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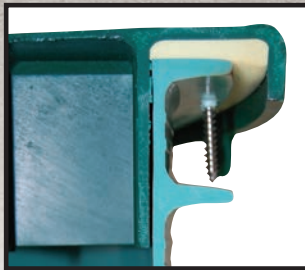
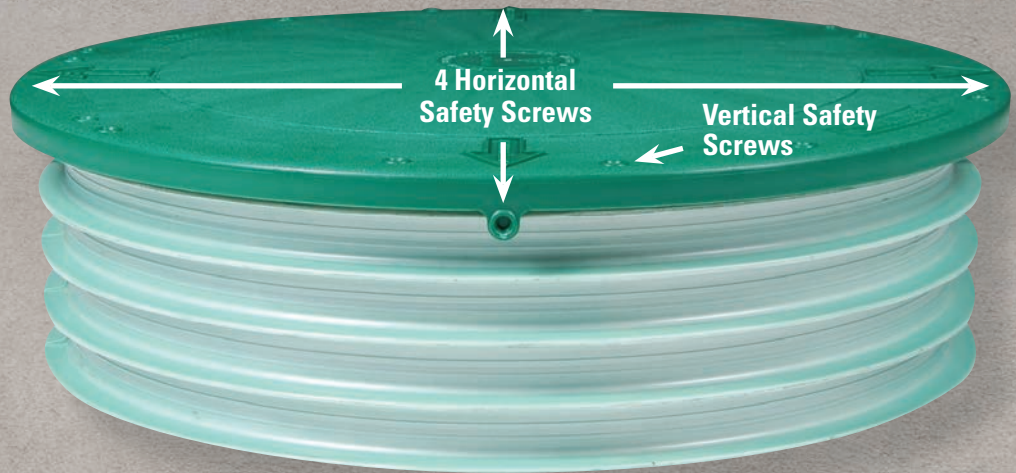
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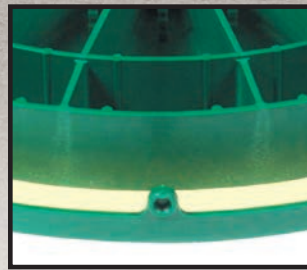
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# This Tank Collapse is a Call to Action

A Michigan woman averts tragedy, but her crumbling onsite system signals your need to be an inspector, educator and strong voice in infrastructure discussion

By Jim Kneiszel



The experience of Phylce Thompson might be the best advertising for routine septic system inspection yet. The La Salle, Michigan, woman was pruning flowers in her garden recently when an aging septic tank below her caved in, plunging her chest-high into human waste. There were no warning signs of an impending problem. Everything looked normal above ground level, but there was clearly something wrong below grade.

**Septic systems are out of sight, and therefore out of mind for millions of homeowners. They remain oblivious to very sudden threats like this tank collapse, but they also often maintain a cavalier attitude about recommended routine maintenance.**

“It was real close to a tragedy,” Phylce’s husband, Jerry, told the *Monroe News* after the tank collapse. “I wouldn’t want her to go in that way.” The 72-year-old woman avoided being submerged in the waste by holding on to the edge of the septic tank while calling out for help. Her husband and son, Randy, pulled her out uninjured, but they wanted to bring attention to the risk of this happening to others.

“People need to be cautious,” Jerry Thompson said. “She was clinging for life.”

Then he said something you’ve heard over and over again from your customers. The couple had lived at

the house since 1988 and had never given a thought to any dangers lurking underground. “I never thought twice about that septic tank,” he said.

The words “out of sight, out of mind” were used by the news reporter.

That about sums it up. Septic systems are out of sight, and therefore out of mind for millions of homeowners. They remain oblivious to very sudden threats like this tank collapse, but they also often maintain a cavalier attitude about recommended routine maintenance.

People are horrified by the image of an elderly woman being swallowed up when a tank suddenly collapses. They should be equally horrified at the prospect of a failing system tainting their water supply, bringing foul and infectious wastewater to the surface in their backyards and threatening the health and well-being of friends and neighbors.

How many situations like the Thompsons can you count in your work territory? How many septic systems are working beyond their expected

expiration date? It’s likely there are thousands of aging septic systems within a half-hour drive of your onsite business. Like the Thompsons, so many of your neighbors have given little thought and spent little money maintaining their septic systems over the past 20, 30 or 40 years. If it ain’t broke, don’t fix it, right?

Trouble is, most of the time homeowners don’t even know “it ain’t broke.” They assume that since waste continues to flush down the toilet, all is well. They don’t see it as their responsibility to make sure the waste is being properly treated and that sludge is removed at regular intervals to ensure continued safe operation. And if they ignore routine pumping, you know they’re never having the systems inspected without being forced to do so.

This is where education plays such a vital role, and you as installers are on the front line of this education effort. Situations like this one point out that it’s not enough to sit on the sidelines and wait for systems to fail and your phone to ring with work. A failure of epic proportions like this illustrates an epidemic infrastructure problem in this country. So many septic systems were installed in the 1960s, ‘70s and ‘80s, and truthfully they are all at a growing risk of failure, either of the treatment process or a structural collapse.

We know this is true, so we shouldn’t sit back and play a passive role. We have information that can save people’s lives and prevent contamination of water supplies, which could lead to illness. It’s important we warn people about potential problems lurking below those carefully manicured lawns. Here are a few ways to get started:

## Talk about the tank.

Use this story out of Michigan to let your customers know about the importance of inspecting components of their septic system. Concrete tank deterioration through hydrogen sulfide gas exposure is a risk being studied today. It is possible for a tank lid to cave in, potentially causing injury or death. Beyond that catastrophic result, tank corrosion can damage baffles or outlets and have a negative impact on system operation. Encourage homeowners to have their tanks pumped and thoroughly inspected for weaknesses that could cause big problems down the road.

## Make a connection between waste and clean water.

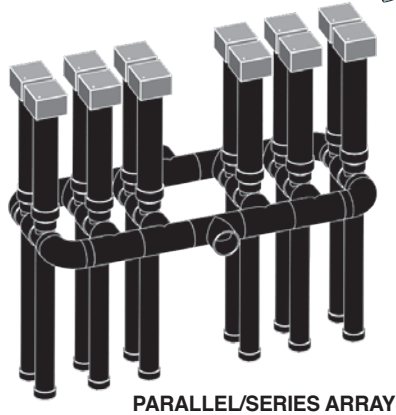
So many septic system owners are most concerned about the bottom line: facing bills for repair or replacement when their systems seem to be operating correctly. They may be reluctant to spend money simply to make sure their



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waste is treated effectively. But if you can tie proper wastewater treatment to a clean drinking water supply, they will sit up and take notice. People will panic when faced with a tainted water supply, but until the worst happens, they don't feel an urgency to take action. Make sure they understand the real link between wastewater and clean drinking water.

### Offer inspections.

If you don't already offer septic system inspections and regular maintenance, now is the time to consider providing this service. Knowing what you know, it's not enough to simply repair or install septic systems on demand. Develop ongoing relationships with customers. Don't simply install their systems and walk away assuming they will use them properly over the next 20 years. Make service after the sale a regular part of the way you do business. Include a few years of annual inspections when you sell a new system. Look for ways to make it affordable for customers to sign up for long-term oversight of their onsite systems.

### Be the expert.

Think about it. You are the leading source of information on decentralized wastewater treatment. Nobody in your town or county knows more about onsite wastewater. Let people take advantage of your years of knowledge and background to educate and inform the public about septic system care. When water and wastewater issues come up in the local media, offer to answer questions from local media or groups of homeowners. Copy educational materials from your state trade association, local health department or other sources and distribute them to customers, local officials and reporters who need to know more about onsite topics. Remember your role in the community should go beyond excavating pits, laying pipe and installing tanks. To fulfill your professional duties, you need to be a teacher. □

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### System Care After Repair

Continuing with the theme of remediation, one of the most important steps is at the end: educating the homeowner about the care of their rejuvenated system. Providing a plan for the homeowner to monitor the system needs to be a priority after a repair or remediation. If they aren't informed, eventually all your hard work getting their system back in shape will be for nothing. Here are some tips on providing a system management plan. [onsiteinstaller.com/featured](http://onsiteinstaller.com/featured)



### Overheard Online

"Guys hear these stories about people dying in trenches, but they say, 'That's someone else. I'm pretty good. I've been doing this a long time. I can tell when it's dangerous.' Unfortunately, sometimes it catches up with them."

- Trenches Don't Have to be Deep to be Dangerous  
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It's not always possible to avoid using a site with compacted soil and it's nearly impossible to install a system without using equipment that will cause some soil compaction, as well. There is no quick recovery for compacted soil, but there are a few things you can do to deal with a less-than-ideal site, and to minimize additional compaction during the installation. [onsiteinstaller.com/featured](http://onsiteinstaller.com/featured)

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Technician Dan Wiczorkowski unloads EZflow media from Infiltrator Water Technologies at the site of a new system install.

# SMOOTH HANDOFF

A long and carefully planned transition made it easy for Randy Dolesy to buy out two partners and assume ownership of Halverson Plumbing

By Ted J. Rulseh | Photos by Jacob Byk

The baton pass in a relay race is a thing of beauty; two runners make the exchange with no delay and without even breaking stride.

In a way, that describes the transition of ownership at Halverson Plumbing in Black River Falls, Wisconsin. The “baton pass” actually took about two years, but through it all the business never missed a step, and it continues to thrive.

Randy Dolesy, 40, who had been with the company since age 19, bought out partners Rich Halverson and Dave Puttbrese last October.

Puttbrese retired; Halverson remains on board as a full-time employee handling mainly soil testing and designs for onsite treatment systems.

Halverson and Puttbrese raised the prospect of ownership with Dolesy early in his tenure. Dolesy steadily added responsibility as he progressed over several years from helper to master plumber. In the last two years before the sale, he essentially ran the business as the partners worked two to three days a week.

“I hate to say the transition was fairly easy, because most people don’t believe that,” Dolesy says. “But I was already taking care of most things — inventory, scheduling work, purchasing tools, making sure the guys had what they needed to get the jobs done. In the two years before the buyout I was directly involved in everything except things like choosing health insurance plans and figuring taxes.”

Dolesy now operates a business with seven employees, built around 40 percent onsite installation and service and 60 percent residential and light commercial plumbing. The onsite side completes about 40 installations per year in Jackson, Monroe and Clark counties in west-central Wisconsin.

## THROUGH THE RANKS

Dolesy joined Halverson Plumbing (first profiled in *Onsite Installer* in November 2004) as a helper in 1995, working on plumbing for new homes. After three years, he became an apprentice and did plumbing service and

### Halverson Plumbing Black River Falls, Wisconsin

**FOUNDED:** 1958

**OWNER:** Randy Dolesy

**EMPLOYEES:** 8

**SERVICE AREA:** 60-mile radius

**SPECIALTIES:** Residential and light commercial plumbing, onsite system installation, general excavation

**WEBSITE:** [www.halversonplumbing.com](http://www.halversonplumbing.com)





repair. Half a dozen years later, he was a journeyman working on new construction, including nearly five years plumbing some 150 cabins at a campground and resort complex — one of the biggest projects in Halverson Plumbing’s history.

Once that project was done, he moved into the office and began working in earnest toward eventual ownership. “When I started with the company, Rich and Dave told me they had a target date when they hoped to retire,” Dolesy says. “They said that if I followed through with my apprenticeship and received my master license on schedule, the option would be available to me to buy them out.”

Halverson observes, “It seemed like a logical fit. Randy is 20 years younger than I am, he’s energetic, and he’s excited about getting things done. About two years ago, Dave and I basically let him start running the show to get a feel for it. For all practical purposes he’s been running 90 percent of the business for the last couple of years.”

Halverson stayed with the company for a couple of key reasons. “I’d just turned 61, and like everybody else I need health insurance,” he says. “In addition, I absolutely love what I do. I wasn’t excited about being an owner anymore, with all the stress involved. I had done it for a long time. Now, just to be able to concentrate on what I love to do, it’s great. I’m doing more service work, more home water treatment systems and water heaters than before, but onsite is still my main focus.”

### DO-IT-ALL TEAM

Dolesy took over a solid business with an experienced team, sufficiently cross-trained to help everyone keep busy even in winter when the onsite business goes largely into hibernation. “Everybody here is really good at something, and pretty good at a little bit of everything,” Dolesy says.

“We don’t lay anybody off for the winter, because anytime you lay somebody off, there’s a chance you might not get them back. Our onsite system installers hold other licenses that allow them to work all winter. Most of our guys are licensed pump installers for well work.”

**ABOVE:** Dan Wiczorkowski measures trench depth as Jeff Stear works the Kobelco excavator while installing a new system for a one-bedroom apartment.

**BELOW:** Former owner and current employee Rich Halverson, left, and new owner Randy Dolesy, of Halverson Plumbing.



**>>RIGHT:** Jeff Stear operates a Kobelco excavator during a system install.

**BELOW:** Dan Wiczorkowski prepares to check the level of a septic tank as it's being installed.

**"It seemed like a logical fit. Randy is 20 years younger than I am, he's energetic, and he's excited about getting things done."**

**Rich Halverson**



### SOILS AND TERRAIN

The company's onsite specialists deal with varied terrain and soil types. It all starts with Halverson conducting soil tests, preparing the designs and securing the permits. "We're right on the west edge of the central plains and the east edge of the central uplands, and the two are divided by the Black River," he says. "The flat land is basically all sand, and the uplands are heavier, silty soils. There's a distinct difference from one side of the river to the other. In terms of soils, we run the gamut. We install pretty much any kind of system that's out there."

In the early 1990s, the company installed a number of Multi-Flo aerobic treatment units (Consolidated Treatment Systems), driven in part by research projects conducted by the University of Wisconsin. "We were installing them on lots that

had too small an area for a normal-sized drainfield," Halverson says. "Or on properties that had failed systems and no room for replacements, we'd put a Multi-Flo unit in, clean the water up, and get the drainfield working again."

Jeff Stear, who joined the company six months before Dolesy did, is an equipment operator and septic system installer, oversees crews in the field, and serves as safety coordinator. "He's a super good guy, a great operator, and extremely intelligent," Dolesy says. "He has a restricted master license for appliance service that allows him to work inside homes when there's no excavating to do. He's also a licensed cross-connection inspector. He is a very versatile asset for us." The other full-time team members are:

- Dan Wiczorkowski, septic system installation and maintenance
- Roy Puttbrese, well work and septic system maintenance
- Charlie Hackelberg, septic system maintenance and service plumbing
- Kevin Fredrickson, plumbing for new construction and water treatment
- Jodi Krueger, office manager and human resources

had too small an area for a normal-sized drainfield," Halverson says. "Or on properties that had failed systems and no room for replacements, we'd put a Multi-Flo unit in, clean the water up, and get the drainfield working again."

"We don't put in as many ATUs as we used to, mostly because demand isn't there. We always try to find alternatives that have the most bang for the buck. I like ATUs — I have one at my own house — but they constantly cost money for electricity, repairs and maintenance. If we can put in a passive system, that's our goal."

These days, on sites requiring more advanced treatment, Halverson tends to choose SludgeHammer aerobic bacterial generators and White Knight microbial inoculator/generators (Knight Treatment Systems), installed inside septic tanks. On sites with high bedrock or seasonal high groundwater, he favors mound systems.

While installing fewer ATUs in recent years, Halverson Plumbing has

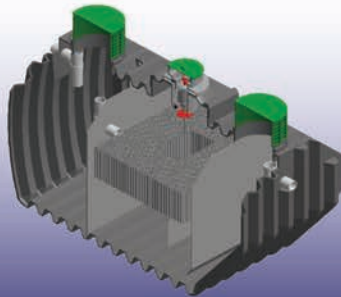


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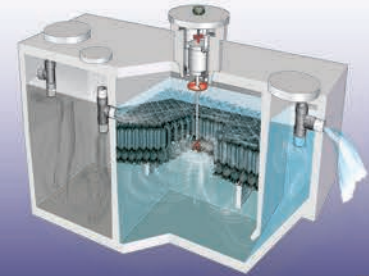
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built a good business in maintaining them every six months as the manufacturers and state law require. Dolesy states, "There are many Multi-Flo systems in the ground, and we're traveling over an hour from our base to service them, just because nobody else is interested in taking care of them. We run a regular route, and it seems like every year more homes are on it."

#### INTO THE GROUND

As for installations, Halverson handles scheduling of the crew. "Once he gets the permit, he knows how long it's going to take to do the project," Dolesy says. "He makes sure those guys know what's coming next and what county they're going to be working in."

Dolesy sees an advantage to being a multifaceted company owning excavating machinery: "Once we get to the site, we can take care of the septic system, the well excavation, the pump installation and the house plumbing. The owner or builder doesn't have to call multiple contractors — we do it all." Well drilling is subcontracted.

Most projects incorporate EZflow media from Infiltrator Water Technologies and a couple of variations of concrete tanks, which Halverson Plumbing purchases from Crest Precast Concrete Inc.

"Our guys are excellent at finish grading. When they get done, there is very little work for the homeowner. We take care of spreading topsoil and seed, and even straw if that's what the owner wants," he says.

## ONSITE INDUSTRY NEEDS YOUNGER WORKERS

"When you're young, you can work all day and into the night and come back and do it all again the next day," says Randy Dolesy, the new owner of Halverson Plumbing.

That's not the case as people get older. So Dolesy worries about staffing his business for the long haul. He'd like to see more young people take an interest in the trades.

"Only one among all of us who work here, Charlie Hackelberg, is under 40 years old," he says. "That's an ongoing problem that I'm trying to address. We hope to hire a high school student to work with our septic installers and make their days a little easier. Jeff Stear is 50 and Dan Wiczorkowski is 47."

Dolesy has visited Black River Falls High School at the invitation of technical education instructors to talk to students about opportunities in the construction trades. "At the end of the session, I talked to the kids about coming to work part time. I know quite a few people involved in apprenticeships who I could call to get them started in a trade, whether plumbing or electrical or carpentry. There was no interest at all. None."

Dolesy noted that three to four plumbers and other tradespeople are retiring for every new person coming in. Against those odds he still hopes to convince one or perhaps two high school students to come aboard.

"One thing I firmly believe is that kids need to go out and get a job they hate before they'll come to a job doing what we do and appreciate it," he says. "Maybe that's a job where they work from midnight to 8 in the morning, and on weekends. Once they come to work with us, they might work harder physically, but at the end of the day, typically they're done, unless they're the on-call guy."



Dan Wieczorkowski measures the distance between a septic tank from Crest Precast Concrete Inc. and a Tuf-Tite drop box during an installation.

**“Once we get to the site, we can take care of the septic system, the well excavation, the pump installation and the house plumbing. The owner or builder doesn’t have to call multiple contractors — we do it all.”**

**Randy Dolesy**

The company’s key machines are a 30,000-pound Kobelco 135SR excavator, a Kubota KX121 mini-excavator, a Case 650G dozer, and a Ford L9000 dump truck. “The Kobelco has been very good to us,” Dolesy says. “It has caused us almost no problems and it’s the machine we use for most of our install jobs.

“The Kubota is also really a good machine. We use it for most of our repair jobs. The hydraulics are fantastic. It starts any time we want to go with it. If it’s 20 below zero and we need to use a hydraulic hammer to bust concrete to get at a water main break, that machine will go. We pull it with a 1-ton diesel pickup.”

### WORKING WITH REGULATORS

Working across county lines means staying close to multiple health department officials. Dolesy and Halverson are on a first-name basis with most of them. One key to solid relationships is attendance at a five-county meeting organized by the health departments and held every year in March.

“It’s a meeting for installers, plumbers, regulators, vendors, soil testers — anyone involved in the industry,” says Halverson. “It’s always an interesting meeting. I touch base with everyone, hang out with them and listen to what they have to say. It helps get me fired up for the upcoming season.”

While his passion for the industry remains, Halverson looks forward to slowing down and spending more time with his extended family, which includes three grandsons. “I don’t have a time frame in mind for actual

retirement,” he says. “If I’m healthy enough to work in spring, summer and part of the fall, and take off in winter, that would be awesome. I could see doing something like that, if my new boss will let me.”

Dolesy and Halverson would suggest their approach to other businesses looking to make a transition in ownership. They recommend engaging a good attorney and accountant to help identify and work out the details that inevitably arise. “They’ll come up with the questions and work on getting you the answers,” Halverson says.

Meanwhile, Dolesy looks forward to keeping the business on the same solid path where it has been. “I have the best team here that I could ask for,” he says. “We have a very experienced group with multiple licenses between us. My goal is to add a couple of younger people to the mix who can learn from those who are older.” □

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# Sampling is a Key to Better Onsite System Performance

As effluent regulations tighten and advanced systems take off as an onsite solution, you'll need to sharpen your wastewater sampling skills

By Jim Anderson and David Gustafson

Last month we discussed a requirement for some Iowa homeowners to provide samples or sample results to prove performance of their discharging onsite systems. In the future, sampling will be a more integral part of service calls, and there will be more emphasis on providing access in systems for monitoring and maintenance. Here are additional aspects of sampling that need to be considered.

First, a sample must be obtained from the right location in the system to provide the needed information. Sampling locations are usually at the inlet or outlet point of a treatment component.

These samples can be defined as influent (inlet) and effluent (outlet) samples.

## FIND THE RIGHT LOCATION

For example, an influent sample to the aeration chamber of an ATU would be collected from the outlet of the trash tank. Even though this sample could be called an effluent sample following primary treatment in the trash tank, an effluent sample notation is generally reserved for a sample taken from the final component of the treatment train, so in this case the outlet of the ATU.

**Select a lab that practices standard methods and is state-approved or accredited. Results from a nonaccredited lab may not be accepted by regulatory agencies or stand up if there is some type of court challenge.**

Influent samples are usually collected from the various internal components of the treatment train to determine the influent wastewater characteristics. This information aids the service provider in diagnosing, troubleshooting or mitigating the system.

Effluent samples collected following a final treatment component are often taken for the purpose of diagnostic evaluation or compliance monitoring.

The sample must be representative of the wastewater that needs to be sampled. It must be done using an analytical method that can be reproduced by another person. Documentation must be provided and the results must

be accurate so sample analysis is defensible and the samples collected should be useful in meeting the objectives of the sampling or monitoring program.

## TYPES OF SAMPLES

Two types of common samples for purposes of evaluating system performance are grab samples and composite samples. A grab sample is one taken from one point in time. It is important to understand what the sample is for and when to take the sample to be most helpful in troubleshooting. It may be necessary in some cases to take a series of samples over time to give the best picture of what is happening.

Composite samples are multiple samples taken at one point, then combined in one sample to give an average picture over the course of a day or some other time frame. Taking a sample from a trash tank ahead of an ATU — or a septic tank ahead of treatment trenches — would give you a composite sample collected over time from the source of the wastewater.

Some typical locations to determine performance include sampling from a pump tank to evaluate a pressure distribution system, a gravity system from the outlet of the septic tank, and proprietary units wherever the manufacturer recommends. As a service provider, many times you will be taking samples from the outlet of the device in question because this provides a view of the wastewater entering the next component.

## CHECK THE LAB

It is important to know ahead of time where the sample will be analyzed and talk with lab staff about any special handling requirements, and the time frame needed to analyze and provide accurate results. Another reason is to make sure the test they run will give you the answer you need in the units you need. So talking with them about expected ranges in value and where the samples are coming from is very important. Select a lab that practices standard methods and is state-approved or accredited. Results from a nonaccredited lab may not be accepted by regulatory agencies or stand up if there is some type of court challenge.

How the sample is collected, stored and handled is important to ensure it provides the desired information. A number of different sampling tools include long-handled dippers or containers, Sludge Judges or dipsticks. Pay



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attention to the type of container necessary for the specific purpose of the sample. For example, different types of collecting devices work if you are pulling the sample from a tank, but sometimes a vacuum pump or some other type of device might be necessary if you are collecting the sample from a small sampling tee. No matter what the device, they must be clean to prevent cross contamination of samples. To avoid cross contamination, the device must be cleaned with distilled water between samples.

The type of sample container will be specific to the type of tests needed. For the most part, the container can be polyethylene or glass, but there are some exceptions. For example, samples that will be analyzed for fats, oils and grease (FOG) must be in a glass container because a strong preservative is used and plastic bottles will break down. Often, the lab will provide a container for the sample. Since many samples look similar, make sure they are clearly labeled with at least the sample number. Label the container — not the cap — with something that is waterproof. Lastly, make sure the container is watertight. You don't want to lose the sample and you don't want melted water in the ice chest to leak into the sample, diluting it.

**SIZE OF SAMPLE**

The amount of sample needed is dependent on the test or tests being performed. Typically, the rule of thumb is a quart. Check with your chosen laboratory to find out how much sample will be necessary. Some testing only requires a small amount of sample, while others need more. Typically, the more tests being run on the sample, the more volume will be needed. Also, the cleaner the sample, the more sample needed. To be on the safe side, fill the container given for sample collection.

These are just some of the aspects to consider if you need to take samples from systems you are maintaining or troubleshooting. We will revisit sampling in other articles in the future. □

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# Providing Wastewater Treatment for the Ultimate Survival Condos

Kansas installer Mark Shepard is tapped to provide the onsite system for an abandoned missile silo converted into luxury bugout housing

By David Steinkraus

If life as we know it were to end because of a natural disaster or nuclear attack, survivors would still have to satisfy basic needs in order to keep surviving. Mark Shepard confronted that thought when Quality Septic & Sewer of Overland Park, Kansas, was hired to install a wastewater system for a survival condo complex.

What made the project more interesting was the site. The condos were constructed within the ultimate survivable shelter: a decommissioned missile silo that in the early to mid-1960s served as part of the United States' nuclear deterrent during the hottest years of the Cold War. At that time, the silo near Salina, Kansas, held an Atlas F intercontinental ballistic missile. After decommissioning, the silo languished for several years until it was purchased by a company that had developed a similar set of survival condominiums at another decommissioned silo several miles away.

Shepard's task was to provide a wastewater system to serve condo residents for years without technical help, because if the world ends, residents will be inside with their five-year food supply but without the ability to call a wastewater professional.

The website for the project ([survivalcondo.com](http://survivalcondo.com)) says the converted silo will support 36 to 70 people within its 14 stories. Condo units that occupy a full-floor area are designed for six to 10 people and have 1,820 square feet. Half-floor units have about 900 square feet of living space for three to five people. Prices range from \$1.5 to \$4.5 million.

## KEEP IT SIMPLE

The condo complex occupies 5 acres, but while the surface area of the site is that large, the missile silo consumes much of the space underground, which produced a challenge in siting components. Another challenge was topography. Near the silo was a pair of dry retention ponds surrounded by berms with sides too steep for vehicles to climb. The ponds proved to be the best place for the drainfield.

Although called ponds, the depressions showed no ability to hold water, Shepard says. Even a heavy rain left only scattered puddles at grade. This section of the property had broken sandstone mixed with the area's sandy soil. Obviously, the sandstone pieces came from excavation for the silo, and the soil was used to build the berms, Shepard says.

<< To handle all the wastewater from the survival condominiums, Quality Septic & Sewer used six 2,000-gallon concrete tanks. Timothy Cantwell (yellow shirt) works on setting one while Eric Clearwater (right in gray sleeveless shirt) works on a tank already set. Tanks have Polylok risers and lids. Just above the Bosch laser level is a worker for Trigard Concrete Products, which supplied the tanks. (Photos courtesy of Mark Shepard)



**ABOVE:** Rolling prairie made a tight fit for equipment at the project near Salina, Kansas. The tank site is to the left, and the crew from Quality Septic & Sewer used soil from the excavation to build a ramp (foreground) so the crane truck could access the site.

**>>RIGHT:** Berms for a pair of ponds and the site topography meant equipment had to be placed so it could drive out again. Timothy Cantwell (in yellow shirt) and the crane truck operator prepare to set the first tanks.



For maximum simplicity, Shepard and engineer Tom Hampton settled on a series of standard septic tanks feeding an Advanced Enviro-Septic drainfield system from Presby Environmental. The system is gravity-powered once wastewater arrives in the first tanks.

Prior to the first tanks, power is involved. The condo website advertises redundant power supplies and shows pictures of a wind turbine and a large generator. All wastewater will be collected at the bottom of the 175-foot-deep silo. Above it will be the condominium units, a small medical facility, an exercise space and an aquaculture installation. A pair of grinder pumps to be installed later by another contractor will send wastewater through a 2-inch force main made of heavy, rolled plastic.

Shepard did not do the interior work, only the treatment system. The owners wanted that in place before interior construction began, so Shepard connected only one outside bathroom for use by the construction crew. The owners will connect the grinder pumps to the wastewater system later.

## REDUNDANT TANKS

The force mains are adapted to 4-inch Schedule 40 PVC that runs into the ends of 2,000-gallon concrete septic tanks. There are six of these in all, set in two lines of three and connected in series at the top. All the tanks came from Trigard Concrete Products in Belleville, Kansas, and have risers and lids from Polylok. The tanks provide both settling and primary treatment.

From the tanks, more Schedule 40 PVC leads effluent out toward the drainfield. But before it gets there, it passes through a pair of ball valves about 10 feet from the end of each tank. This was a change Shepard made in the field while he was thinking about the need for the system to be independent of technical help. The valves will allow for shutting off half of the drainfield and channeling all the effluent to the other half should some problem arise. This will have to be done outside at the valve and not remotely from inside the silo.

The drainfields are about 100 feet from the septic tanks, and a run of 4-inch SDR 35 pipe takes effluent from the ball valves to the distribution boxes. Four-inch laterals distribute effluent into the Presby pipes.

There are four beds in the drainfield. Under normal circumstances, two beds are dosed by one set of three tanks and one distribution box, and the

## SYSTEM PROFILE

<b>Location:</b>	Salina, Kansas
<b>Facility served:</b>	Survival condos created in abandoned missile silo
<b>Designer:</b>	Mark Shepard, president of Quality Septic & Sewer; engineer Tom Hampton of Blue Springs, Missouri
<b>Installer:</b>	Quality Septic & Sewer
<b>Type of system:</b>	Standard septic coupled with Presby AES system
<b>Site conditions:</b>	Level ground with sandy soil and broken sandstone
<b>Hydraulic capacity:</b>	6,000 gpd

other two beds by the other set of tanks and a separate distribution box. Each bed comprises of 10 lines, all 70 feet long, for a total of 2,800 total linear feet of Presby pipe. Each bed is further split into four cells, and if it becomes necessary to adjust the effluent flow to completely fill all the pipes, Shepard will install slotted flow-equalization caps over the ends of the laterals. It's another non-mechanical, low-technology, survivable solution.

The drainfield beds sit on a 12-inch layer of sand. Lines are spaced 12 inches apart, and there is 6 inches of sand above the lines. A 10-foot-wide perimeter of sand surrounds each bed.

## TIGHT DIGGING

Construction was not difficult because of the sandy soil, Shepard says. Even the broken sandstone was easily handled. He took along his pair of Takeuchi TL230 compact track loaders to move earth around. His Case

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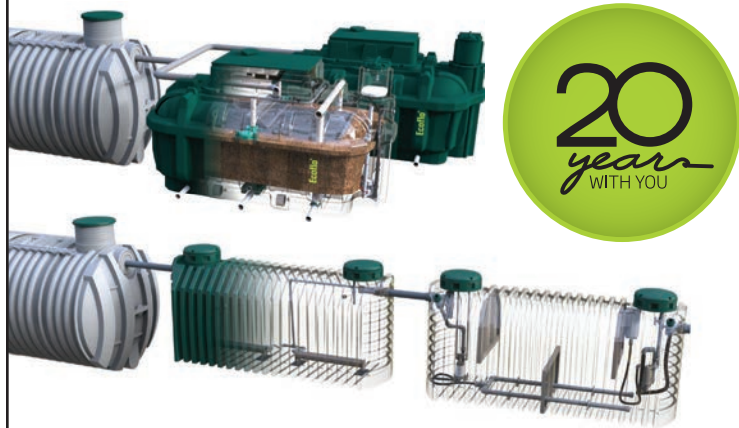
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Two of the completed drainfield beds lie beneath the sand with only their vent pipes visible. In the foreground are the Polylok riser and lid for one of the concrete septic tanks. Even though the drainfield site sheds water easily, technicians made an opening in the surrounding berm (background) to ensure water would not pool after a rain.



backhoe did the heavy digging.

The tanks were placed inside one of the berms and covered with excavated soil. This provided about 15 feet of fall for effluent from tanks to the drainfield, but it was also a

necessity because of the space used by the missile silo.

When they began, Shepard and his crew used the excavated soil to build a ramp so the crane truck could approach the tank site. “Between the silo and our tank site there was a depression that restricted our movement. There was only one narrow path to the tank site, and every day we had to make sure our equipment was facing in the right direction so we could drive it out,” he says.

**“I’ve never had such a large project, and we started running out of time to complete the job. I knew it was time to be creative.”**

**Mark Shepard**

They cut in from the side of the berm because its top was only about 8 feet wide. After the tanks were in place they backfilled with the soil they had excavated. The landowners handled restoration.

To set the drainfield pipes Shepard made a wooden template to ensure proper spacing. He bought several sheets of plywood, cut arches in them, and placed them over the Presby pipes to hold them in place while his crew filled sand around them. Other parts of the work provided a different challenge that Shepard solved in a different way.

“I’ve never had such a large project, and we started running out of time to complete the job. I knew it was time to be creative,” Shepard says.

He went to a local gas station, approached some of the teenagers working there, and asked if they or their friends would be willing to work for him. There isn’t much for young people to do in this part of Kansas, and they were willing. He used teens to hook the Presby pipes together as they came out of the truck and to rake sand into place on top of the beds. Over the course of three days he employed six teenagers on the project.

If the end of the world ever comes, the people sheltered inside the survival condominiums in Kansas won’t have to worry about their wastewater. As long as the complex has power from its wind turbine or generator, the gravity system from Quality Septic & Sewer will treat wastewater long after the food is gone. □

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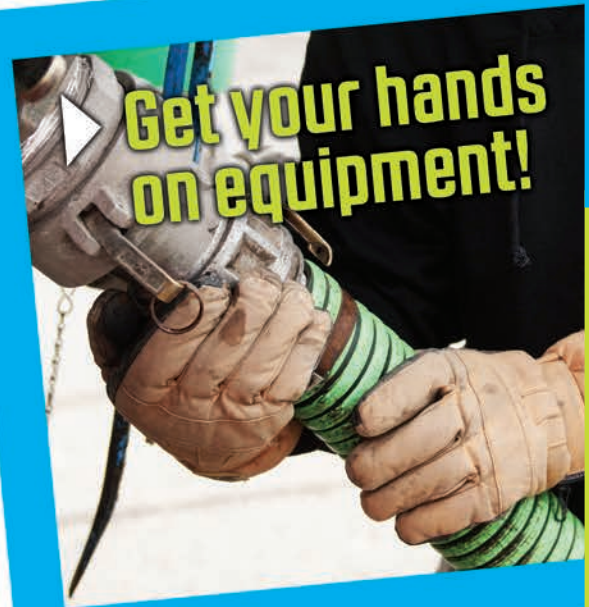
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# Housing Development in South Dakota Depends on Septic Systems

Lack of quality land to fill demand for new homes pushes decentralized wastewater professionals to look toward onsite technologies and technical training

By Doug Day

**P**eople love living out in the country. As more people go in for the rural lifestyle in South Dakota, the demand for septic systems is growing and challenging installers, because most of the good lots have already been developed.

Environmental scientist Scott Hipple with the South Dakota Department of Environment and Natural Resources (DENR) says most of the 654 certified installers do a good job following the regulations set forth by the state — which establishes the minimum standards — and the municipalities, sewer districts and 66 counties that can have more stringent regulations.

**Unfortunately, most of the areas that have decent soils in the Black Hills have already been built on. Trying to locate a septic system on some of these lots is very difficult, if not impossible. Sometimes, they have to resort to holding tanks and have them pumped.**

Scott Hipple

them mainly if they need a variance to one of the rules. The state does not have a construction inspection program.

We'd like counties to set up inspection programs or at least permitting programs. It's easier to enforce if it is at the local level. We'd like them to get a copy of what is being installed so later we don't have a homeowner build a garage on top of the drainfield system and then wonder why it's backing up into the home. Some counties have inspection programs, especially out in the Black Hills.

**What issues keep you busy in South Dakota?**

**Hipple:** In certain parts of the state, we have extremely high seasonal groundwater levels and some have really impervious soils. Then we have the Black Hills that has both bedrock and groundwater issues, not to mention that it is a major recharge area for several important aquifers in the state. Our regulations are working to protect the groundwater, provided people follow the rules.

We do have a plan review program that is set up mainly for commercial operations, but we will review any plan for a residential system that is submitted. We get

**Scott Hipple**  
South Dakota Department of Environment and  
Natural Resources environmental scientist,  
605/773-3351 or [denr.sd.gov/des/fp/septic.aspx](http://denr.sd.gov/des/fp/septic.aspx)  
**DENR**



**Looking ahead, what is it that will challenge the industry in the future?**

**Hipple:** About 27 percent of homes in South Dakota have onsite systems, and that number is increasing because people want to move out into the country. Probably 30 to 35 percent of new construction is using onsite systems.

The Black Hills are a favorite for people. Unfortunately, most of the areas that have decent soils in the Black Hills have already been built on. Trying to locate a septic system on some of these lots is very difficult, if not impossible. Sometimes, they have to resort to holding tanks and have them pumped.

So we're getting into more creative ways to build on lots that aren't very conforming, such as taking the low spots where the soil has settled and putting in community cluster systems. In that case, all the homes are required to have an advanced treatment system and they are part of a sanitary district that has the legal right to operate, maintain and pump those systems. That has worked well.

We've also had some older homes and cabins located around lakes where there have been issues with nitrates and fecals getting into the lakes. They've come to our department and received funding to do a central collections system from their tanks using lift stations and a lagoon system. Another town put in four large drainfields but only needs to use three of them. They rotate one out every year to let it rest.

In Lincoln County (far southeast corner of the state), the glaciers left an impervious layer of clay 14 to 24 feet underground with a perched water table above it. So in a lot of the county, you'll find sandy water at 30 inches. You end up using a mound system and there has to be at least 4 feet of separation between the bottom of the pipe and the seasonal high groundwater level. So some installers have to do creative landscaping to avoid an eyesore.





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**Are you generally happy with the performance of installers?**

**Hipple:** The vast majority are doing a decent job of following the rules, but you always have a couple of bad apples. The biggest issue for me is that not everybody is doing percolation tests like they should.

DENR has a certification program for installers. We mail the rules to them and they have to do an open-book test. If they pass, they are certified for five years. There is no fee and no continuing education requirement. One county, Pennington, does have a requirement for continuing education.

We used to have laws and a program to certify and train pumpers. The Legislature let that sun set many years ago, in the late 1990s. They just thought it was unnecessary and burdensome. So land application is now subject to the EPA 503 biosolids rule. Our best guess is that we have about 30 to 50 companies that do just pumping; most are in the Black Hills. A lot of installers also do pumping.

It would be easier for us to track what's going on and make sure things are being done appropriately if we had our own (pumping) rules. The only time we find out something is going on is when we receive a complaint. We get about a dozen pumper complaints a year, mainly discharging close to a housing development, too close to a creek, or not spreading or liming the product. We investigate those complaints. If they have, in fact, discharged inappropriately, we can use some of our pollution control rules. Usually what we do is work with the pumper to bring the operation back into compliance.

**What is the most common violation by installers?**

**Hipple:** They may be installing systems in clay soils that are obviously way too small, and homeowners have systems fail within a couple of years. We've had installers who use traditional drainfield systems in areas with very high seasonal groundwater and they end up backing up into the home or draining to the surface.

Then it becomes an issue of having the system replaced and us going after the installers for not having followed the rules, and the homeowner has to try to get financial reparations for the system by taking them to court.

**With no installer association, how do you communicate information, including rule changes, to the industry?**

**Hipple:** When we have a proposed change to administrative rules and it has gone through review and rewrite in the department, we then notify installers by mail and post the changes online, where they can offer their comments. We haven't done any rewrites in some time. We did one about seven years ago and we got quite a few comments.

I think it would be advantageous to work with an organized installers group. They would be very good at helping get more communication out to installers. I've had several of them talk to me about starting an organization over the years, but that's as far as it's gone. □

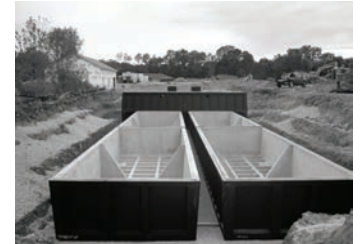
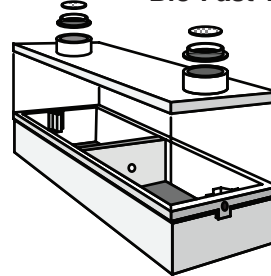
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## Florida's Land Application Ban Survives Objections

By Doug Day

Despite efforts by the onsite industry to delay or overturn it, a ban on land application of septage in Florida went into effect June 30. The law was passed by Legislature in 2010 and has survived many attempts to defeat it — the latest bills to repeal the law died in committees in both the Senate and House in March. Septage must now be disposed of at licensed treatment facilities and pumpers must provide a letter to the Department of Health proving that such arrangements have been made. Industry experts have expressed concern that the ban will raise the cost of septic service.

### NEW JERSEY

More septic systems will be allowed under proposed changes in density standards for New Jersey's Highlands region, which stretches 60 miles along the Atlantic Ocean and provides about 70 percent of the state's drinking water. The current standard is one individual septic system for every 25 acres of nonforested areas and one for every 88 acres of forested land. The new standards will allow about 12 percent more septic systems based on new data from a scientific analysis of nitrate levels by the U.S. Geological Survey.

The new density standard establishes three zones:

- Developed communities (32,896 acres) – one system per 11-acre lot
- Agricultural and woodlands (54,555 acres) – one system per 12-acre lot
- Lands important to water-quality protection (327,449 acres) – one septic system per 23 acres

### OREGON

Failure to repair a septic system has drawn a big fine from the Oregon Department of Environmental Quality against a Coos Bay homeowner. The homeowner has been fined \$4,553 for allowing untreated or partially treated sewage to be discharged onto the ground from a broken drainfield line. The agency also ordered the homeowner to apply for a major repair permit, repair the system, enter into a contract with a licensed plumber, and have the septic tank pumped regularly until repairs have been completed.

A family in Eugene has been using an old septic system for 27 years thinking their home was connected to the city's sewer system. They are now considering legal action against a former plumbing contractor who failed to complete the work all those years ago. The situation was discovered when sewage began backing up into their basement shower in April. □

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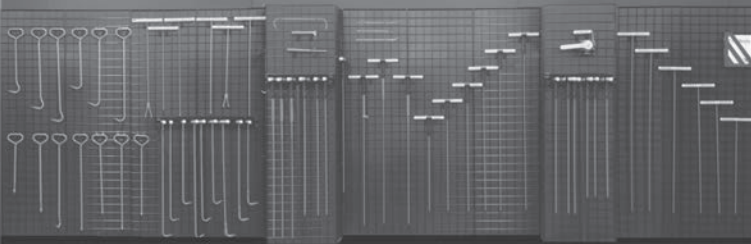
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# Filtration System Introduced by Norweco Helps Meet Stringent Regulations

By Craig Mandli

Shoreline homes and residences in wetland areas often need to adhere to higher onsite wastewater treatment standards than typical homes. That's why installers need to stay a step ahead of regulations, and keep abreast of the latest treatment options. One new option, the Hydro-Kinetic Bio-Film Reactor from Norweco, was a topic of discussion for installers at the 2016 Water & Wastewater Equipment, Treatment & Transport (WWETT) Show.

The unit employs Hydro-Kinetic attached growth technology to produce clean, consistent effluent. It is designed to work in a wide variety of applications, and can be installed as a part of an existing decentralized wastewater treatment system. Installation of the unit between the treatment tank and final disposal system can help improve the treatment process, according to Norweco, producing cleaner effluent while extending the life of the system and meeting or exceeding stringent regulations.

"We are seeing a need for this type of unit in areas that have restrictive soils or have a very high water table," says Annette Simon, the company's marketing coordinator. "This unit is a way to improve effluent quality without having to install an entire new system."

The treatment process begins when flow enters the Reactor, where it moves downward and is evenly distributed beneath the Reactor elements. Liquid then travels upward through attached growth filtration media, where final polishing takes place. The attached growth technology begins working immediately upon startup, Simon says. Completely non-mechanical, the reactor requires no electricity and operates continuously with minimal maintenance. The design of the unit meets the structural requirements of IAPMO/ANSI Z1000 and has the capacity to treat up to 800 gpd.

"Our target market is installers who need to meet high treatment demand, and this system certainly helps those installers meet demands that continue to increase," says Simon. "It can be installed as an add-on with our current ATU offerings, or with other treatment systems."

The rotationally molded, durable, UV stabilized, high-density polyethylene Reactor incorporates internal and external ribbed walls to ensure structural integrity and long-term performance. The compact unit weighs 505 pounds, and can be easily delivered in a standard full-size pickup truck for installation at difficult job sites using a backhoe. It has built-in connections for inlet and outlet piping. A rotationally molded riser with a sealed lid is included, which allows easy service of the Reactor at grade.

"This is our answer to customers who need a system that offers advanced treatment," says Simon. "It is compact enough to easily fit as an add-on for new construction, or existing systems."

Norweco is a longtime exhibitor at the WWETT Show, and Simon says



Annette Simon, right, marketing coordinator for Norweco, explains the added filtration benefits of the Hydro-Kinetic Bio-Film Reactor. The unit is added to existing treatment systems to produce cleaner, more consistent effluent. (Photo by Craig Mandli)

interest in the company's products has grown every year as installers look for new options for providing onsite treatment to properties that don't qualify for traditional septic systems. As regulations for the quality of the effluent discharged become more stringent, interest in the company's product rises, Simon says.

"It's been a very good show for us," says Simon. "Once installers see what our products can do, and where they can fit, they are intrigued. We help make situations that were previously impossible possible." 800/667-9326; [www.norweco.com](http://www.norweco.com). □



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# Consider Torque, Speed, Mounting Options When Selecting PTO

Power take-offs give your work trucks great versatility in the field. Be sure to pair your rig with the right power-handling accessory for efficiency.

By Ed Wodalski

The world of power take-offs, or PTOs, continues to see a growing trend toward automatic transmissions in the work truck industry. While not yet 50-50, it's getting close, says Dave Douglass, director of training and education, Muncie Power Products.

"On a manual transmission, you have PTOs that are mechanically shifted," Douglass says. "It could be a cable shift or an air shift. You have PTOs that are engaged by gears sliding in and out. In the case of automatic transmissions, you have PTOs that are engaged by hydraulic pressure from the transmission that acts on a piston to engage a clutch pack. Those kinds of PTOs are commonly referred to as clutch-shifted PTOs."

The advantage of the clutch-shifted PTOs for a vacuum truck operator is the elimination of gear clash. In some cases, the PTO can also be engaged before the truck reaches a full stop.

"Currently, the pneumatic blower industry is not switching over to automatic transmissions," Douglass says. "That will probably come, but right now that's still a segment of the market dominated by manual transmissions. In the vacuum truck market, there's a mix of manuals and automatics. The larger vehicles — the Class 7s and Class 8s — are still predominately manual, although there are some automatics in the smaller Class 4 and 5 trucks. Automatics have made an impact there."

## SELECTION

When matching a PTO to a transmission, it's critical to make sure you have the complete make and model number of the transmission, including any prefixes or suffixes.

"Those things can make a difference in PTO performance," Douglass says.

You'll also want to make sure the input rotation of the pump matches



**1:** The Muncie Power Products CS24 power take-off is engaged by a direct mounted solenoid that activates an internal wet clutch pack. It has a maximum torque of 325 ft-lbs and maximum 62 hp at 1,000 rpm. (Photos courtesy of Muncie Power Products)

**2:** The 82 Series eight-bolt power take-off from Muncie is built for high torque (maximum 500 ft-lbs) and heavy-duty requirements (maximum 95 hp at 1,000 rpm). The PTO features a lever or air shift cast iron housing and a single or dual optional hydraulic pump mount.

**3:** The Muncie SH Series air shift power take-off is designed for high torque applications (maximum 400 ft-lbs) and up to 76 hp at 1,000 rpm.

the rotation of the PTO. Another thing, critical in the case of blowers and vacuum pumps, is to make sure the PTO can transmit the necessary torque and horsepower required to run your equipment.

Since blowers rely on high torque and high speed, PTO selection is critical. With vacuum pumps, selection often comes down to the size of the truck and the pump.

When evaluating torque ratings, it's important to determine if the driven equipment will be performing continuous- or intermittent-duty applications. A rating higher than the actual required torque will be necessary if the driven equipment is performing continuous duty. To determine torque

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**"If you're doing maintenance on the hydraulic system, make sure the pressure is relieved before loosening any couplings. Never look for a hydraulic leak by running your hand along the hose or any of the fittings or couplings."**

Dave Douglass

rating, multiply the horsepower requirement of the driven equipment by the engineering constant of 5,252 and divide by pump input rpm.

## INSTALL THE PTO

Once you've selected the correct PTO, it's time to focus on installation and maintenance.

When mounting the PTO to the transmission, you typically have two options. In the case of manual transmissions, there's a six-bolt aperture on the right or curb side of the vehicle and an eight-bolt aperture on the bottom of the transmission offset to the left. Automatic transmissions have two 10-bolt apertures, one on each side. Accessibility is the primary determiner of which aperture is used.

"With manual transmissions, the eight-bolt aperture on the bottom of the transmission can typically be used to mount larger PTOs, as opposed to the six-bolt opening on the right side," Douglass says. "Usually, on a manual transmission, you'll use the PTO on the bottom eight-bolt aperture because it can handle more horsepower and torque."

Many truck manufacturers have also eliminated the right-side option by mounting exhaust systems in that area, leaving only the bottom or left side of the transmission for mounting the PTO.

Backlash between the mating gear of the manual transmission and the PTO is determined by adding or subtracting gaskets to achieve a backlash between 0.006 and 0.12 inches, while backlash in automatic transmissions is determined by the transmission manufacturer and the single supplied gasket.

## MAINTAIN IT SAFELY

Primarily installed by upfitters, the hardworking PTO requires little maintenance beyond periodic checks of the mounting bolts for proper torque and the shaft seal for evidence of wear.

Where the PTO is supplying hydraulic flow to drive a vacuum pump, it's important to keep the spline coupling between the pump and the power take-off lubricated. Some manufacturers offer a wet spline that lubricates the cavity between the pump and PTO.

"There's really not much maintenance to a power take-off," Douglass says. "And if you would have called me 20 years ago, we'd be talking about just manual transmissions, and it probably would have been the same answer. PTOs aren't traditionally high maintenance."

It's always a best practice to put safety first when working around equipment. And never inspect a PTO with the truck running. "We always say the best place for the keys if someone is going to be under a vehicle is in that person's pocket," Douglass says.

"And if you're doing maintenance on the hydraulic system, make sure the pressure is relieved before loosening any couplings. Never look for a hydraulic leak by running your hand along the hose or any of the fittings or couplings," he says. "Hydraulic oil systems can carry up to 3,000 psi and can result in a serious oil injection injury."

Always put safety first.

# Large-Scale and Commercial Treatment Systems

By Craig Mandli

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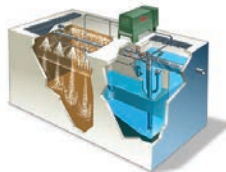
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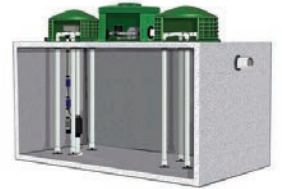
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The Modulair package wastewater treatment system from Norweco is available in capacities ranging from 1,500 to 500,000 gpd. Plants employ the extended aeration treatment process to quickly and efficiently oxidize organic compounds. The system can be easily enlarged or modified, and has the flexibility for any treatment requirement, including pretreatment, AFE, ASH, tertiary, disinfection, denitrification and phosphorus removal. Non-clog Evenair diffusers reduce plant maintenance and the Air-lift surface skimmer simplifies maintenance. Heavy-duty reinforced precast concrete tanks provide durability and long life to each plant. Each system is sold complete, including delivery, tank setting, equipment installation, startup and service. 800/667-9326; [www.norweco.com](http://www.norweco.com).



### SBR Wastewater Technologies SYBR-AER

The SYBR-AER advanced wastewater treatment system from SBR Wastewater Technologies is based on sequential batch reactor technology, which allows the entire treatment process to happen in a single, locally secured tank. The system ships preassembled from the factory and ready for installation. To ensure proper performance, the package includes a preprogrammed control, including an internal logic module with battery backup. All components are easily serviceable and use quick-release connectors to remove any part for inspection or service. It is ANSI and NSF Standard 40 approved and is available in 500, 600, 800, 1,000 and 1,500 gpd systems. 855/391-2448; [www.sbrww.com](http://www.sbrww.com).



## COMMERCIAL TREATMENT SYSTEMS

### Hydro-Action commercial aerobic treatment unit

Commercial aerobic treatment units from Hydro-Action use an activated sludge treatment process that constantly infuses oxygen to wastewater where aerobic bacteria metabolize the waste. Commercial units are available as Set-N-Go designs for 1,000 and 1,500 gpd, and can be modularly designed to treat up to 6,000 gpd. These units are made of lightweight, high-strength fiberglass, resulting in easier installation. The simple treatment process means easier maintenance and reduced operating costs. 800/370-3749; [www.hydro-action.com](http://www.hydro-action.com).



### Premier Tech Aqua Modular Decentralized Wastewater Treatment Solutions

Pre-engineered, compact and ready-to-use Modular Decentralized Wastewater Treatment Solutions for commercial applications from Premier Tech Aqua reduce wait time for professionals and the initial investment required from clients. Integrating Ecoprocess MBBR and Ecoflo Biofilter for final polishing, the approach offers a variety of treatment options that can be mixed and matched in many treatment combinations. Ideal for campgrounds, restaurants and small shopping centers, they provide a one-stop shop of easy-to-use solutions and treatment possibilities. Integrated into roto-molded polyethylene tanks, the product is suitable for both domestic and high-strength wastewater and projects between 1,000 and 20,000 gpd. 800/632-6356; [www.premiertechaqua.com](http://www.premiertechaqua.com).





## CONTROL PANELS

### Septic Products 50B019-120/240DD

The 50B019-120/240DD control panel from Septic Products is a duplex time-dosing panel for use in residential or commercial applications. It can be used with 120- or 240-volt incoming power, and accommodates two dosing pumps controlled by a repeat cycle timer. It has a durable weather-resistant NEMA 4X polycarbonate enclosure with SST latches; large, easy-to-access terminal block; circuit breakers for the pumps and control circuits; a rugged, externally mounted UV-resistant alarm light; audible alarm and run-mute-test switch with UV-resistant sealing boot; definite purpose motor contactors; alternating relay; and pump hand-off-auto switches. Compressor hookups are available. Wiring schematic and detailed connection diagrams are provided for the installer, as well as mounting feet for the enclosure. It is UL-listed. 419/282-5933; [www.septicproducts.com](http://www.septicproducts.com).



### Septic Services Red Alert

The dual-voltage Red Alert time-dosing control panel from Septic Services is designed for dosing applications including LPP, mound, drip irrigation, spray irrigation and standard absorption field. It operates a single submersible pump system and can be used on systems that have cycles of peak hours when the system is operating more frequently. A repeat cycle timer for scheduled dosing distributes the flow of water through a wastewater system evenly throughout the day, creating more efficient operation. It is UL-listed and has a digital elapsed time meter, solid-state timer, lightning arrester and easy-access terminal blocks. It includes three 20-foot cable floats, mounting hardware, wiring diagram and owner's manual. 800/536-5564; [www.septicserv.com/store](http://www.septicserv.com/store).



### SJE-Rhombus EZ Series In-Site CL

The EZ Series In-Site CL data logging control panel from SJE-Rhombus is designed to control one or two 120-, 208- or 240-volt single-phase pumps in water and sewage installations. The panel utilizes the C-Level sensor for continuous level monitoring and records up to 4,000 system events, including pump runtimes, pump cycles, alarm conditions, HOA settings, power outages and service calls. The panel includes a Bluetooth, Smart-Ready module for wireless connection to an Android device, enabling users to configure the panel, view system status or download data via the EZ Connect mobile app. 888/342-5753; [www.sjerrhombus.com](http://www.sjerrhombus.com).



## DISINFECTION

### Scienco/FAST SciCHLOR

The SciCHLOR sodium hypochlorite generator system with multi-pass SciCELL electrochemical activation technology from Scienco/FAST can produce an available supply of disinfectant solution. It is available in sizes of 10 to 60 pounds chlorine equivalent per day to provide a reliable method of safely producing liquid chlorine for medium to



large onsite disinfection applications, while surpassing operational efficiency performance requirements. Connected to an incoming water source and with operating modes of batch, continuous, clean, setup and diagnostic, the brine solution multi-passes through a low-voltage DC electrolytic cell to produce the sodium hypochlorite. When it reaches the low-level float setpoint, the system automatically restarts to replenish its water supply. If no solution is used, the system shuts down to save power. With an 800 ppm FAC sample taken from the generator, the solution killed 100 percent of the *Staphylococcus aureus* and *Escherichia coli* organisms within 30 seconds, according to the maker. 866/652-4539; [www.sciencofast.com](http://www.sciencofast.com).

### WEDECO - a Xylem Brand DURON

The DURON UV system from WEDECO - a Xylem Brand helps meet the disinfection needs of midsized to large wastewater treatment sites. To maximize disinfection efficiency and hydraulic performance, it uses staggered 600-watt ECORAY lamps at a 45-degree angle. Simple to install and operate, and validated for a diverse range of water characters, it can be designed to meet any site's specific disinfection requirements. No lifting device is required and maintenance is made easy with fully automatic UV module lifting. Energy savings come from providing the required dose based on integrated OptiDose control, which is based on real-time lamp aging, fouling and water parameters. It provides closed-loop monitoring of UV intensity, UVT and flow rate to quickly adapt to water-quality changes. 855/995-4261; [www.xylem.com](http://www.xylem.com).



## DRAINFIELD MEDIA AND COMPONENTS

### Advanced Drainage Systems septic stack

Available in configurations of nine, 11 and 13 pipes, septic stack units from Advanced Drainage Systems allow for soil contact without using gravel. Pipe is engineered with holes and slots, allowing it to collect and disperse effluent as it passes over the corrugations in the pipe. Using 4-inch HDPE pipe provides abrasion and corrosion resistance. With lengths of 10 feet, design flexibility is allowed due to fast installation times. The units are lightweight and have a high storage volume with structural strengths that will support H-10 load rating with 12 inches of settled cover. Applications include trench low-pressure piping, pressure distribution, and trench, mound and bed configuration. They are available for use in both residential and commercial applications. 800/821-6710; [www.ads-pipe.com](http://www.ads-pipe.com).



### Sim/Tech Filter orifice shields

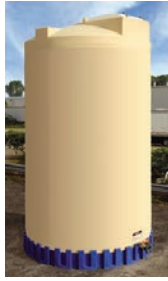
Sim/Tech Filter offers orifice shields designed to prevent drain media, such as drain stone, from blocking discharge holes. This is very important for keeping pressurized systems distributing effluent evenly. The shields have a sturdy design that keeps them firmly in place after snapping them on the laterals. The large amount of open area between the pipe and the shield allows for easy placement over the holes and reduces media clogging by debris. The enclosed design has a large amount of open area, but all openings are small enough to prevent media from entering the shield. Two styles are available — for top-discharge distribution holes and for bottom-discharge holes. Shields are available to fit 3/4-, 1-, 1 1/4-, 1 1/2-, 2- or 3-inch pipe. 888/999-3290; [www.simtechfilter.com](http://www.simtechfilter.com).



## LARGE-CAPACITY HOLDING AND TREATMENT TANKS/COMPONENTS

### Assmann Corporation of America full drain outlet

The molded-in full drain outlet assembly for tanks of 2,500 gallons and larger from Assmann Corporation of America allows draining the tank without the need for mechanically installed nozzles, and can be used where heavy solids or salts may accumulate in the bottom of the tank. It can help eliminate difficult maintenance work, stands up to virtually any service condition and is available with multiple expansion joint options. The outlet is available in 3- and 4-inch sizes and in material variations of 316 stainless steel, titanium and Hastelloy construction. A replaceable polyethylene flange adapter allows the adapter to be removed for tank installation. The flange can be replaced in case of chemical or mechanical damage without needing to replace the entire vessel. 888/357-3181; [www.assmann-usa.com](http://www.assmann-usa.com).



## NITROGEN-REDUCTION SYSTEMS

### SeptiTech STAAR

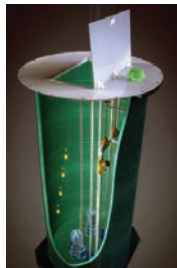
STAAR residential trickling filter systems from SeptiTech are NSF/ANSI Standard 40, Class I and NSF/ANSI Standard 245 (nitrogen removal) certified. The clean effluent prevents biomat formation and leachfield clogging. They are compatible with shallow drip, direct discharge, pressure distribution, spray irrigation and conventional leachfields. Utilizing an enhanced, biological, unsaturated media filter process, they are ETV-U.S. EPA verified and NSF/ANSI Standard 40/245 certified. With an optional UV disinfection system, the systems are designed for direct discharge or water reuse and engineered to fit most typical small-flow residential and commercial applications. 800/318-7967; [www.septitech.com](http://www.septitech.com).



## PUMP STATIONS

### AK Industries lift-out station

Fiberglass and polyethylene lift-out stations from AK Industries are available in sizes from 18 up to 120 inches in diameter. Capacities range from 30 to over 11,000 gallons. The pump stations are available in pre-plumbed designs, or can be custom-built to accept any pump manufacturer's engineering specifications. 800/462-6072; [www.akindustries.com](http://www.akindustries.com).



### Polylok PL-PS40

The PL-PS40 prepackaged basin assembly from Polylok comes ready to assemble. It is made of high-density polyethylene and is lightweight and compact. To install, glue three pieces of PVC and connect the inlet and outlet pipes, and provide power. The design allows for an adapter ring to add up to 24 inches of risers to reach the desired height. The prepackaged basin assembly is easy to access and discon-



nect for future servicing, according to the maker. The installation kit includes a 24- by 40-inch basin, 24-inch heavy-duty cover, .4 hp effluent pump with a piggyback float for automatic on/off operation, indoor/outdoor audible and visual alarm with float, internal piping system (2-inch PVC piping and a gate, check and union all in one valve assembly), three grommets, one 4-inch inlet, one 2-inch discharge and one 1 1/2-inch for electrical, and a junction box with three watertight connectors. 877/765-9565; [www.polylok.com](http://www.polylok.com).

## PUMPS

### Ashland Pump effluent pumps

Heavy-duty effluent pumps from Ashland Pump are available in multiple horsepower sizes for various performance requirements, and have efficient permanent split-capacitor motors. The oil-filled pumps have an upper and lower ball bearing design and handle solids up to 3/4 inch. They are made of heavy cast iron, with cast iron impellers and equipped with a piggyback switch (20-foot standard cord) or in manual configurations. They are offered in 3/10, 4/10, 1/2, 3/4, 1 and 1 1/2 hp models. 855/281-6830; [www.ashlandpump.com](http://www.ashlandpump.com).



### Flygt - a Xylem Brand Experiior

The Experiior pump from Flygt - a Xylem Brand has state-of-the-art hydraulics and premium efficiency motors, and its N-technology and SmartRun control provide optimal wastewater pumping, according to the maker. Other features include adaptive N-hydraulics for clog-free, energy-saving performance. Its self-cleaning functionality operates independently of rotational speed. The pump's SmartRun control is preprogrammed to meet specific wastewater requirements. 855/995-4261; [www.xylem.com](http://www.xylem.com).



### Franklin Electric AG Series

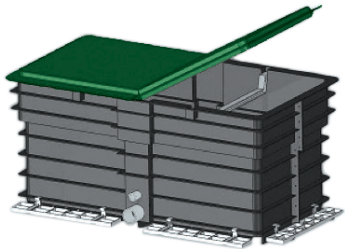
AG Series centrifugal close-coupled pumps from Franklin Electric are designed for challenging water transfer applications demanding efficiency in industrial, commercial and agricultural markets. The expanded series now includes 10 pump families covering the most popular hydraulic performance ranges with models from 3 through 75 hp, flow ratings from 50 through 2,000 gpm, and heads up to 300 feet. Each pump is equipped with either a NEMA standard JM or JP motor for mechanical seal or packing gland configurations, both of which include a 416 stainless steel shaft sleeve for durability and ease of service. 260/824-2900; [www.franklinwater.com](http://www.franklinwater.com).



### Gorman-Rupp Company 6500 Series

The 6500 Series line of solids- and clean-liquid-handling end suction centrifugal pumps from Gorman-Rupp Company is available in 3 to 16 inches, flows to 15,000 gpm, total dynamic head to 530 feet and solids-handling capabilities up to 4 inches. It comes with oversized bearings, an atmospheric vent, side-access inspection port (on solids-handling models), and indexable Smart Scroll discharge locator. 419/755-1011; [www.grpumps.com](http://www.grpumps.com).





E-Z Treat Company is pleased to announce the **E-Z Treat Re-Circulating Synthetic Sand Filter**, the *First and Only*, biological based treatment system to pass the **NSF-350 Water Reuse, NSF-245 and NSF-40** testing.

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E-Z Treat Company is currently seeking Dealers and Distributors-  
**Contact 866-753-4770 or [www.eztreat.net](http://www.eztreat.net)**

### Liberty Pumps LSG-Series Omnivore

LSG-Series Omnivore grinder pumps from Liberty Pumps have V-Slice Cutter Technology for shredding performance in demanding sewage applications, according to the manufacturer. The hardened stainless steel cutting system shreds jeans, shop rags, diapers, sanitary napkins and other difficult solids into fine slurry with infrequent jamming. Models are available in single- or two-stage designs, providing maximum pumping heads to 180 feet. Complete predesigned grinder systems are available in a variety of basin sizes. 800/543-2550; [www.libertypumps.com](http://www.libertypumps.com).



### Vertiflo Pump Company 2100 Series

The 2100 Series trash and solids-handling self-primer pump from Vertiflo Pump Company is offered in a variety of materials, including cast iron, 316 stainless steel fitted, all 316 stainless steel, CD4MCu fitted and CD4MCu. With several model sizes available, customer requirements for pumping clear and corrosive liquids can be satisfied with capacities ranging up to 1,300 gpm, heads of 112 feet, suction lifts up to 25 feet, and 3-inch spheres. 513/530-0888; [www.vertiflopump.com](http://www.vertiflopump.com).



### Webtrol Pumps V-Series

V-Series wastewater pumps from Webtrol Pumps have a recessed, cast iron impeller that reduces the load on the bearing and prevents clogging. The motors are air filled and offer continuous-duty ratings. They have potted epoxy cord seals as well as double silicon-carbide mechanical seals, providing defense against water intrusion. Constructed from stainless steel and cast iron, the pumps are available from 1/2 to 2 hp in 115- or 230-volt, single- and three-phase models for residential or commercial applications. 800/769-7867; [www.webtrol.com](http://www.webtrol.com). □

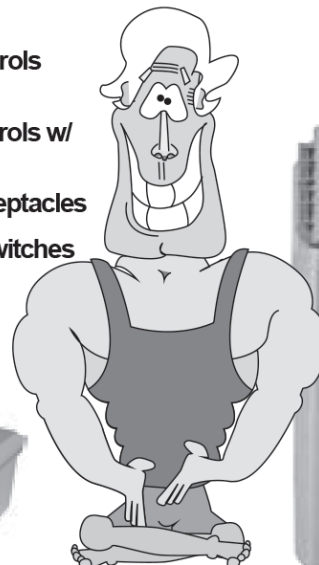


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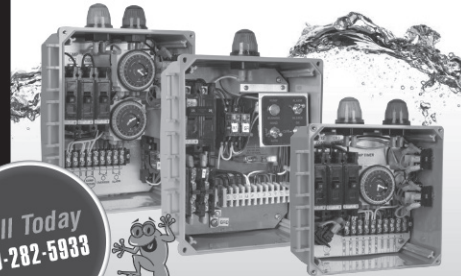


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# Large-Scale and Commercial Treatment Systems

By Craig Mandli

## Cluster system allows resort to reclaim effluent for irrigation

**Problem:** A resort in Costa Rica was using seepage pits to dispose of effluent. The owners wanted to reclaim the water for spray irrigation. They were using potable water for irrigation and had a monthly water bill of more than \$3,300.

**Solution:** Pacific Aqua Systems installed eight AERO-TECH 1,500 gpd aerobic treatment units in a cluster design. They are designed to treat wastewater to NSF Standard 40 requirements with little maintenance. The treated water from the 12,000 gpd system was disinfected and returned to the irrigation tank.



**Result:** The system allowed the resort owner to increase spraying and lower the monthly water bill. The treated water is tested weekly, with results of less than 1 mg/L of TSS, BOD and CBOD. 574/935-0908; [www.aerotech-atu.com](http://www.aerotech-atu.com).

## Control panel helps achieve efficiencies at football stadium

**Problem:** Observing an efficiency issue during install of a control panel associated with wastewater handling, an electrician for the Minnesota Vikings' new stadium in Minneapolis double-checked the design, and informed the contractor of an issue. A Check It Series Panel from Alderon Industries was recommended for the situation.

**Solution:** A low-cost strategy was quickly redesigned to include an optional seal fail and thermal cutout into the original panel design to provide longer runtime and shelf life. The field-adaptable, expandable panel has individually labeled floats, terminals and switches, one-button self-diagnostic Check It switch, individual HOA switches, and UL-listed NEMA 1/4X enclosure to reduce install and service time, and diagnose electrical wiring, float operation and installation. The panel monitors and alerts users to high levels or pump failures in water or wastewater applications, and alternates pump commands.

**Result:** The solution saved several weeks and thousands of dollars on the stadium project. 218/483-3034; [www.alderonind.com](http://www.alderonind.com).

## Treatment solution designed to meet environmentally sensitive standards

**Problem:** As a result of stringent environmental standards of Canada's provincial Manitoba Conservation, the lodge owners of Quesnel Lake Caribou Lodge needed to upgrade their wastewater system. With no access to a municipal sewer system and no power source available, the treatment system required high efficiency with very low power consumption.

**Solution:** Installation was done in two stages, the first of which employed the existing ejector system. This was accomplished using two Anua Platinum 24 submerged aerated treatment units, along with a 2,000-gallon pump tank. This allowed the use of an ejector for the first season and, by substantially reducing the effluent strength, a temporary license was awarded for that season. The second phase involved erecting a raised mantle portion of the area bed along with 16 Purafluo modules.



**Result:** Installing the two Platinum treatment units reduced the size and quantity of materials required for construction. A sequencing valve was installed, ensuring the system was only pumping to four Purafluo units at a time, reducing the cost and complexity of the system. 336/547-9338; [www.anuainternational.com](http://www.anuainternational.com).

## New system incorporates elements of existing treatment infrastructure

**Problem:** Barrel House Brewery is a commercial craft beer brewery in Virginia. Citing a lack of treatment capacity and given the high-strength wastewater generation common to craft beer production, the local public sewer was unable to receive the brewery's wastewater. Therefore, the brewery discharged to an onsite aerobic treatment system, which suffered a drainfield failure.

**Solution:** The owner reached out to Apptech Solutions for guidance. After completing a pilot study that focused on the business' unique water chemistry, Apptech developed a custom-engineered solution using the **Mobile Inceptor** treatment system designed to serve current needs and provide the foundation for future expansion. The engineered solution incorporated infrastructure that the owner had already invested in. The primary clarifier was left in service, the effluent pump station was converted to an influent pump station, and the aerobic treatment units were repurposed as sludge holding tanks. The system included flow equalization, multistage aerobic treatment with membrane filtration, an effluent pump station and a controls and equipment room.



**Result:** The system is now producing effluent far exceeding permit limits. 540/380-5600; [www.apptech-solutions.com](http://www.apptech-solutions.com).

## Clustered system helps condominium achieve total nitrogen permit standard

**Problem:** In 2007, a small condominium trust in Stow, Massachusetts, was forced to replace its wastewater treatment system to meet a permit standard of less than 10 mg/L total nitrogen. The trust was concerned with capital equipment and life cycle operating costs as well as process reliability.

**Solution:** The trust's engineer recommended replacing the system with a two-stage **Bioclere** trickling filter system followed by an anoxic **AquaCELL** moving bed biofilm reactor for denitrification from **Aquapoint**. The design included a primary tank, which also serves as a pre-anoxic zone and for sludge holding, and an equalization tank to regulate flow through the treatment process. Chemical-feed systems were also installed to restore alkalinity and provide carbon to the post-anoxic zone.



**Result:** The 12,000 gpd system has been in consistent compliance for nearly 10 years, operating at a fraction of the cost of the previous activated sludge system. Performance averages are 10.5 BOD, 5.2 TSS and 3.7 TN. 508/985-9050; [www.aquapoint.com](http://www.aquapoint.com).

## Gravel filters help lower treatment costs

**Problem:** The people of Hayden, Indiana, were faced with a dilemma. Failing septic systems were becoming an issue, and seemingly the only solution was to move the waste from the homes to be treated at another location. Hiring The Lochmueller Group for a solution, the township was presented with different alternatives, including a conventional sewer and treatment plant, or a decentralized treatment system.

**Solution:** Working with Watermark Engineering, the decision was made to install two large gravel filters from Clarus Environmental.



**Result:** The filters enable the residents of Hayden to have their waste treated at an overall lower cost to the town. 800/928-7867; [www.clarusenvironmental.com](http://www.clarusenvironmental.com).

## Upgrade aims to extend life of single-chamber septic system

**Problem:** In June 2014, ESSE Canada, an onsite system installer in Ontario, Canada, identified a residential customer looking for a preventive upgrade to extend the life of their existing septic system.

**Solution:** A **ClearPod** was placed into the single-chamber septic system (800-gallon tank) with an effluent filter. The system receives annual maintenance checkups to ensure it is operational.

**Result:** Recent wastewater sampling indicates effluent of 8.8 mg/L CBOD and 7 mg/L TSS. The results indicate an approximate removal rate of BOD/TSS of 90 to 95 percent and significantly reduced loading to the leachfield, and will significantly improve hydraulic flow, extending the life of the system. This is expected to eliminate the chance for leachfield failure, repair or replacement. 819/598-7153; [www.clearpodwater.com](http://www.clearpodwater.com).



## System effective for market with poor soil conditions

**Problem:** A food market in north-central Pennsylvania needed to repair its septic system after it malfunctioned. Plans to expand the facility were also factored into the repair. The site had multiple constraints, including a 20-inch limiting factor (bedrock) as well as poor soils (127 mpi). Because of this, a traditional system or elevated sand mound would not fit on the site.

**Solution:** The designer specified an Eljen GSF bed system for the site, using 192 B43 modules and a dual-compartment tank for the 1,250 gpd system. The system used low-pressure distribution by putting a 1.5-inch pressure lateral into the 4-inch SDR 35 perforated pipes that sit on top of the GSF modules. The bed was separated into two zones, each 48 feet wide by 97.5 feet long, that were alternately dosed.



**Result:** The owners were able to expand the market and still meet the multiple site constraints with a system that is able to treat effluent to NSF Standard 40, has lower material costs, and requires no annual maintenance or media replacement in the future. 800/444-1359; [www.eljen.com](http://www.eljen.com).

## MBRs enable strip-mining site to become resort

**Problem:** Giant Goose Ranch is a reclaimed strip-mine property in Fulton County, Illinois, covering more than 800 acres and with more than 50 lakes famous for fishing. Plans to rehab an existing campground to add resort cabins and 90 campsites required a new wastewater treatment system. The inconsistent soils, lakes, drastic elevation changes, and stringent code requirements challenged system designer Ray Tebo of New Excavating Technology.

**Solution:** The water-recycling membrane systems designed include Bio-Microbics BioBarrier Membrane systems installed within Infiltrator Water Technologies IM-Series tanks. The numerous MBRs are either 500 or 1,000 gpd units built to suit the location; single units serve individual cabins and 1,000 gpd MBRs serve clusters of resort cabins, beach houses, a store and a banquet hall. IM-Series tanks are also used for trash and pump tanks. Dispersal fields are time-dosed by Aquaworx IPC control panels. A blower outside the tanks blows air to scour clean the membrane, which keeps the biomass alive and growing. A 1.5-amp marine pump attached to each MBR slowly pulls the recycled water out and then transitions to gravity flow to the dispersal fields.



**Result:** Installing the tanks allowed offsite assembly of the units and delivery and installation without a heavy boom truck, resulting in substantial cost savings. EZflow by Infiltrator was used for the treated effluent dispersal fields, eliminating heavy trucking and the spreading and compaction challenges of stone. 800/221-4436; [www.infiltratorwater.com](http://www.infiltratorwater.com).

## System helps facility meet higher summer discharge levels

**Problem:** Crossville Health and Rehab in DeKalb County, Alabama, had a lagoon system that retained and partially treated 12,000 gpd. The effluent was discharged into a nearby stream. During the summer months the stream had minimal flows, resulting in higher discharge standards set by Alabama Department of Environmental Management. The system could not meet the required treatment levels during this time of year and fines were imposed.

**Solution:** The nursing home hired Judith Pike, P.E., from Highland Technical Engineering. She explored many options before deciding on AES from Presby Environmental for its onsite treatment system. Space, cost and maintenance were among the deciding factors. The facility generated two separate flows from the building, which was easily handled with the AES system and design. The system consisted of three beds — two treating 5,000 gpd each and a third that treats 2,000 gpd. The total amount of AES pipe used for this application was 6,400 feet. The two larger beds were installed using a sloping bed method; the smaller bed was installed level.



**Result:** The system saved the facility money, space and maintenance fees, while maintaining treatment levels set by the state. 800/473-5298; [www.presbyeco.com](http://www.presbyeco.com).

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## Strict disinfection needs solved at oceanfront Malibu restaurant

**Problem:** Located on the oceanfront in Malibu, California, Duke's is a popular restaurant, named for Duke Kahanamoku, the father of surfing. Wastewater from the restaurant averages 6,000 gpd, and must be treated on site and directly discharged to the sensitive sandy beach environment. The existing wastewater treatment system was outdated and causing numerous water-quality and discharge violations.

**Solution:** Carlile-Macy was selected to provide an upgraded treatment system in 2011. They chose an upflow sludge blanket filtration system, USBF, and Salcor UV disinfection, consisting of four 3G units in two parallel tracks. The design was approved by the California Regional Water Quality Board and city of Malibu, and construction of the new plant was completed in April 2012.



**Result:** The system immediately produced high-quality effluent, which met the stringent disinfection requirement of California Title 22. Results have been consistent since operation began. Effluent total coliform count has been non-detectable, and the dissolved oxygen concentration has averaged 6 mg/L. The discharge has reduced coliform levels in the groundwater lens under the site and adjacent beach from more than 1,600 MPN to less than 2 MPN. The UV units were initially inspected weekly for possible fouling of the Teflon barrier. Since no fouling has occurred, the inspections have been eliminated. 760/731-0745.

## System allows restaurant to treat effluent without need for leachfield

**Problem:** Legs Inn in Harbor Springs, Michigan, is a restaurant serving over 500 meals a day. It discharges almost 6,000 gpd of high BOD effluent, and is located on Lake Michigan. The leachfield had failed, and the restaurant needed a quick, efficient solution. The old system consisted of two 1,200-gallon grease traps from the kitchen leading to a 2,500-gallon septic system for the domestic waste. This flowed to a lower siphon tank to the leachfield downhill. The system was woefully undersized given the load.

**Solution:** SludgeHammer Group designed a system that would treat the effluent to the level necessary to abandon the leachfield and install a subsurface Geoflow drip irrigation field. A 2,500-gallon grease trap was added next to the others, and eight 4,000-gallon single-chamber treatment tanks were added in series for the S-86 Aerobic Bacterial Generator treatment units to be installed. A final 4,000-gallon pump tank was installed to supply the dripfield. A 15,000-square-foot dripfield with 7,600 feet of dripline with emitters on 2-inch centers was installed over the old leachfield. The lines were laid so they drained back to the pump tank to avoid freezing.



**Result:** Samples are taken annually with BOD typically below 10 mg/L, so the dripfield is protected. The restaurant is seasonal, so recycled water from the lower tanks is used to flush and treat the grease trap in winter to eliminate the need for grease pumping. 800/426-3349; [www.sludgehammer.net](http://www.sludgehammer.net).



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## Presby Environmental onsite wastewater treatment system

The EnviroFin passive onsite wastewater treatment and dispersal system from Presby Environmental is designed for residential and commercial applications. The compact system can be installed in



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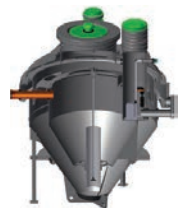
## Watson-Marlow peristaltic metering pump

The Qdos 120 peristaltic metering pump from Watson-Marlow Fluid Technology Group delivers flows up to 31.7 gph at a maximum pressure of 58 psi. The pump has no valves, ancillaries or gas-lock issues, reducing installation and maintenance costs. Accurate, linear and repeatable flow reduces chemical costs. A fully contained pump head ensures no spillage or exposure to chemicals. 800/282-8823; [www.watson-marlow.com](http://www.watson-marlow.com).



## Premier Tech Aqua sewage treatment plant

The Conder ASP HDPE sewage treatment plant from Premier Tech Aqua is designed for commercial and domestic applications where mains drainage is unavailable. The system features a final effluent discharge pump system. By eliminating the need for a separate pumping station installed downstream of the drainage, installers are able to overcome common obstacles where gravity discharge is not possible. Options include a telescopic extension kit. 800/632-6356; [www.premiertechaqua.com](http://www.premiertechaqua.com).



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Pictured (from left) are Dan Miller, president and CEO of Manitou Americas; Kelly Katzung, Northland Farm Systems; and Francois Piffard, executive vice president of sales and marketing for Manitou Group.

**Mustang-Gehl Company presents 2015 Top Dealer awards**

Mustang-Gehl Company presented 2015 Top Dealer awards to Northland Farm Systems (Owatonna, Minnesota), Alta Equipment Company (Wixom, Michigan) and Binkley and Hurst L.P. (Lititz, Pennsylvania).

**BASE Engineering appoints industrial specialist**

Alex Prosser was named industrial specialist for BASE Engineering. Prosser has worked with a diverse range of oil and gas projects throughout Canada.



Alex Prosser

**Manitou welcomes two to dealer network**

Dragoon's Farm Equipment and Toyota Material Handling Ohio joined the Manitou dealer network. Dragoon's Farm Equipment provides sales, service and parts support to Mooers, New York, and surrounding areas. Toyota Material Handling Ohio serves Columbus and Toledo, Ohio. □

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