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Membrane Solution

Bioreactor technology enables a couple to build a system for a dream home in an environmentally sensitive area of western Idaho

By Scottie Dayton | System Profile | February 2012

A couple wanted to build their five-bedroom dream home on the Payette River in Emmett, Idaho. The Gem County Health Department mandated pretreatment due to high groundwater and nitrogen limitations, and provided a short list of approved products.

The couple contacted Ryan Spiers of Alternative Wastewater Systems in Caldwell. "I had recently installed the first BioBarrier membrane bioreactor from Bio-Microbics and knew it would work well at this site," he says. The agency agreed. The unit is certified NSF/ANSI 40 Class 1, NSF/ANSI Standard 245 (nitrogen reduction), and NSF/ANSI Standard 350 Class R (water reuse).

Site conditions

Soils are loamy sand with the water table 36 inches below grade. The house, on a 5-acre lot, is 200 feet from the Payette River, a major tributary of the Snake River.

System components

Spiers designed the system to handle 500 gpd. Major components are:

1,500-gallon single-compartment concrete septic tank with Sanitee-418 4-inch effluent filter from Bio-Microbics. Tanks made by Valley Precast in Caldwell.

1,500-gallon, two-compartment concrete treatment tank with 1/3 hp Goulds Water Technology effluent pump in the first chamber and BioBarrier 0.5 bioreactor in the second
720-square-foot drainfield with two 6-foot trenches
Control panel from Bio-Microbics

System operation

Wastewater from the house and a bathroom in the garage drains by gravity through 4-inch PVC Schedule 40 line to a wye, then to the septic tank. Effluent passes through the angled slots in the sides of the effluent filter and then to the treatment tank.

"It's important that the compartments share the same water level for efficient circulation, so I core drilled a few holes in the middle of the center partition," says Spiers.

The effluent pump in the 750-gallon anoxic chamber runs 30 minutes on and 30 minutes off to keep solids in suspension. The bioreactor in the 750-gallon aerobic compartment attaches to an aeration grid with a 2-inch blower line. Aeration scours the membranes and facilitates the breakdown of nitrogen.

The bioreactor's flat-sheet membranes in a double-plate configuration provide high surface treatment while acting as a physical barrier for most wastewater pollutants. An on-demand transfer pump draws 250 to 300 gallons per dose through the pores to the space between the films and into the 4-inch gravity

discharge line. Retention time in the treatment tank is 12 hours for 500 gpd. The system requires no backwash.

A tee in the discharge line splits the flow to two 60-foot laterals in the drainfield 25 feet away. The 4-inch laterals have 1/2-inch predrilled holes every six inches.

"The advantage of membranes is that the direct discharge permeate numbers remain identical no matter the installation," says Spiers. "Samples average less than 2 mg/l BOD and TSS, less than 1 mg/l ammonia, less than 5 mg/l total nitrogen, and less than 10 E. coli colonies per 100 ml. Phosphorus is less than 0.1 mg/l."

Installation

Darren Spiers and Trevor McCallahan of Spiers Construction in Caldwell installed the sewer lines, tanks and drainfield. "The homeowner imported 2,000 yards of gravel for a 4-foot-high pad that elevated the house above the floodplain," says Ryan Spiers. "We located the system 15 feet behind the home – the side facing the street – in an area that shouldn't flood."

Darren Spiers used a Case 225 tracked excavator to dig 5-foot-deep holes that then filled with 12 inches of groundwater, causing the walls to become unstable. He moved the machine 10 feet from the excavations to set the tanks, filling them with enough water to prevent flotation. They protruded 18 inches aboveground, enabling Spiers to later mound them with soil and smooth it into the home's gravel pad.

Ryan Spiers reduced the 2-inch discharge on the effluent pump to 3/4-inch to lower amperage. "If 1/3 hp pumps run without head, they draw 15 amps," he says. "Necking them down drops the amperage to 10 or 11." A separate dosing tank was unnecessary because the bioreactor pump handles elevation requirements up to five feet. Spiers ran the discharge line up through the 30-inch plastic riser, then installed a union two feet down from the lid and plumbed the discharge line to the drainfield.

Spiers pumped out the ballast water in the treatment tank, drilled holes for the piping, and meticulously vacuumed the tank to remove concrete chips and plastic shavings. To prevent debris and rocks from falling on the sensitive membranes, Spiers plumbed the 60-pound unit, then he removed it to a safe location until the system was ready to activate.

"At startup, I installed the BioBarrier, filled the two compartments with water, and seeded them with activated sludge from a wastewater treatment plant," he says.

Spiers Construction used the excavator to remove 24 inches of soil for the drainfield, then placed 18 inches of ASTM sand followed by six inches of washed drain rock using a Caterpillar 297 tracked skid-steer. Workers ran the laterals, covered them with six inches of rock, protected the drainfield with geotextile filter fabric, and backfilled with 12 inches of sculpted native soil.

Maintenance

Alternative Wastewater Systems maintains the system. Spiers draws permeate samples annually and reports results to the state. Because the membranes keep microbes and solids in the tank, pumpouts are annual or every other year.
