Decentralized wastewater treatment systems for small, rural communities protect water resources from contamination. **Dennis F. Hallahan** of Infiltrator Systems Inc. explains how this approach helped the Canadian Village of Omemee solve its wastewater woes.

Decentralized systems for communities

Finding cost-effective sustainable solutions for wastewater infrastructure challenges is a balancing act for rural and growing communities. In the past, most communities turned toward centralized wastewater collection and treatment whenever possible. Today, this cost-intensive option is not practical or desirable in areas that do not have nearby systems to tie in to, or where there is a lack of any infrastructure or funding source to offset the cost to individuals and businesses. In rural and suburban areas, decentralized treatment using community systems or individual onsite septic systems is becoming the solution of choice.

In the decentralized approach, groundwater is extracted, used, and treated onsite. Then, it is returned close to its point of origin to recharge the aquifer. From small residential systems to large-scale facilities, or community discharges more than four million liters per day, these natural approaches provide long-term treatment solutions, better development practices, and can be more cost-effective than centralized systems. Due to the compactness of the model there is also less energy consumption.

The technologies available for large-scale decentralized systems are now available for small-scale systems as well. This is a real boost to rural and growing communities that need wastewater solutions. Because of these advances on the treatment and disposal side, decentralized systems are no longer limited to small flow systems and those in remote locations. Today there are several decentralized facilities operating at a capacity of over 4 million liters per day. In addition, communities, owners, and developers do not have to wait for sewer extensions to reach their site or the treatment plant to be expanded in order to move forward with a community or development project.

Every situation is unique and wastewater volumes, treatment needs, design challenges, and local regulations vary greatly. When communities choose a sustainable development and wastewater treatment path, they base the choice on factors including community planning, anticipated growth, economics, and environmental sensitivity. But there are basic questions that community leaders and residents should ask before determining the best route to take.

What wastewater treatment challenges currently exist?

Officials and residents of rural communities need to understand the current problems and shortcomings of the wastewater treatment system in the community, such as leaking sewers, an over-capacity system, sewage overflows, underfunding, watershed issues, groundwater pollution, and regulatory non-compliance. Residents also need to be informed about the options and costs of proposed solutions.

What are the projections for community growth and how do they impact anticipated wastewater treatment needs?

Each community has to make choices based on its unique circumstances and needs. Centralized sewers offer the possibility for large-scale rapid commercial and residential growth, but many communities want to avoid that and retain historic and community character, while others simply can't raise the funds for large infrastructure improvements. With decentralized treatment, a community can focus on only

Plastic tanks are becoming more common in decentralized wastewater treatment systems. Ease of shipping and installation coupled with high strength, water tightness, and materials that are inert to septic gases have helped the industry. In this rural system, the Infiltrator IM-Series plastic tank is lowered by hand into place at the installation location. Photo by Infiltrator Systems

When communities choose a sustainable development and wastewater treatment path, they base the choice on factors including community planning, anticipated growth, economics, and environmental sensitivity.

treating the areas that are causing a problem or have the potential to do so. This allows for smaller design flows, smaller disposal areas, and therefore lower costs. This also places the financial burden on those properties where issues are seen or anticipated.

What treatment options are available?

Decentralized, centralized, or a melding of the two are the most common choices. Consulting an expert in each model can be an important step toward making the best choice without being bias-directed toward only one of the options.

What are the true costs?

Cost savings can be a significant advantage in the decentralized approach. Decentralized treatment can offer many cost advantages. Design, permitting, legal, land purchase, and construction costs all need to be dealt with in the short term. Long-term costs include operations and management, licensed operators, billing structure, district vehicles (specialized trucks), and specialized equipment.

Conclusion

Communities have options when facing their wastewater challenges. In spite of the perceived benefit of centralized sewers, they continue to be the primary contributor to surface water pollution, and the cost and infrastructure challenges associated with a centralized system make them a questionable choice for rural communities and outlying areas.

In the United States and Canada more than 25 percent of the population is served by decentralized systems. Worldwide, these high-performing community and individual systems provide efficient and effective wastewater treatment for rural and growing communities.

Author's Note

Dennis F. Hallahan is the technical director at Infiltrator Systems where he is responsible for technology transfer between the company and regulatory and design communities. With more than 25 years of experience with onsite wastewater treatment systems' design and construction, he has authored several articles for onsite industry magazines and has given numerous presentations nationally on the science and fundamentals of onsite wastewater treatment systems. He holds several patents for on-site wastewater products.

Case study

OMEMEE, CANADA

The Village of Omemee, located in the Village of Kawartha Lakes, is a small, rural town in Canada where private septic systems and growing development density were resulting in the contamination of drinking water supplies.

Private water wells supply potable water and the majority of the residents are serviced by a municipal wastewater system with an original design capacity of 608 cubic meters per day that includes a collection system, two sewage lagoons, and a spray irrigation system for effluent disposal.

With the current estimated population of 1,359 and a projected population increase of 664 residents over the next 10 years, Omemee outgrew the existing septic lagoon and spray irrigation system – resulting in a ban on development and required emergency discharges.

Initial proposals recommended a "big pipe" solution for water and wastewater servicing, however the high capital and operating costs of such a system was not acceptable to the residents. Due to the presence of permeable soils and the deep position of the water table onsite, engineers determined that a large subsurface disposal system could be an effective solution. With development in the village halted by the Ministry of the Environment and the need for a year-round solution they could afford, approval for the subsurface system was granted.

There were many benefits: the community already owned the property, the soils were well drained and had proper separation to groundwater, and the lagoon-treated effluent quality was ready for disposal without additional treatment. It would also allow for year-round disposal of effluent instead of the seasonal system now in use. Also, system automation allowed for consistent effluent dosing intervals, thereby reducing the potential for adverse hydraulic loading on the native soils. Not to mention that the cost for installing the subsurface system was less than US$3 million – a dramatic savings compared to the $14.9 million cost of a big pipe solution.

The sewage lagoons and the pump house are retained at the site, with disposal to a large subsurface disposal system. A nitrate loading assessment determined that nitrate concentrations would be considerably lower with the subsurface disposal system than the required limit of 2.5 milligrams per liter and therefore, no impacts to the surrounding water resources would result.

Sized for 1,353 cubic meters per day, the Omemee modular disposal system design includes the existing flow and allows for expansion for future growth. This will enable the village to remove the development ban, while moderating the initial capital expenditure of the wastewater system. In contrast, a typical centralized wastewater system requires sizing for 20-year or longer growth projections with additional capacity difficult to add at a later date, which results in higher upfront capital expenditures.

Sized for 1,353 cubic meters per day, the Omemee modular disposal system design includes the existing flow and allows for expansion for future growth.

A series of disposal beds in 24 cells incorporate Infiltrator Quick4 chambers. The chambers were selected due to the lower material cost when compared to stone with a significant reduction in labor required for installation. The distribution piping attached to the inside of the chamber allows effluent to spray across the chamber's inside area, resulting in even distribution of the effluent across the infiltrative surface.

The new decentralized wastewater system allows for year-round disposal of effluent and village growth, without the large capital cost of constructing and maintaining a big pipe system. The disposal system also eliminates the need to discharge the lagoon sewage directly to the Pigeon River, protecting an important recreational resource in the area. Its modular design enables possible expansion in the village, which could balance incoming development charges with the future cost of expanding the system as required. Finally, the residents are satisfied with a made-in-Omemee solution for their wastewater servicing.

Above: The installation of two separate zones separated by 10 feet of soil is shown. There are a total of 24 beds in the dosing system cycle. The lightweight chamber system was installed quickly following excavation and then backfilled with large-tracked equipment.