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Choosing Your Community Wastewater System: A Life-Cycle Cost Analysis Can Prevent Financial Woes

Tyler Molatore[1]

Straight pipes, failed drainfields, polluted lakes, out-of-compliance discharge permits, and several other indicators of wastewater management issues are widespread throughout Iowa's rural communities. In fact, Iowa Department of Natural Resources has identified more than 500 small communities that lack adequate sewer infrastructure to meet today's environmental standards.

Unlike sizeable municipalities, small communities face unique challenges to solving their wastewater problems. Houses are scattered, flows are low and highly variable, and, most notably, funding options are limited, especially with the expiration of federal and state assistance programs in the mid-90s. In addition, full-time operators are uncommon; operators are typically hired part-time or serve in other capacities, such as road superintendent or community board member. For all these reasons, conventional wastewater solutions — with their full-time operations, complex controls, and large up-front capital costs — make sewering small communities financially difficult, if not impossible.

The Advantages of Alternative Wastewater Technologies to Small Communities

To reduce overall costs, an increasing number of small communities are choosing wastewater management solutions that use alternative technologies, such as *effluent sewers* (i.e., STEP/STEG systems, which collect wastewater from each property in an underground septic tank and then pump the filtered effluent to a centralized treatment facility or neighboring sewer, leaving solids in the tank to decompose naturally) and *grinder sewers* (which collect wastewater from each property in an underground basin, grind it, and pump it to a centralized treatment plant or neighboring sewer).

Alternative wastewater collection and treatment systems offer several benefits for small communities, including reduced up-front capital costs, lower life-cycle costs, improved system performance at low flows, reduced maintenance (compared to traditional gravity sewers), and increased reliability (allowing part-time operation). Moreover, systems can be installed in half the time. No deep (and costly) excavations are necessary ... just a shallow trench that follows the contour of the land, small-diameter (typically 2-4 in.) mainlines, and cleanouts instead of manholes. These and many other features of alternative collection systems can save utilities thousands of dollars in up-front costs compared to conventional solutions.

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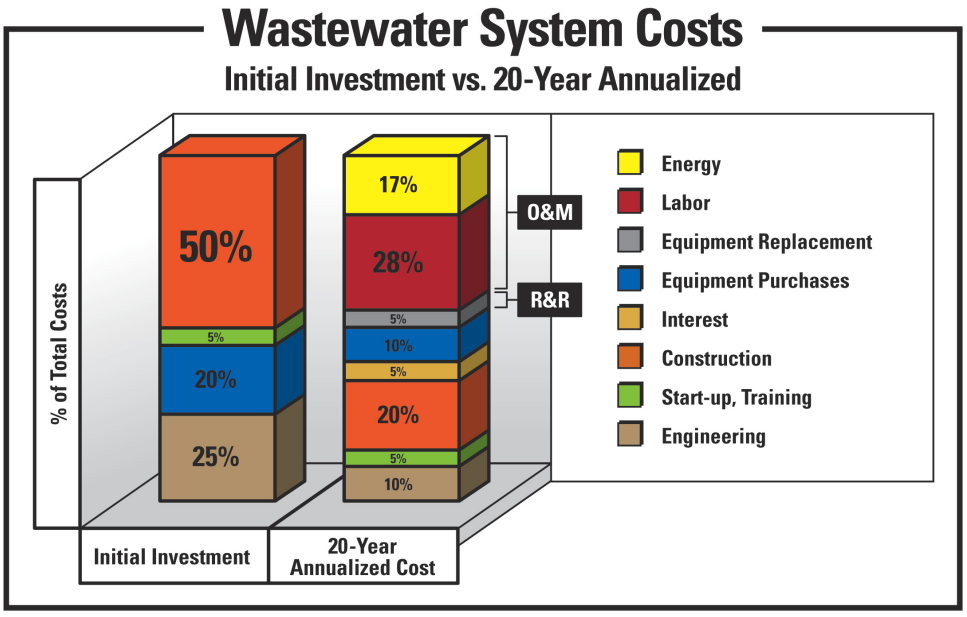
The Importance of Life-Cycle Cost Analysis When Evaluating Alternative Technologies

Since effluent sewers and grinder sewers have similar benefits, decision-makers often compare them on price. Upfront costs are generally similar, though in some cases, grinder sewers may cost less up-front because they only require a small underground basin at each property, rather than the larger septic tank that's used to provide primary treatment with effluent sewers.

Upfront cost differences are misleading, however, because they only represent one part of the overall cost of a system. They ignore O&M costs, for example. Consequently, it's worth it to take the time to analyze life-cycle costs. Life-cycle costs take all costs into account, which is particularly important for small communities, because small communities are responsible for — and bear the costs of — maintaining the system, for the life of the system, after it's installed.

The life-cycle cost of wastewater collection and treatment systems includes design and construction, repair and replacement (R&R), and operation and maintenance (O&M). While design and construction are typically the same for both alternative systems, R&R and O&M costs differ significantly — and the life-cycle costs for effluent sewers are typically lower. To avoid financial problems in the future, decision-makers must evaluate these differences during the selection process and plan for them in the management and rate-setting process.

Here's why. As the following chart shows, half the total 20-year annualized cost of a wastewater system is for O&M and R&R. That means, if you choose reliable equipment (as opposed to cheaper equipment) upfront, you'll save money throughout the life of the system. An incremental increase in equipment cost, however, is negligible over the long run. For example, a $400 difference in upfront costs equates to little more than $2/month/household over a 40-year term, at 6% interest.



This chart is based on decades of bid tabulations and was developed by Energenecs, Inc., a Wisconsin consulting company (and, in the interests of full disclosure, now an Orenco distributor) that specializes in life-cycle cost analysis for its clients.

The Difficulty of Obtaining Life-Cycle Cost Data

Clearly, decision-makers need, but often lack, the life-cycle cost data that could help them select a technology that offers the best and lowest life-cycle costs. This data is hard to come by because differences in sites, permit requirements, and O&M practices (protocols) for each system vary greatly; consequently, comparative analyses require many assumptions about what's typical and what's not.

For the purposes of this article, then, I'd like to provide comparative analyses on just a few important "hard costs" for both grinder sewers and effluent sewers that do not require a lot of assumptions: pump R&R costs, pump power costs, and tank pumping costs. Together, they have a significant impact on life-cycle costs.

Cost Comparisons for Pump R&R, Pump Power Consumption, and Tank Pumping[2]

Pump R&R — As the following chart shows, pump R&R for grinder systems is more than $8/month/household ... eight times higher than pump R&R for effluent sewers, which is about $1/month/household.

Here's why. Grinder systems typically use heavier (±90 lb), 1.5-2 hp, 230V grinder pumps with a repair frequency of 8-10 years at a repair cost of up to $800, and a replacement frequency of about 20 years at a cost of $1,500 to $2,000. Assuming a 40-year term, the monthly cost for grinder pump R&R is $8.13/household.

By contrast, effluent sewer systems use lighter (±30 lb), 1/2 hp, 115V high-head effluent pumps with a life cycle of 20 years and a replacement cost of about $500. Assuming a 40-year term, the monthly cost for effluent sewer pump R&R is $1.08 per household.

Onsite Pump Power Consumption — Using the national average of $0.08 per kWh and the pumps specified above, power consumption for grinder systems is nearly $4.50/month/household ... nearly four times higher than power consumption for effluent sewers, which is $1.15/month/household.

Onsite Tank Pumping — Onsite tank pumping costs for grinder systems are $0.00/month/household (because grinders typically have no tanks; solids are ground up and pumped to the treatment system, so the cost of handling those solids is transferred to the treatment system). Tank pumping costs for effluent sewers, on the other hand, are $1.19/month/household. This assumes a pumpout cost of $250 (pumpouts range from $150 - $350) and a pumpout interval of 12 years, based on four occupants/1500 gallon tank.[2]

[2] *All cost comparisons in this section are based on a 40-year term at 6% interest.*

Sample Life-Cycle Cost Comparisons[1]

	Grinder Sewers		Effluent Sewers	
	Frequency	Cost/Event	Frequency	Cost/Event
Onsite Pump R&R				
Repair frequency	@ yr 10, 30		————	
Repair labor/materials		$800		————
Replacement frequency	@ yr 20, 40		@ yr 20, 40	————
Replacement labor/materials		$1,500		$500
Subtotal (Annualized) ▶		**$8.13/mo/household**		**$1.08/mo/household**
Onsite Solids Removal				
Solids removal frequency	————		@ yr 12, 24, 36	
Solids removal costs		————[2]		$250
Subtotal (Annualized) ▶				**$1.19/mo/household**
Onsite Power Consumption				
Pump run time: hr/day total	0.5 hr/day		0.33 hr/day	
Average cost per kWh	$0.08		$0.08	
Subtotal (Annualized) ▶		**$4.46/mo/household[3]**		**$1.15/mo/household[4]**
Total 40-Year Life Cycle Cost (Annualized)		**$12.59/mo/household**		**$3.42/mo/household**

[1] Life cycle cost based on 40-year term @ 6% interest
[2] Cost transferred to treatment facility
[3] Assumes 1½ hp, 230 V grinder pump pumping 10 gal/minute for 30 minutes
[4] Assumes ½ hp, 115 V effluent pump, pumping 15 gal/minute for 20 minutes

These three line items show the differences in selected life-cycle costs between alternative wastewater technologies. They total $12.59/month/household for grinder systems and $3.42/month/household for effluent sewer systems. Clearly, life-cycle costs like these can stress a utility if not planned for, especially when coupled with debt retirement costs. And these are by no means the only line items that decision-makers and utility managers should consider for their life-cycle cost analyses.

Additional Life-Cycle Cost Items

When selecting an alternative wastewater technology, decision-makers need to consider whether or not costly lift stations will be required (often necessary with grinder systems, rarely necessary with effluent sewer systems) and the type of secondary treatment system necessary. Effluent sewer systems provide primary treatment, reducing solids by about 80%. Therefore, they are often followed by downsized and less costly secondary treatment facilities, such as a media filter, constructed wetland, or lagoon.

On the O&M side, additional costs (beyond pump power consumption and tank pumping) include scheduled and unscheduled service calls, mainline cleaning, and air valve maintenance, all of which are markedly different for grinder and effluent sewer systems. Communities that are considering an investment in any sewer technology should diligently seek out other communities with comparable systems and ask about maintenance costs.

In fact, real life data should be used to validate all manufacturers' claims. If possible, it's best to visit, tour, and acquire data from alternative systems that have been operational for several years, preferably over ten. Contact alternative system manufacturers or your regulatory authority to determine the closest system near you.