Better Soil Treatment

Effective and long-lasting soil absorption systems depend not just on drainfield material but on effluent quality

By Scottie Dayton

Every installer knows that a well designed soil treatment system is critical to onsite system life and performance. Today, onsite professionals have a wide range of drainfield design options.

These include a broad selection of drainfield media, and a host of advanced treatment alternatives that improve the quality of septic tank effluent before discharge. Choosing the right system design is a matter of deciding what combination of effluent quality and drainfield size, configuration and media will best meet the needs of the site.

Manufacturers offer a variety of products that affect drainfield design. They also have opinions about the interplay of system designs and technologies, and the vagaries of state, county and local regulations.

Regulatory issues

Theo Terry, manager of technology for **Ring Industrial Group,** believes that the rules under which designers and installers must work often fail to maximize efficiency. He observes that while manufacturers often can see how to make improvements, regulatory and legal hurdles prevent or delay their implementation.

EZflow drainage systems from Ring Industrial Group

"We can get past this problem only by repeating the facts until their validity overcomes the myths and misconceptions of the past," Terry says. "State and national organizations play a big role in achieving that goal because they provide a forum where people can present their research and add to the knowledge base."

Ring Industrial manufactures **EZflow** single-bundle drainage systems, consisting of pipe surrounded by lightweight geosynthetic aggregate. The material is designed to provide an optimum balance of infiltrative surface area, oxygen transfer and storage.

Terry observes that getting codes modified to allow new materials can be a long, frustrating process. The first criterion when sizing and designing drainfields is to maximize the infiltrative area, Terry says. Science and common sense often collide in the regulation of secondary factors — surge volume and oxygen transfer, he observes.

Where surge volume is concerned, codes are still based on typical rock and trench drainfield system specifications and do not take into account how much water that represents. "Georgia considers rock-and-pipe drainfield to have a 35 percent void area," says Terry. "Based on the state's standard 300-foot-long by 3-foot-deep by 1-foot-wide trench, that's 2,200-gallons of wastewater for a three-bedroom home. Even with safety factors built in, if the house generates only 450 gallons per day, why design a system that stores six or seven days of it?"

Storing that much wastewater produces a problem on the other end, too: If the water can't infiltrate the soil, a trench, no matter how big, will fill up. "Science says the surge control required is two or maybe three days at most," says Terry. "Anything beyond that is overkill."

Terry notes that scientists researching oxygen transfer are leaning toward long, narrow trenches that minimize the distance oxygen must travel to facilitate treatment. However, state codes require six to eight feet of undisturbed soil between each sidewall.

"Developers and homeowners don't want to see lots become bigger just to support drainfields," says Terry. "So to reduce the overall footprint, most drainfields are either 4-foot-wide beds or wider chambers. Longer, narrower trenches will eat up more space if the six- to eight-foot separation is maintained." Yet research shows no reason to maintain that distance, according to Terry. He says trenches can have on-center separations of four or five feet and experience no problems.

Geotextile Sand Filter (GSF) from Eljen Corp.

Running out of room

Smaller, cost-effective onsite systems are becoming the priority, especially in environmentally sensitive areas or those limited by space or soils, according to **Mark Bram,** co-owner of **Eljen Corp.** His company offers the **Geotextile Sand Filter (GSF),** designed to work like a conventional system, but replacing crushed stone with filter modules.

"Our niche is tight spaces, and the product's

advantages are simplicity and ease of installation," he says. "Nothing can break because the modules have no moving parts, nor is electricity required. They can substitute for aerobic treatment units, but it's a fine line because the modules handle conventional and problem sites. The units are reliable, trouble-free and affordable — three qualities homeowners love."

Based on the site's percolation rate, one 3- by 4-foot or 2- by 4-foot module is installed per bedroom. "That's a large surface area and reservoir space per module," says Bram. "They can be configured for serial distribution, pump systems, level and slope sites — any new or replacement application."

The modules, installed shallower than conventional systems, minimize site impact and add flexibility when dealing with site constraints. Each module uses 100 square feet of filter fabric, representing 12 square feet of soil interface. Partially treated effluent then passes through the secondary treatment zone — six inches of washed sand under and around each unit. Bram states that the sand layer's long-term acceptance rate (LTAR) is two times that of conventional systems.

The modules, when laid in series and sized for the site's LTAR, prevent a clogging biomat from developing in the soils below. Pretreated effluent and enhanced surface area enable drainfields to be up to 50 percent smaller than traditional pipe and stone beds, reducing land requirements, lumbering costs on wooded sites, and preserving the environment, according to Bram.

A distribution box disperses effluent to the modules. "Clean backfill and using washed sand are critical parts of the installation," says Bram. Installation labor is reduced. When trucks cannot access the site, installers can carry a module in each hand as opposed to transporting gravel in wheelbarrows.

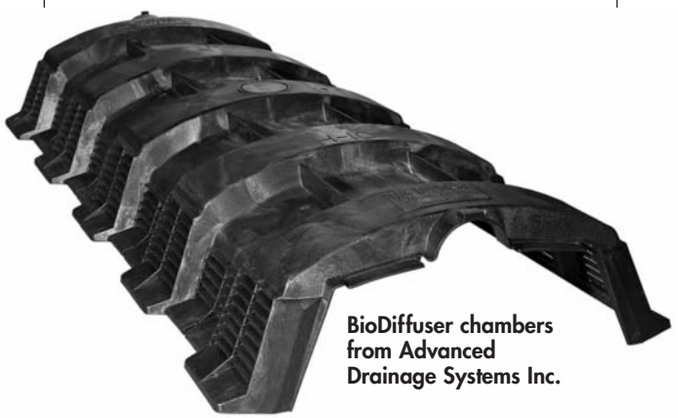
Working with regulations

Alternate technologies replacing stone-and-pipe drainfields usually promise two benefits: smaller footprints and enhanced performance. How manufacturers achieve those results is what distinguishes their products.

Chambers from **Infiltrator Systems Inc.** have open bottoms for unobstructed infiltration into the soil. "This design allows up to a 50 percent reduction in trench length over traditional drainfields," says company marketing communications manager **Evelyn Laurenzi.** "Greater soil-to-effluent interface means better performance."

The chambers' solid top prevents rain from infiltrating and fines from intruding, while sidewall louvers promote leaching and evapotransporation. With no stone in the drainfield, the fully open chambers provide ample storage capacity to accommodate peak flows without leaking, since the chambers interlock end-to-end in a precise fit.

The company's offerings include 4-foot-long **Quick4 Standard** and **Quick4 Equalizer 36** chambers. "These chambers contour up to 15 degrees, right or left, to follow the natural terrain or go around obstacles or slopes," says Laurenzi. "Customers are telling us that the Quick4 chambers greatly increase the ease of installation, design, and even inspection."



BioDiffuser chambers from Advanced Drainage Systems Inc.

An inspection port cutout permits monitoring and maintenance. Another development is a **MultiPort End Cap** with multiple inlets and outlets that allow piping in any direction within a 180-degree swing. "The end cap can accommodate basically any system design by eliminating the number of pipes and fittings," says Laurenzi. "That increased flexibility makes designing and installing systems much easier, and allows installers to save on materials."

Another supplier, **Advanced Drainage Systems Inc.** offers **BioDiffuser chambers,** which are open-bottom, louvered sidewall units available in four sizes to suit narrow- and wide-trench designs. The product's post and dome joint configuration requires no screws or nails for installation. A universal end cap can be used for either end of the trench. An articulating joint is available for flexible contour designs. The chambers are designed for gravity, pressure dosing and mound systems.

Beyond basics

Drainfield media is not the only determinant of drainfield life. **Brian Borders,** who heads the Engineered Systems Group at **Zabel Environmental Technology,** observes, "Drainfields often fail because septic tanks aren't pumped. Consequently, adding an effluent filter at the tank's outlet is becoming the norm, and 13 state codes now require them." Effluent filters reduce solids entering the drainfield and force homeowners to maintain their septic tanks.

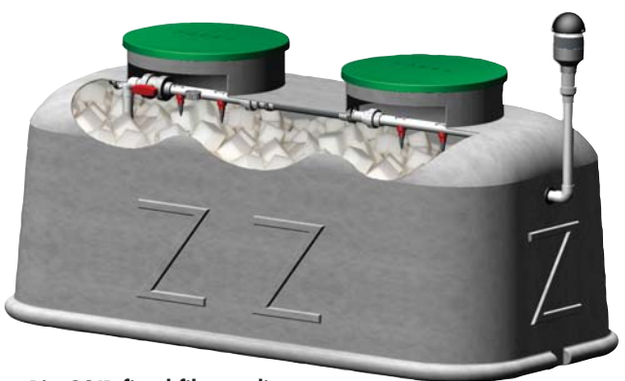
The trend toward marginal or porous sites with higher probabilities of failure is driving installation of advanced treatment systems (ATS). Borders noted that regulatory bodies are beginning to require them for shallow and high-clay soils, and on lake properties or areas with sensitive receiving environments, like Chesapeake Bay and the Florida Keys where nitrogen reduction is a concern.

While an ATS adds cost, it can prolong system life, since it produces higher-grade effluent. According to Borders, an ATS is often lumped with aerobic treatment units. "An ATU suspends microbes and wastewater in a mixture into which air is forced," he says. "The emerging technology is fixed film — some type of media in a single container to which microorganisms attach and clarify the liquid as it gravity-flows down." The liquid is recirculated many times before being pumped to the drainfield.

Zabel's **AeroCell** and **Bio-COIR** fixed-film media filters recently received NSF Standard 40 Certification. The AeroCell system, which uses a synthetic open-cell foam cube, was introduced in 1998. Its 80 percent recirculation rate through a filter produces liquid with 2 mg/l BOD and TSS and 9 mg/l nitrogen. The standard for certification is 25 mg/l BOD and 30 mg/l TSS.

The new Bio-COIR system has media consisting of coir, a fiber byproduct of coconut processing. "It's a waste product that lies in heaps around coconut-processing plants in Third World countries," says Borders. "They are anxious to get rid of it, so we're helping their economy." Treated effluent averages 9 mg/l BOD and 12 mg/l TSS, but Borders says further extended testing has produced lower numbers.

Fixed-film systems either spray or drip effluent onto the media, making an effluent filter or a pump tank with a filter pump vault vital to preventing solids from clogging the dispersal orifices. Both systems are certified to treat 500 gpd and use the same patented fiberglass module and delivery system.



Bio-COIR fixed-film media filters from Zabel Environmental Technology

Where drainfields are concerned, according to Borders, "If the drainfield was properly installed, only adding accessory products like filters and advanced treatment, and using common sense can possibly improve its long-term performance."

Orenco Systems Inc.'s Biotube Pump Vault

Passive vs. active

Jeff Ball, vice president of marketing and sales for **Orenco Systems Inc.,** agrees with Borders. "If drainfields are adequately sized and are preceded by watertight tanks, then the first line of defense against premature failure is an effluent filter," he says. "Beyond passive filters, you enter the realm of mechanical devices."

Such devices include a pump vault, containing a screening system and pump in a single module. Orenco's **Biotube Pump Vault** places the pump on the downstream side of the filter, preventing gross solids from reaching the pump.

According to Ball, the advantage of the screened pump vault is that it does not require a dual-compartment septic tank or separate dosing tank. Once suspended in the clear zone in a single-compartment tank, the pump draws effluent into the vault through holes around its perimeter.

"The liquid passes through the screening system — the Biotubes — then is delivered to wherever it has to go," he says. "Pump vaults are economical because they eliminate the need for another tank, and the extra excavation and labor to install it."

Ball notes that pumps used with programmable dosing timers can prevent excessive flows to the drainfield or, at minimum, alert homeowners if they occur. A leaking toilet can allow 1,500 gpd to enter the tank.

"Without some sort of control on that flow, the drainfield can easily become inundated," he says. "Worse, the excessive flow can cause solids to carry through the tank, exacerbating the problem in the drainfield." ■

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