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Effluent Sewers Down Under

Devastated community finds innovative wastewater solution

BY BILL HENSLEY

The community of Kinglake West, Victoria, Australia, was on a waiting list to receive government financing for a new sewer system when, in 2009, a disastrous fire swept through the area. The damage was so extensive that funding for a wastewater collection system was expedited. The new system needed to be up and running as soon as possible, without being an undue financial burden to homeowners.

In early 2009, a record-breaking heat wave struck the state of Victoria in southeast Australia, making already dry conditions even worse. In addition, strong winds and low humidity combined to create some of the highest-risk fire conditions ever experienced in the region. Fierce winds knocked down power lines, resulting in fires that quickly grew into the largest, most destructive firestorm in Australia's modern history.

The community of Kinglake West, Victoria, is home to Australia's first Orenco® Sewer, installed in 2010. Photos courtesy: Orenco Systems.

The community of Kinglake West, home to about 1,000 residents, was dramatically impacted. Much of the town needed to be rebuilt, including its infrastructure. In particular, the community needed a collection system to transport wastewater from individual homes to a decentralized wastewater treatment plant.

One of the primary goals of Yarra Valley Water, the local water and wastewater authority, was to construct an innovative collection system that would be affordable and effective and would also provide some environmental benefits. Challenges included small lot sizes, steep gradients, and high rainfall.

With support from the community, Yarra Valley Water chose an Orenco® Effluent Sewer, a type of pressure sewer also known as a STEP/STEG system. This solution addressed the community's challenges and offered many unique advantages, including:

- Watertight collection, with no need for manholes or expensive lift stations
- Shallowly buried, small-diameter sewer lines, quickly installed with light equipment
- Passive, on-lot primary treatment
- Reduced size, complexity, and cost of the wastewater treatment system
- A minimum of 24-hour emergency storage in watertight, on-lot tanks (with normal, daily flows)
- Low operation and maintenance costs for both collection and treatment
- Long-term sustainability

A GRADUAL REBUILDING

Kinglake West began the installation of its effluent sewer in 2010. The sewer includes an Orenco STEP (Septic Tank

Effluent Pump) package in an underground tank, which provides passive, primary treatment at each residence. Small-diameter force mains move the effluent from each home to the community's treatment facility. Because an effluent sewer transports only liquids, its mainlines are typically just 50–100 mm (2–4 inches) in diameter and can be installed quickly and easily with light-duty equipment. This allowed the wastewater collection system to be completed in a relatively short period of time, despite the area's hilly terrain.

First, the watertight force mains and service connections to the community were installed. With nothing but effluent being pumped through the pipes, minimum flushing velocities, manholes, and costly lift stations were unnecessary. This was especially important because new homes would not be connected to the wastewater system all at once. Instead, individual residences were added gradually as homeowners were able to rebuild.

Another unique benefit of effluent sewers is their use of shallowly buried, small-diameter transport lines that follow the natural contour of the land. These lines can be installed using light-duty equipment such as a trencher, directional boring machine, or small excavator. This dramatically reduced the time, cost, and complexity of designing and installing the wastewater collection system. In stark contrast, a conventional gravity sewer system would likely have required deep excavations to install 200-mm (8-inch) mainlines, plus manholes and lift stations.

Considering the hilly terrain around Kinglake West, the installation of an effluent sewer was estimated to cost 40 percent less than that of a gravity sewer. The savings of $785,000 AUD ($727,000 USD) was large enough that Yarra Valley Water could

An effluent sewer uses shallowly buried, small-diameter collection lines that are quickly installed along roadsides with light-duty equipment.

The Orenco STEP package includes a buried, watertight tank.

have used it to pay for the installation of an effluent sewer for an entire second community of the same size.

Next, an Orenco STEP pumping package was installed at each property. The package includes a watertight interceptor tank, a Biotube® pump vault and filter, an Orenco high-head effluent pump, and a set of float switches. Once connected to the force main, primary-treated effluent from each home is pumped to the community's wastewater treatment facility.

The watertight, on-lot interceptor tank has a volume of 3,800 liters (1,000 gallons). Primary treatment takes place in the tank, diminishing the strength of the organic waste being discharged to the wastewater treatment system. This allows designers to reduce the overall size and cost of the treatment facility. The tank's volume is large enough for several days of retention time. It also has a minimum 24-hours' worth of emergency storage volume that prevents unnecessary disruption to homeowners during power outages and routine maintenance. This alleviates the need for operators to make expensive after-hours maintenance calls in the event of a nighttime alarm.

An Orenco Biotube pump vault is installed in each on-lot tank. The pump vault houses the filter, the pump, and the float switches. The Biotube filter consists of 3-mm (1/8-inch) mesh, which prevents the discharge of any larger solids. The organic matter retained in the tank is anaerobically digested by naturally occurring bacteria. Undigested solids accumulate slowly in the tank, so pump-outs are typically needed only once every ten years, depending on the number of residents in the home.

The pump typically comes on only 3–5 times a day for a total of less than 30 minutes. The float switches include a high-level alarm float, a pump on/off float, and a redundant off/low-level alarm float. Liquid is stored in the watertight tank until it reaches the float "on" level. The pump then engages until the liquid is reduced to the "off" level.

Undigested solids accumulate slowly in the on-lot tank, so pump-outs are typically needed only once every 10 years.

"The Kinglake West project was undertaken to determine whether it was possible to deliver a more sustainable sewerage solution in a developed, unsewered 'community sewerage' area," Andrew Gellie, community sewerage planning manager for Yarra Valley Water, said. "We found the

The Orenco high-head effluent pump housed in the pump vault has a life expectancy of over 20 years.

use of the STEP tanks to be a successful approach to extending wastewater services to this small community. The tanks allowed us to proceed with a staged approach to help Kinglake West rebuild."

LOW OPERATION AND MAINTENANCE REQUIREMENTS

The operation and maintenance requirements of an effluent sewer are extremely low. Each residence and business connected to the system requires routine service only every other year. A typical service consists of measuring and recording solids accumulations in the on-lot tank, cleaning the Biotube filter and pump intake screen (if needed), and verifying proper operation of the pump, floats, and control panel. The valves in the system are also inspected and tested to make sure they're in good working condition. Because solids aren't pumped through the force main, flushing (or "pigging") of the mainline isn't required.

A control panel at each home monitors the components of the on-lot STEP package.

An Orenco Sewer allowed Yarra Valley Water to provide a feasible, long-term solution to its customers in Kinglake West soon after a major crisis.

"We benefited from reduced capital and operating costs for the collection system and sewerage treatment plant," Gellie said. "This cost-effective technology has gone a long way toward helping the community rebuild and recover from the devastating fires of 2009." **WW**

About the Author: Bill Hensley is an international project manager for Orenco Systems Inc., a wastewater equipment manufacturer. In his primary role, he manages engineered projects outside of the U.S. and Canada. Learn more at www.orenco.com.