Northeast Tri County Health District

Standards and Guidance for Gravity

These standards and guidance for gravity flow on-site sewage systems are based upon Northeast Tri County Health District Regulation 01-2007, which governs on-site sewage disposal systems in Ferry, Stevens, and Pend Oreille Counties.

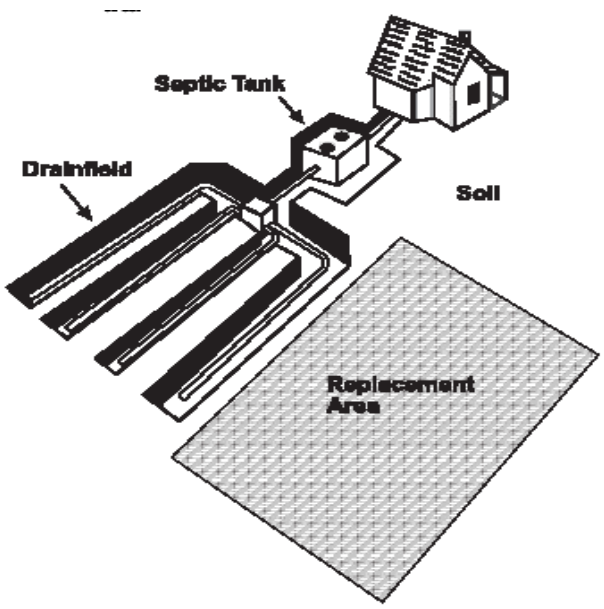
Effective: May 1, 2008

GENERAL INFORMATION

An on-site sewage system is the most common method of sewage disposal for homes that cannot be served by a public sewer system. This type of sewage system must be located, designed, installed, and maintained so that the wastewater from a home is disposed of in a manner that will not contaminate the groundwater and/or surface water and will not present any hazard to public health or environmental quality.

Before construction of an on-site sewage system can begin, a permit must be obtained from the Northeast Tri County Health District, Environmental Health office. This guideline is intended to assist the applicant in the design and installation of a gravity flow on-site sewage system.

Figure 1 – Typical Conventional Gravity Sewage Disposal System



Gravity Flow On-Site Sewage Disposal System

For Residential Structures

1. Operation

Raw sewage from a residence enters the septic tank through the building sewer at a point where it is diverted downward by a sanitary tee or baffle. The heavy solids settle to the bottom of the first compartment of the septic tank, where bacterial action partially converts them to a digested sludge. The light solids, fats and greases float to the liquid surface and form a scum layer. The liquid portion (effluent) in between these two layers flows into the second chamber for further separation and treatment and then out of the tank to the drainfield where fine, suspended solids are further decomposed and liquid is absorbed by the soil, evaporated, or taken up by plants. The quantities that are evaporated are greatly dependent on the climate. Cooler temperatures and increased precipitation tend to reduce the assistance of evaporation, while warmer, dryer climates can result in significant evaporation.

2. Location

The location of the on-site sewage system on a lot is determined by a number of factors. Unless sewage disposal is given adequate consideration during the planning of the residential development, installation and maintenance of the on-site sewage disposal system may become unnecessarily complex and expensive.

The drainfield location must be in the area of test holes that have been reviewed and approved by the Health District

Generally, the location of an on-site sewage system depends on:

1. absorbent quality of the soil
2. depth to maximum seasonal ground water and/or impervious layer
3. size and slope of the lot
4. distance to drinking water sources
5. distance to streams, lakes and other surface waters
6. general development plan for the lot

On-site sewage system must meet the minimum horizontal separations shown in Appendix I.

3. Use

The on-site sewage system must be designed to receive all wastewater from the structure. Water from garage floor drains, as well as footing and roof drains, should not enter the on-site sewage system or the area in which the system is located.

4. Site Preparation

All site preparation done before the septic tank and drainfield are installed should be carefully planned to not impact the sewage system location. Driveway and roads must be placed so that no vehicle traffic will be over the septic tank or drainfield. Well locations must be at least 100 feet from the proposed drainfield and 50 feet from the septic tank. A drainfield cannot be placed in fill material.

CONVENTIONAL GRAVITY ON-SITE SEWAGE SYSTEM COMPONENTS

1. Building Sewer

The building sewer begins at a point two feet outside the building foundation. The pipe used for the construction of the building sewer must be 4-inch diameter PVC, ASTM 3034, or equivalent.

Construction of the line should be such as to secure watertight joints. It is recommended that the bells be on the upgrade side when possible. The line shall be on a grade of at least ¼" per foot from the house to the septic tank. Lesser grades of fall must have prior approval by the designer of the system and the Health District. If elbows or bends are used, they cannot be greater than a 45 degree angle, but a sweep 90 degree may be used if a cleanout is installed. Cleanouts are also required for every 100 feet of tight line from the house to the septic tank. Two-way cleanouts are recommended.

The depth of the building drain can affect the placement and depth of the septic tank and as a result, the depth of the drainfield. Therefore, the location and depth of the drainfield should be considered prior to constructing the house drain.

2. Septic Tank

A watertight tank, approved by the Washington State Department of Health shall be used. The tank shall be installed in accordance with the manufacturer's specification. The septic tank must be set on undisturbed soil, or by the manufacturer's standards if other than a concrete tank is used.

All septic tanks must contain two compartments, with the first compartment equal to ½ to 2/3rds of the total liquid volume.

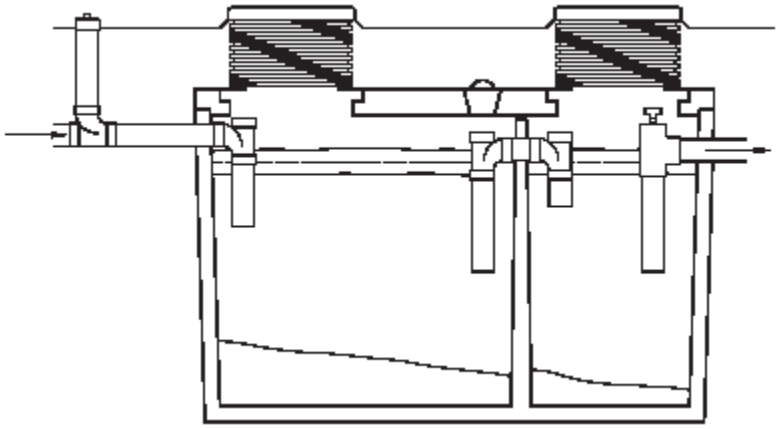
Septic tanks are designed to treat household strength wastewater. For single family homes, 250 gallons per bedroom capacity is required, with a minimum capacity of 1000 gallons.

Access to the tank for inspection and maintenance at finished grade is required. However, the health officer may allow access for tanks to be a maximum of six inches below finished grade provided a marker showing the location of the tank access is installed at finished grade.

All piping entering and exiting the tank must be bedded on compacted soil and kept uncovered until the system is inspected.

The depth at which a septic tank is installed will directly affect the depth of the drainfield. For gravity flow on-site sewage systems, the septic tank depth should be minimized, yet be deep enough to allow grass to grow.

Figure 2 – Septic Tank Example



3. Gravity Flow Drainfield

Location and sizing:

The purpose of the drainfield is to treat and dispose of the effluent from the septic tank. The drainfield is designed to create aerobic conditions for additional treatment by bacteria, as well as by filtration and other processes. For disposal, however, the water must either percolate down through the soil or be taken up by plants.

The area needed to absorb the effluent depends on the amount of wastewater discharged from a residence and the ability of the soil to absorb the water. Since the size and habits of individual families may change, the absorption area is based on the number of bedrooms in the residence.

Drainfields for gravity flow on-site sewage systems should not be located in areas where:

a. the soils are either too tight or too permeable,
b. the groundwater table is within 4 to 5 feet of the surface,
c. the slope is greater than 30%,
d. surface waters drain over the site,
e. minimum setback requirements cannot be met, or
f. areas where driving will (or is likely) to occur

Drainfields must be designed with the minimum square footage requirements as noted on the site evaluation sheet completed by Health District staff at the time the test holes are evaluated.

Soil Evaluation:

To determine the soil type in a drainfield area, Health District staff evaluates soil test holes (see Appendix 3). At a minimum, two test holes must be dug to a depth of 6 feet in the proposed drainfield area. The soil in the test holes is examined and the soil types are identified. The primary soil qualities examined are:

a. **Soil Texture:** soil texture refers to the percent of sand, silt, and/or clay in a soil. The texture frequently varies for each soil horizon or layer. Evaluation of the soil's texture will reveal necessary information concerning the absorptive capacity of the soils, which in turn, directly affects the degree of treatment and the ability of the soil to dispose of the effluent. Too tight a soil won't let the wastewater disperse while too course a soil won't adequately treat the wastewater.

b. **Soil Structure:** soil structure refers to the natural grouping of soil particles. The structure of a soil will generally be indicative of its drainage characteristics. Well structured soil allows for easier passage of wastewater. Soil with platy structure inhibits passage of wastewater.

c. **Color:** color is a useful characteristic for soil identification, often combined with soil structure. Generally, soils that are brownish to reddish to yellow in coloration tend to be well drained. Such soils are more suitable for on-site sewage disposal due to the absence of a high water table. Soils that are grayer in coloration or soils that contain reddish specks or mottles generally are more poorly drained and warn of high water tables

It is important to know the above information for the upper 6 feet of the soil. Thus, the textures, structures and colors of the soil layers are recorded during the site evaluation process.

For more information on soil textural classification, methods of effluent distribution for soil types and depths, and soil log constructions, see Appendix 2.

DESIGN

Based on Washington State and Health District regulations, the design of an on-site sewage system for a single family residential structure can be prepared by the homeowner if they will be the resident owner for at least six months. Designs for all other systems, including residential structures that will be rentals, must be prepared by a designer or engineer licensed with the State of Washington.

Assurance must be made that an equal quantity of effluent will flow in to each drainfield lateral. On sloping ground a distribution box (d-box) may be required between the septic tank and drainfield. The purpose of a distribution box is to provide for equal distribution to each of the drainfield laterals. See examples below.

Figure 3 -Typical Level Drainfield Layout

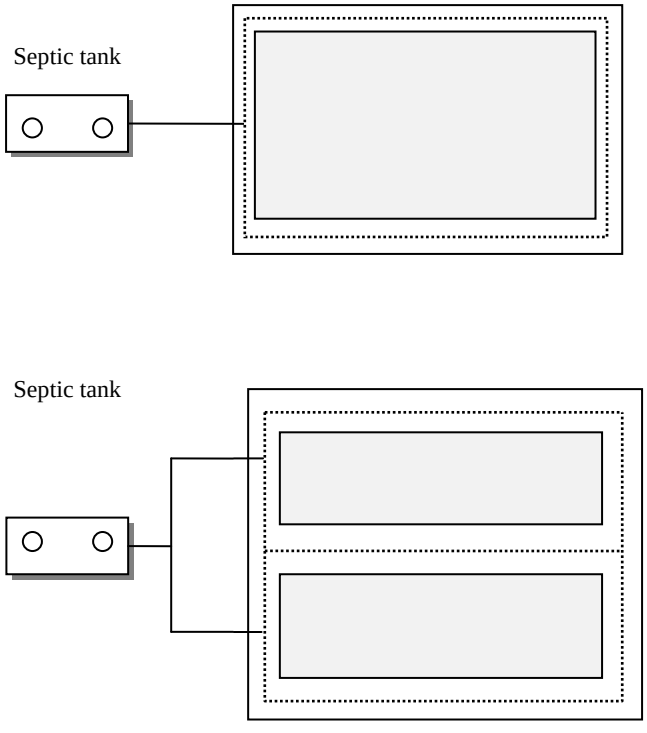


Figure 4- Drainfield Layout With D-Box

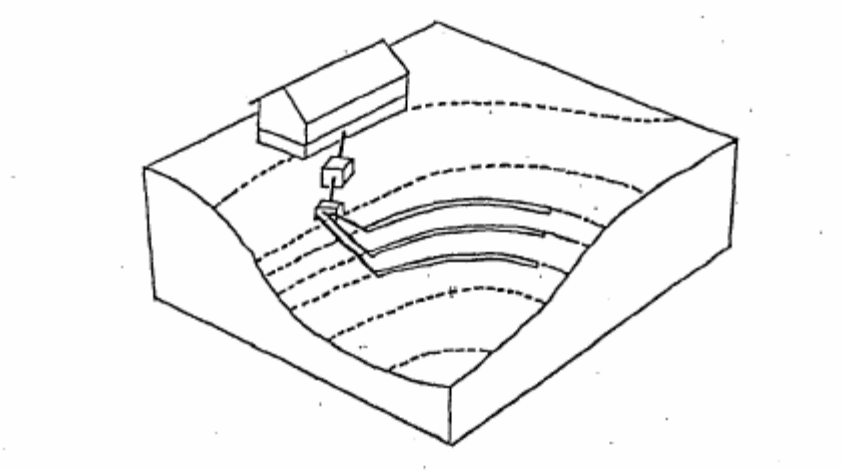


Figure 5- Section & Plan View of D-Box

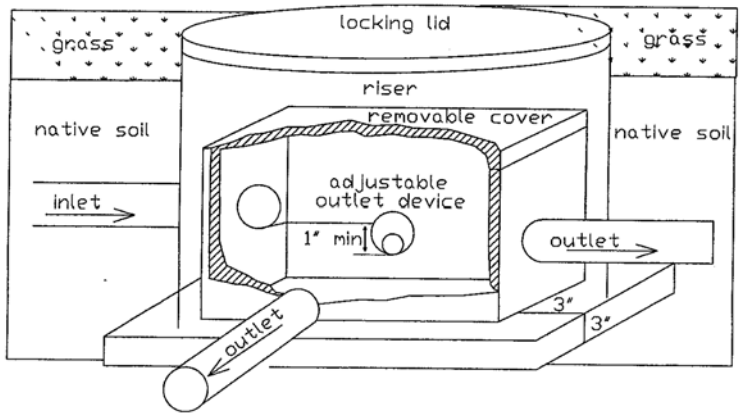
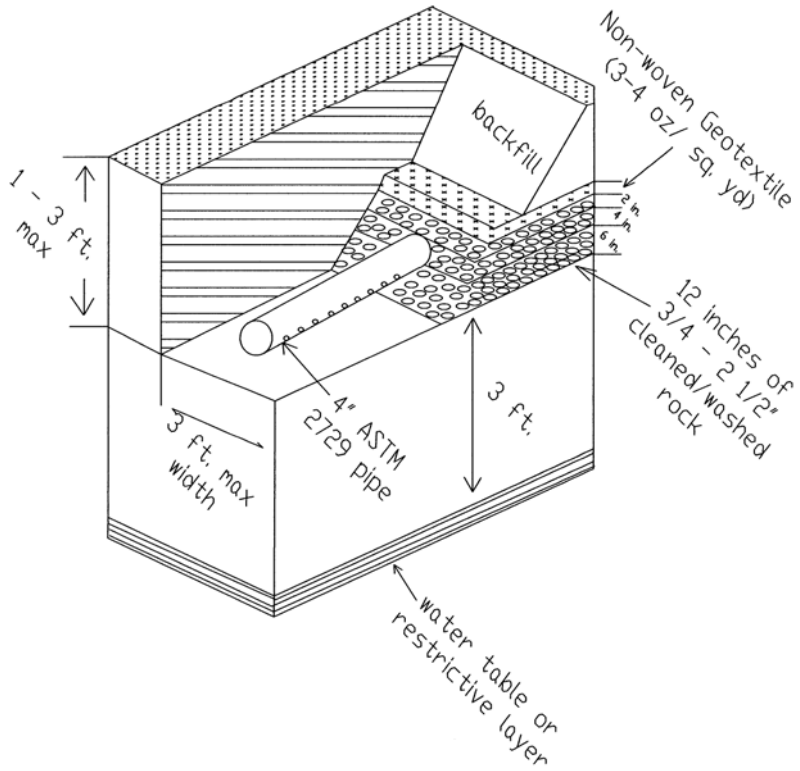
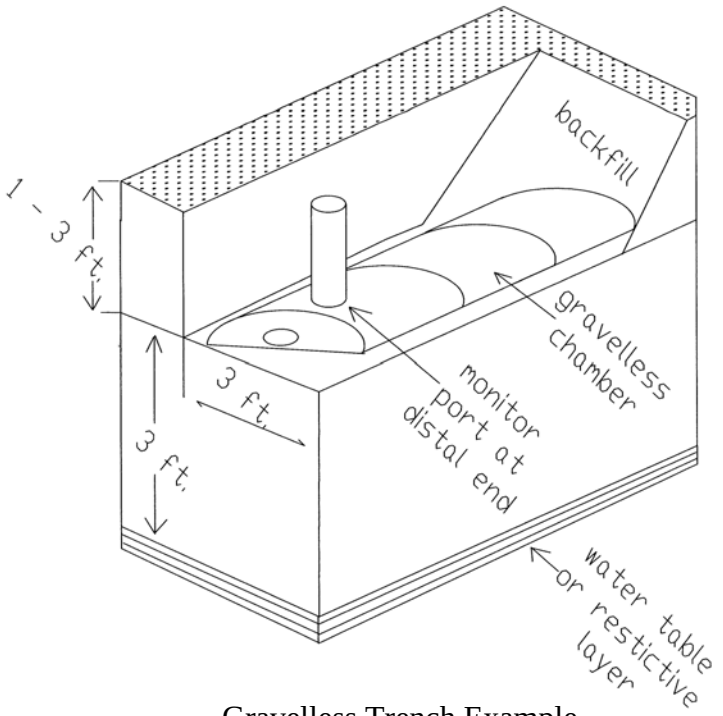


Figure 6– Cross-Section View of Typical Drainfield Trench

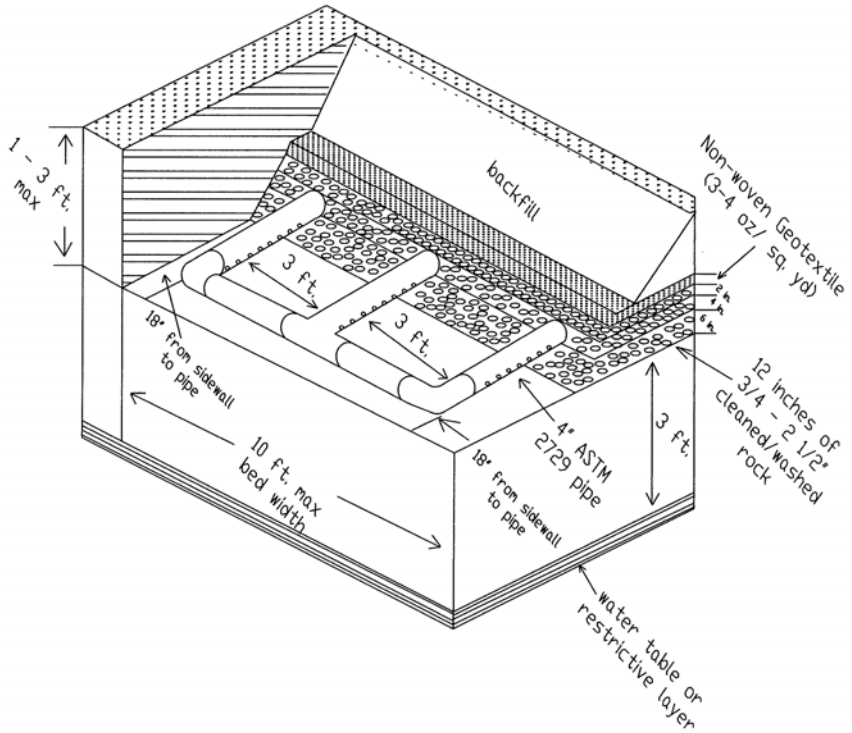


Gravel Trench Example

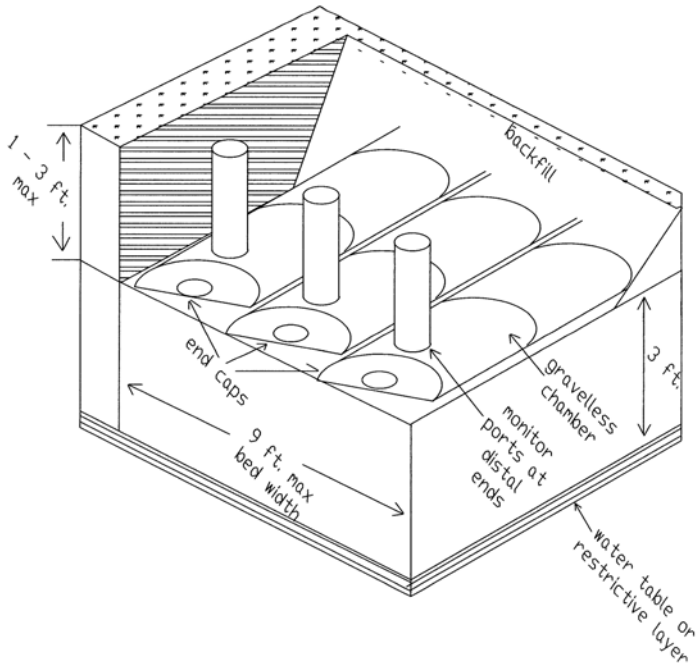


Gravelless Trench Example

Figure 7 – Cross-Section View of Drainfield Bed



Gravel Bed Example



Gravelless Bed Example

CONSTRUCTION

The care taken during the construction of on-site sewage system will ensure proper performance. Thus, it is necessary to observe the appropriate precautions during construction.

Important design and construction specifications are:

a. A minimum of 10 feet on center trench separation;
b. A minimum of two lateral lines in a drainfield;
c. Drainfield lines must be perforated 4-inch ASTM 2729 PVC pipe or equivalent;
d. The length of an individual drainfield line cannot exceed 100 feet;
e. Drainfield lines must be positioned with holes at 5 and 7 o'clock;
f. The standard drainfield trench width is 3 feet;
g. The bottom of the drainfield trench and the grade of the perforated pipe must be level;
h. Trench depth is dependent upon soil conditions below the infiltrative surface and is established during the site review process. The maximum drainfield trench depth is 36 inches and the maximum cover is 24 inches. The depth of cover over the drainfield will be 6 to 24 inches;
i. A minimum of 6 inches of gravel shall be placed under the distribution pipe, 4 inches along side the pipe, 2 inches covering the pipe and must extend the width of the trench;
j. Gravel used in drainfields must be clean, washed gravel 3/4” inch to 2 ½” inches in diameter.
k. All tight lines used must meet or exceed ASTM 3034. Tightlines must be bedded with ASTM ratings turned up for easy viewing.
l. There must be a minimum of five feet of tight line between the septic tank and the distribution box or the drainfield.
m. The slope in the line from the septic tank to the drainfield or d-box must be a minimum of 2 inches or 1 inch per 100 feet, whichever is greater.
n. Where a distribution box is used, all drainfield trenches and lines shall be the same length.
o. Between the distribution box and the beginning of a drainfield trench, there must be at least 5 feet of non-perforated line.
p. When a distribution box is used, it shall be set on a level concrete pad. The pad must be a minimum of 3 inches thick and extend 3 inches beyond the edges of the distribution box. Adjustable outlet devices must be installed in the d-box to facilitate the equal distribution of the effluent. The distribution box must then be filled with water and the outlet devices adjusted to allow equal flow into each drainfield trench.

q. When a distribution box is used, a method must be utilized to ensure inlet flow is equally directed into all outlets. Typically this is done by the installation of a 90 degree sweep installed on the inlet to direct the effluent to the floor of the box.
r. The ends of the laterals must be capped.
s. Drainfields cannot be installed in fill. Fill can be used as cover over a drainfield, up to a maximum of 24 inches, provided that no portion of the drainfield trench is installed in this material.
t. The filter fabric installed over the drainfield must be a non-woven, spun bound fabric, without coatings which reduce permeability, and have a fabric weight of 3 to 4 oz/ square yard, or an apparent opening size of 0.212 to 0.300 millimeters.

Care must be taken when determining the proper elevations for the drainfield trenches. The maximum drainfield trench depth is measured from the ground surface elevation when the test holes are reviewed. To assure that the drainfield trenches will not exceed the maximum trench depth, the elevations must be determined before installation begins. Site modification, such as excavating soils or bringing fill material into the drainfield area, should not be done without the approval of the Health District.

Septic tank depth should also be given careful consideration. The tank depth should be chosen to allow proper pipe slope to the drainfield depth. Likewise, house and plumbing elevations should be established to allow proper grade to connect to the septic tank.

Figure 6 depicts the components of a gravel drainfield trench. The use of grade boards on which to lay the distribution pipe may be desired to ensure level installation. Gravel 3/4" to 2 ½" in diameter is placed evenly to a depth of at least 6 inches up to the tops of the grade boards (if used). More gravel is placed around and over the pipe until the gravel bed is at least 12 inches deep. To prevent the soil cover from clogging the gravel, a strip of geotextile fabric is then placed on the gravel. The Health District must then be notified that the installation is ready for inspection. **Do not cover the system until the system has been inspected and approved.**

Once the inspection has been performed and the installation approved, the trench should be back-filled with soil and the area seeded with shallow rooted vegetation.

Backhoes, shovels and other equipment used for excavating drainfields tend to smear the side and bottom surfaces, reducing the soil's ability to absorption. This smearing occurs more extensively as the moisture and clay content in soil increase. To help avoid this, soils should only be worked when they are relatively dry. The sidewall and bottom surfaces of the trench should be raked after excavation.

If the soil is wet, trench excavation should not be done. Work in wet conditions will cause compaction of the soil surface and close soil pores necessary for drainage. If there is a question whether the soil is too wet for installation, contact the Health District.

Precautions should be taken before and after the construction of any type of on-site system to divert both surface and ground waters, including drainage water from downspouts, footing drains and curtain drains away from the septic tank and drainfield areas. In addition, heavy equipment or any vehicular traffic should be kept off the completed sewage disposal area. Once the system is completely installed, grass or other appropriate vegetation should be established as soon as possible.

MATERIALS

All tightline piping (leading from the house to the tank or from the tank to the drainfield) must meet or exceed ASTM Standard 3034

Perforated plastic for use in drainfields must meet or exceed ASTM Standard 2729.

The septic tank must consist of two compartments, be watertight, and be included in the Washington State Department of Health's List of Approved On-Site Sewage Tanks, which can be accessed at http://wwwldoh.wa.gov/wastewater.htm

Drainrock must be clean washed gravel or crushed rock ranging in size from ¾" to 2 ½".

Filter fabric used in gravel drainfields must be a fabric that is spun bound (non-woven), free of any chemical treatment or coating which reduces permeability, inert to chemicals commonly found in soil, free of petroleum products, and have a fabric weight of 3 to 4 oz per square yard, or have an apparent opening size (AOS) of 0.212 to 0.300 millimeters.

For other distribution products used, such as gravelless chambers, Washington State Department of Health approval and listing on the List of Registered On-site Treatment and Distribution Products is necessary. The list can be accessed at http://wwwldoh.wa.gov/wastewater.htm

MAINTENANCE

Proper Operation and maintenance of an on-site system is important! Don't forget about it after the system is completed and covered up. After the completion of the final inspection and approval of the on-site sewage system, the Health District will provide you information, in the form of brochures and a DVD, which will give recommendations for the proper maintenance and operation of the system.

Appendix 1

Minimum Horizontal Separations

Items Requiring Setback	From edge of soil dispersal component and reserve area	From sewage tank and distribution box	From building sewer, and nonperforated distribution pipe
Well or suction line	100 ft.	50 ft.	50 ft.
Public drinking water well	100 ft.	100 ft.	100 ft.
Public drinking water spring measured from the ordinary high-water mark	200 ft.	200 ft.	100 ft.
Spring or surface water used as drinking water source measured from the ordinary high-water mark1	100 ft.	50 ft.	50 ft.
Pressurized water supply line	10 ft.	10 ft.	10 ft.
Decommissioned well (decommissioned in accordance with chapter 173-160 WAC)	10 ft.	N/A	N/A
Surface water measured from the ordinary high-water mark	100 ft.	50 ft.	10 ft.
Building foundation/in-ground swimming pool/ lined water features	10 ft.	5 ft.	2 ft.
Property or easement line	5 ft.	5 ft.	N/A
Interceptor/curtain drains/foundation drains/drainage ditches			
Down-gradient2:	30 ft.	5 ft.	N/A
Up-gradient2:	10 ft.	N/A	N/A
Other site features that may allow effluent to surface			
Down-gradient2:	30 ft.	5 ft.	N/A
Up-gradient2:	10 ft.	N/A	N/A
Down-gradient cuts or banks with at least 5 ft. of original, undisturbed soil above a restrictive layer due to a structural or textural change	25 ft.	N/A	N/A
Down-gradient cuts or banks with less than 5 ft. of original, undisturbed soil above a restrictive layer due to a structural or textural change	50 ft.	N/A	N/A
Other adjacent soil dispersal components/subsurface storm water infiltration systems	10 ft.	N/A	N/A

1If surface water is used as a public drinking water supply, the designer shall locate the OSS outside of the required source water protection area.

2The item is down-gradient when liquid will flow toward it upon encountering a water table or a restrictive layer. The item is up-gradient when liquid will flow away from it upon encountering a water table or restrictive layer.

Appendix 2

Soil Type Description

Soil Type	Soil Textural Classifications
1	Gravelly and very gravelly coarse sands, all extremely gravelly soils except where soil types 5 and 6 make up the non-gravel component.
2	Coarse sands.
3	Medium sands, loamy coarse sands, loamy medium sands.
4	Fine sands, loamy fine sands, sandy loams, loams.
5	Very fine sands, loamy very fine sands; or silt loams, sandy clay loams, clay loams and silty clay loams with a moderate or strong structure (excluding platy structure).
6	Other silt loams, sandy clay loams, clay loams, silty clay loams.
7 Unsuitable for treatment or dispersal	Sandy clay, clay, silty clay, strongly cemented or firm soils, soil with a moderate or strong platy structure, any soil with a massive structure, any soil with appreciable amounts of expanding clays.

Soil and Vertical Separation Conditions that Allow Gravity Flow Drainfields

Vertical Separation in inches	**Soil Type**		
	1	**2**	**3-6**
12 < 18	Gravity Flow System Not Allowed	Gravity Flow System Not Allowed	Gravity Flow System Not Allowed
≥ 18 < 24	Gravity Flow System Not Allowed	Gravity Flow System Not Allowed	Gravity Flow System Not Allowed
≥ 24 < 36	Gravity Flow System Not Allowed	Gravity Flow System Not Allowed	Gravity Flow System Not Allowed
≥ 36 < 60	Gravity Flow System Not Allowed (without Soil Type 1 or 2 exemption)	Gravity Flow System Not Allowed (without Soil Type 1 or 2 exemption)	**Gravity Flow System Allowed**
≥ 60	Gravity Flow System Not Allowed (without Soil Type 1 or 2 exemption)	**Gravity Flow System Allowed**	**Gravity Flow System Allowed**

Appendix 3

Guide To Test Holes For On-Site Sewage Disposal

NORTHEAST TRI-COUNTY HEALTH DISTRICT

On-site sewage disposal systems must treat the waste water and then dispose of the treated water in a way that does not present a hazard to your health or pollute the environment. Improperly treated sewage can contaminate local wells; lakes and streams, or even damage an aquifer. There is a wide variety of terrain and soil types in the three county areas, each with their own unique characteristics. In order to determine the best type of sewage treatment and disposal system for your individual property, the soil must be evaluated to a depth of at least six feet.

1. **TEST HOLE SITING**. Test holes should be dug in the area where you want to construct your drainfield. This location should be away from rock outcroppings, proposed vehicular traffic such as driveways and parking areas, livestock areas, foundations, damp or poorly drained soil, excessive slopes, and at least 100 feet away from a well or surface water. You should also avoid areas you expect to irrigate such as a garden or orchard. Test holes should not be dug in filled areas.

2. NUMBER OF TEST HOLES REQUIRED. The number of test holes dug depends upon the site conditions. At least two test holes in the proposed drainfield area, approximately 100 feet apart, will be required. On sloping sites, the holes should be dug at the same elevation and a third test hole is recommended. Sites with complex terrain or soils may require more test holes.

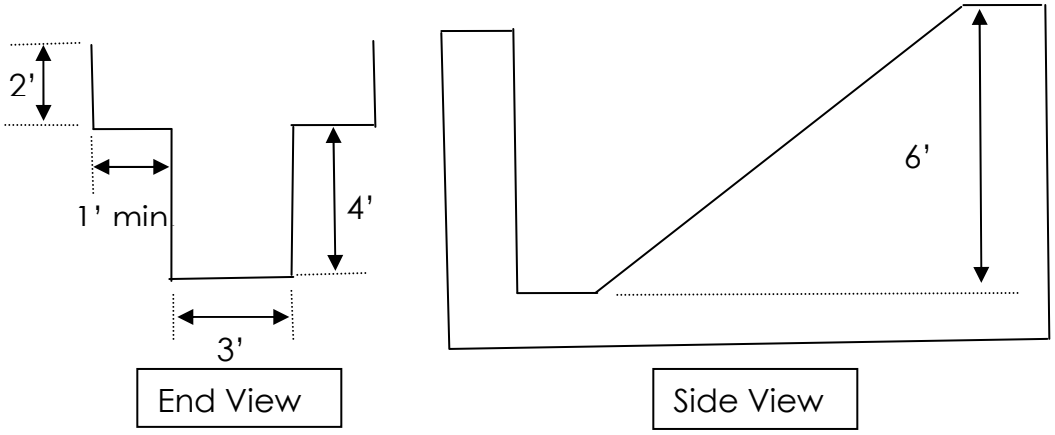
When a test hole is dug in extremely gravely soil, clay or you find water in the hole, wet soil, or you encounter bedrock, it is best to dig additional test holes to try to find more suitable soil. These test holes must be left open until the site review is completed by the Health District staff.

3. WHAT TO LOOK FOR WHEN DIGGING TEST HOLES. Desirable soils are those that provide both drainage and treatment of sewage effluent. Undesirable soils are those that are too porous to provide treatment (sands & gravel) and those that are too tight to allow drainage (silts & clays). Other undesirable characteristics would include shallow groundwater and bedrock. Even though soil conditions may not be desirable, sewage disposal systems can be installed, but the systems may require enhanced treatment and be more expensive.

Construction Of Test Holes. Test holes must be constructed in such a manner that they are safe to enter and deep enough to evaluate the soil to a depth of six feet. The initial excavation should be seven feet wide and two feet deep. An additional excavation should be dug in the center that is three feet wide and four feet deep. There should be an earthen ramp from the surface to the bottom of the hole that has a slope of thirty-three degrees or less for safe egress and exit. All spoils should be placed at least two feet from the edge of the test hole. For safety, the six-foot face of the hole should be dug with a slight angle. Health District staffs are prohibited from entering test holes not constructed to these specifications or that they consider unsafe.

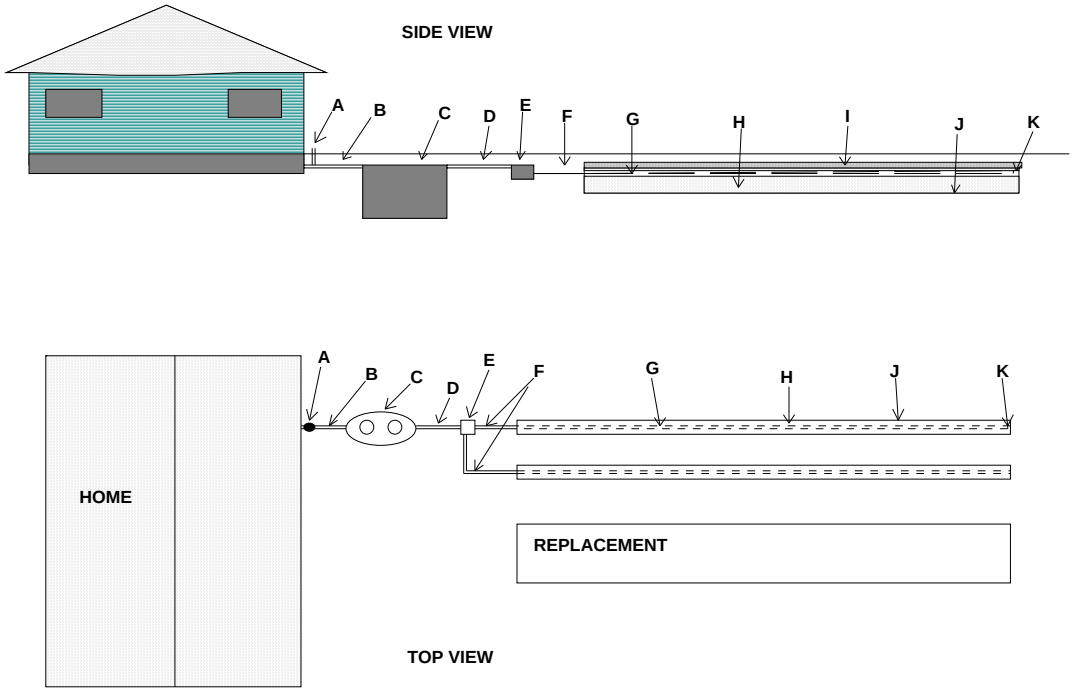
It is the property owner's responsibility to maintain the test holes in a safe manner to prevent physical injury. A warning barrier must be placed around each test hole. When the test holes are ready contact the Environmental Health office in your county at least forty-eight hours in advance. For Stevens County call 509 684-2262 or 1-800-776-6207; Ferry County. Call 509 775-3111 or 1-800-876-3319; in Pend Oreille County the number is 447-3131 or 1-800-873-6162.

Soil Log Illustration



APPENDIX 4

Typical House and gravity flow on-site sewage system



A. **Clean out**.
B. **Building sewer:** Carries all sewage to the septic tank.
C. **Septic tank:** Provides initial treatment of household sewage (retains solids).
D. **Tight Line** (No perforations): Carries septic tank effluent (liquid only) to the distribution box.
E. **Distribution box**: Equally distributes liquid effluent to each line of the drain field.
F. **Tight Line** (No perforations): Carries liquid to the beginning of each perforated drain pipe, thus providing a dry, solid base for the distribution box.
G. **Perforated Drain pipe**: Distributes liquid effluent throughout the drain field for final treatment and disposal.
H. **Gravel:** Surrounds perforated pipe to promote aerobic conditions for bacteria which play an important part in the treatment of the septic tank effluent.
I. **Soil Barrier:** Separates earth backfill from the gravel thus preventing the filling of the airspace between the gravel; geotextile fabric only.
J. **Drainfield Trench**: The excavated soil trench in which gravel and pipe are laid.
K. **End Cap:** To prevent uncontrolled flow of effluent out the end of the perforated drainfield pipe.