System Design

Klamath County requires a licensed Department of Environmental Quality (DEQ) installer with experience installing sand filters submit the design, the hydraulic calculations, and complete the installation. Retailers that sell sand filter components can also help with design and hydraulic calculations.

1. Identify the sand filter dimensions to meet the required surface area. The minimum required sand filter size for each installation is indicated in the site-specific installation permit.

2. Lay out the laterals orifices no more than thirty (30) inches apart (one orifice per 6 square feet). Each lateral should be no more than fifteen (25) inches from the edge of the container.

3. Determine the correct pump size to allow for a minimum five (5) foot squirt height from the distal orifice in each lateral with no more than 10% height variation throughout the system.

Overview

Bottomless sand filters are used in place of a drainfield when at least one of the following conditions exists:

- The approval area is too limited to fit adequate drainfield trench lengths;
- There is not enough separation from ground water;
- The soil is too rapidly draining for soil treatment to take place

Like a traditional drainfield, bottomless sand filters remove pollutants in the wastewater through biological, physical, and chemical means, although biological activity is the primary treatment process in a sand filter. Sand filters produce high quality effluent, significantly reduce fecal coliform bacteria, remove organics, and nitrify ammonia. Septic tank effluent is pumped to the top of the sand filter bed into distribution laterals, which releases the effluent through orifices in the pipe. As the effluent trickles through the sand, bacteria digest the waste before the fluid infiltrates the soil below the sand filter.
Total Dynamic Head and Design Flow Rate

Use the equations below to determine the required hydraulic calculations for level sites where all lateral piping is the same elevation. Sloping and complicated sites may require a consultant's calculations to verify uniform distribution throughout the system.

1. HOW TO CALCULATE THE DESIGN FLOW RATE

\[(N) \times (R) = \text{__________ gpm (design flow rate)}\]

- **(N)** Number of orifices: Total number of (1/8) inch holes = __________
- **(R)** Discharge rate: Discharge rate per (1/8) inch hole = ____0.43____ gpm

2. HOW TO CALCULATE THE TOTAL DYNAMIC HEAD (TDH)

\[(A) + (B) + (C) + (D) + (E) = \text{__________ feet (TDH)}\]

- **(A)** Static Head: The elevation difference from the low water level in the tank (pump off) to the laterals = __________ feet
- **(B)** Friction Head: Length of transport pipe multiplied by friction loss (refer to manufacturer's tables) = __________ feet
- **(C)** Discharge Assembly: Refer to hose and valve assembly tables = __________ feet
- **(D)** System Allowance: Includes distribution piping losses and a residual head discharge at the distribution laterals of 5 feet. Generally, 10 feet is acceptable for this factor. = ________10_____ feet
- **(E)** Other: = __________ feet

Installation

1. Build the sand filter container using (2 x 4) foot enforced (3/4) inch plywood or oriented strand board, supported by an earthen berm, or a reinforced watertight concrete box. The minimum required contained surface area depends on the identified use of the property and whether the sand filter is preceded by an ATT unit or a septic tank. The minimum required surface area is indicated in the installation permit.
2. Install the transport line to the sand filter deep enough to be freeze protected.
3. Apply a minimum six (6) inches of clean underdrain media (e.g., "DEQ pea gravel"). Inspect**

  required after this step.
4. Install a minimum twenty-four (24) inches approved, clean, damp sand media. Inspect**

  required after this step.
Pump Setting Tips
For most 1500 gallon tanks with flow-through between compartments:
1" drawdown in pump basket = 35 gallons
For most 1500 gallon tanks with a compartment separation baffle & sanitary tee:
1" drawdown in pump basket = 10 gallons
Don't forget to set the bottom float to account for volume of effluent in transport piping (system design dependent)

Installation Continued

5. Apply a minimum of three (3) inches of clean drain rock or pea gravel on top of sand.

6. Install the pressure distribution laterals level with distribution orifices oriented downward and equipped with removable slotted-faced shields. One orifice at the end of each lateral should be oriented upward. Orifices may be drilled with a (1/8) inch burr-less bit. The distal end of each lateral should have a clean-out riser consisting of an approved long radium elbow riser or (2) 45 degree elbows.

7. Mount a sand filter monitoring port above the sand media with a cap at finished grade.

8. Install pump in approved dosing tank. Adjust the alarm float (top float) so that the bracket center is two (2) inches below the invert of the tank’s outlet. The center bracket of the on float (middle float) should be set two (2) inches below the center bracket of the alarm float and the off float (bottom float) should be set so that no more than 100% of the permitted daily flow is pumped to the sand filter per dose.

9. Mount the control box at least three (3) feet above the ground and within fifty (50) feet of structures to be served. The control box should be visible from the structures being served. Inspection required after this step.

10. Evenly cover the tops of all laterals and shields with clean underdrain media.

11. Completely cover the media with approved filter fabric. Inspection required after this step.

12. Backfill the sand filter container with fourteen (14) inches of unsettled fill [10 inches settled] over the center of the container and ten (10) inches of unsettled fill [6 inches settled] over the side walls. A 3-to-1 slope is required from the top of the container sides to the ground surface. Backfill should be firm but not compacted. Inspection required after this step.

13. Plant a shallow rooted vegetable cover (e.g., grasses or wildflowers {not trees!}) over the top of the sand filter container.
Operation and Maintenance Requirements

Prior to the issuance of a pressure distribution installation permit, a copy of a maintenance agreement (contract) between the property owner and a DEQ certified maintenance provider is required to be submitted to the Klamath County Onsite Division.

For all pressure distribution systems permitted on or after January 1st, 2014, it is the responsibility of the pressure distribution system owner to maintain an ongoing contract with a maintenance provider for the life of the system [OAR 340-071-0290 (7)].

The maintenance provider is responsible for providing the following information to the Klamath County Onsite Division on the property owner’s behalf:

- An annual report that demonstrates the system has been properly maintained during the reporting year and is operating in accordance with the agent approved design specifications, or the owner has applied for a repair permit under OAR-340-071-0215;

- Payment of an annual report evaluation fee.

For more information about operation and maintenance of sand filter systems, check out the DEQ Sand Filter and Pressure Distribution Maintenance Fact Sheet, available online at: https://www.oregon.gov/deq/Residential/Pages/Onsite-Resources.aspx

Inspections

During the installation process, several inspections are required, as well as a final inspection. Please contact Klamath County Onsite Division to schedule these inspections. Call (541) 883-5121, Option #6 or visit our offices at 305 Main Street (Government Center) to schedule.

For your final inspection, please complete the Final Inspection Request Form (available online) and submit to the Klamath County Onsite Department in person or via mail or fax at 305 Main Street, Klamath Falls, Oregon 97601. You must include the materials list, the as built drawing, watertype test levels, and trench depths. Your inspector will arrive within seven (7) business days for the final inspection (upon receipt of the completed final inspection form).

Please ensure your inspector has access to the property; this includes securing livestock and dogs and making gates accessible.

Upon completed inspections, your inspector will contact you with the results. If you have any questions, you may contact our offices at (541) 883-5121, Option #6, Monday through Friday, 8 a.m. to 5 p.m.

This installation guide is designed to explain the basic workings of a sand filter system and the basic layout. For construction and material standards for all septic system types, refer to Oregon Administrative Rules (OAR) 340, Division 71 and 73, available online at: https://www.oregon.gov/deq/Residential/Pages/Onsite-Rules.aspx