

# Fact Sheet

## On-Site Sewage Denitrification Verification Project: Enhanced Recirculating Gravel Filter 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.

### ERGF System

The enhanced recirculating gravel filter (ERGF) system is designed for nitrification to take place in the oxygen rich top layer, and denitrification to take place in the oxygen-free bottom layer.

There are three distinct zones in the enhanced recirculating gravel filter system. Effluent is continually circulated through these zones. Denitrification occurs after a full circuit is completed and the effluent flows a second time through the first zone of the system.

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



Photos of the ERGF

### Sponsors



To learn more about the project go to  
[www.doh.wa.gov/CommunityandEnvironment/Shellfish/EPAGrants/Denitrification.aspx](http://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](mailto:wastewatertmgmt@doh.wa.gov)

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**Zone 1 (beginning circuit):** The septic tank effluent comes in through a mixing chamber at the bottom of the filter system, and enters the gravel layer in this anoxic (oxygen-free) zone. Bacteria consume and oxidize organics in the effluent, and the effluent travels upward to a slotted pipe leading to the recirculating basin.

**Zone 2:** The treated effluent from Zone 1 enters the recirculating basin. As the effluent level rises, a float activates a timer that controls a pump. The pump sends timed, multiple doses of effluent (96 doses/day) to the filter bed in Zone 3.

**Zone 3:** In this oxygen-rich zone, wastewater from the recirculating basin is distributed into the oyster shell. The oyster shell contains a high amount of calcium carbonate, providing an alkalinity source the bacteria in Zone 3 need to thrive. The effluent continues through the fine gravel layer where the bacteria convert ammonia to nitrate. The nitrified effluent then passes through a slotted pipe that returns it to the mixing chamber.

**Zone 1 (repeated circuits):** In the mixing chamber the septic tank effluent, containing the carbon required for bacteria in this level to thrive, mixes with the nitrified effluent. The mixed effluent enters the anoxic gravel layer. Bacteria in this oxygen-free environment convert nitrates to nitrogen gas.

**Zone 2 (repeated circuits):** The effluent flows back into the recirculating basin to repeat the process. When the recirculating tank fills to a certain level, the denitrified effluent is discharged to the drainfield.

### Enhanced Recirculating Gravel Filter

