

Fact Sheet

On-Site Sewage Denitrification Verification Project: Recirculating Gravel Filter with Vegetated Woodchip Bed System



Background

Nitrogen removal from wastewater happens in a two step process.

1. Oxygen loving bacteria convert ammonia to nitrite. Other bacteria then convert nitrite to nitrate. This process is called “nitrification” and the effluent becomes “nitrified”.
2. Under oxygen-free conditions, another type of bacteria converts nitrate to nitrogen gas. This process is called denitrification. Denitrification can only occur in an oxygen-free environment. (Note: The bacteria in these conditions do not need oxygen to survive, but do require a carbon source as food to live.)

After denitrification occurs, nitrogen gas is released into the air. Nitrogen gas makes up most (78%) of the air we breathe, so its release does not cause an environmental concern.

RGFW System

The recirculating gravel filter with the vegetated woodchip bed system (RGFW) is a two-stage system. It is designed for nitrification to take place in the oxygen rich gravel filter bed and denitrification to take place in the oxygen-free woodchip bed.

There are three distinct zones in the recirculating gravel filter system. Effluent is continually circulated through the first two zones. With each cycle, a portion of the nitrified effluent is released to the third zone where denitrification occurs.

A diagram of the system and description of the process are on the back.



Photos of the RGFW

Sponsors



To learn more about the project go to
www.doh.wa.gov/CommunityandEnvironment/Shellfish/EPAGrants/Denitrification.aspx

Or contact:

Wastewater Management Section, Office of Shellfish and Water Protection
Phone: 360.236.3330 Email: wastewatertmgmt@doh.wa.gov

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Zone 1 (beginning circuit): The septic tank effluent flows into the recirculating tank. As the effluent level rises inside the tank, a float activates a timer that controls a pump. The pump sends timed, multiple doses of effluent (72 doses/day) to the recirculating gravel filter (RGF) in Zone 2.

Zone 2: Wastewater from the recirculating tank is distributed to the RGF, flowing down through the gravel. Bacteria in this zone convert ammonia to nitrate. The nitrified effluent then passes through a slotted pipe at the bottom and flows back toward the recirculating tank (Zone 1). About 80% is returned to the recirculating tank; the rest goes directly to Zone 3.

Zone 1 (repeated circuits): The nitrified effluent mixes with the septic tank effluent. Organic matter from the septic tank effluent provides a carbon source for the bacteria in this zone, and some denitrification occurs here. The mixture is pumped back to the RGF to repeat the process.

Zone 3: The nitrified effluent from the RGF (about 20% of the mixture) enters the vegetated woodchip bed. The woodchips are always submerged, creating an anoxic zone, and provide additional carbon needed by bacteria to convert nitrates to nitrogen gas. Denitrification occurs as it flows horizontally through the woodchip bed. Cattails planted in this zone also provide some nitrate removal and play an important role in cycling additional carbon through the woodchip bed. A slotted pipe at the far end of the bed transfers denitrified effluent through a water level control basin to the drainfield.

Recirculating Gravel Filter with Vegetated Woodchip Bed

