Photo by Tom Canaker, Sr., Flo-Systems, Inc., Troy, Illinois

STEP System Clears the Air in Illinois Village

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Two years ago, New Minden, a tiny village located in the flat, prairie country of Illinois, had raw sewage stagnating in the ditches. Septic tank systems, the only means of wastewater treatment, were failing at an alarming rate, and the ground was saturated.

Although it wasn't a direct threat to their public water system, which is piped in from Nashville, Illinois, local officials were afraid the untreated wastewater was finding its way into the Kaskaskia River, a major state waterway. In addition, the raw sewage left a less than pleasant aroma in the air.

Today, New Minden's 250 residents are breathing a lot easier since the installation of a septic tank effluent pump (STEP) and gravity (STEG) sewer system for collection and pretreatment in combination with a recirculating gravel filter for final treatment. Effluent values from the plant have far exceeded even the project engineer's hopes, with the latest monthly data showing biochemical oxygen demand at 1.1 milligrams per liter (mg/L), total suspended solids at 3.6 mg/L, and ammonia-N less than 0.20 mg/L.

Engineer Bill Walker of Walker Baker & Associates of Harrisburg, Illinois, commented, "I think at first we were surprised. This was a very interesting project. This is an alternative system and innovative in nature. It's an old concept with a twist. If it's done properly, the results are great."

Located in Washington County in South Central Illinois, New Minden is almost entirely residential. Prior to the recirculating gravel filter project, the standard treatment method was single-house septic tank systems.

New Minden Mayor Rich Karmeier explained that the village has a very high water table. "It was especially bad in the spring, when we would get heavy rain. Everybody's septic tanks would overflow into the ditches, and everyone's washers would overflow, too. It was really becoming a health hazard," said Karmeier.

A major obstacle for the village council in finding an affordable wastewater treatment system was the topography of the area. "There is a layer of limestone underlying the entire town. It's solid rock—limestone bedrock—2 to 12 feet below the surface," Walker explained.

> "Effluent sewer technology and equipment have been refined over the past two decades. We know that effluent sewers perform extremely well, as long as they're carefully designed and installed."

"That was a big problem with installing a conventional gravity sewer. The contractor estimated it would have taken $2.1 million. Right then, we realized an effluent sewer system would save a million dollars in excavation costs."

New Minden's Demonstration Project

The New Minden project was part of an Illinois demonstration project, one of four communities selected by the state for installation of a cost-effective, alternative wastewater treatment system. The other communities were Browns, Creston, and Eddyville.

In 1992, the Illinois Rural Community Assistance Program (RCAP) and Illinois Rural Development (formerly Farmer's Home Administration) asked the governor's Rural Affairs Council to help these small communities reduce costs, speed up planning and construction, and overcome regulatory barriers to address their wastewater problems.

The Illinois Community Action Association report concerning the demonstration project outlines five goals:

- Target, coordinate, and maximize the use of federal and state wastewater treatment funds for small communities.
- Reduce the administrative and regulatory burden on small communities as they seek alternatives to conventional wastewater systems.
- Encourage and support the development and application of proven, low-cost alternative wastewater technologies.
- Design and implement an alternative wastewater demonstration project for small communities that is representative of the geographic, topographic, and wastewater problems in Illinois.
- Develop and implement an outreach technical assistance and educational program on proven alternative wastewater technologies.

The total cost of New Minden's project was $1,090,000. As part of the demonstration project, the village received technical assistance from RCAP and planning and engineering design grants from the state's Department of Commerce and Community Affairs. In addition, the Community Development

Assistance Program and Rural Development provided construction grants and loans.

The Plant

"The treatment plant at New Minden is 50 by 100 feet, and the entire treatment plant has a footprint of less than an acre," said Walker. "The system is very unobtrusive. It's pretty much hidden. The treatment plant is not recognizable to the average person as a treatment plant."

The recirculating filter is buried to ground level. There is a maintenance shed and process and storage building.

The system, manufactured by Orenco Systems of Sutherlin, Oregon, consists of 119 gravity flow septic tank effluent gravity (STEG) systems and 11 septic tank effluent pump (STEP) systems, 9,900 feet of 2- and 3-inch gravity flow pipe, 22 pump stations containing duplex 1/2-horsepower turbine effluent pumps, and 17,000 feet of pressure mains followed by a two-cell recirculating granular filter, according to Walker.

The average size of the septic tanks is 1,000 gallons. "Each house has a septic tank that is owned by the village," Walker said. "The reason the treatment plant can be so small is that each septic tank has a built-in screening system that allows the tank to operate to its maximum effectiveness. This also allows no solid larger than an eighth of an inch to exit the tank. In other words, the septic tanks act as septic tanks should. They provide the primary treatment."

He added that the largest sewer line in the village is 4 inches in diameter. "During construction, we didn't tear up one street," Walker said. "The village of New Minden is perfect for this type of system because it is a small town on a prairie-type setting with farm land up to its boundaries. We used alleys and bored under driveways to keep the costs down.

"When the state's Rural Development director came to town for our dedication, he pulled me aside and asked me when we were going to get this project finished," Walker said. "I told him it was finished. He couldn't believe that none of the streets had to be torn up."

Effluent flows from the STEG tanks by gravity to a small diameter collection line, which can serve up to 12 New Minden houses. Where gravity flow cannot be achieved, individual pumps are placed in STEP septic tanks and the effluent is then pumped into the line.

"The pump stations in town are all fed by small diameter gravity flow lines from individual houses. They consist of two submersible well-type pumps and can be replaced at a cost of $250 apiece. The actual electrical cost for the average pump station per month is $1.50," Walker added.

One of the problems the village has encountered, however, despite lengthy negotiations with Illinois Power, the local electricity supplier, is an $18 per month minimum meter fee for each of the 20 stations.

"The $18 meter charge in my opinion makes operation costs appear to be artificially high," Walker said.

Mayor Karmeier agreed. "The rates were higher than we were wanting because of the minimum meter fee. We had to raise our rates overall," he said.

Residents pay a base bill of $18.80 per month, with a small surcharge for usage in excess of 2,000 gallons. A new installation costs approximately $3,000, not including a $300 collection fee. A flow meter shows that power costs for effluent collection and distribution average about 18 cents per home per month.

Operation and Maintenance

The village has one maintenance person to operate both water and wastewater systems and has a part-time operator who reviews data and makes recommendations for repairs. The maintenance person spends less than one hour per month on service calls.

Walker said that although the plant is permitted for a Class Three operator, he recommended that the village employ a Class One operator. "I felt they might need to keep better records and have a more technical approach to the plant since it is an innovative-type system," he said.

Frank Sharp, operator of the New Minden plant, said he spends approximately five hours per month on process evaluation, sampling, testing, record keeping, and reporting to the U.S. Environmental Protection Agency.

"It's really a good system, and it's an easy plant to run," he commented. "The best part of the system is that the effluent quality has always been exceptional, even when the plant screens have been 90 percent plugged, which doesn't occur often. It's very forgiving in that respect."

Sharp said a spot check of several of the septic tanks during the first year found less than an inch of sludge accumulation on the bottom and less than an inch of scum on the top. He added that there have been no odor complaints since the system has been operational.

In addition to service calls, the maintenance person takes care of general maintenance, such as lawn mowing, screen cleaning, and raking the pea gravel on top of the filter weekly to deweed the system.

To aid the maintenance worker, the village purchased a trailer that can be transported from home to home. It includes a water tank with a pressure washer, and a sludge judge to test each septic tank to determine how much sludge is building up so pumping of the tanks can be scheduled.

Karmeier commented, "It has been great. We had a few minor bugs the first year, but we ran trouble-free last year with just the normal cleaning of filters in the treatment plant."

CONTINUED ON PAGE 57

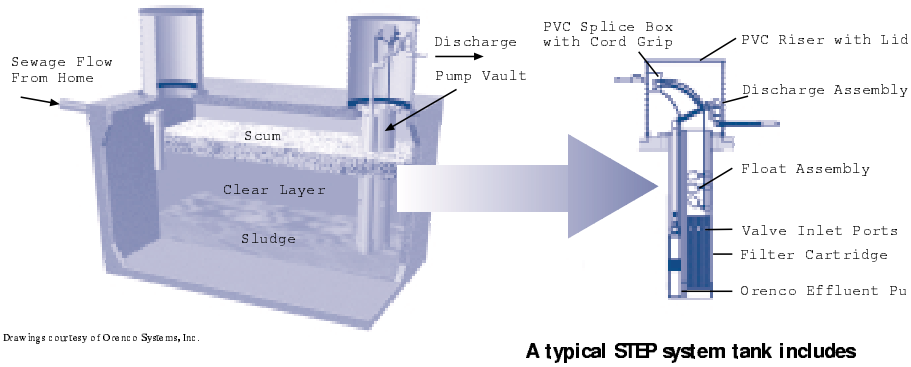

Figure 1

Example STEP System Design

A typical STEP system tank includes access risers, lids, and a pump vault that houses the pump, float assembly, and effluent filter.

NODP II Helps West Virginia Overcome Barriers to Onsite Systems

CONTINUED FROM PAGE 13

they are paying for and what type of service to expect," Adams said.

The third part of the triangle is the service provider who promises to perform maintenance that meets state requirements. "This is the area of greatest concern," said Adams. "Without definitive maintenance requirements from the state, service providers will only do the minimum. Service provision must be performance based."

Performance Measures

Since 1970, approximately 20 percent of the permits issued each year in Monongalia County have been for modifications to repair failing systems. Many of these failures have been traced to using inappropriate technology and poor installation practices. MCHD maintains these records in a central database. These records can then be used as a baseline from which future installations can be compared.

The success of Monongalia County's sewage program is directly linked to providing training and education. "Sanitarians have been working one-on-one with installers since 1970 and have provided training through that forum," said Adams. "The recent emphasis on formal classroom training will demonstrate better success down the road but probably not immediately. I feel training and education are cornerstones in the foundation of a good sewage program, and I am looking forward to providing increased emphasis on training and education through several local initiatives.

"Without keeping our installers current with the changes in the field, success in the future would mirror the past. It is essential to pass along technological product changes and installation techniques to assist installers in providing more efficient systems," Adams said.

Project Successes

"The project was a success," said Powroznik. "We didn't go down the path we thought we were going to go down, but we made a positive step in the right direction. One of the biggest accomplishments of the grant was conducting a file search of all the onsite wastewater systems in Monongalia County for the last 30 years. I reviewed and recorded data for 6,526 permitted and approved systems in the county. We can use this data for a variety of purposes, such as showing trends and outcomes."

Another positive outcome of the project was the revolving loan fund that Monongalia County was able to provide for its residents. "We are the only county in the state to have a revolving loan fund. This program will really help the homeowners," said Powroznik.

The revolving loan fund is open to all county residents with a failing wastewater system. The system is needs based and encompasses two categories: those situations that are deemed as emergencies and those that are ranked by household family income. In both cases, the financial obligation imposed on the homeowner is minimal. Homeowners can obtain loans of up to $10,000 payable over 30 years with interest of only 2 percent.

The revolving loan fund program issued its first loan in spring 2000. So far, 11 loans totaling $43,389.12 have been approved. The homeowner doesn't have to pay any out-of-pocket expenses to originate the loan, which takes about one week to complete. The loan includes construction, labor, and permitting fees.

Individual systems range in cost from $2,000 to $5,000 depending on the technology used to correct the problem. "The Monongalia County Revolving Loan Fund is a success that will continue to grow and provide many residents an affordable solution to their failing wastewater system problem," Powroznik said.

For More Information

For more information about this project, contact Powroznik at (304) 598-5127 or email him at kpowroznik@monchd.org. SI

STEP System Clears the Air in Illinois Village

CONTINUED FROM PAGE 29

Grant Denn, Orenco's systems engineering manager, said New Minden's track record is typical, adding that Orenco has provided equipment and design assistance for more than 200 effluent sewer projects since 1981 and has been tracking their performance.

"Effluent sewer technology and equipment have been refined over the past two decades," said Denn. "We know that effluent sewers perform extremely well, as long as they're carefully designed and installed."

Public Education

Although the majority of residents were in favor of the treatment system due to the failing septic systems, the town held public information hearings.

"We just tried to explain what we were doing and how we would build the system," said Walker. "There are always some people who will object, but the majority of the people were receptive. As for those who objected, they were pretty much satisfied after the public input section of the meetings."

The main objections raised concerned cost and durability. "There was some misinformation about the system, probably through gossip and just a general lack of information. We were able to field their questions and answer them to their satisfaction," Walker added. "There have been no complaints from the public since we began operation in 1998. The community is very happy with the way its new system is working."

Karmeier said, "The board and I struggled for years with the wastewater problem. I would recommend this type of treatment system to any village as a very economical, affordable option."

For More Information

If you would like more information about New Minden's project, contact Walker at (618) 252-7944. SI