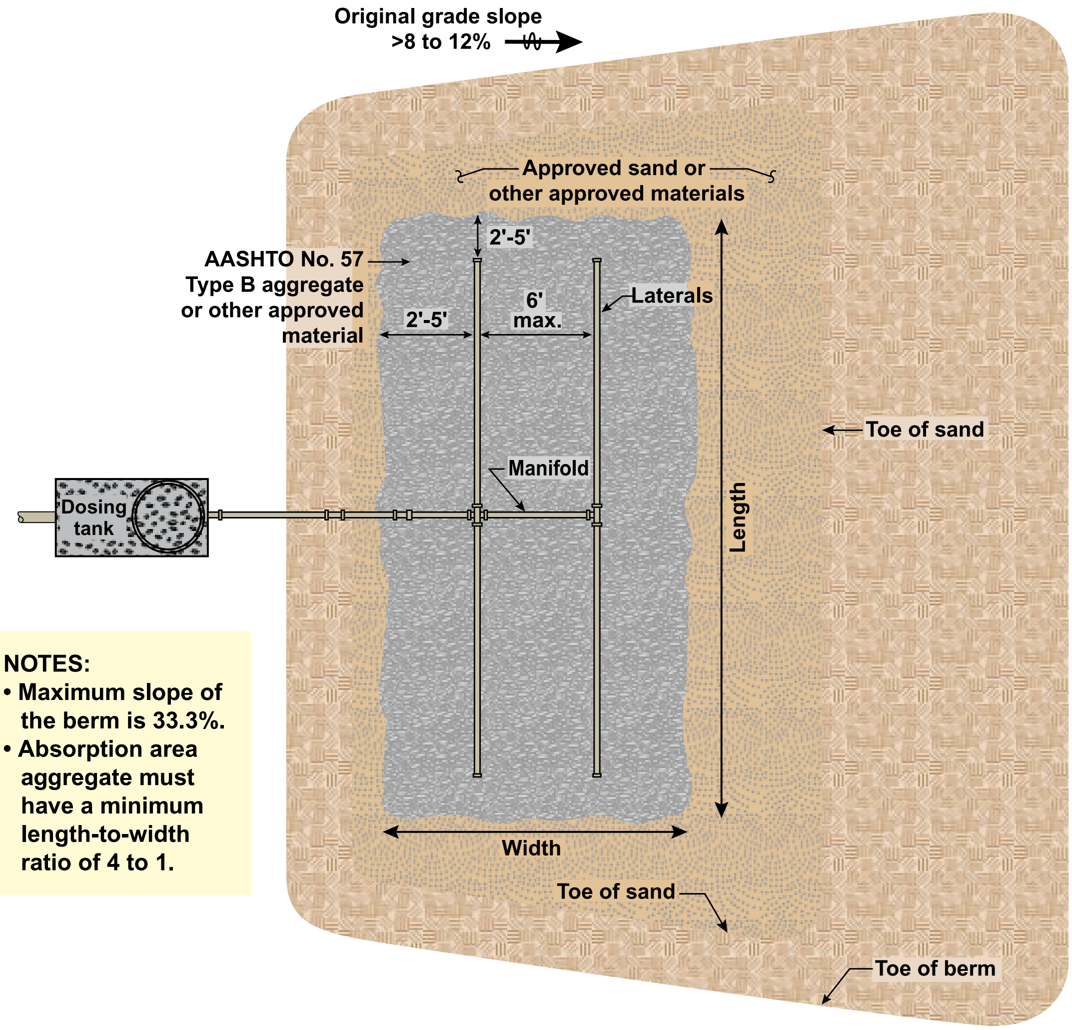
NOTES:

- **All joints must be watertight.**
- **Top of aggregate, sand, manifold, and laterals must be level.**
- **Two inches of aggregate must be placed above laterals and 6 inches of aggregate below laterals.**
- **Aggregate length must be at least four times greater than the aggregate width.**
- **Bed must be installed on contours.**

Pressure Distribution Elevated Sand Mound Bed on Slopes >8 to 12%

(Top View)

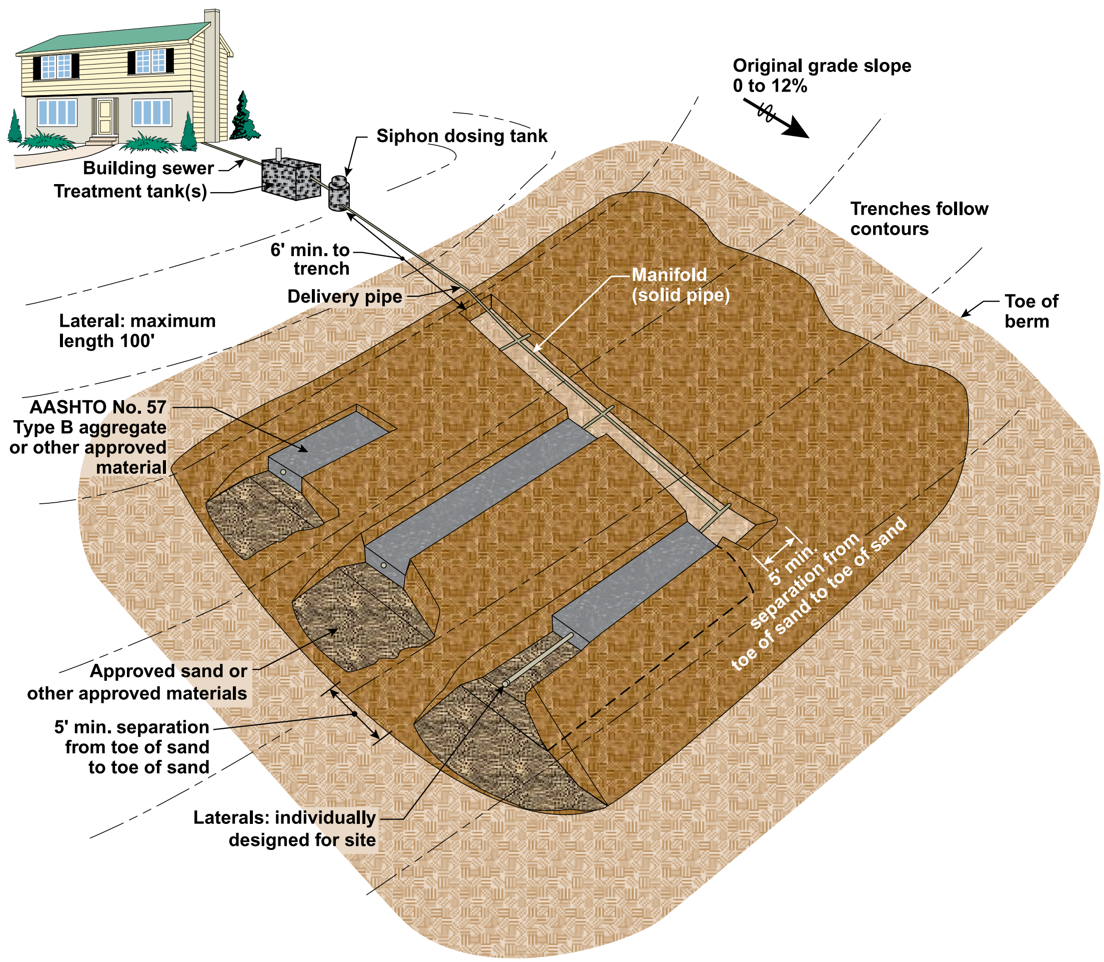
This illustration shows some of the regulatory requirements for a pressure distribution elevated sand mound bed placed on a slope greater than 8 to 12 percent.



NOTES:
- **Maximum slope of the berm is 33.3%.**
- **Absorption area aggregate must have a minimum length-to-width ratio of 4 to 1.**

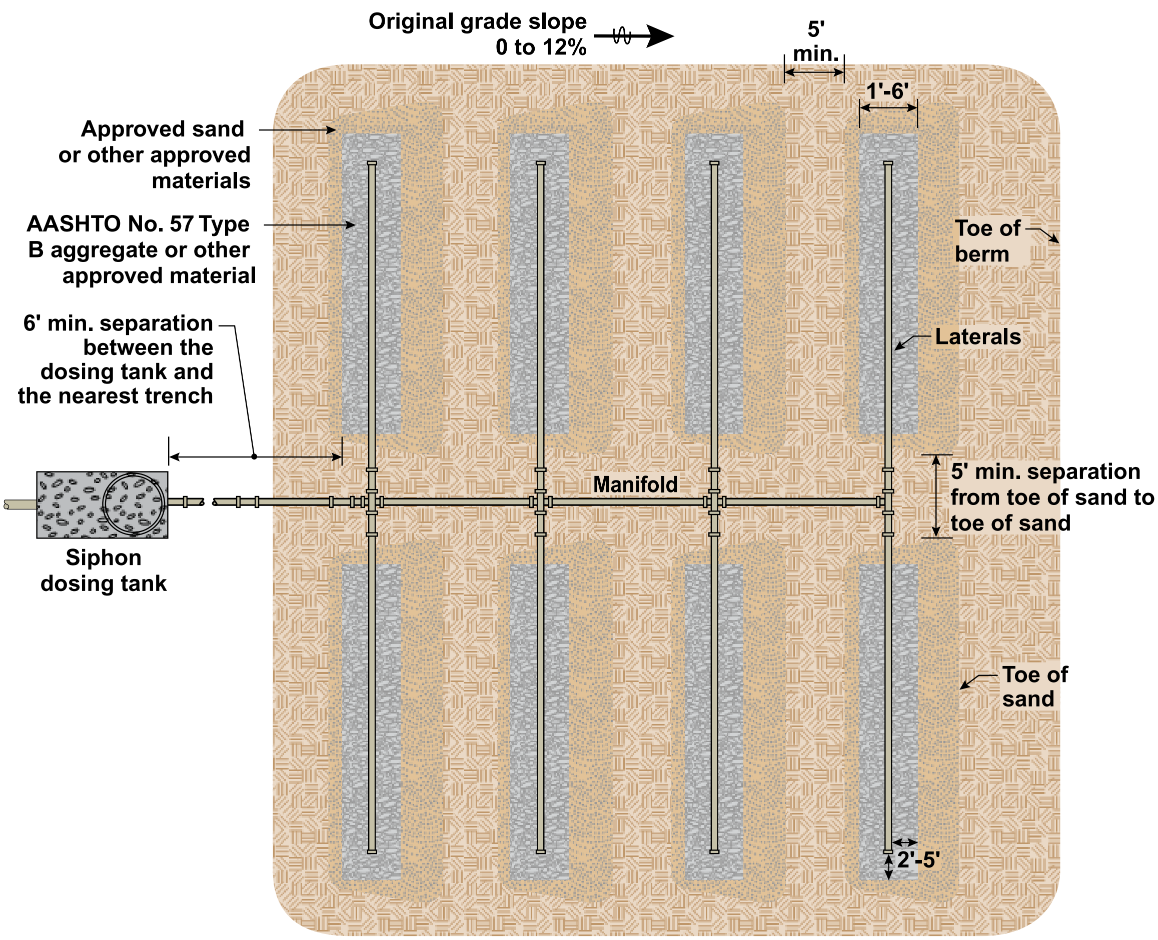
PRESSURE DISTRIBUTION ELEVATED SAND MOUND TRENCHES USING A SIPHON

This illustration shows some of the regulatory requirements for pressure distribution elevated sand mound trenches in a system that uses a siphon to move the effluent.



Pressure Distribution
Elevated Sand Mound Trenches
Using a Siphon
(Top View)

This illustration shows some of the regulatory requirements for a pressure distribution elevated sand mound trenches in a system that uses a siphon to move the effluent.



INSPECTIONS

REGULATORY INSPECTIONS

Final Inspection

Sections 72.30

During the final inspection, the SEO will verify that the onlot sewage disposal system was installed according to the permit that was issued. All parts of the system must be inspected. After the system passes final inspection, it may be covered.

OPTIONAL INSPECTIONS

While the final inspection is required under the regulations, the SEO may conduct other optional inspections during the construction of an onlot sewage disposal system. The local agency may require these additional inspections, including:

- Preconstruction
- Elevated systems chisel-plow inspection
- Sand or stone placement
- Top of sand for elevated sand mound
- Installation of components
- Grading, cover, and seeding
- Depth of excavation

INSPECTION FORMS

The forms on the next two pages are not official DEP documents. The forms were developed to assist SEOs with the final inspection process and any optional interim inspections.

SAMPLE FINAL INSPECTION FORM

Name: ________________________________ Application #: ______________________

Subdivision: ___________________________ Lot #:______________________________

Location: ____

Township/County: ______________________ Contractor: _________________________

THE FOLLOWING CHECKED ITEMS APPEAR TO MEET REGULATIONS AT THIS TIME:

____ Isolation Distances ____

____ Cleanout(s) ____

____ Building Sewer ____

____ Treatment Tank(s) ____

____ Inspection Port ____

____ Watertight Conveyance Pipe ______________________________________

____ Pump/Dosing Tank ____

____ Pump/Siphon ____

____ Electrical Controls ____

____ High-Level Alarm ____

____ Delivery Line ____

____ Distribution Box ____

____ Absorption Area ____

____ Sand Analysis ____

____ Pressure Dosing Test ____

____ Berm ____

____ Final Grade ____

____ Other (specify) ____

COMMENTS: ____

____

____

____

____

____

____ Sewage disposal system appears to meet the regulations at this time.

____ Absorption area must be covered within five days (weather permitting).

Partial Approval ☐ Approved ☐ Not Approved ☐
(see reasons above)

____ ____________________

SEWAGE ENFORCEMENT OFFICER DATE

SAMPLE OPTIONAL INTERIM INSPECTION

Name: ________________________________ Application #: ________________________

Township/County: ________________________ Date: ________________________________

As a condition of the issuance of an onlot sewage disposal system permit, the local agency may require the sewage disposal system to be inspected by the SEO after the following stages of construction are completed.

If item is checked, inspection is required.

		Date Inspected
____	The absorption area(s), both primary and replacement, must be roped off to protect them from vehicles and construction equipment.	______________
____	Trenches staked out and inspected prior to excavation.	______________
____	Rake and remove vegetative cover or organic litter.	______________
____	Excavation of system.*	______________
____	Sand specifications.	______________
____	Sand placement.	______________
____	Construction of berm.	______________
____	Placement of the stone and pipe.	______________
____	Placement of treatment tank(s).	______________
____	Installation of lift station.	______________
____	Dosing siphons/pump installation.	______________
____	Finished grade.	______________
____	Seeding and cover.	______________

*This does not apply to elevated sand mounds.

____ ______________________

SEWAGE ENFORCEMENT OFFICER DATE

CONSTRUCTION

Section 72.28

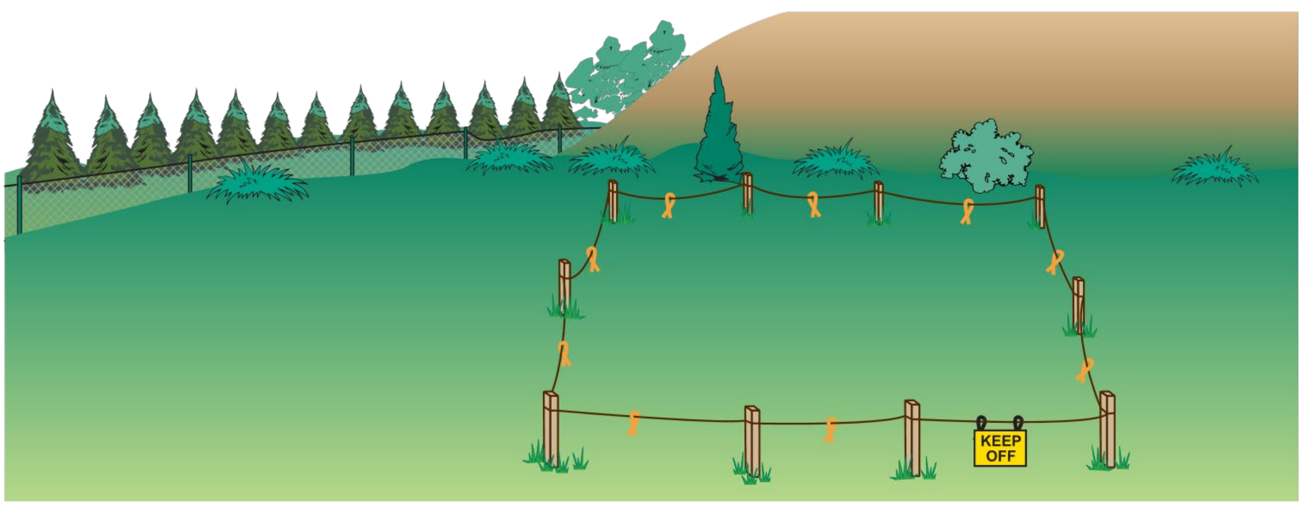
Good construction practices help ensure the proper functioning of the onlot sewage disposal system being installed. A permit may be revoked if the Pennsylvania Sewage Facilities Act (Act 537) or the Pennsylvania Code Title 25, Environmental Protection Chapters 72 and 73 regulations are violated.

PROTECTING THE SITE

Preserve Site Prior to Building Construction

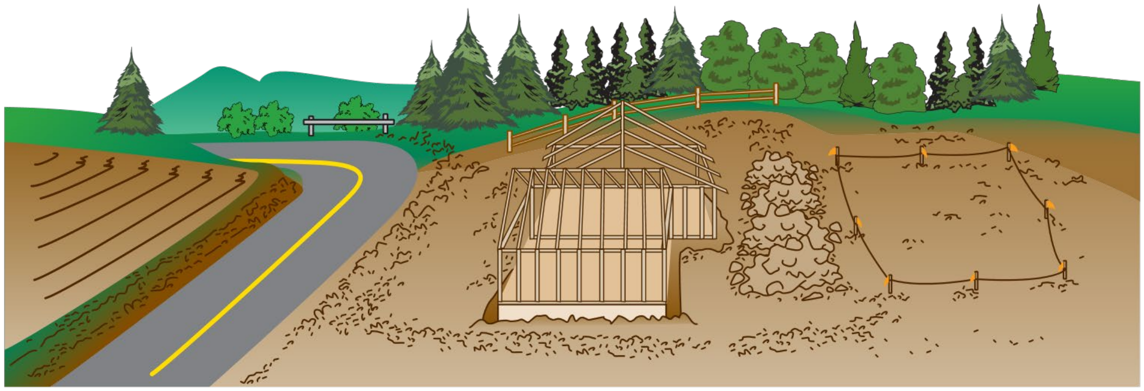
Section 73.51

Once a suitable site for an onlot sewage disposal system is found, and before construction begins, the disposal area should be staked out and preserved.



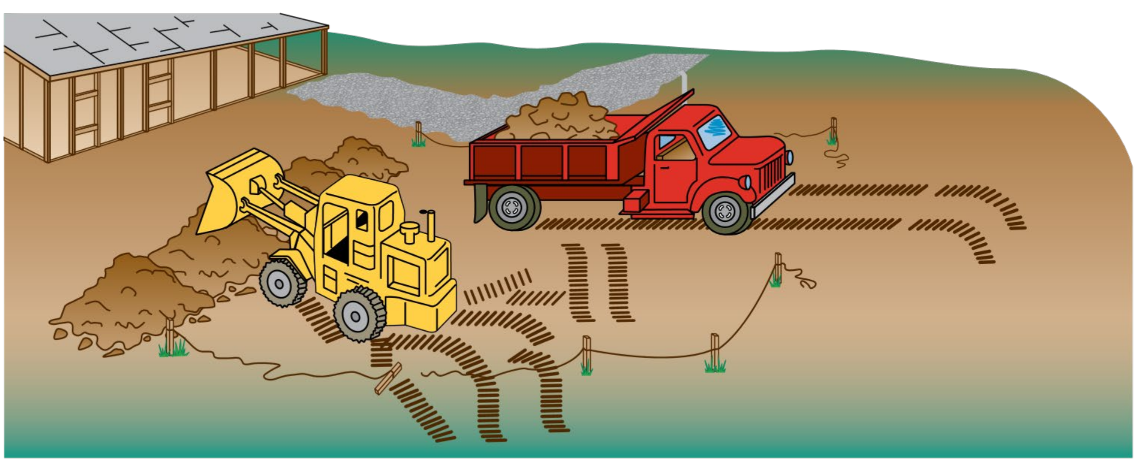
Protect Site During Building Construction

Section 73.51



The area that is reserved for the onlot sewage disposal system should be staked and protected.

Divert all surface water away from the disposal area.



Make sure equipment stays off the disposal area. Materials may not be stacked and stored on the disposal area.

PRECONSTRUCTION INSPECTION

Sections 72.30 and 72.42

A local agency may require a preconstruction inspection. The purpose of this inspection is to prevent any potential problems that cannot be easily corrected after the installation is completed.

Items to Check During Preconstruction Inspection:

Sections 72.28, 73.12, and 73.51

1) Absorption area, replacement area, or spray field have been preserved and protected.
   a) Topsoil has not been stripped.
   b) Heavy equipment has not been on or downslope of the absorption area.
   c) Heavy items are not being stored on or downslope of the absorption area.
2) Also, recheck isolation distances. Has a well been drilled since the permit was issued?

Sections 73.14 and/or 73.15

3) System is in the area tested.
4) System is sized and staked correctly according to the permit issued.
5) Contractor is working from the issued permit for the system to be installed.

Section 73.51

6) Soil moisture is correct for installation. To check the soil moisture, conduct a soil moisture field test.

   This test determines if the soil moisture level is low enough to minimize compaction of the soil while the system is installed. If the soil is too moist, the installation process may cause the soil to compact and lead to problems in the future.

Soil Moisture Field Test Procedures

1) Squeeze a handful of soil in one hand.
2) Open your hand.
3) Bounce the sample once lightly in your hand, or tap the soil lightly with your finger.
   a) If the sample of soil crumbles or breaks up immediately when bounced or tapped, the soil moisture should be acceptable.
   b) If the sample sticks together, construction must be postponed.

7) Local agency may require progress inspections of the construction being done on the lot.

8) System measurements are checked.

In-Ground System

- Verify proposed depth of excavation, which may be marked at each staked location within the absorption area.

Elevated System

- Verify proposed sand and/or stone height, which may be marked at each staked location within the absorption area.

IRSIS

- Verify the system parameters and the location of the spray nozzles, which may be staked.
- Verify that the land use is in compliance with the slope requirements.

PREPARING SITE FOR INSTALLATION

In-Ground System

1) Excavate absorption area with a backhoe and leave the rough bottom to provide a transitional layer between the aggregate and soil.

2) Scarify the vertical sides and bottom of the absorption area (if needed).

Section 73.52

3) Check bottom of excavation to make sure it is level to a tolerance of 2 inches per 100 feet.

4) Check depth of excavation.

5) Keep topsoil from excavation to put back into the system for cover.

Elevated System

Section 73.55

1) Cut trees flush with grade.

2) Rake and remove vegetative cover or organic litter.

3) Chisel plow to a 6-inch maximum.

- Rototillers are prohibited for this process.
- A chisel plow or similar implement must be used.

IRSIS

Section 73.163

1) Verify the spray field has been preserved and protected.

INSTALLING SYSTEM COMPONENTS

Building Sewer

JOINTS

Section 73.21

- The joints of the building sewer must be sealed with the correct glue or gaskets.

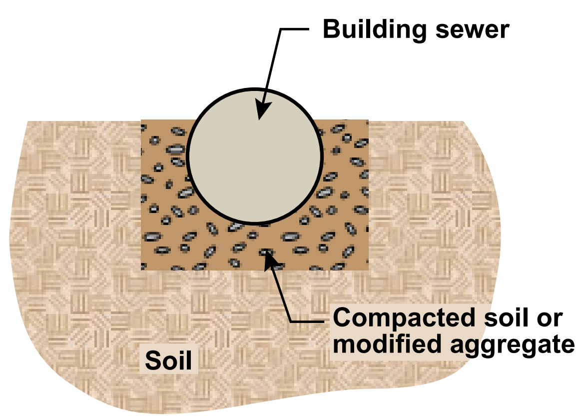
SUPPORT PIPING

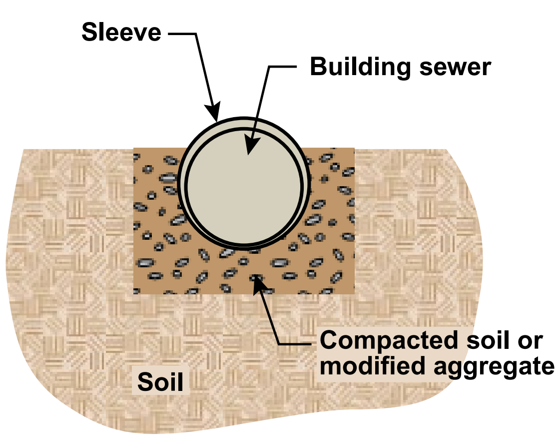
Section 73.21

- The entire length of the building sewer pipe must be supported with material suitable to prevent damage from settling. Use clean, hand-tamped backfill or modified aggregate. Modified aggregates are aggregates of different sizes that will compact.

Note: When the entire length of pipe is properly supported, it will be protected from damage.

The two illustrations below show a building sewer supported with compacted soil or modified aggregate. The bottom illustration also has a sleeve to provide extra support under driveways or other structures that could cause damage to the pipe.

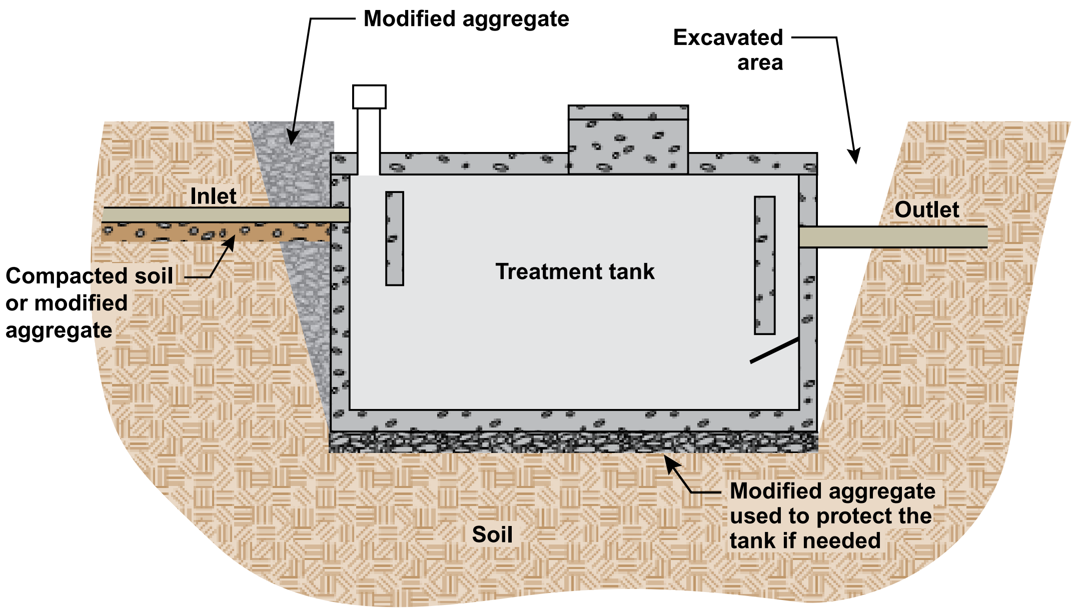




Treatment Tank(s) or Dosing Tank

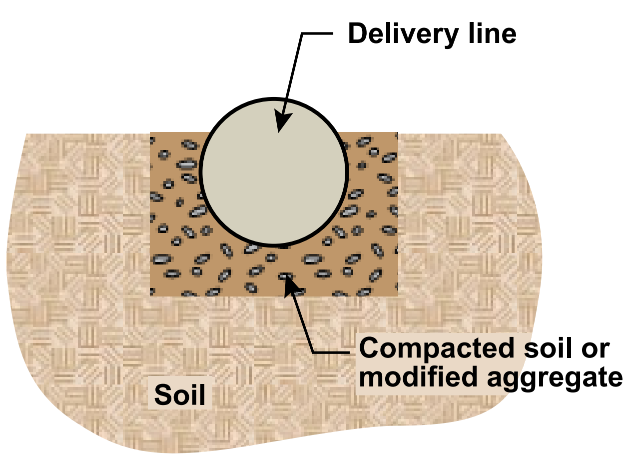
- The excavation for a tank must provide a level bottom.
- Clean or modified aggregate may be placed on the bottom of the excavation to support and protect the tank.

Note: Modified aggregates are aggregates consisting of different sizes that will compact.



Distribution Method

- Pressure fittings must be used for pressure distribution or lift pump pipe.
- Rigid conduit may also be used to protect the wiring.
- The pipes from the treatment tank(s) to the distribution method must be supported with material suitable for preventing damage from settling. Use clean hand-tamped backfill or modified aggregate.



Absorption Area

- Pressure fittings are necessary when pressure distribution is used.

RECOMMENDED PROCEDURES FOR PLACING DISPOSAL/ABSORPTION AREA MATERIALS

In-Ground

When placing the aggregate:

- Use lightweight track equipment or a backhoe from outside of the absorption area.
- Do not drive rubber-tire equipment on the absorption area.
- Avoid compaction of the bottom of the bed or trench.
- Place aggregate from outside of the bed or trench.
- Avoid placing heavy equipment on downslope side of absorption area whenever possible.

Elevated

When placing aggregate and/or sand:

- Use lightweight track equipment or a backhoe from outside the absorption area.
- Do not drive rubber-tire equipment on the absorption area.
- Place sand and aggregate from outside of the bed or trench.
- Avoid placing heavy equipment on downslope side of absorption area whenever possible.

IRSIS

- Minimize compaction and disturbance in the spray field area.

MALFUNCTIONS

SEOs have a responsibility to assist or legally require a property owner to correct a malfunctioning onlot sewage disposal system.

Section 72.41 and 73.11
Section 14 of the PA Sewage Facilities Act (Act 537)

A Malfunction Occurs When...

1) Untreated or partially treated sewage is discharged into the waters of the Commonwealth.
2) Untreated or partially treated sewage is discharged on to the ground surface.
3) Untreated or partially treated sewage is backing up into a structure.

Malfunctions Need To Be Corrected, Because...

- It is the law.
- They are a health hazard.

The SEO must advise the local agency of any known violation of the PA Sewage Facilities Act (Act 537) that occurs within the local agency's jurisdiction. The SEO must advise the local agency of its responsibility to prevent a potential violation of the PA Sewage Facilities Act (Act 537). The SEO must also independently take any necessary action within the scope of his or her authority to prevent a malfunction from occurring or require its correction when discovered.

Civil Penalties

Section 13 of the PA Sewage Facilities Act (Act 537)

- The PA Sewage Facilities Act allows a civil penalty of no less than $300 and no more than $2,500 to be charged to violators for each violation of the act.

CORRECTING A MALFUNCTION

1) Identify the Malfunction

- An SEO may be notified of a possible malfunction, or
- An SEO may identify a possible malfunction.

2) Investigate the Malfunction

- The first step in dealing with a malfunction is to identify the problem.
- Thoroughly investigate the situation so that the real cause of the malfunction is found and corrected.

OBSERVE THE CONDITIONS

Look at what is going on inside and outside the structure.

Examples:

- Is there an area on the property that is wet and/or soft?
- Is there an odd smell coming from the property?

GATHER BACKGROUND INFORMATION

Example questions to ask the property owner:

1) Does a permit or plot plan exist?
2) When was the system installed or when was the structure built, and how long has the facility been used?
3) When was the treatment tank last pumped?
4) Is there a history of problems?
    - Does the problem recur frequently?
    - Is the problem constant or periodic?
    - When does the problem happen?
5) What is the facility's daily water usage? Are there items in the structure that use a lot of water, such as:
    - Hot tub
    - Water softener
    - Washing machine (Are many loads washed in one day?)
    - Leaky plumbing fixtures
6) Are special activities that use water conducted in the structure?
    - Canning
    - Grinding materials that require water
    - Beauty shop
7) When is the system used? How many days a week? How many occupants?

8) Are any waste products besides water and human waste being put into the system?

- Chemicals
- Grease
- Excess organic wastes
- Wastes from hobbies that require water
- Photography
- Printing
- Beauty shop

9) Has the well been recently tested? If yes, did the results show a high bacteria content?

10) Does the structure have any of the following devices connected to the system?

- Garbage disposal
- Grease trap
- Sump pump
- French drain
- Rain spout

INSPECT THE SYSTEM

- Inspect all parts of the system to determine if the cause of the malfunction is a broken or faulty system component.
- Visually inspect the overall system. If an obvious problem exists, begin the investigation at that point. There is no correct order to inspect the system, as every situation will be different.

When inspecting each system component, check for the following:

Building Sewer

- ✓ Broken pipes
- ✓ An obstruction in the pipe
    - Diaper
    - Toy
    - Paper
    - Foreign object(s)

Treatment Tank(s)

- ✓ No tank-If no tank is found, a cesspool may exist
- ✓ Sealed inlet and outlet connections
- ✓ Leaks in the tank(s)
- ✓ Wet areas outside of the tank(s)
- ✓ Electrical connection on aerobic treatment tank(s) disconnected

Distribution Method

- ✓ Leaks in components
- ✓ Unequal distribution in a gravity flow system (ie: distribution box not level)
- ✓ Improperly functioning pump in a pressure distribution system
- ✓ Improperly functioning siphon in a pressure distribution system

Disposal Area

- ✓ A spongy or ponding area
  - If effluent is not being absorbed into the sand and/or soil, the system may be clogged somewhere. Another cause might be that too much waste is being generated. As a result, ponding will occur. The effluent may move on to the surface in the path of least resistance.
  - Cracks or breaks in the pipes
  - Broken lateral risers
  - Surface water improperly diverted

Note: A probe rod (also known as a poke rod) may be used to determine if saturation is occurring within the system. If a brown or black liquid substance is found on the rod after probing the disposal area, then ponding may be occurring.

The disposal area may also clog when:

- Solids move into the absorption area
- An excessive organic mat develops
- Inappropriate sand was used during construction
- The soil was too wet or was compacted before or during construction
- The site was not properly evaluated
- The system was not properly installed
- Actual flows exceed the design flows
- Grease has entered the absorption area

Note: An organic mat develops when the soil is saturated, and there is a lack of oxygen. These conditions cause anaerobic bacteria to grow within the absorption area. An abnormally thick layer of organic material forms and, ultimately, clogs the pores in the soil and reduces permeability. The effluent may travel to the edges of the absorption area and seep out the sides. In some cases, if the absorption area is "rested" for a period of time, the organic mat may dry out and eliminate the problem.

FIND THE SOURCE OF DISCHARGE

Dye test

- This test can sometimes be used to determine the source of the problem. The dye should be placed directly into the onlot sewage disposal system. The path of the dye may determine where the effluent is traveling.

3) Diagnose the Malfunction

- Determine the problem.
- Make sure the correct cause has been identified.

4) Correct the Malfunction

- After the cause of the malfunction has been determined, a long-term solution needs to be implemented.
- When correcting the malfunction, the cause, not the symptoms, need to be treated and corrected.
- If a new absorption area needs to be installed, testing to determine site suitability must be completed in compliance with the Pennsylvania Code Title 25, Environmental Protection Chapter 73 regulations.
- Alternate and experimental technologies may be used to correct a malfunction.

PREVENTING A MALFUNCTION

1) Install water-conserving fixtures and implement a water conservation plan in the facility.

2) Encourage a maintenance program.

3) Regularly inspect the system and repair any broken part(s).

Sections 7 of the PA Sewage Facilities Act (Act 537)

Note: When any part of the system is repaired, a permit is required.

4) Educate people at the facility about items detrimental to onlot sewage disposal systems.

HAZARDS TO ONLOT SEWAGE DISPOSAL SYSTEMS

Because these systems are "alive," a biological mat in the system is constantly decomposing and treating raw sewage. This mat is extremely sensitive to pollutants that it is not able to treat. Therefore, the homeowner should avoid placing the following items down the drain:

- Oils and grease
- Harsh drain cleaners
- Pesticides
- Paints and thinners
- Disposable products, including sanitary napkins and diapers
- Paper towels
- Plastic products (children's toys, product wrappers)
- Septic tank additives/cleaners (These items are not needed and may harm the system's plumbing and/or biological mat.)
- Bones, eggshells, or coffee grounds
- Laundry detergents with high sudsing elements

Note: Eliminating these items from the waste stream may help to increase the life of the onlot sewage disposal system.

BEST TECHNICAL GUIDANCE (BTG)

The SEO must ensure that all the **REGULATIONS** that apply to the location and installation of an onlot sewage disposal system are met whenever possible.

Best technical guidance (BTG) may be used when a malfunction needs a new disposal area and the minimum criteria specified in the Pennsylvania Code Title 25, Environmental Protection Chapter 73 regulations eliminate any possible site on the property.

Section 73.3

- This section provides some latitude to the local agency or the DEP in repair situations where site limitations on **existing properties** prohibit compliance with all Chapter 73 regulations.
  1) The SEO must first consider all individual and community sewage systems in Chapter 73.
  2) If the use of these systems is not physically possible, BTG may be used to correct the malfunction.

BTG allows the SEO to systematically reduce or waive standards that cannot be met on a particular site. This systematic elimination or reduction of a standard is based upon the impact such an action may have on the environment or the protection of the public health. Some standards, such as isolation distances to property lines, may have very little potential to affect the environment or public health. These less important standards should be eliminated or modified first. Other critical standards, such as depth to limiting zone, may have a significant environmental impact if they are eliminated. Other alternatives should be pursued if **critical standards** cannot be met on a site.

Critical Standards

Other alternatives to BTG should be pursued if any of the following standards cannot be reasonably met on a site:

1) Isolation distances from the system to a water supply
2) System sizing versus percolation rate
3) 48-inch vertical separation between bottom of the absorption area aggregate and the top of the limiting zone

Note: meeting these standards is DEP policy and will not be found in the Pennsylvania Code Title 25, Environmental Protection Chapters 72 or 73 regulations.

When BTG Can Be Used

The SEO must verify the following to use BTG:

1) The system to be installed will not create a nuisance or public health hazard.

2) The system employs the best available technology.

3) The system has a reasonable probability of functioning long term.

When BTG is used to repair a malfunction, written notification must be given to the applicant explaining the possibility of a system failure.

WRITTEN NOTIFICATION

If BTG is used, written notification to the homeowner should include the following information:

A) The permit is being issued under the Pennsylvania Code Title 25, Environmental Protection Chapter 73.

B) The site does not meet the Pennsylvania Code Title 25, Environmental Protection Chapter 73 regulations. Include a list of all the deviations from the regulatory standards.

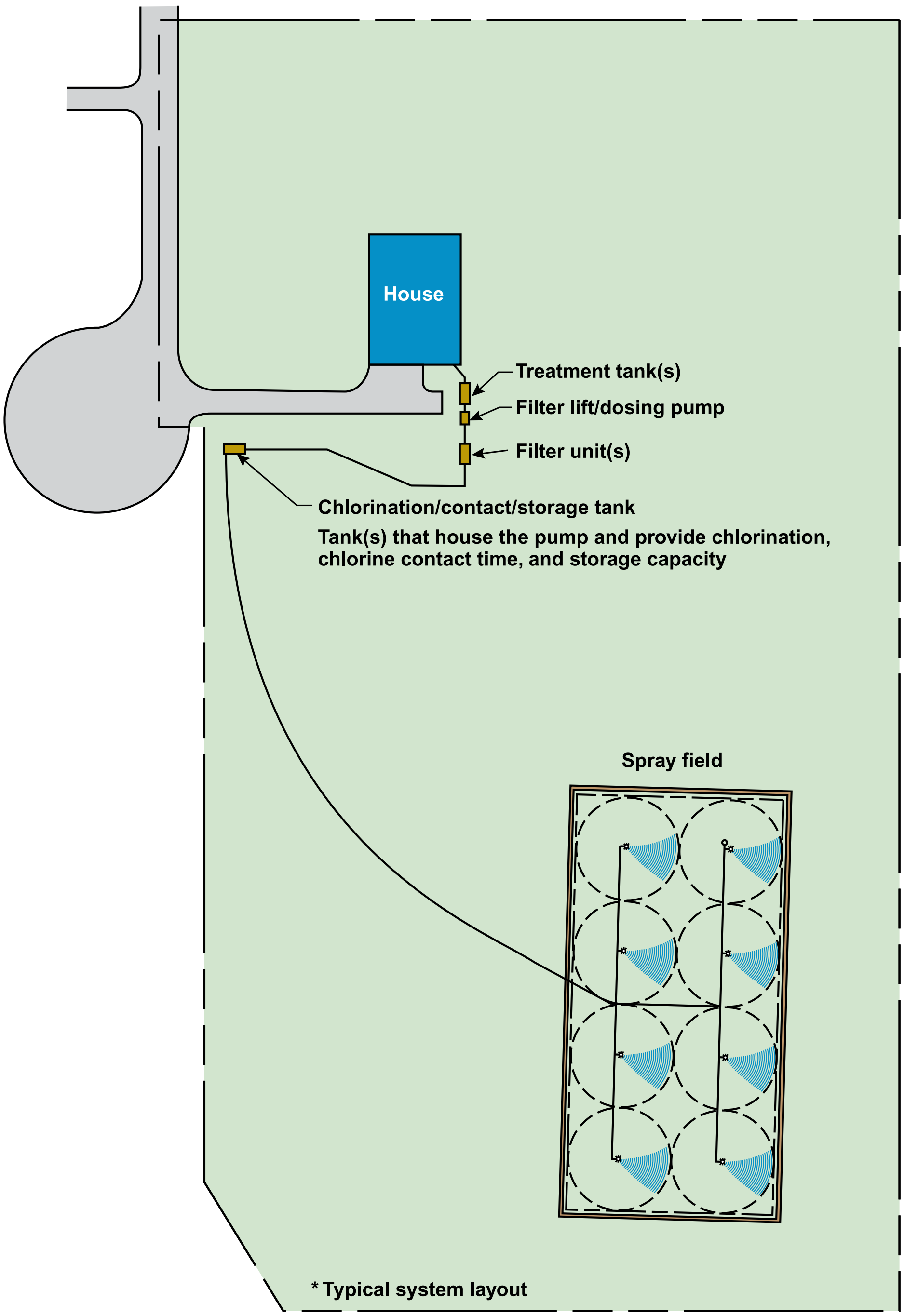
C) To help prolong the life of the system, water consumption should be reduced and water conservation devices should be installed.

D) There is a possibility the repair system could fail.

E) The repair permit does not relieve the applicant of the responsibility to correct any malfunctions that may occur in the future.

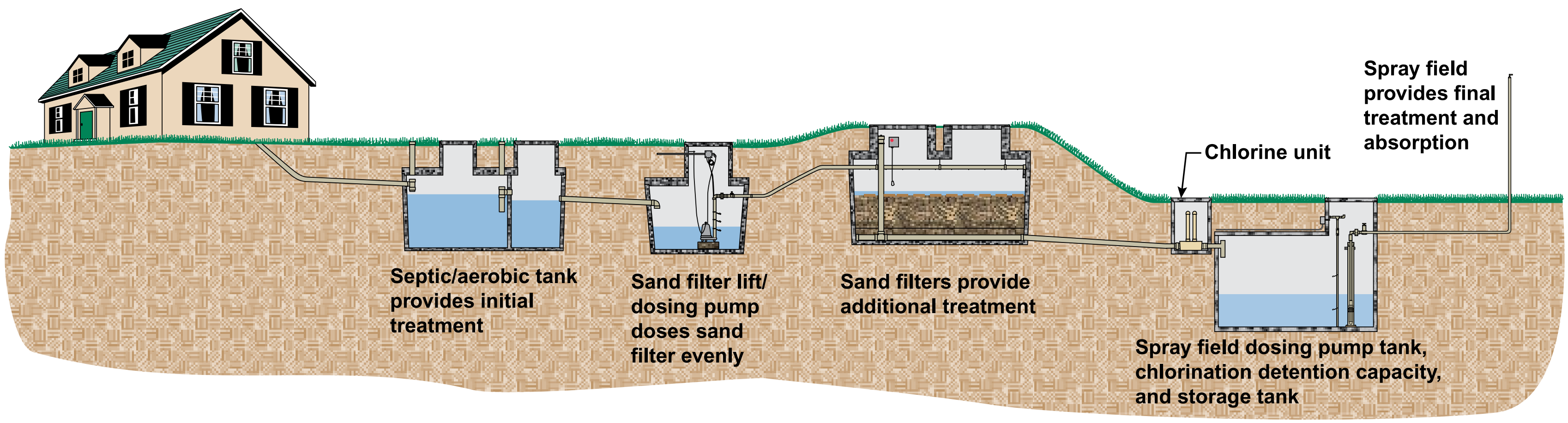
IRSIS

INDIVIDUAL RESIDENTIAL SPRAY IRRIGATION SYSTEM



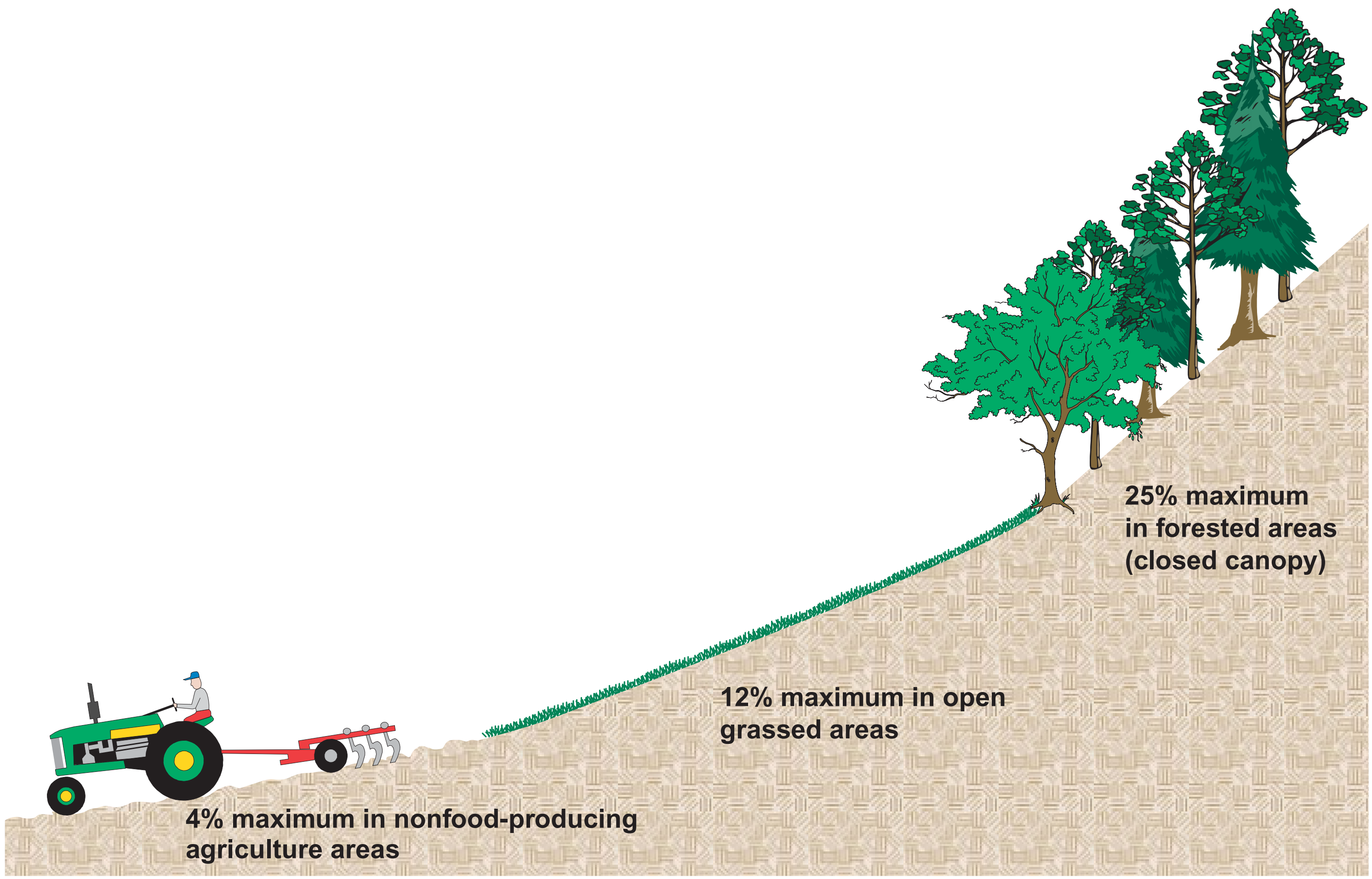
HYDRAULIC PROFILE OF AN IRSIS

This illustration shows a typical hydraulic profile of an IRSIS with a free access sand filter.

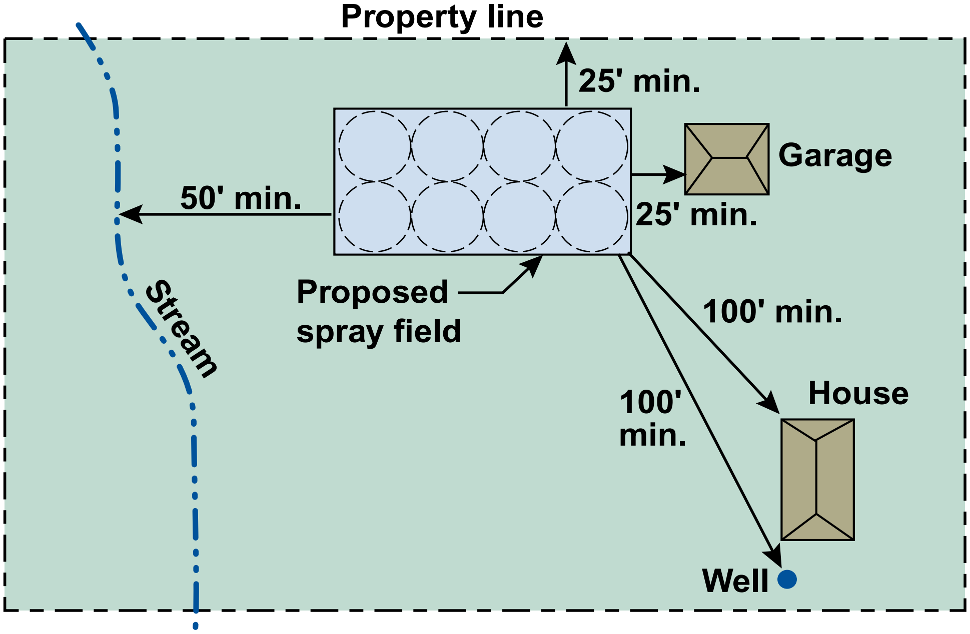


IRSIS TESTING REQUIREMENTS

IRSIS Slope Requirements



IRSIS Spray Field Isolation Distance Requirements



This illustration above shows some of the IRSIS minimum isolation distances. Below is a complete list of all the isolation distances for this system.

Section 73.13

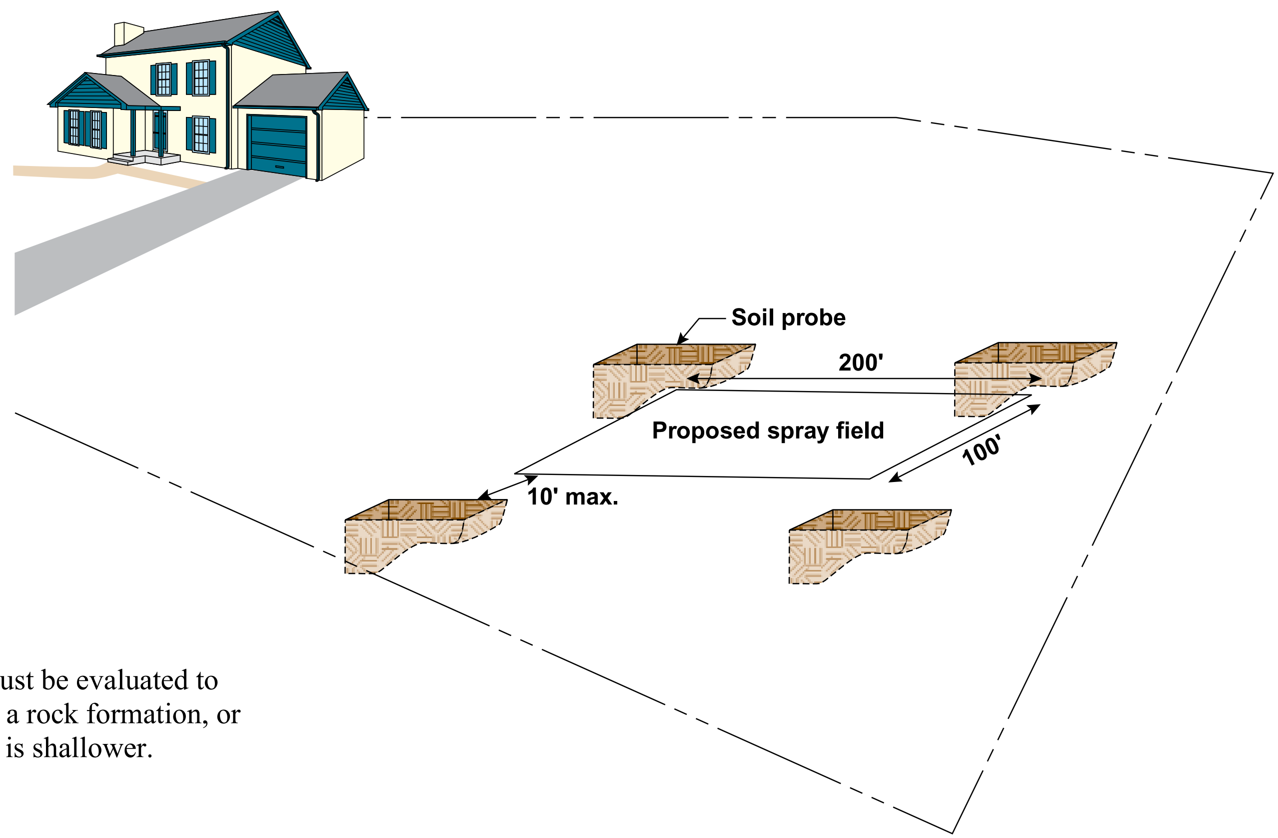
- The following minimum horizontal isolation distances must be maintained between the features named and the **wetted perimeter of the spray field:**

  1) Property lines, easements, or right-of-ways – 25 feet
  2) Occupied buildings and swimming pools – 100 feet
  3) An individual water supply or water supply suction line – 100 feet
  4) A cistern used as a water supply – 25 feet
  5) Water supply line under pressure – 10 feet
  6) Streams, watercourses, lakes, ponds, or other surface waters – 50 feet *(For the purposes of Chapter 73 of the regulations, wetlands are not surface waters.)*
  7) Mine subsidence, boreholes, sinkholes – 100 feet
  8) Roads or driveways – 25 feet
  9) Unoccupied buildings – 25 feet
  10) Rock outcrop – 25 feet

- The area within the wetted perimeter of the spray field may not be sited over an unsuitable soil profile.

Soil Probes for an IRSIS ≤20,000 Square Feet

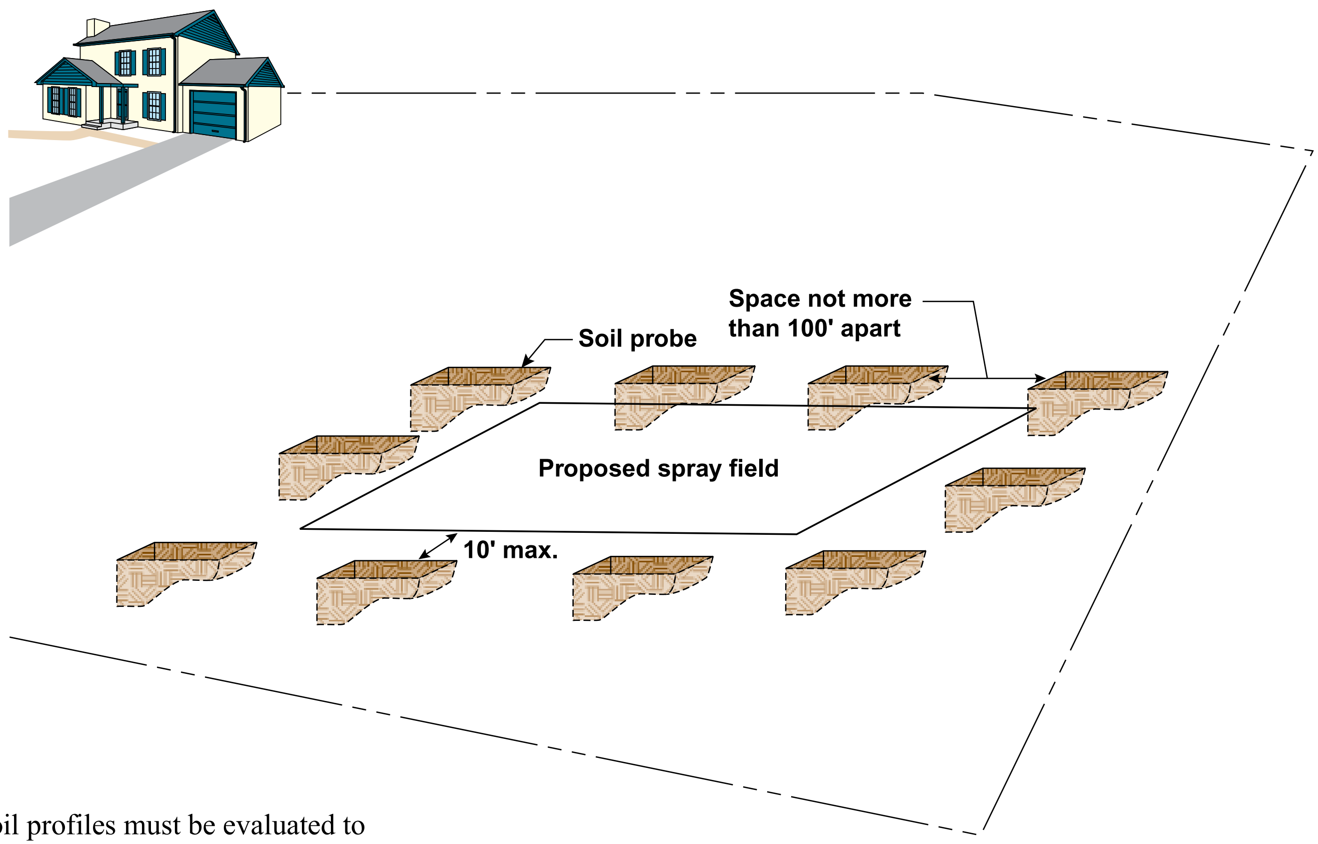
A minimum of four soil probes is required for an IRSIS with a spray field ≤20,000 square feet. The probes must be dug no more than 10 feet from the spray field location.



Note: Soil profiles must be evaluated to the depth of bedrock, a rock formation, or 40 inches, whichever is shallower.

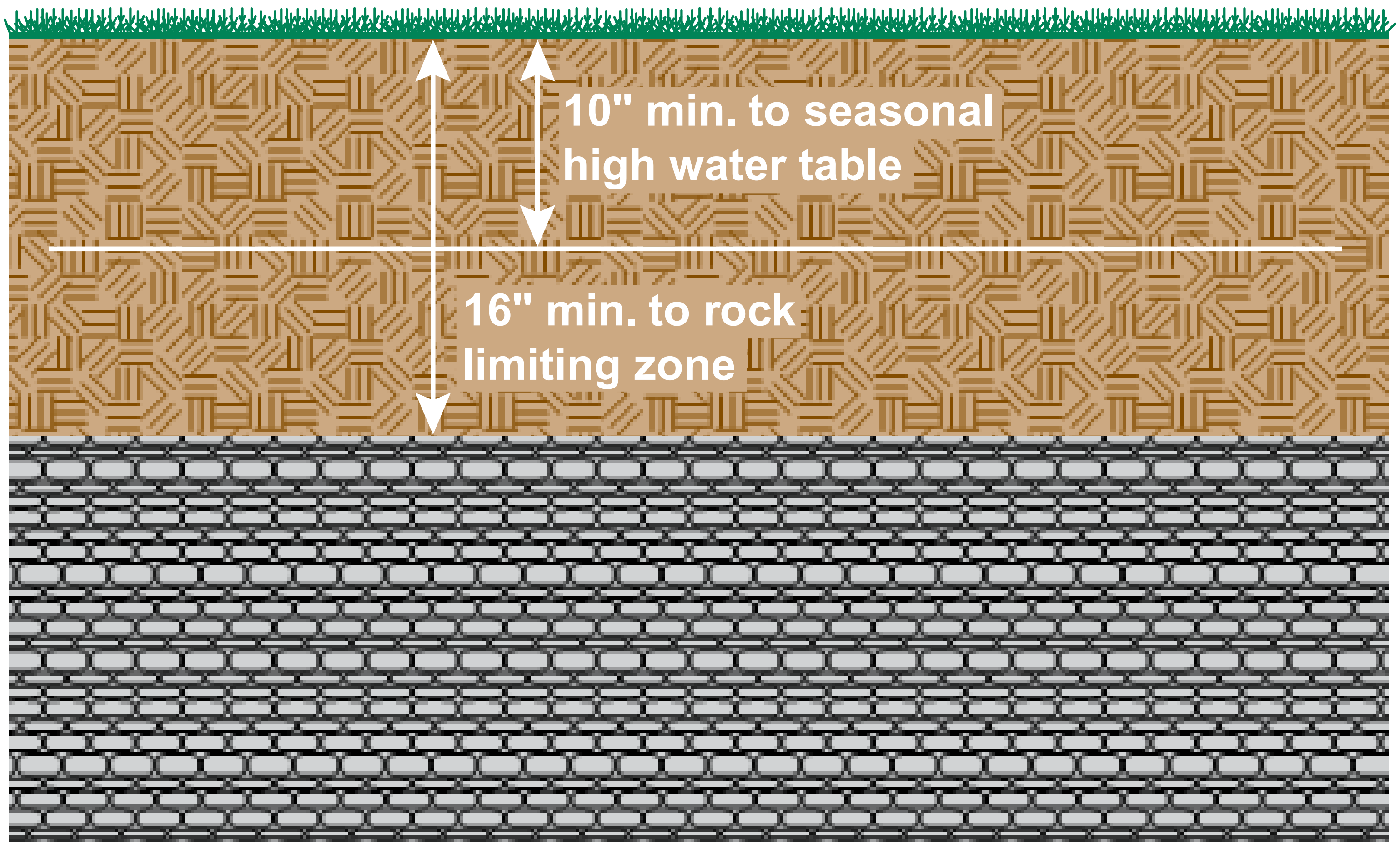
Soil Probes for an IRSIS >20,000 Square Feet

A soil probe must be dug at least every 100 feet for an IRSIS with a spray field >20,000 square feet.



Note: Soil profiles must be evaluated to the depth of bedrock, a rock formation, or 40 inches, whichever is shallower.

IRSIS Minimum Depth to a Limiting



Calculating Size of IRSIS Spray Field Area

Section 73.16

Table B must be used in calculating the square footage of an IRSIS spray field based on flows determined in Section 73.16 of the regulations. Table B includes allowances for garbage grinders, automatic washing machines, dishwashers, and water softeners.

TABLE B

SOIL CHARACTERISTICS		SLOPE	REQUIRED SPRAY FIELD AREA (SQUARE FEET)	
Depth in Rock	**Depth to Water Table**		**Three-Bedroom Home**	**Additional Area Per Bedroom**
16 to 20 inches	10 to 40 inches	≤12%	40,000	10,000
		>12%	80,000	20,000
	>40 inches	≤12%	15,000	3,750
		>12%	30,000	7,500
>20,000	10 to 20 inches	≤12%	20,000	5,000
		>12%	40,000	10,000
	>20 inches	≤12%	10,000	2,500
		>12%	20,000	5,000

IRSIS COMPONENTS

Building Sewer

Refer to the building sewer section (III-A) of the field manual.

Treatment Tank(s)

Refer to the treatment tanks section (III-B) of the field manual.

Sand Filters

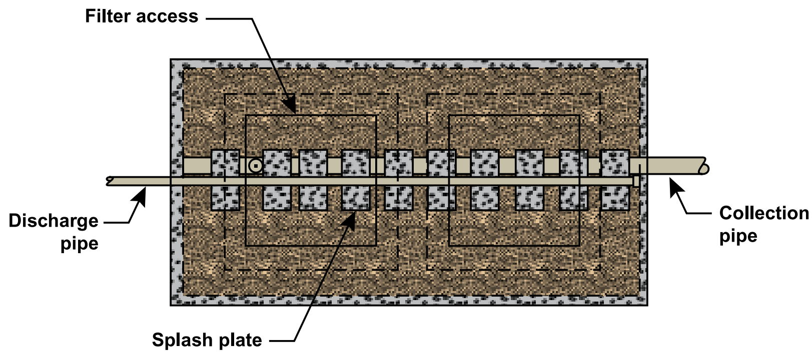
Two types of intermittent sand filters may be used in an IRSIS:

1) Free access sand filter
2) Buried sand filter

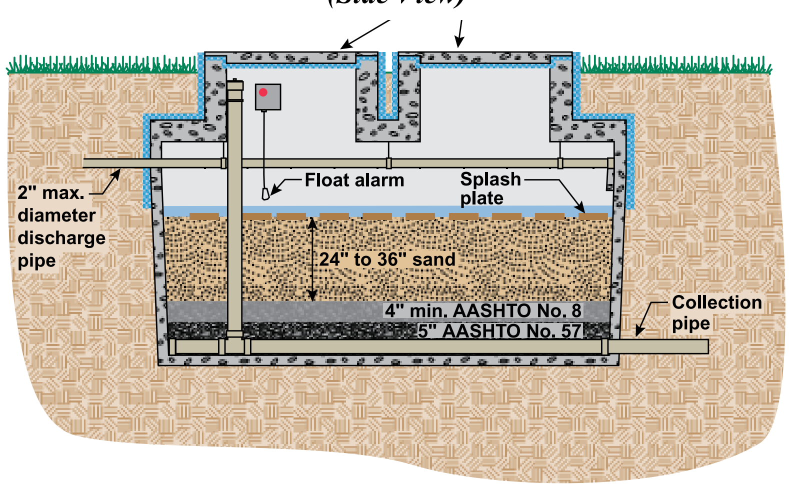
Note: The designer can choose either of the filters.

1) IRSIS FREE ACCESS INTERMITTENT SAND FILTER

(Top View)

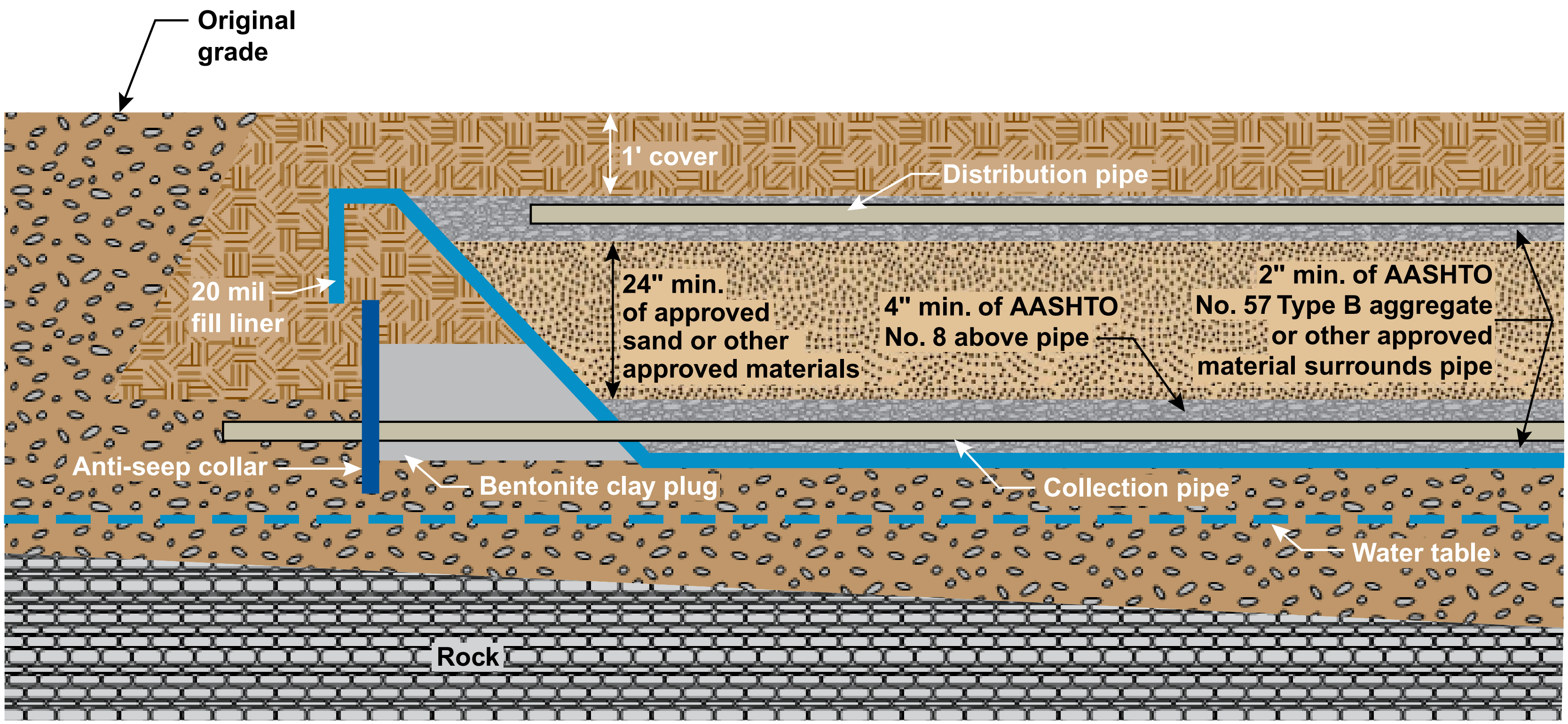


(Side View)

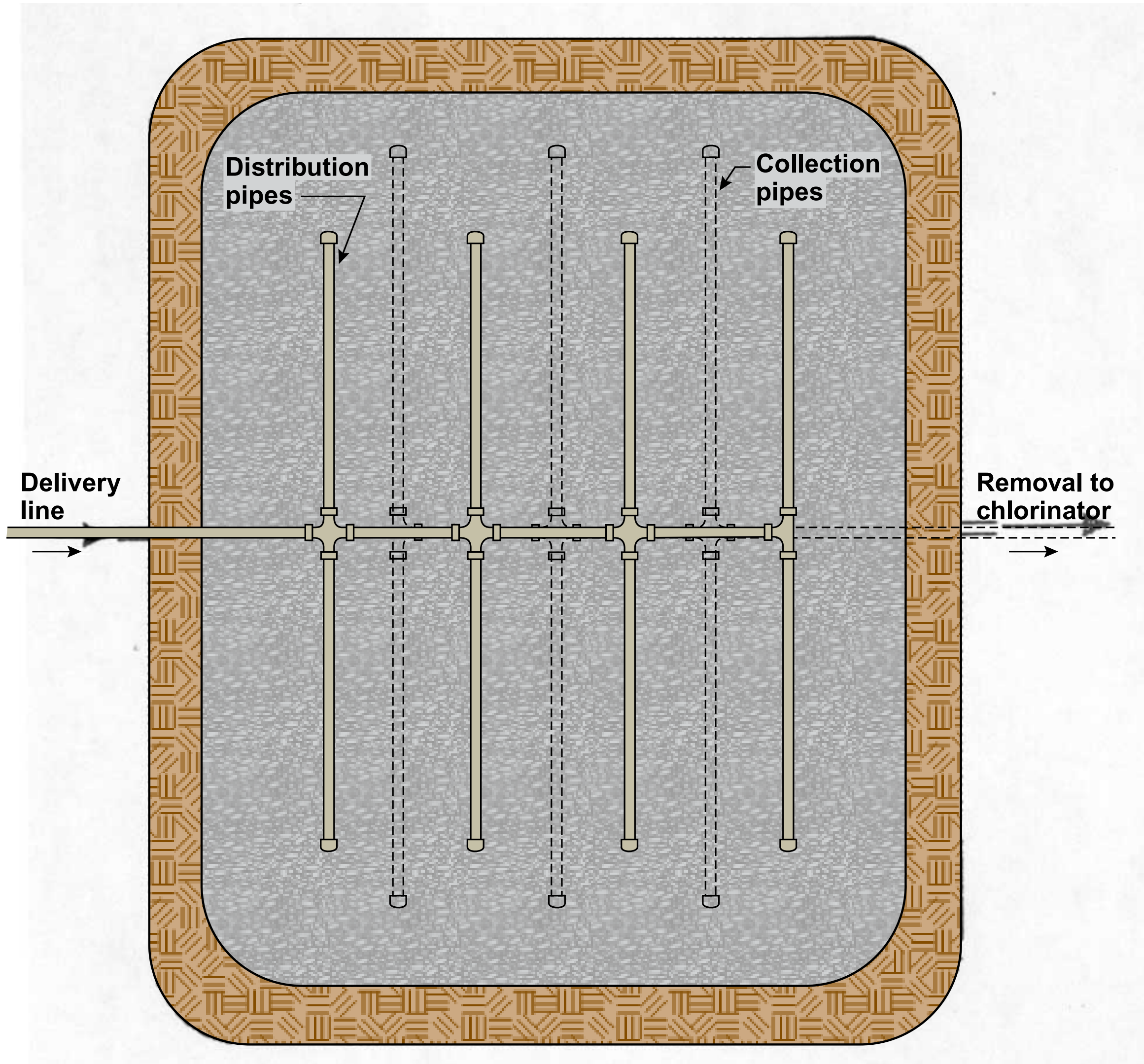


Note: Sand specifications are on page VII-12 of the field manual.

2) IRSIS BURIED INTERMITTENT SAND FILTER
(Partial Side View)



NOTE: Two inches of sand or 10 oz. porous geotextile surround liner on both sides.



2) A TYPICAL IRSIS BURIED INTERMITTENT SAND FILTER
(Top View)

IRSIS INTERMITTENT SAND FILTER SPECIFICATIONS

Free Access Sand Filters

Sand Specifications

- Effective size:0.3 to 0.6 mm
- Uniformity coefficient of <3.5
- <4% pass the #100 sieve
- $\leq$15% deleterious material

Sand Filter Sizing

Treatment	Total Surface Area in Square Feet		
	Three Bedroom	**Four Bedroom**	**+ Bedroom**
Septic	80	100	20
Aerobic	40	50	10

Buried Sand Filters

Sand Specifications

- BC sand type B #1 or #3

Sand Filter Sizing

Treatment	Total Surface Area in Square Feet		
	Three Bedroom	**Four Bedroom**	**+ Bedroom**
Septic	460	575	115
Aerobic	307	384	77

Note: Measure area at the bottom of the sand surface.

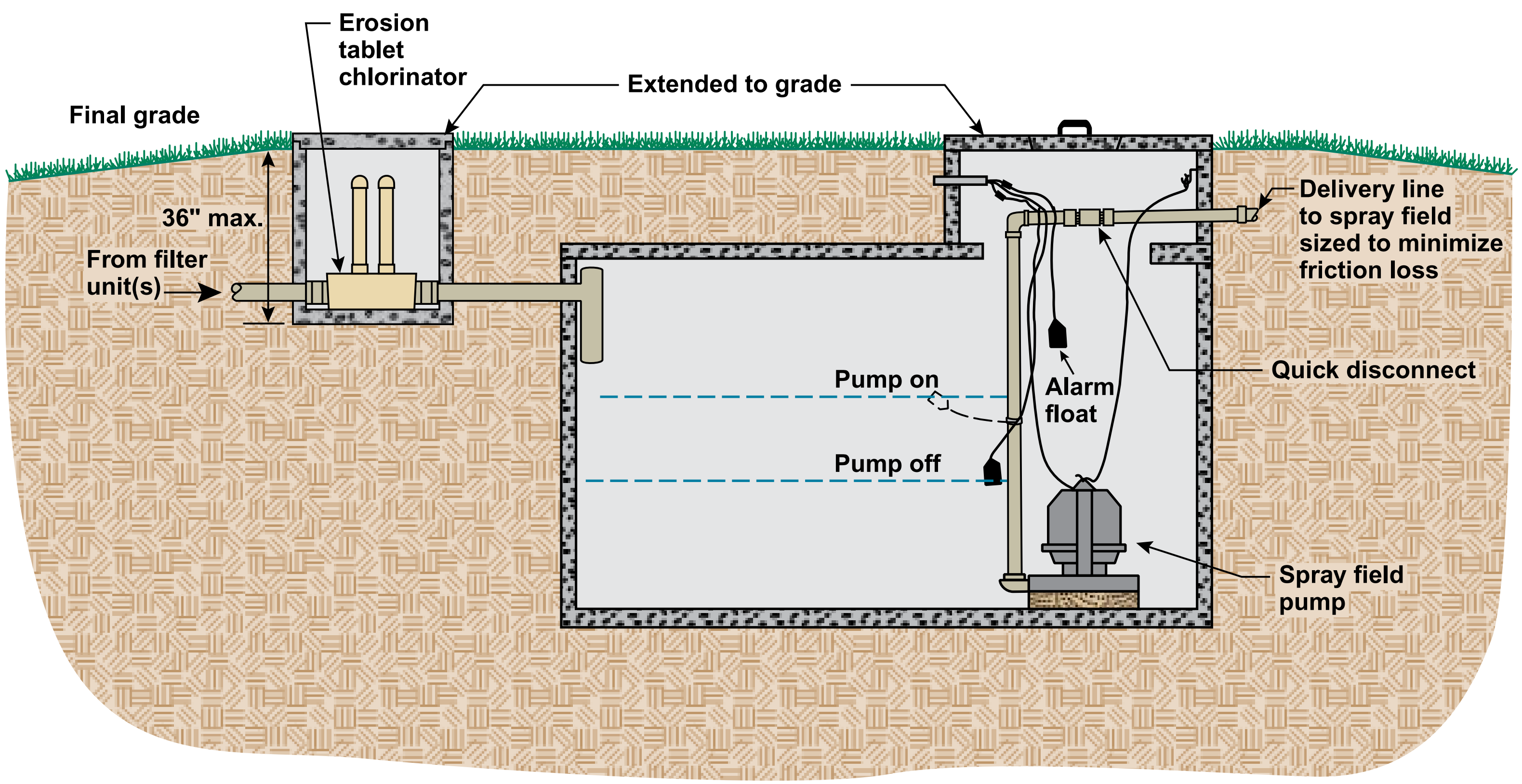
Storage Tank Sizing

Bedrooms	**Three**	**Four**	**+ Bedroom**
Capacity (gallons)	2,000	2,500	500

Note: If the chlorine contact tank and the storage tank are combined, the chlorine capacity must be added to the storage tank capacity.

Chlorine Contact, Storage, and Pump Tank
(Side View)

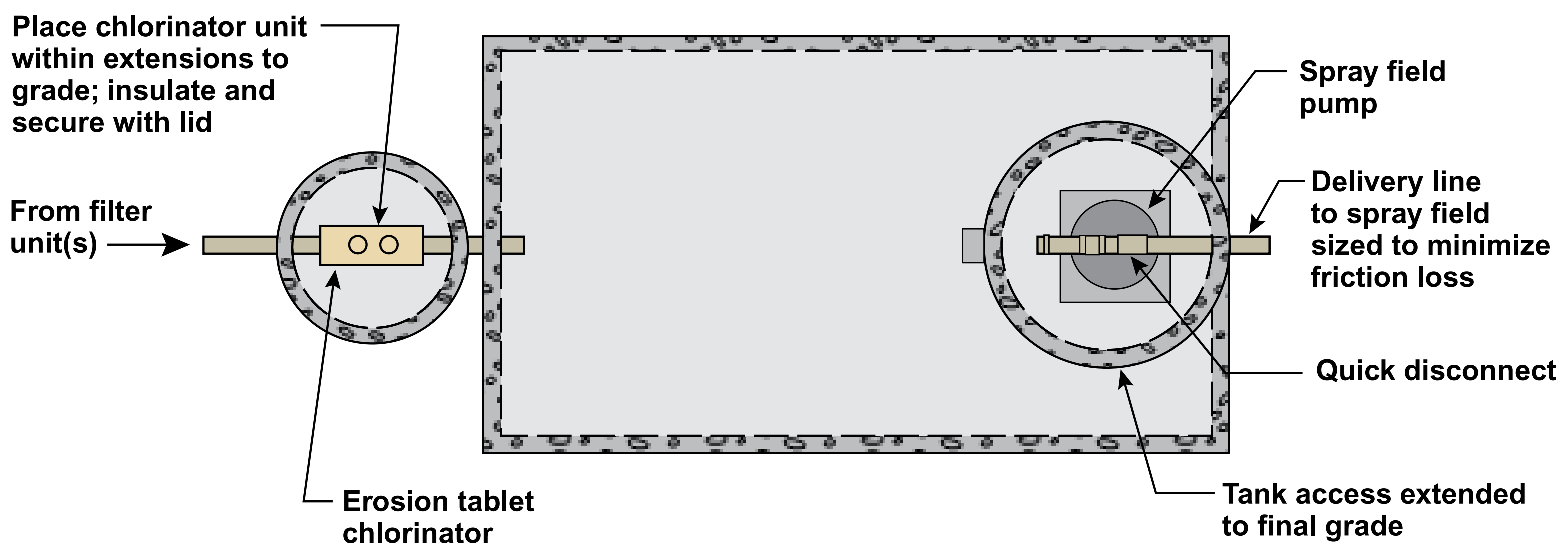
This illustration shows the side view of a typical IRSIS chlorine contact, storage, and pump tank



CHLORINE CONTACT, STORAGE, AND PUMP TANK

(Top View)

This illustration shows the top view of a typical IRSIS chlorine contact, storage, and pump tank.



IRSIS Chlorination Using an Erosion Tablet

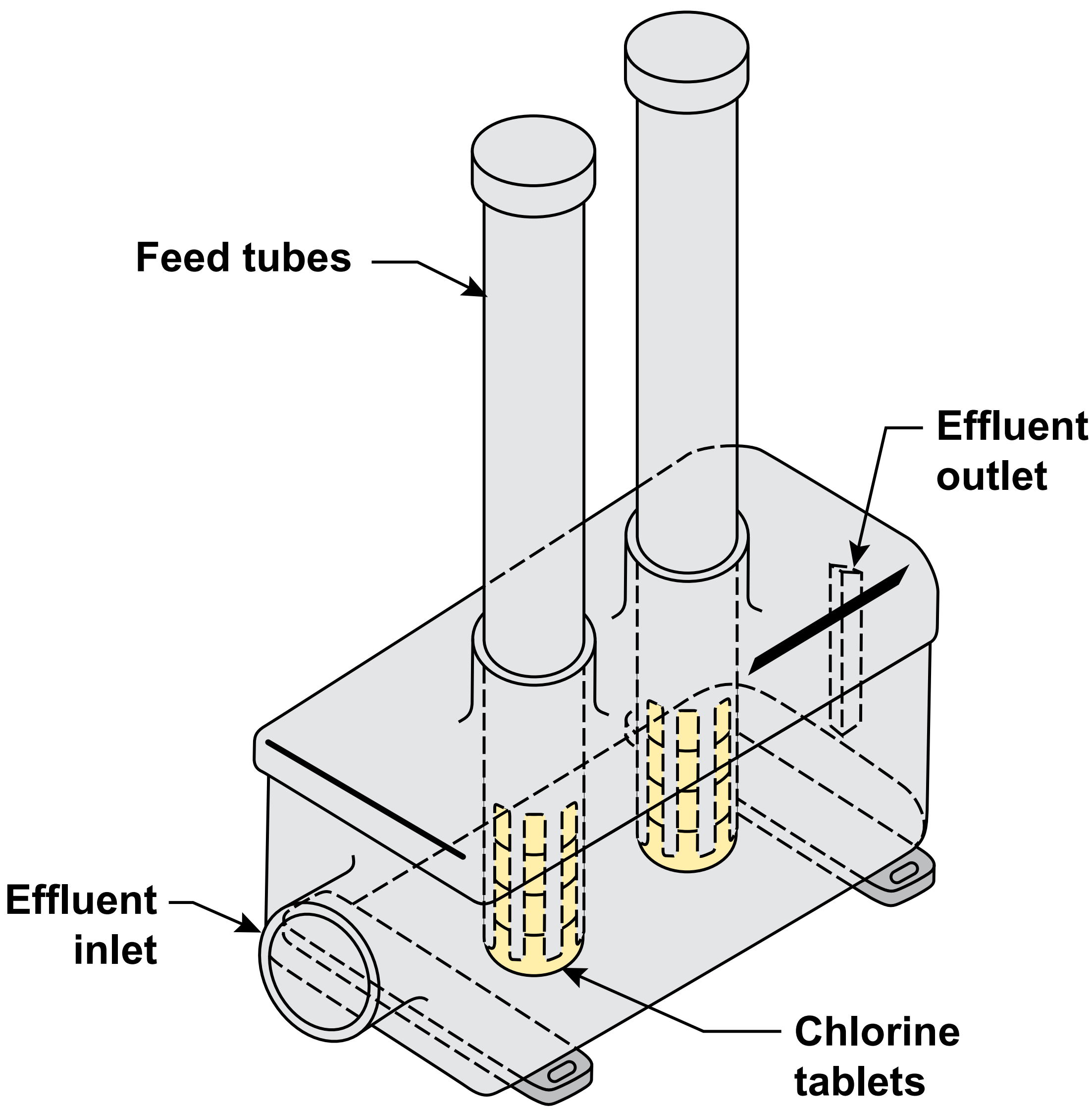
ADVANTAGES

- No moving parts
- Low maintenance
- Less expensive

DISADVANTAGES

- Difficult to calibrate
- Bridging

This illustration shows a typical erosion tablet unit.



IRSIS Chlorination Using a Hypochlorination (Liquid) System

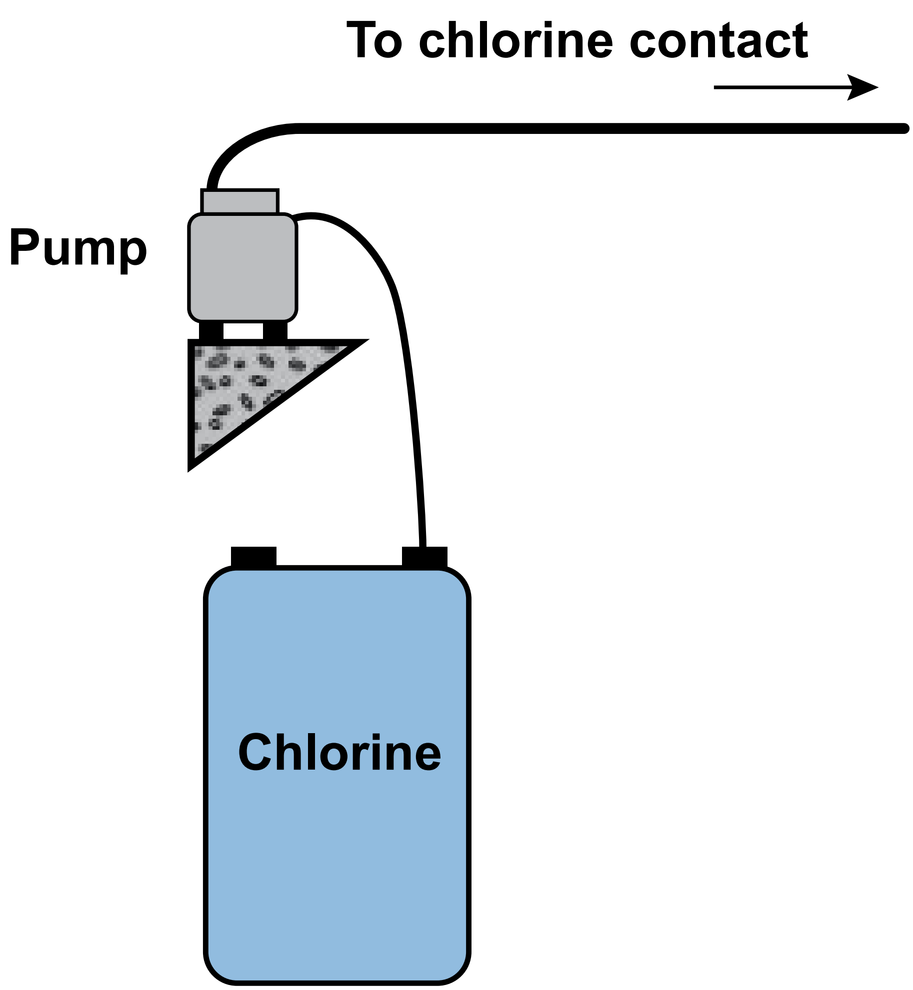
ADVANTAGES

- Does not bridge
- Easy to calibrate

DISADVANTAGES

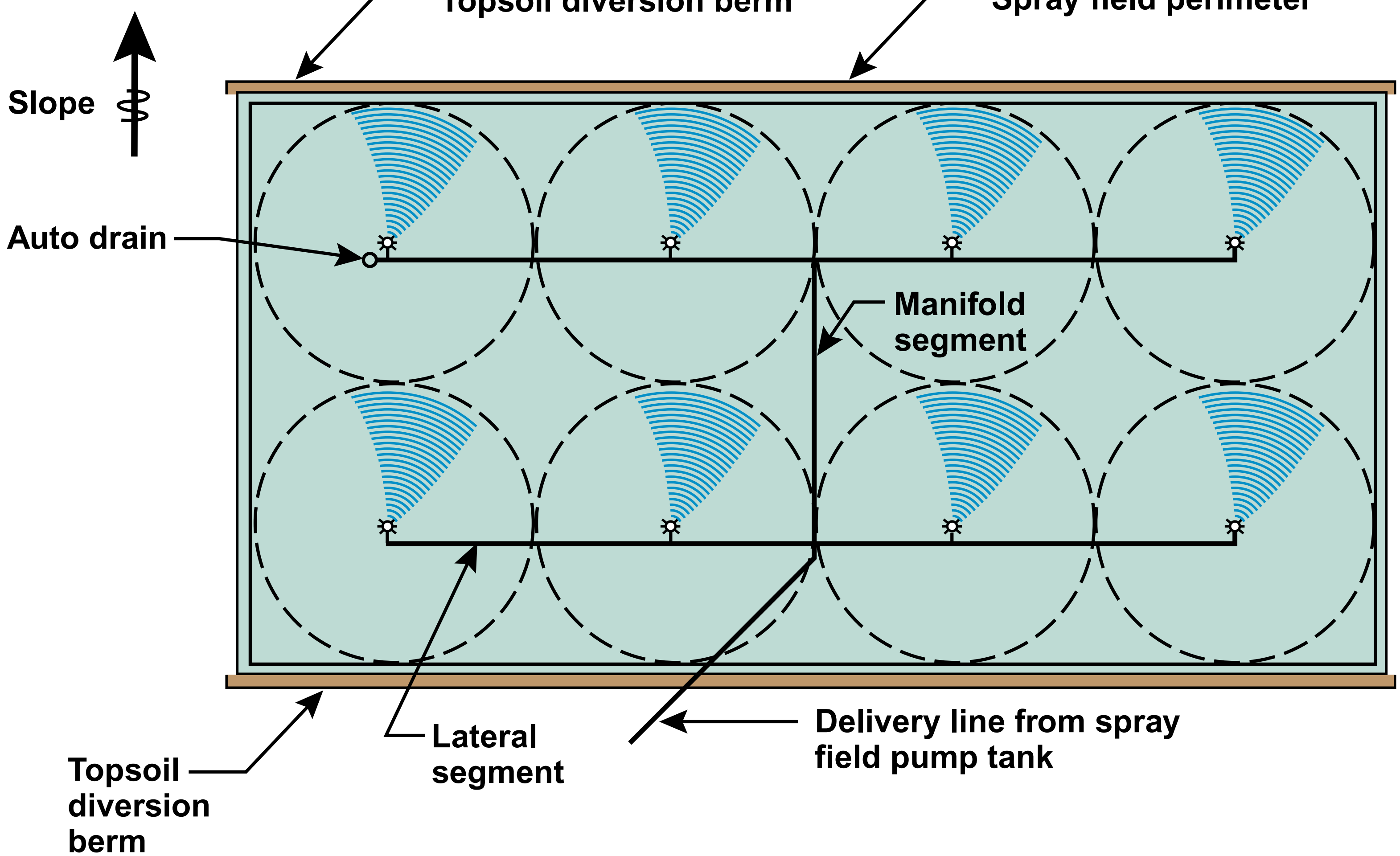
- Moving parts
- More expensive
- Tubing can clog when chlorine builds up
- High maintenance

This illustration shows a typical hypochlorination system.



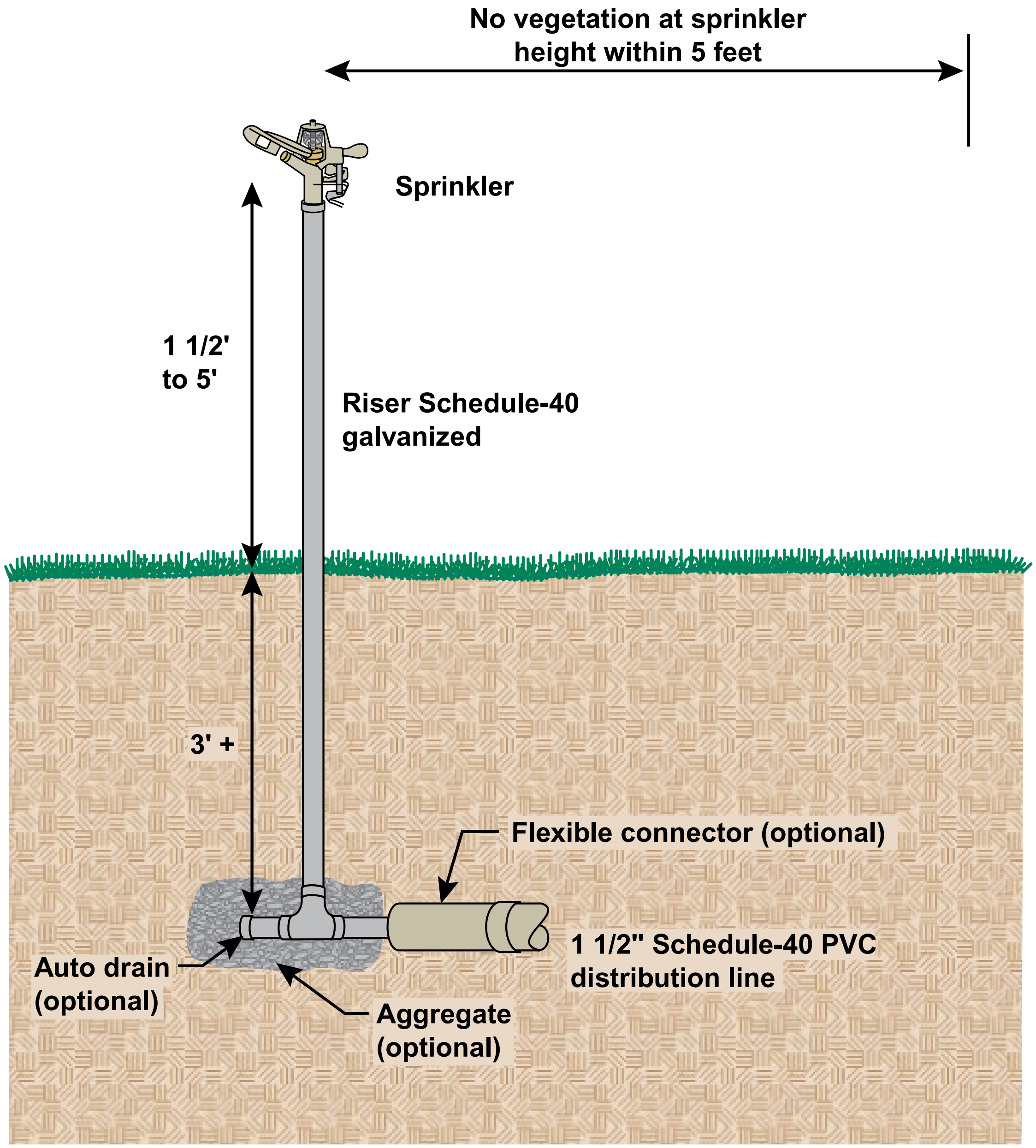
IRSIS Spray Field

(Top View)



IRSIS Riser and Sprinkler

This illustration shows a typical riser and sprinkler.



REQUIRED IRSIS INSPECTIONS AND LAB TESTING

Semi-Annual Inspection Required (every six months)

Section 73.167

During this inspection, make sure all parts of the system are functioning properly:

- Tanks
- Filters
- Chlorination
- Distribution to the spray field
- Spray field
- Risers and sprinklers

Annual Lab Testing Required (once a year)

Sections 72.42 and 73.167

TEST	**REQUIREMENTS**
CBOD	25 mg/L (max.)
Suspended solids	30 mg/L (max.)
Free chlorine residual	.2 to 2.0 ppm
Fecal coliforms	200 fecal coliforms/100 milliliters (max.)

Note: A copy of the test results must be sent to the local agency every year.

APPENDIX

Glossary

Absorption area—A component of an individual or community sewage system where liquid from a treatment tank seeps into the soil; it consists of an aggregate-filled area containing piping for the distribution of liquid and the soil or sand/soil combination located beneath the aggregate.

Act—Act 537, the Pennsylvania Sewage Facilities Act (35 P.S. §§ 750.1–750.20).

Aerobic—Using or needing oxygen, or characterizing an environment where oxygen is present.

Aerobic sewage treatment tank—A mechanically aerated treatment tank that provides aerobic biochemical stabilization of sewage prior to its discharge to an absorption area.

Aggregate—Coarse material manufactured from stone, gravel, or slag, having Type B characteristics as described in Department of Transportation specifications, Form 408, Section 703.3, Table B, and uniform size and grading equivalent to American Association of State Highway and Transportation Officials No. 57, as described in Form 408, Section 703.3, 2 Table C.

Agricultural areas—Areas used primarily for the production of crops and where the soil is without vegetative cover during certain periods of the year.

Alternate sewer system—A method of demonstrated onlot sewage treatment and disposal not described in the Pennsylvania Code Title 25, Environmental Protection Chapters 72 and 73 regulations.

Anaerobic bacteria—Bacteria that can survive in an environment without oxygen.

Berm—Cover material that surrounds the absorption area, holds it in place, and supports the vegetative cover that protects the onlot sewage disposal system against erosion.

BOD (biological oxygen demand)—The amount of dissolved oxygen used by microorganisms in the biochemical oxidation of organic matter.

Building sewer—Piping carrying liquid wastes from a building to the treatment tank or holding tank.

Buried sand filter—A system of piping, sand media, aggregate, and collection piping in a buried liner used for the intermittent filtration and biochemical treatment of sewage.

Cesspool—A lined hole that stores sewage and allows the liquid sewage to seep out into the surrounding soil and rock mass.

Chisel plow—A farm or tractor implement used to “rough up” the soil surface, break down surface vegetation, and increase the soil surface area.

Conventional sewage system—A system employing the use of demonstrated onlot sewage treatment and disposal technology in a manner specifically recognized by the Pennsylvania Code Title 25, Environmental Protection Chapters 72 and 73. The term does not include alternate sewage systems or experimental sewage systems.

Detention basin—A graded area of lower elevation designed to temporarily collect and detain excess stormwater runoff.

Dosing pump—The pump housed in a dosing tank, which provides a measured volume of sewage effluent to the pressurized distribution system in an absorption area.

Dosing tank—Tank that stores sewage effluent for a period of time. Effluent is periodically discharged into an absorption area through a pressurized distribution system.

Effluent—The wastewater that is discharged from a treatment tank after solid matter from sewage wastes has settled.

Eluviation—The removal of soil material in suspension (or in solution) from a layer or layers of a soil. Usually, the loss of material in solution is described by the term "leaching."

Experimental sewage system—A method of onlot sewage treatment and disposal not described in the Pennsylvania Code Title 25, Environmental Protection Chapters 72 and 73, which is proposed for the purpose of testing and observation.

Extremity of aggregate—The perimeter of the aggregate.

Filter tank—The tank housing the piping and sand of the free access sand filter.

Footprint (sand mound)—Outer edge of the berm surrounding the absorption area.

Forested areas—Areas where the predominant vegetative cover is comprised of trees with a closed canopy.

Fragipan—A firm, dense soil horizon that generally restricts the downward passage of water.

Free access sand filter—An accessible system of tanks, dose piping, sand media, aggregate, and collection piping used for the intermittent filtration and biochemical treatment of sewage.

Genetic horizon—A separate soil horizon produced by soil-forming processes.

Geotextile—Material consisting of mesh polypropylene, polyester, nylon, or similar material used to prevent migration of the soil into coarser aggregate.

Gleyed soil—A soil condition resulting from prolonged soil saturation, which is manifested by a low chroma in the soil mass.

Grassed area—An area where the predominant vegetative cover is comprised of grasses, bushes, or trees not forming a closed canopy.

High water table—The highest part of the soil or underlying rock material that is wholly or partially saturated with water, during some part of the year.

Horizon boundaries—A surface or transitional layer between two adjoining soil horizons.

Horizon break—Justification to separate one soil horizon from another, based upon such characteristics as color, texture, or structure.

Illuviation—The process of depositing soil material removed from one soil horizon into another, usually from an upper to a lower horizon in the soil profile.

Individual onlot sewage disposal system—An individual sewage system that uses a system of piping, tanks, or other facilities for collecting, treating, or disposing of sewage into a soil absorption area or spray field, or by retention in a retaining tank.

Individual residential spray irrigation system (IRSIS)—An individual sewage system that serves a single-family dwelling and that treats and disposes of sewage using a system of piping, treatment tanks, and soil renovation through spray irrigation.

Industrial waste—A liquid, gaseous, radioactive, solid, or other substance, which is not sewage, resulting from manufacturing or industry or other plant or works and mine drainage, silt, coal mine solids, rock, debris, dirt, and clay from coal mines, coal collieries, breakers, or other coal-processing operations. The term includes substances whether or not generally characterized as waste.

Lift pump—A submersible pump used to convey effluent to another part of the onlot sewage disposal system.

Lift tank—Temporary storage tank, where sewage effluent is collected, containing a pump that discharges to a septic system's distribution network which is typically at a higher elevation.

Limiting zone—A soil horizon or condition in the soil profile or underlying strata which includes one of the following:

(i) A seasonal high water table, whether perched or regional, determined by direct observation of the water table or indicated by soil mottling.

(ii) A rock with open joints, fracture or solution channels, or masses of loose rock fragments, including gravel, with insufficient fine soil to fill the voids between the fragments.

(iii) A rock formation, other stratum, or soil condition which is so slowly permeable that it effectively limits downward passage of effluent.

Manganese coatings—Black coatings that are present on the face of a soil profile and are associated with deposits of manganese accumulations.

Master horizon—A layer of soil identified by the capital letters O, A, E, B, C, or R. Horizon separations are generally based on differences in color, texture, and/or structure.

NSF (National Sanitation Foundation)— The NSF is an independent, nonprofit organization committed to public health, safety, and protection of the environment. It provides a wide range of services focusing on food, water, indoor air, and the environment. NSF develops national standards, provides learning opportunities, and provides third-party conformity assessment services.

Open joints—The open space between masses of shattered rock fragments, with insufficient fine soil to fill the voids between the rock fragments.

Oxidation—The loss of one or more electrons by an ion or molecule, typically associated with an aerobic environment.

Perched high water table—A zone of saturation, which is ponded above a soil or rock stratum with restrictive permeability.

Perpendicular—At exactly a right angle to a flat, level surface or contour line.

Privy—A tank designed to receive sewage where water under pressure is not available.

Probe rod (poke rod)—A T-shaped rod that is poked into the ground to check various depths and subsurface conditions.

Regional high water table—The highest part of the soil or underlying rock material that is wholly saturated with water within a regional area.

Renovate—To purify wastewater as it moves into and through the soil, providing physical, chemical, and biological treatment.

Retaining tank—A watertight receptacle that receives and retains sewage and is designed and constructed to facilitate ultimate disposal of the sewage at another site. The term includes:

(i) **Chemical toilet**—A permanent or portable nonflushing toilet using chemical treatment in the retaining tank for odor control.

(ii) **Holding tank—**A tank, whether permanent or temporary, to which sewage is conveyed by a water-carrying system.

(iii **Privy—**A tank designed to receive sewage where water under pressure is not available.

(iv) **Incinerating toilet—**A device capable of reducing waste materials to ashes.

(v) **Composting toilet**—A devise for holding and processing human and organic kitchen waste employing the process of biological degradation through the action of microorganisms to produce a stable, humus-like material.

(vi) **Recycling toilet—**A device in which the flushing medium is restored to a condition suitable for reuse in flushing.

Scarify—To scratch the surface of the soil.

Septic tank—A treatment tank that provides for anaerobic decomposition of sewage prior to its discharge to an absorption area.

Sewage—A substance that contains the waste products, excrement, or other discharge from the bodies of human beings or animals; a substance harmful to the public health, to animal or aquatic life, or to the use of water for domestic water supply or for recreation; or a substance that constitutes pollution under the Clean Streams Law.

Sewage enforcement officer (SEO)—An official of the local agency who reviews permit applications and sewage facilities planning modules and issues permits as authorized by the Sewage Facilities Act (Act 537) and conducts the investigations and inspections that are necessary to implement the Act and the Pennsylvania Code Title 25, Environmental Protection Chapters 72 and 73 regulations thereunder.

Soil horizon—A layer of soil approximately parallel to the soil surface, the chemical and physical characteristics of which are distinguishable by observation or other method of analysis, from the chemical and physical characteristics in adjacent layers of soil.

Soil mottling (redoximorphic features)—A soil color pattern consisting of patches of different colors or shades of color interspersed with the dominant soil color, which results from prolonged saturation of the soil.

Soil profile—A one-dimensional presentation of the individual soil horizons used to support the establishment of soil suitability and any corresponding limiting conditions.

Solids retainer—A deflection device at the outlet tee or baffle of a treatment tank designed to deflect solids from escaping the tank.

Solution channels—Open channels with insufficient fine soil to fill the voids between the rock fragments.

Spray field—Piping, spray heads, and ground surface to the outside edges of the wetted perimeter, used for the application and treatment of the sewage effluent in an individual residential spray irrigation system.

Stormwater seepage bed—A bed of aggregate designed to collect and disperse excess stormwater runoff.

Subordinate distinctions—A further separation within a soil master horizon layer. A lowercase letter is used for these distinctions.

Treatment tank—A watertight tank designed to retain sewage long enough for satisfactory bacterial decomposition of the solids to take place. The term includes the following:

(i) **Septic tank**—A treatment tank that provides for anaerobic decomposition of sewage prior to its discharge to an absorption area or spray field.

(ii) **Aerobic sewage treatment tank**—A mechanically aerated treatment tank that provides aerobic biochemical stabilization of sewage prior to its discharge to an absorption area or spray field.

Undisturbed soil—Soil or soil profile, unaltered by removal or other man-induced changes, except for agricultural activities, that would adversely affect the siting or operation of onlot sewage disposal systems.

Waters of this Commonwealth—Rivers, streams, creeks, rivulets, impoundments, ditches, water courses, storm sewers, lakes, dammed water, ponds, springs, and other bodies or channels of conveyance of surface and underground water, or parts thereof, whether natural or artificial, within or on the boundaries of this Commonwealth.