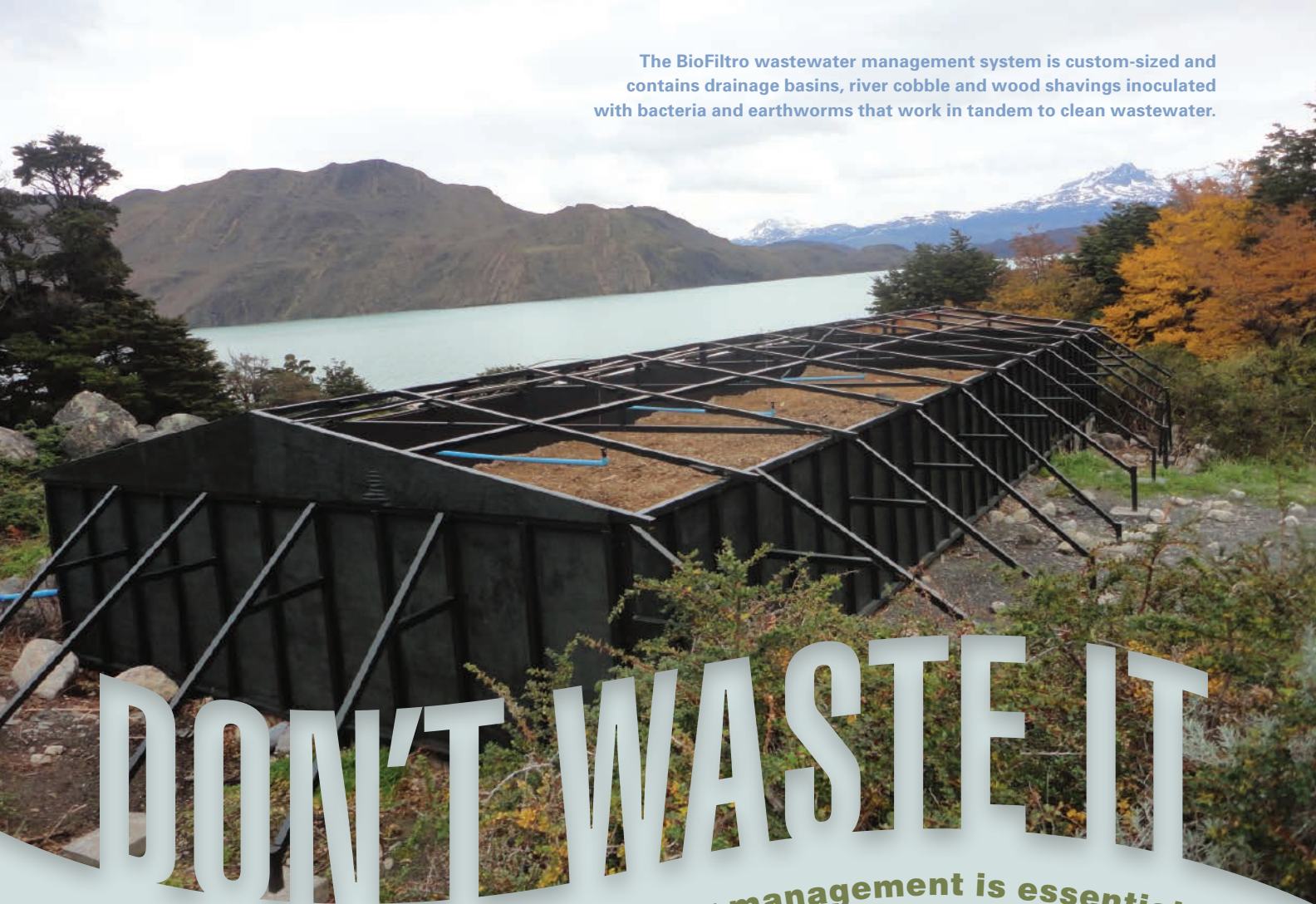


The BioFiltro wastewater management system is custom-sized and contains drainage basins, river cobble and wood shavings inoculated with bacteria and earthworms that work in tandem to clean wastewater.



# DON'T WASTE IT

Wastewater management is essential, especially in drought-stricken areas.

BY JANICE CESSNA

Producing a single gallon of wine, from grapes to bottling (not including vineyard demands), typically requires six gallons of water, depending upon winery-specific procedures. And since they're located in the most populated and highest water-consuming state in the nation, Californian winemakers have felt mounting environmental and economic pressures to reduce consumption and reuse wastewater.

"There's a lot of interest every time I talk about this," says Anita Oberholster, cooperative extension specialist at UC Davis. In California and other states that closely regulate winery wastewater discharge, producers typically pay heavy municipal fees to discharge untreated wastewater, pay to truck waste to an offsite disposal facility, or employ an onsite treatment option that most commonly involves aeration lagoons or biore-

actors. Some wineries, typically the state's largest producers with the deepest pockets, have implemented recycling technology and reused their treated wastewater for onsite landscape and vineyard irrigation.

"I don't understand why [wineries] wouldn't do this," says Rob Perman, director of operations at Free Flow Wines in Napa, Calif. "There's a lot of water to be had if you put in a reuse system. It's just a matter of putting in the effort and infrastructure."

## EXISTING WASTEWATER REUSE

Based on experience in her region, Oberholster estimates half of California's roughly 4,600 wineries currently treat their wastewater onsite. "No numbers are available, but I estimate that about 50% of

## AT A GLANCE

- + Onsite wastewater reuse saves disposal fees and freshwater costs.
- + Irrigating with reused wastewater doesn't affect vine health and wine quality.
- + New onsite treatment technologies offer cost-effective and low-maintenance options.
- + Appoint dedicated staff to research, implement and maintain a wastewater treatment system.

wineries that treat their wastewater may reuse it for different purposes, such as landscaping and, sometimes, vineyard irrigation. The latter definitely became more popular during the recent drought," she says.



**Anita Oberholster of UC Davis estimates half of California's wineries treat their wastewater onsite.**

Considering California produced more than 638 million gallons of wine and approached nearly half a million wine grape acres in 2015, the potential substitution of recycled wastewater in place of fresh-water irrigation could be significant.

## **AERATION LAGOONS OR BIOREACTORS**

Many wineries already employ aeration lagoons or bioreactors to prepare their wastewater for disposal, using these systems to settle out solids or reduce pH levels before discharging to municipal systems or land application. With minor infrastructure adjustments, many could redirect the water to their vineyards. Some producers, like Francis Ford Coppola Winery, have irrigated vineyards for roughly 20 years with treated aeration

lagoon water. But an industry-wide stigma lingers, preventing widespread acceptance of the practice.

"The problem is that most people doing it don't want to talk about it, and others worry about the long-term effects," says Oberholster. But several recent UC Davis studies help dispel these fears by concluding that the most significant issue with wastewater irrigation seems to be its salt content if a winery uses sodium-based cleaners. "Most wastewater treatments don't remove cation minerals such as potassium or sodium, so if you're using a lot in your winery, they stay in the water," explains Oberholster. Since vines can use potassium much more readily than sodium, that explains why sodium can build up in soils and eventually become toxic if not leached from the soils, while a potassium buildup is less likely.

The most recent study, conducted in part by Oberholster, further investigated the effects of potassium and sodium concentrations in wastewater on vineyard soils, vine biochemistry, grape phenology and finished wine quality. In all areas, although there was slight elevation of cation concentrations, actual impacts were negligible. "It appears that using wastewater is pretty safe, but it should fall within certain parameters before you put it on vines, so it should be treated," says Oberholster. "The toxicity levels for plants is pretty high and I haven't seen close to those levels [in treated wastewater]."

For those still turned off by irrigating vines with anything other than fresh water, there are other ways to harness wastewater. Although Free Flow doesn't have a vineyard to irrigate, it relies on wastewater for cleaning, primarily tanks and floors. "We have three bioreactors totaling 45,000 gallons and a 15,000-gallon tank for treated water," says Perman. He learned a lot from his experience selecting and installing Free Flow's system. "At the time, I knew nothing about wastewater treatment, so I relied on the engineer to design and implement the system. It's

important to work with a qualified engineering team that will build a system to your needs and provide support if you have any issues with the system."



**Free Flow Wines' Rob Perman relies on wastewater for cleaning primarily tanks and floors and worked with an engineer to design and implement his treatment system. [Photo by Bob McClenehan]**

After installing the Free Flow system, Perman encountered numerous painful complications. "We initially weren't doing chemical separation in the clarifier, which led to poor-quality water. The clarifier wasn't sized properly, limiting the GPM we could move through the system and maintain high-quality effluent," he says. "Everyone I talk to who's run a system says it's a lot of work. You need dedicated staff and the infrastructure and capacity to absorb the constant monitoring of a wastewater treatment plant (WWTP)." Perman also cautions that installing a recycling system takes patience to observe performance nuances and fine-tune its function, which is why he insists on the importance of dedicated staff. "It's definitely not a plug-and-play thing," he says.

## NEW TECHNOLOGIES

Mai Ann Healy, United States regional manager at BioFiltro, notes how critical wastewater management can be to operations. "If you have major issues with your wastewater, a facility must shut down and address the issue or risk noncompliance with discharge standards. We want to prevent that." BioFiltro sells bio-filtration systems that look like

above-ground concrete pools, custom-sized to each client's wastewater volume and concentrations. But instead of being filled with water, the pool contains drainage basins, river cobble and wood shavings inoculated with bacteria and earthworms that work in tandem to clean wastewater applied via intermittent surface irrigation. The system footprint depends on how many gallons and pounds of contaminants the system needs

to remove each day so that it can deliver rapid results in four hours.

"As water percolates through the system, wood shavings trap contaminants on their surface. In turn, the worms eat these solids and excrete rich waste in the form of castings," explains Healy. "These castings, and the airways created by burrowing worms, nourish billions of bacteria colonies that feed away at the dissolved and soluble contaminants. This

## OZONE AS A WINERY DISINFECTION TOOL

BY MARC DEBRUM

Disinfecting a winery is a huge contributor to wastewater. And while some wineries use chemicals, steam or hot water for disinfecting equipment, many are turning to ozone technology as an effective alternative that significantly cuts down water use.

Ozone is the most powerful oxidizer and disinfectant that can safely be used and is commercially available for the control of bacteria, molds and other microbes. It provides disinfection through a lysing process that breaks down the microbe membranes and cell walls, destroying them completely and quickly. It's far more efficient in disinfection than hot water, caustic chemicals or acids. Further, it's generated onsite, reducing the need for handling and storage of such chemicals.

FDA- and USDA-approved for food surface contact, ozone leaves behind no residues or aftertastes. Because it's created from oxygen, once this powerful molecule is consumed by the contaminant, it reverts back to oxygen very quickly.

### POINT-OF-USE

Cleaning and disinfection procedures take time — many

winemakers admit it takes far more time to clean and disinfect the winery than it does to actually make the wine. Traditional procedures start with a pre-rinse to knock down all the large debris; then the chemical cleaning step, typically using alkalis and acid-based products to remove dirt, sugars and other debris; a post rinse to remove the cleaning chemicals; then the disinfection rinse to reduce and destroy microbes, oftentimes using hot water, peracetic acid, caustic soda or even hydrogen peroxide; and a final rinse to remove the disinfectant.

However, when using ozone as the disinfectant, the post rinse and final rinse can often be eliminated, as there are no negative effects of the ozone mixing with the cleaning chemicals and, because ozone is safe for food contact, the ozone disinfectant rinse can also be the final rinse.

Typical disinfection products can take 30 minutes or more to provide sufficient contact time, whereas the proper levels of ozone can take mere seconds. Further, if hot water is being used in the disinfection protocol, it can be eliminated, as the ozone rinse will use cold water only.

Ozone is an excellent addition to disinfection protocol to

assure microbe-free surfaces within processing equipment such as hoppers, conveyors, destemmers and crushers. In addition, it can be used to disinfect barrels and fermentation tanks (inside and out), transfer lines, hoses, fittings, valves and clamps.

Floors, walls, and drains also need disinfection. Left untouched, these places can attract fruit flies and other pests, creating a breeding ground for microbes that can eventually become the source of microbial problems throughout the winery. Ozone-containing water can be used in these places simply and effectively on a daily basis to help prevent microbial outbreaks.

The use of ozone for disinfection has now spread throughout much of the wine industry and is an industry standard worldwide. As its benefits and cost advantages become more widely understood, the technology's role in wineries will grow.

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biofilm is a chemical-free and virtually odorless method that removes up to 99% of biological oxygen demand and total suspended solids, plus 95% of nitrogen while using up to 95% less energy than traditional aeration lagoons." BioFiltro offers various maintenance packages and financial models so facilities of all sizes can implement the system.

Fetzer Vineyards was the first winery in the United States to contact BioFiltro, but BioFiltro oversees installations for diverse industry verticals from Antarctica to Atacama, and its longest-running system has been operating in Chile for 26 years. "We've never had to replace an entire system," says Healy. "Rather, you only need to remove the castings that form across the system surface over time.

"Typically, for wineries, it's every 18 to 24 months, depending on the discharge rate of the winery and the characteristics of the process water." Healy also says the system can handle the seasonality of winery wastewater production, noting that almost a third of the 140 systems operating worldwide shut down for months on end during the off season.

Another proven technology, the EcoVolt Reactor, harnesses bacteria that produce electrical current and biogas as byproducts of digesting organic matter contained in winery wastewater. Cambrian Innovation of Boston, Mass., manufactures the reactor as modular, containerized solutions capable of treating up to 72,000 gallons per day while providing its own operational energy. "The EcoVolt Reactor is ideally suited to wineries producing 10,000 to 300,000 gallons per day," says Matthew Silver, Cambrian founder and CEO. As a modular system, the EcoVolt Reactors can be stacked and connected in parallel to handle each customer's wastewater volume.

"As with all wastewater treatment systems, standard operational adjustments, including sampling, testing, recording of measurements and probe clean-

ing should be made," says Silver. An EcoVolt Reactor installed in late 2013 at Clos du Bois in Geyserville, Calif., demonstrated 80% to 90% removal efficiency of biological oxygen demand during two crush seasons. Cambrian expects the EcoVolt Reactor to operate for 15 to 20 years at full operational capacity with minimal maintenance required.



**Cambrian Innovation's EcoVolt Reactor harnesses bacteria that produce electrical current and biogas as byproducts of digesting organic matter contained in winery wastewater.**

Cambrian also provides both purchase and lease options. "Our water-energy purchase agreement lets customers access wastewater treatment as a service. We own, install and operate EcoVolt solutions for customers and simply charge by gallons of wastewater

treated, kWh of clean energy supplied and gallons of clean water returned to the facility," says Silver. Costs for different systems vary depending on individual winery needs and specifics. "All our current EcoVolt installations have had impressive payback periods and high rates of return," says Silver. Healy compared BioFiltro's system to aeration lagoons, saying its solution is much more cost effective.

## REUSE CONSIDERATIONS

Like other winery and vineyard systems, wastewater treatment for purposes of reuse involves complex, carefully balanced and somewhat mysterious processes. "Wastewater is very different on every site, and it's very difficult to apply one solution to everyone," says Oberholster. "Examine your plants, test your soil every three years and test your wastewater every year during harvest to determine potential risk."

Appropriate investigation and planning can prevent headaches and buyer's remorse. "Do your research and make sure you understand what you're actually getting," recommends Perman. "Know what your needs are and know what the people are selling you." Recognize a treatment system functions as a living, breathing system and adjustments take time. "Usually, it takes a certain amount of time, maybe days, to see the results of what you did," says Perman.

Also, consider worst-case scenarios, like system failures and operational accidents. "Wastewater doesn't sleep; it continues to move and can catch you off guard if you're not paying attention," says Perman.

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**Janice Cessna** is a freelance writer who crafts informative content for magazines and businesses. Her experiences as a vineyard manager and cellar rat help inform her wine industry articles.

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 Comments? Please e-mail us at [feedback@vwmmmedia.com](mailto:feedback@vwmmmedia.com).