Surf, Sand, and Cesspool

An innovative alternative system based on an absorbent trickle filter resolves site constraints in America's oldest fishing port

By Scottie Dayton

A home with a spectacular view of the Atlantic Ocean meeting rocky shores lost some of its charm for Jim and Marcia Noga after their cesspool failed and septage broke out above ground in fall 1997.

Their single family, two-bedroom home on a 4,100-square-foot lot in Gloucester, Mass, faced the sea. At one time, the house and cesspool were on the same property, but years ago the land was subdivided and the cesspool became part of the neighbor's lot to the south.

Noga, who researched wastewater treatment options on the Internet, learned that traditional septic systems were too large for his plot. This meant he would need an innovative alternative system, in which a component inserted after the septic tank treats the wastewater. Of the available technologies, he chose a trickling filter, then contacted design firm D.F. Clark in nearby Ipswich to discuss the installation. "He met with us a couple of times before making up his mind," says president Dave Clark.

Gloucester is under State Consent Decree to reduce non-point pollution to its coastal banks. When D.F. Clark's designer engineer, Charles Johnson, visited Nogas' property, he found that it was less than 50-feet from the ocean. He also found that the property couldn't meet four Gloucester Board of Health and seven Massachusetts Department of Environmental Protection regulations due to site constraints.

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Dave Clark

However, Nogas received variances from all 11 regulations when authorities approved Johnson's onsite treatment system design. It reduced organic loading of wastewater to a level that wouldn't contaminate coastal waters.

Site conditions

Gloucester sits on a spit with the Atlantic Ocean on its eastern shore and Massachusetts Bay on the west. Seasonal high ground water is 12-inches below grade and coincides with a granite ledge 48-inches below the sandy loam Class 1 soils. The percolation rate is five minutes per inch. A 20-foot-wide street separates Nogas' property from the high-water mark.

A septic hauler pumps out the original cesspool for the property in Gloucester, Mass. The cesspool was located on the neighbor's property. Photographs by Marcia Noga.

System operations

Wastewater gravity flows from the house through 4-inch PVC pipe into a two-chamber concrete septic tank. After the solids settle out in the 1,500-gallon compartment, the effluent gravity feeds into the 500-gallon second chamber. A 1/2-hp high-head turbine pump inside a screened vault then pumps the effluent into a 1,500-gallon concrete chamber containing a Waterloo Biofilter from Clear Water Industries of Ipswich, Mass.

The filter's medium consists of open-celled foam cubes compacted into two 4 1/2-foot high by 4-foot diameter baskets. A 3/8-inch threaded helical spray nozzle above each one disperses the effluent in an umbrella-shaped pattern. "They work just like an overhead sprinkler system," explains Clark.

An Orenco control panel from Orenco Systems Inc. of Sutherlin, Ore., time-doses the medium. During the 40 seconds the 1/2-hp turbine pump runs, each basket receives 6 gallons of effluent. Then the system rests for 30 minutes. Johnson designed it to handle 220 gallons per day (gpd) to accommodate two adults and a young child.

Aerobic bacteria grow on the outside and inside of the foam. "Each time the baskets are dosed," says Clark, "a drop of effluent seeping into one cube forces another drop down to the next cube. By the time a drop travels 4-1/2-feet to the bottom of the basket, bacteria have consumed almost all the organic components." A 5-inch fan constantly circulates air through the foam to ensure aerobic conditions.

When the water level reaches 9-inches, floats trigger a 1/3-hp Grundfos effluent pump sitting on the base of the chamber.

SYSTEM profile

Location:
Gloucester, Mass.

Facility served:
Single family, two-bedroom home

Designer:
Charles Johnson, D.F. Clark, Ipswich, Mass.

Installer:
D.F. Clark, Ipswich, Mass.

Site conditions:
Sandy loam over granite with seasonal high ground water table

Type of system:
Absorbent trickling filter discharging to pressure distribution disposal bed

Hydraulic capacity:
220 gpd

Cost:
$38,000

D.F. Clark employee Travis Good connects pipes for the pressure distribution field.

The Waterloo Biofilter removes 90 to 97 percent of BOD and TSS; 95 to 99 percent of fecal coliform, and 50 to 60 percent of total nitrogen.

Jim Stevens of E.F. Shea Concrete Products prepares to vacuum-test the septic tank.

A tee in the pump recirculates half the effluent to the septic tank's incoming line and half to the 14-foot-wide by 22-foot-long pressure distribution field. Should any part of the system fail, buzzer and visual alarms go off on the control panel, mounted on the outside of the house.

For innovative alternative technologies, the state's maximum effluent concentrations are 30 mg/l for biochemical oxygen demand (BOD) and total suspended solids (TSS). Over six years, secondary effluent from this system has averaged 15.4 mg/l BOD and 12.2 mg/l TSS.

Installation

Due to site constraints and the cesspool's location, installation was impossible without the approved variances. It also was impossible to install the system without encroaching on the neighbor's property. Permission was obtained to use the neighbor's gravel driveway and cross his lawn.

Clark's crew immediately pumped out and filled in the cesspool, then excavated holes for the septic and filter tanks on the south side of Nogas' home. Digging as far back on the lot as possible left them two feet short of the Board of Health's minimum 100-foot setback between wetland and septic tank.

State regulations require septic tanks to be set back 10 feet from the foundation and property line. Approved variances allowed Clark's crew to install the septic tank and filter chamber on a three-foot setback from the house. Property line setbacks were three and five feet. Two-inch PVC pipe connected the tanks to each other and to the disposal field 40 feet away.

State regulations require pressure distribution fields to be at least three feet above seasonal high ground water. This presented another problem, because the ground water was only 12 inches below grade. After excavating the subsoil in Nogas' front yard, Clark's crew erected forms five feet from the edge of the disposal field, then poured 3-1/2-foot high concrete retaining walls. The fourth wall abutted the front of the house. Into this box went three feet of sand for the disposal field's base topped by six inches of crushed gravel. The bottom of the concrete structure is open.

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Before leaving, his men repaired and landscaped the neighbor's lawn, laid a new stone base for the driveway, and graded the gravel.

Maintenance

The system has been trouble-free. During its first year, the Board of Health required D.F. Clark, the maintenance provider, to conduct four inspections that included sampling. After the system met the 30 mg/l BOD and TSS maximums, Clark petitioned the state and received permission to sample once a year. Quarterly inspections include making sure that the pumps are running, the spray nozzles aren't clogged, and the floats are functioning properly. ■