



Northeast Tri County Health District Environmental Health Division

What you Need to Know to Submit an On-Site Sewage System Design

This guidance document is intended to provide basic information to assist in the development of an on-site sewage system design. Primarily, it is intended to outline information necessary for the design of a gravity flow system serving a single-family residence. It may also assist in the development of a design for other types of systems requiring pumps and enhanced treatment.

Northeast Tri County Health District allows resident owners to design an on-site sewage system to serve their single-family residence. All other designs must be completed by a licensed designer or engineer. Health District staff can assist with general questions about design requirements; however, if resident owners have detailed design questions, it is advisable to contact an on-site sewage system designer or engineer licensed by the Washington State Department of Licensing. For a current list of licensed designers or engineers, contact the Washington State Department of Licensing at 1-360-664-1575 or <http://www.dol.wa.gov>.

For a resident owner design, if after two attempts the design does not meet the minimum submittal requirements, a licensed designer or engineer must submit further designs. A \$55 design revision fee will be assessed each time the design is not approved and requires re-submittal.

All regulations, standards & guidance, and checklists referenced are available from any Northeast Tri County Health District Environmental Health Office or at <http://www.netchd.org>.

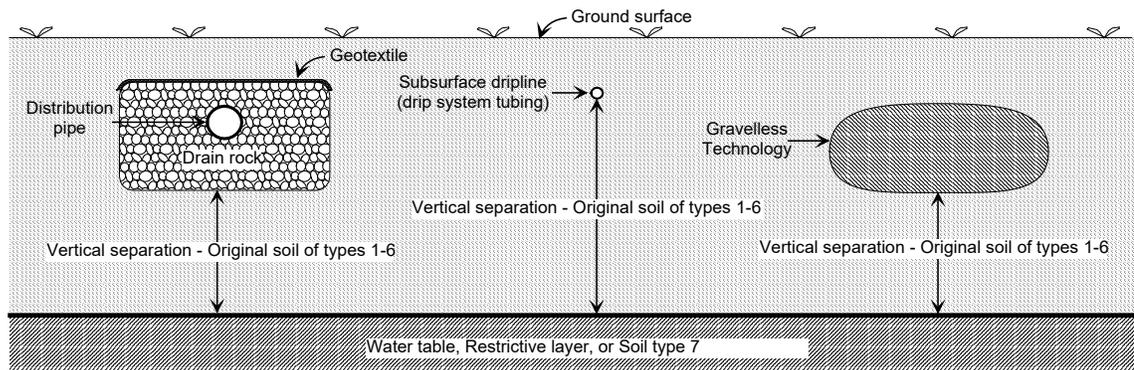
What you need to complete a design:

- *Site Review and Basic Design Criteria Form and Field Map* completed by Northeast Tri County Health District after a site review has been completed and mailed to the primary contact
- Northeast Tri County Health District's *Checklist for Minimum Design Submittal Information*
- Northeast Tri County Health District's *On-Site Sewage System Construction and Specification Sheet – Effective May 1, 2008*
- Northeast Tri County Health District's standards and guidance document developed for the type of system being designed
- Northeast Tri County Health District *Regulation 01-2007 On-Site Sewage Systems*
- For systems other than gravity, the Washington State Department of Health *List of Registered On-Site Treatment and Distribution Products*

Step 1- Determine System Type:

- Review the *Site Review and Basic Design Criteria Form* for soil test hole information in the area where the drainfield is to be placed. The design boundary shown on the test hole information indicates the amount of vertical separation to a restrictive soil, bedrock, or groundwater (or indications of groundwater). This vertical separation establishes the treatment level and soil loading rates. General principles in determining system type and size are:

- Coarse soils, with sands and gravel, don't treat wastewater very well. Therefore, they require enhanced treatment. For example, soils that are considered very gravelly coarse sand requires a type of system that treats the wastewater to a high degree prior to discharge into these very porous soils. Examples of these types of systems include sand filter, aerobic treatment units, or packed bed filters.
- The soils underneath the drainfield determine the system size. Coarse soils require less square footage than tighter soils, such as loams, silt, and clayish soils. The most restrictive soil in the vertical separation determines the size, based on how much the soil can absorb (known as the loading rate.) The vertical separation of concern in a gravity flow system is three feet. If, for example, the soil conditions changed in the three feet below the proposed bottom of drainfield trench, the size of the system would be based on the tightest soil in those three feet.
- In determining the type of system, the following information may be helpful:
 - Vertical separation means the separation between the bottom of the trench or bed and any underlying limiting layer, such as restrictive soils, bedrock, groundwater, or indications of groundwater (soil mottling.)



- The following chart provides a means to compare vertical separation to treatment levels (A, B, C, E), distribution methods (pressure with time dosing, pressure, gravity), and soil loading rates for new building sites:

Soil Type	Soil Type	Loading Rate (gal./sq. ft./day)	Vertical Separation 12" < 18"	Vertical Separation ≥18" < 24"	Vertical Separation ≥24" < 36"	Vertical Separation ≥36" < 60"	Vertical Separation ≥60"
1	Gravelly and very gravelly coarse sands, all extremely gravelly soils excluding Soil Types 5 and 6, all soil types with greater than or equal to 90% rock fragments	1.0	A Pressure Timed Dosing (No Disinfection)	B Pressure Timed Dosing (No Disinfection)	B Pressure Timed Dosing (No Disinfection)	B Pressure Timed Dosing (No Disinfection)	C Pressure (No Disinfection)
2	Coarse sands	1.0	B Pressure Timed Dosing	B Pressure Timed Dosing	C Pressure (No Disinfection)	E Pressure	E Gravity
3	Medium Sands, loamy coarse sands, loamy medium sands	0.8	B Pressure Timed Dosing	B Pressure Timed Dosing	E Pressure	E Gravity	E Gravity
4	Fine sands, loamy fine sands, sandy loams, loams	0.6	B Pressure Timed Dosing	B Pressure Timed Dosing	E Pressure	E Gravity	E Gravity
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)	0.4	B Pressure Timed Dosing	B Pressure Timed Dosing	E Pressure	E Gravity	E Gravity
6	Other silt loams, sandy clay loams, clay loams, silty clay loams.	0.2	B Pressure Timed Dosing	B Pressure Timed Dosing	E Pressure	E Gravity	E Gravity
7	Sandy clay, clay, silty clay, strongly cemented or firm soils, soil with moderate or strong platy structure, any soil with a massive structure and any soil with expanding clays	Not Suitable	Not Suitable	Not Suitable	Not Suitable	Not Suitable	Not Suitable

- For example, if the soil test hole results indicate that greater than 36” of vertical separation can be maintained to the design boundary, with soil types 3-6, a gravity system could be installed.

Step 2- Calculate the Design Flow

- Calculate the design flow based on the number of bedrooms in the home:
 - # of bedrooms x 120 gallons per day = design flow
 - The minimum design flow for any system is 240 gallons per day

Step 3- Calculate Septic Tank Size

- For a home serving 4 bedrooms or fewer, the minimum septic tank size is 1000 gallons.
- For homes with more than 4 bedrooms, add 250 gallons of capacity per bedroom.

Step 4- Calculate the Maximum Depth of the Drainfield Trench (or Bed if Soil Type 1, 2, or 3)

- Review the soil test hole results and design boundary identified. For gravity flow systems, subtract 36” from the design boundary to establish maximum trench depth. For pressure distribution, subtract 24” from the design boundary to establish maximum trench depth. For other types of systems, see chart listed above.
 - For example, if a restrictive clay layer is encountered at 60” below original grade, the design boundary is 60”. To install a gravity system, the maximum trench depth must not exceed 24”.

Step 5- Calculate the Absorption Area

- Review the soil test hole results. Calculate the absorption area needed by determining the application rate of finest textured soil within the vertical separation to be utilized.
- Divide the design flow (see Step 2) by the soil loading rate (see above chart for soil loading rates). This will provide the square feet of absorption area needed. To calculate trench length requirements, divide the square feet by the trench width (maximum width 3’.)
 - For example, if the site will support a gravity drainfield for a 3 bedroom home, and it is determine that the most restrictive soil loading rate below the planned installation depth is a sandy loam with a loading rate 0.6 gallons/square foot/day, the drainfield size is calculated by:

$$360 \text{ gallons per day} / 0.6 \text{ gallons/square foot/day} = 600 \text{ square feet}$$

Using 3-foot-wide trenches: $600 \text{ square feet} / 3 \text{ feet} = 200 \text{ linear feet}$ of 3-foot-wide trenches.

- Note that for gravity systems, a minimum of two trenches are required and no single trench can exceed 100’.
- Absorption beds are allowed in Soil Types 1, 2, and 3. The width of absorption beds cannot exceed ten feet. To calculate absorption bed dimensions, divide the square feet by the bed width (maximum width 10’.)
 - For example, if the drainfield is required to be 600 square feet and a 10’ wide bed will be utilized, bed size is calculated by:

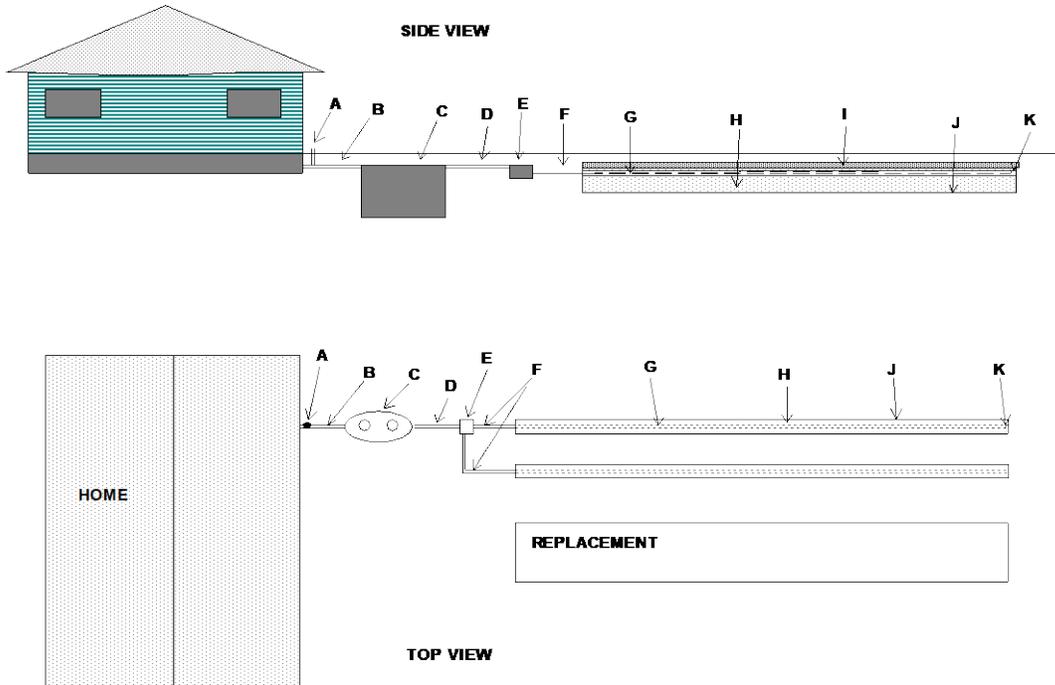
$$600 \text{ square feet} / 10\text{-foot-wide bed} = 10\text{-foot} \times 60\text{-foot absorption bed}$$

Step 6- Develop the Design

- By completing steps 1-5 above, the system type, size and maximum installation depth is established.
- Utilize the *Checklist for Minimum Design Submittal Information*, the appropriate Northeast Tri County Health District’s standards and guidance document developed for the type of system being designed, and the Northeast Tri County Health District’s *Standard Specifications for On-Site Sewage Systems*.
- Be sure to submit two complete designs. One copy of the approved design will be kept by Northeast Tri County Health District and the other copy will be sent to the primary contact along with the permit authorizing installation.

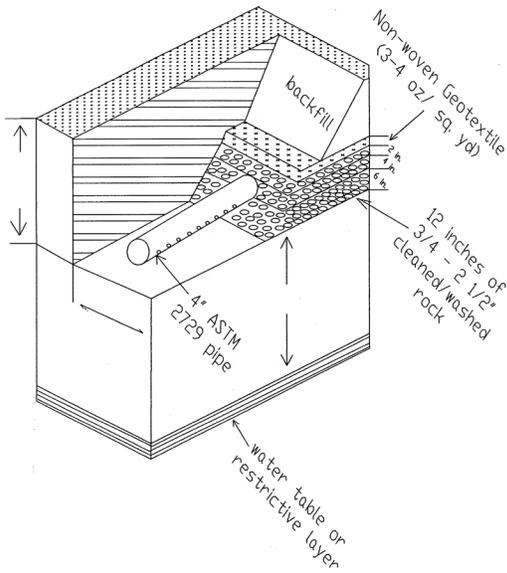
Attached is additional information that may be helpful in the completion of a design.

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. Used on sloped sites.
- F - Tight Line (No perforations): Carries liquid to the beginning of each perforated drainpipe, thus providing a dry, solid base for the distribution box.
- G - Perforated Drainpipe: 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; filter fabric only.
- J - Drain Field 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 drain field pipe.

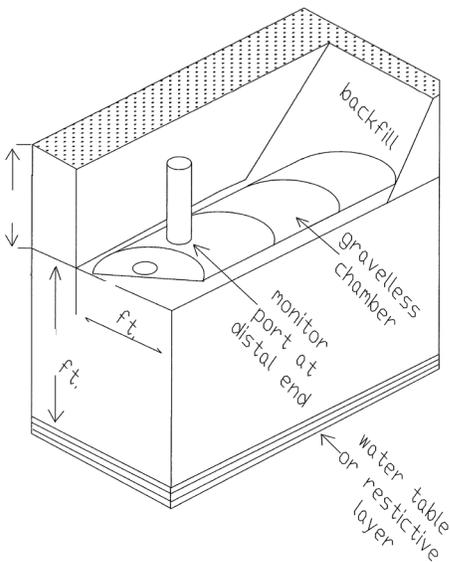
Example of gravity flow gravel drainfield trench cross section and calculations for size



Calculations for Drainfield Length

$$\frac{\text{Sq. feet needed}}{\text{Width of Trench}} = \frac{\text{Total length of Trench needed}}{\text{feet}}$$

Example of gravity flow gravelless chamber cross section and calculations for size



Calculations for Drainfield Length

$$\frac{\text{Sq. feet needed}}{\text{Width of Trench}} = \frac{\text{Total length of trench needed}}{\text{feet}}$$

If using reduction:

$$\frac{\text{Total length of trench needed}}{\text{feet}} \times \frac{\% \text{ reduction}}{100} = \frac{\text{Drainfield reduction}}{\text{feet}}$$

$$\frac{\text{Total length of trench needed}}{\text{feet}} - \frac{\text{Drainfield reduction}}{\text{feet}} = \frac{\text{Reduced length of trench needed}}{\text{feet}}$$

Reductions Allowed by Soil Type

- Soil Type 1: No Reduction Allowed
- Soil Type 2: Up to 20% Reduction Allowed
- Soil Type 3: Up to 25 % Reduction Allowed
- Soil Type 4: Up to 25% Reduction Allowed
- Soil Type 5: Up to 15% Reduction Allowed
- Soil Type 6: No Reduction Allowed

If a reduced size drainfield is being designed, ensure that the full size of the initial and replacement drainfield is shown. This is done to allow expansion to a full-size system if necessary, in the future.

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 non-perforated 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 mark ¹	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-gradient ² :	30 ft.	5 ft.	N/A
Up-gradient ² :	10 ft.	N/A	N/A
Other site features that may allow effluent to surface			
Down-gradient ² :	30 ft.	5 ft.	N/A
Up-gradient ² :	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.

Stevens County	Pend Oreille County	Ferry County
240 E. Dominion Colville, WA 99114 Phone: (509)684-2262 Option 2 Fax: (509)684-8506	605 Highway 20 Newport, WA 99156 Phone: (509)447-3131 Fax: (509)447-5644	PO Box 584/ 147 N. Clark, Ste 1 Republic, WA 99166 Phone: (509)775-3111 Fax: (509)775-2858
Website: www.netchd.org		Email : EHMAIL@NETCHD.ORG

Northeast Tri County Health District –Minimum Design Submittal Information

Use this checklist to ensure that all items are completed prior to design submittal, otherwise the design will be returned for corrections. For systems other than gravity flow, see the applicable standard and guidance document for additional submittal requirement

<p>General Information</p> <ul style="list-style-type: none"> <input type="checkbox"/> Name/address of property owner <input type="checkbox"/> Name/address of applicant <input type="checkbox"/> Property legal description <input type="checkbox"/> Parcel number <input type="checkbox"/> Parcel size <p>General System Information</p> <ul style="list-style-type: none"> <input type="checkbox"/> Type of system (new, repair, replacement, expansion, alteration) <input type="checkbox"/> Source(s) of sewage (residence, shop, RV connection, etc.) <input type="checkbox"/> Design flow/number of bedrooms <input type="checkbox"/> Soil type and application rate <p>Water Supply Information</p> <ul style="list-style-type: none"> <input type="checkbox"/> Drinking water source (private well, two-connection well, public system) <input type="checkbox"/> If public system, name of water system <p>Piping Information</p> <ul style="list-style-type: none"> <input type="checkbox"/> Specific type of pipe used <input type="checkbox"/> Diameter <p>Septic Tank Information</p> <ul style="list-style-type: none"> <input type="checkbox"/> Capacity <input type="checkbox"/> Specification sheet from manufacturer <input type="checkbox"/> Riser (if used) specifications <input type="checkbox"/> Effluent filter (if used) specifications <p>D-Box Information (if used)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Schematic drawing <input type="checkbox"/> Specification sheet for riser to surface <input type="checkbox"/> Leveling devices <input type="checkbox"/> Concrete pad dimensions <p>Drainfield Information</p> <ul style="list-style-type: none"> <input type="checkbox"/> Overall length <input type="checkbox"/> Drainrock specification <input type="checkbox"/> Filter fabric specification <input type="checkbox"/> If gravelless type used, specification sheet 	<p>Detailed and Dimensional Site Plan (draw to scale or show distances)</p> <ul style="list-style-type: none"> <input type="checkbox"/> North arrow <input type="checkbox"/> Property lines and dimensions <input type="checkbox"/> General topography showing site drainage characteristics <input type="checkbox"/> Buildings (existing and proposed) <input type="checkbox"/> Roads/driveways/parking <input type="checkbox"/> Easements (road, utility, etc.) <input type="checkbox"/> Any filled or excavated areas <input type="checkbox"/> Any cutbanks greater than 5' located down-gradient of drainfield <input type="checkbox"/> Surface water, including seasonal streams, wetlands, creeks, and irrigation ditches <input type="checkbox"/> Drinking water (existing or proposed) sources located on property or within 100' of property <input type="checkbox"/> Water line locations (existing or proposed) including irrigation lines <input type="checkbox"/> Location of septic tank <input type="checkbox"/> Location of d-box <input type="checkbox"/> Location of existing/proposed drainfield and replacement area <input type="checkbox"/> Location and identification of soil test holes <input type="checkbox"/> Elevations (assume 100' at house location) <ul style="list-style-type: none"> <input type="checkbox"/> House <input type="checkbox"/> Septic tank lids <input type="checkbox"/> Drainfield-show surface elevations at beginning and end of each lateral <input type="checkbox"/> If a reduced size drainfield is installed using gravelless chambers, show 100% of required area for both initial and replacement drainfield area 	<p>System Layout</p> <ul style="list-style-type: none"> <input type="checkbox"/> Length, slope, angles of building sewer line (between house and septic tank) <input type="checkbox"/> Cleanouts, if used <input type="checkbox"/> Septic tank location <input type="checkbox"/> Marker showing tank location, if access below finished grade (6" max.) <input type="checkbox"/> Length, slope, angles of tightline <input type="checkbox"/> Lines encased under driveways/roads (if applicable) <input type="checkbox"/> Location of d-box, if used <input type="checkbox"/> Water/sewer line crossing detail <input type="checkbox"/> Initial and replacement drainfield trench/bed dimensions <input type="checkbox"/> Critical distances within drainfield layout <input type="checkbox"/> Indication of trench/bed levelness <input type="checkbox"/> Observation ports, if used <p>Cross Section</p> <ul style="list-style-type: none"> <input type="checkbox"/> Septic tank drawing showing depth of cover and risers to surface, if used <input type="checkbox"/> D-box schematic drawing, showing riser to surface <input type="checkbox"/> Drainfield trench/bed <ul style="list-style-type: none"> <input type="checkbox"/> Shallowest and deepest portions <input type="checkbox"/> Depth of cover <input type="checkbox"/> Depth of gravel below and above distribution piping <input type="checkbox"/> Vertical separation to groundwater or restrictive layer <input type="checkbox"/> Observation ports, if used <p>Designer Certification</p> <ul style="list-style-type: none"> <input type="checkbox"/> Name, signature, date <input type="checkbox"/> Certification statement: <i>"I certify that this design meets all rules and regulations of Washington State Department of Health and Northeast Tri County Health District."</i>
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