sustainable decentralized treatment

Rural communities often struggle to afford conventional wastewater collection and treatment methods.

By Rick Bruno

Indiana township expands use of attached-growth treatment for local utility

Lexington Township in Scott County, Ind., is a rural community 30 miles north of Louisville, Ky. The community was plagued with failing onsite leech fields and experienced sewage draining into open ditches. Scott County retained the services of Saegesser Eng., Scottsburg, Ind., to design a system to remediate the situation, connecting approximately 100 residential, commercial and municipal buildings to a communal wastewater treatment system funded through the U.S. Department of Agriculture's Rural Development program.

The Lexington Sanitary Sewer Project entailed the installation of a 10,000-gpd communal system.

ARTICLE SUMMARY

Challenge: A rural township faced failing onsite leech fields and sewage draining into open ditches—plus the operation and maintenance cost limitations that many small and rural communities face.

Solution: The township installed decentralized wastewater systems to cost-effectively address the leech field failures and sewage drainage.

Conclusion: The systems are operational and have been performing well.

For many rural communities, the high operational and maintenance costs associated with conventional wastewater collection and treatment are prohibitive, requiring them to seek smaller-scale solutions to collect, treat and dispose of domestic wastewater safely. Communal or cluster decentralized wastewater systems bridge the gap between traditional onsite and municipal options, allowing communities to cost-effectively address domestic wastewater issues.

System Upgrades

System design for the Lexington Sanitary Sewer Project was overseen by Bill Saegesser, P.E., of Saegesser Eng., who considered a variety of factors influencing the design of the project.

As part of a previous project in 2005, a 10,000-gal-per-day (gpd) communal system was engineered and installed for the Three Springs Youth Rehabilitation Center located at the township's Englishton Park site. The center had been forced to close due to the onsite septic system's failure and could not reopen without a new wastewater system.

The system design included the installation of two 10,000-gal septic tank effluent pumping (STEP) tanks at the campus, a 10,000-gpd EnviroFILTER package plant, a disinfection building with ultraviolet disinfection, flow monitoring and gravity discharge to nearby Town Creek under the National Pollution Discharge Elimination System (NPDES) permit. At the time, Lexington Township requested certain design modifications to allow for treatment capacity expansion and the connection of a sanitary sewer to transport its wastewater to the site for treatment and disposal.

For the expansion project, Saegesser chose a pressurized small-diameter effluent sanitary sewer because ground conditions required blasting to lay conventional gravity sewer pipes. In order to provide collection capacity and primary wastewater treatment, a STEP system was specified that utilized fiberglass tank installations at each system client's property. The design specified attached-growth secondary treatment at Englishton Park, where effluent would be treated to meet permitted limits prior to discharge into Town Creek per the NPDES permit.

The project was awarded to Dan Cristiani Excavating Co. Inc., Clarksville, Ind. Construction began in late 2010, and the system became operational in May 2011.

Decentralized System Benefits

Historically, rural communities with populations of less than 2,500 residents often opt for communal systems that provide for site collection of domestic effluent, primary and secondary treatment, and disposal. As permitted discharge limits become increasingly stringent, considered treatment options must meet discharge limits yet remain affordable to install and operate.

Many rural remediation projects are funded through public agencies and subject to open bidding. In writing project specifications, addressing treatment discharge performance is fairly straightforward. The difficulty lies in quantifying operation, maintenance and repair costs and requiring that installers take responsibility for those costs meeting specification.

In the paper, "Evaluation of Large-Scale Decentralized Wastewater Systems: Sustainability Considerations," by Dr. Susan Parten, P.E., originally published in 2009, the findings and recommendations of a two-year study funded by the Water Environment Research Foundation are discussed. In the study, U.S. nationwide performance, cost and operational data was gathered and analyzed for systems with flows between 5,000 and 50,000 gpd with at least five years of operational history.

Parten discusses the reliability of performance for system types, capital and operational costs, energy consumption and sludge production. Useful service lives are identified, wherein the costs of operating, maintaining and repairing the system become as important to communities as systems' original capital costs.

Parten points out that developers and system owners frequently opt for wastewater systems with the

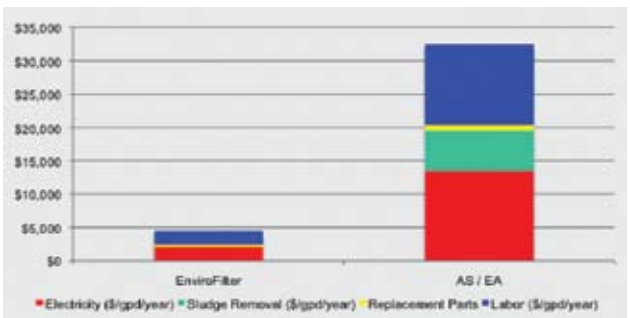
lowest short-term expenditure rather than invest long term in lower life-cycle costs—choices often largely based on the absence of readily available information that might assist in the decision-making process.

Treatment options familiar to most civil engineers are taught at the university level utilizing traditional municipal treatment technologies. These types of activated sludge/extended aeration (AS/EA) technologies are suitable for municipalities generating millions of gallons of wastewater per day, striking an excellent balance between capital costs and annual operating costs, primarily because applications of this size can afford the overhead structure to staff the facility on a 24/7 basis. This allows operators to monitor and make frequent changes to treatment conditions in order to meet permitted discharge limits.

Conversely, when the system size is scaled down for smaller communities typically generating less than 250,000 gpd of wastewater, the overhead structure for the mechanized AS/EA treatment technologies becomes prohibitive. Figure 1 compares annual operation, maintenance and repair and 20-year life-cycle costs between a 50,000-gpd HydroLogex EnviroFILTER and a typical AS/EA system. It demonstrates the significance of operation, maintenance and repair on smaller-scale systems.

"In 1998, we began formalizing the concept of a recirculating package plant that contained recirculation basin, textile media filter bed and effluent dosing basin in a factory-assembled vessel," said Kevin Chaffee, chief engineer for HydroLogex. "This provides an innovative and affordable wastewater treatment solution for these types [of] communal projects. This concept has several patents attached and forms the basis for today's HydroLogex systems."

Figure 1. OM&R Comparison



Meeting Regulations

Proven attached-growth secondary treatment was specified for the Lexington project. "We had a unique situation in Lexington as the township operated the Englishton Park EnviroFILTER system for more than five years with zero permit violations," Saegesser said. "Additionally, the Indiana Department of Environmental Management (IDEM) performed a complete plant audit in 2008, and the facility was awarded a "Superior Grade"—one of few ever awarded by the state for a small-package plant facility."

Because of the township's earlier success with the system, Saegesser chose to specify an EnviroFILTER treatment package plant that utilizes textile media for attached growth as the method of secondary treatment.

Returning clean water to Town Creek is a priority for Scott County and IDEM. Jason Combs, a licensed wastewater operator at the Scott County Regional Sewer District, has maintained the original Englishton Park system for the past five years and will oversee the new expanded system.

"We clean the filters on the recirculation pumps and spray nozzles and inspect the pumps and controls twice a year," he said. "The EnviroFILTER textile chips self-clean and have required no maintenance. The STEP tanks are pumped every two years."

"The treated effluent has met the regulatory discharge permit limits of 10 mg/L BOD_5, 12 mg/L total suspended solids, 125 count/100 mL *E. coli* and 1.5 mg/L ammonia as nitrogen since the system went into operation in 2005," Combs added. "The site is in the 100-year floodplain of Town Creek, and a major concern was meeting the NPDES discharge permit because the creek has no water to dilute the treated effluent during the dry season. To date, we've had no issues." WWD

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