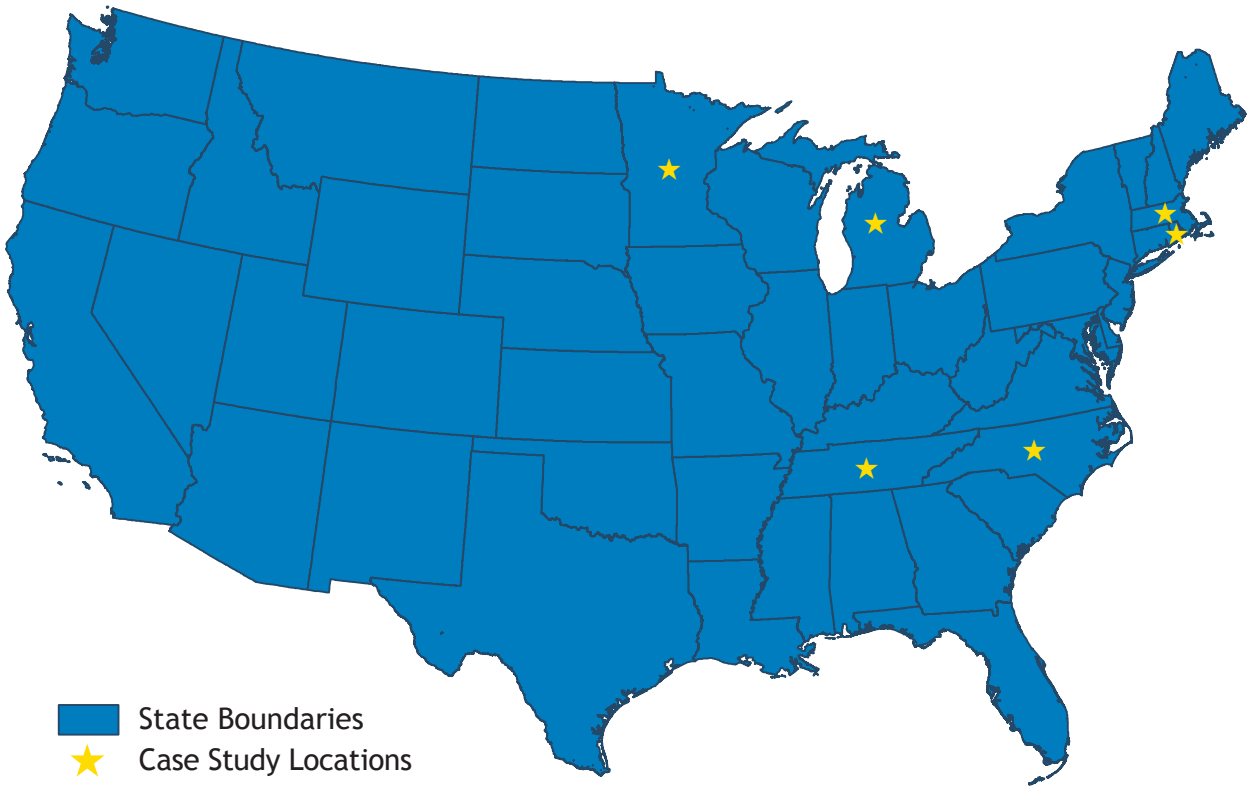
Case studies: building blocks for decentralized wastewater

Across the United States, researchers, private companies, advocates, and state regulatory agencies are coming up with innovative ways to advance the decentralized wastewater treatment approach. These successes represent "building blocks" for future success in the sector. Click on the stars below to learn more:

- In Michigan, a non-profit organization builds broad coalitions to tackle issues related to public health, decentralized systems, and water quality.
- In Rhode Island, planners, regulators, and researchers work together to connect land use planning and wastewater management planning.
- In Minnesota, funders mandate an alternatives analysis process that ensures decentralized solutions are considered fairly by engineers and others.
- In Massachusetts, regulators administer a clear, fair process for approving new onsite wastewater treatment technologies.
- In North Carolina, engineers and developers are working under risk-based reuse regulations to integrate distributed wastewater with stormwater and other water treatment and reuse systems.
- In Tennessee, privately owned, publicly regulated utilities provide full-service management for development-scale distributed wastewater treatment systems.



Building consensus through broad networks

BUILDING BLOCK

Create coalitions of people and organizations across disparate disciplines and interests by finding and leveraging common interests.

Onsite Wastewater of Northwest Michigan is "a regional non-profit education, research and information clearinghouse serving northwest Michigan. Comprising representatives from a wide range of governmental, wastewater management, and environmental groups, the goal of the organization is to coordinate information on the ever-increasing options for waste water management and groundwater protection" (from website, cited below).

The organization's message is simple: whether municipal or individual, all wastewater systems should perform, and be operated and maintained, to the highest standard. Onsite Wastewater's activities are intended to counteract turf battles that can confuse or alienate the public, divide the players, and result in wasteful duplication of effort. Thus, the organization seeks funding for and implements projects that build bridges and collaborations through identifying a common purpose. Their approach is to consider wider implications, find common ground, and engage in healthy discussion and debate while recognizing individuals' and organizations' differing viewpoints and constraints.

WATER TO WASTE?

One example of Onsite Wastewater's bridge-building activities is their championing of a take-back program for unused medications. The organization built upon EPA Region 5's April 2008 Great Lakes Earth Day Challenge "to collect and properly dispose of old and unused, expired or unwanted medicine" by inviting community leaders to discuss creating a collaborative program providing a continuing solution. Onsite Wastewater received a grant to print a 130,000-copy run of "Water to Waste" (available at www.michigan-onsitewastewater.org/watertowaste.html). This 16-page newspaper insert provided public information on a variety of water-related topics, devoting two pages to the assumption that wastewater systems safely treat pharmaceuticals and other man made compounds.

The "Water to Waste?" publication used attention-grabbing graphics like this one to ask important questions.

BUILDING CONSENSUS THROUGH BROAD NETWORKS

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CREATING THE SAFE DISPOSAL TASK FORCE

As a result of positive reactions to this publication, Onsite Wastewater received funding to form a Pharmaceutical Collection and Safe Disposal Public Education Task Force. The intent was to seek collaboration and pool resources to create a sustainable program for collection and safe disposal of pharmaceutical products. The action became an opportunity for motivating both existing and new partners, plus the general public, to think about "how wastewater systems were designed to work and why the toilet should not be used as a trash can".

"There are inevitable disagreements, and mandated regulation can be a hindrance to our goals, but it is our intent that, through finding common ground, consensus can be reached to move forward on common sense solutions. The threat to our water resource is simply too important to be squabbling over as to who should do what."

--Dendra Best,
Executive Director

Early on, board members and staff identified prospective participants from a broad range of water and wastewater providers, regulators, environmental groups, physicians and pharmaceutical providers, and local government. Potential participants were personally contacted to assure them that their expertise was valued, that the effort was not starting with preconceived views, and that there was no intent to view anyone as an adversary.

The core group of partners now includes two regional hospital systems, seven local and county health departments, environmental groups, coordinators of local Household Hazardous Waste Collection Days, the Commission on Aging, Michigan Department of Environmental Quality, Michigan Rural Water Association, Michigan Environmental Health Association, and a private septage receiving facility.

The Task Force developed another image that immediately makes the link between pharmaceutical disposal and water resources.

When hurdles arose to ensuring that collection locations were safe while at the same time not deterring returns, the team grew to include a local independent pharmacy and law enforcement, and the collection initiative began in cooperation with area County Sheriffs. The pilot 'drop box' collection system is based on an existing program in Pontiac, MI.

The planning grant has expired, but the goal was more than achieved. A Pharmaceutical Collection and Safe Disposal Team is now in place and is actively coordinating existing programs with resource recovery and law enforcement, seeking additional funding for more collection boxes and a wider marketing campaign, and cooperating across a variety of professional, regulatory, and environmental groups to state: water matters, we all care, and we all have a part to play.

FOR MORE INFORMATION

Onsite Wastewater of Northwest Michigan: www.michigan-onsitewastewater.org (contact Dendra J. Best, tel (231) 233-1806, secretary@michigan-onsitewastewater.org)
Prescription Task Force weblog: ownwmi2009.wordpress.com/about/

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Integrated land use and wastewater planning

BUILDING BLOCK

Ensure that land use planning processes consider how wastewater treatment will be provided to current and future development.

In Rhode Island, cities and towns have the power to control growth, so long as they meet state-mandated responsibilities for managing land use. Towns are required to develop a comprehensive land use plan, and to review and update that plan at least once every five years. These land use plans describe a community's goals and policies pertaining to land use, housing, economic development, natural and cultural resources, services and facilities, open space and recreation, traffic circulation--and the town's plans to enact these goals and policies. Local zoning and subdivision review ordinances are required to dovetail with these comprehensive plans. The state's emphasis on zoning and land-use planning to control and manage growth means that towns need to set centralized or cluster wastewater service area boundaries that are consistent with the boundaries of their designated growth areas—and to carefully consider how wastewater treatment will be provided outside of those service areas.

NO MORE "ZONING BY SEPTIC"

Rhode Island's challenge is to manage existing development while protecting finite drinking water supplies and environmental resources from future development, which could impact those resources, property values, and the tourism that is often the mainstay of coastal towns' economies. In the face of these challenges, regulators, planners, and researchers have made significant efforts to integrate land use and wastewater management planning efforts.

Researchers at the University of Rhode Island and planners throughout the state developed tools and resources for local decision makers that emphasize the connection between land use planning and planning for wastewater treatment infrastructure. The tools include a pollution risk assessment tool called MANAGE (Method for Assessment, Nutrient Loading,

Denis Tangney Jr.

Rhode Island's historic land use patterns often place dense development close to sensitive water resources.

And Geographic Evaluation), which combines readily available spatial information with a spreadsheet model that calculates values for risk indicators such as stormwater runoff, nutrient loading estimates, and impervious surfaces. Resources for local officials include publications and case studies that explicitly link land use and wastewater planning decisions, and support for assessments and outreach from the University of Rhode Island Cooperative Extension's Nonpoint Education for Municipal Officials program.

WASTEWATER REGULATORS SUPPORT PLANNING FLEXIBILITY

The enabling atmosphere fostered by Rhode Island's Department of Environmental Management (DEM), the regulatory authority for onsite systems, is a key part of the state's success. The department provides grants and technical assistance to towns and has established inspection procedures, review and approval processes for alternative technologies, and training and certification programs for onsite wastewater professionals the University of Rhode Island's New England Onsite Wastewater Training Center.

The Town of Glocester, Rhode Island used alternative technologies to upgrade systems serving multi-family and commercial properties on particularly difficult sites in historic Chepachet Village, supporting revitalization while preserving unique natural and architectural features. See case study at the link below for more information.

PLANNING IS PART OF MANAGEMENT

There is a clear understanding between all parties that, particularly where shared systems and nutrient-removal technologies are installed to protect resources and fix problems on small and difficult sites, ongoing management and accountability are critical to the long-term success of onsite systems as permanent wastewater treatment infrastructure. Rhode Island has had legislation enabling management districts for onsite systems since the mid-1980s. Eight towns have adopted onsite management program ordinances, and 78% of the state's unsewered communities have completed wastewater planning processes. Towns with approved wastewater management plans can participate in the Community Septic System Loan Program. This program, managed by the RI Clean Water Finance Agency and RI Housing and Mortgage Finance Company, uses Clean Water Act revolving funds to loan money at low interest rates directly to homeowners for system repairs and replacements.

Another important tool is the Rhode Island Wastewater Information System. This is a web-accessed database for managing information about decentralized systems, including inspection reports, repairs, and maintenance activities. The database provides standard forms and procedures to simplify tracking of inspections and maintenance for both municipalities and service providers.

FOR MORE INFORMATION

Rhode Island DEM's Onsite Wastewater Program:
www.dem.ri.gov/programs/benviron/water/permits/isds/index.htm

A creative combination: Merging alternative wastewater treatment with Smart Growth:
University of Rhode Island Cooperative Extension Publication No. 4068, available from
www.uri.edu/ce/wq/NEMO/Publications/index.htm

University of Rhode Island's documentation of the MANAGE Method:
www.uri.edu/ce/wq/NEMO/Tools/pollution_assessment.htm#manage

Chepachet Village Decentralized Wastewater Demonstration Project:
www.uri.edu/ce/wq/NEMO/Publications/PDFs/WW.Chepachet.pdf

Creative Community Design and Wastewater Management:
www.ndwrcdp.org/userfiles/WUHT0030_post.pdf

Rhode Island Wastewater Information System:
www.uri.edu/ce/wq/RESOURCES/wastewater/Resources/RIWIS.htm

Lorraine Joubert, Director, URI Nonpoint Education for Municipal Officials,
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Testing and allowing appropriate technology

BUILDING BLOCK

Institute clear, fair, accurate procedures for piloting and approving treatment technologies.

The Massachusetts Department of Environmental Conservation (MassDEP) encourages the development of innovative and alternative (I/A) onsite wastewater treatment technologies with performance superior to that of conventional onsite wastewater treatment systems. The state has a three-tier approval process. Each tier of approval and type of system has specific operation, management, and maintenance provisions. Since Massachusetts changed their regulations in 1995 to allow I/A technologies, over 50 technologies have been approved, over 3,000 systems using these technologies have been installed, and several hundred more systems are installed each year.

TIER ONE: PILOTING

Technologies can be piloted when available data indicate a technology is likely to perform at least as well as a conventional system. Piloting involves installations on up to 15 sites per technology, with field testing for at least 18 months and full reporting of results. A technology can proceed to the Provisional Use approval stage if 75% or more of the pilot systems performed as expected for at least 12 months.

For over a decade, the Massachusetts Alternative Septic System Test Center in Barnstable County has evaluated the full-scale field performance of new and innovative wastewater disposal technologies and assisted vendors with obtaining approvals for in-state use. See their website, below, for more.

TIER TWO: PROVISIONAL USE

The Provisional Use Approval process evaluates whether an I/A technology can perform at least as well as a conventional system under local field conditions in a less controlled environment than piloting. This stage occurs after a technology has passed the pilot stage or has two or more years of successful general-use performance in one or more other states. At least 50 systems must be installed, and their operation, maintenance, and monitoring is tracked by the manufacturer with reporting to MassDEP for at least three years. Provisional Use is considered successful if 90% or more of the installations have, over three years, performed at least as well as a conventional system.

TIER 3: GENERAL USE

When a technology successfully completes the Provisional Use stage, it is certified for General Use. Certified technologies can be installed at any site where a conventional system can be installed. The system owner is required to complete inspection and testing requirements on a regular schedule as required by the approval. MassDEP uses the data from the Provisional Use Approval process to set discharge standards and other conditions for General Use.

FOR MORE INFORMATION

Technology approval program details: www.mass.gov/dep/water/wastewater/iattap.htm
Listing of approved technologies: www.mass.gov/dep/water/wastewater/techsum.htm
Massachusetts Alternative Septic System Test Center: www.buzzardsbay.org/etimain.htm
MassDEP I/A Coordinator: David Ferris, tel 617-654-6514, David.Ferris@state.ma.us

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Prioritizing and funding right-size solutions

BUILDING BLOCK

Promote alternatives analyses, priority ranking systems, and financing structures that insist on consideration of all appropriate treatment alternatives.

In the early 2000s, state wastewater and financing regulators in Minnesota recognized that the priority ranking system used to establish the Project Priority List under the Clean Water State Revolving Fund, while still working to distribute funding, was no longer entirely in line with available resources or state policy. One area of concern was with how projects in areas without centralized sewers were reviewed and ranked on the priority list. For example, the way that points were assigned in the priority system led to larger projects than were needed to correct environmental or public health problems in areas without sewers. There were no clear regulatory requirements for defining and documenting areas of wastewater "need", and there was no mandate to fully consider all possible solutions, starting with the simplest and lowest-cost alternatives.

A RANKING SYSTEM THAT MATCHES STATE PRIORITIES

As a result of legislative actions during the 2002 legislative session, the Minnesota Pollution Control Authority and the Minnesota Public Finance Agency began a collaborative process to update the criteria and ranking system used to place proposed wastewater treatment facility construction projects on the state's Project Priority List. Changes to the priority ranking system, implemented in 2006, included assigning points based on the operating condition of existing onsite wastewater treatment systems, modifying the density factor to require that 90 percent of the structures served be located within the "project area", and requiring thorough review of conditions in unsewered areas.

M. L. Konski / ASLO

Minnesota, the "Land of ten thousand lakes," recently enacted changes to wastewater regulatory and funding programs to efficiently use limited financial resources in better accord with state policies.

DEFINING ALTERNATIVES FOR ANALYSIS IN UNSEWERED AREAS

To support the changes to the priority ranking system, changes were also made to the assessment and facilities planning process to require consideration of all reasonable wastewater treatment options. Documentation of needs in unsewered areas, for example, includes review of soil survey data, site and system inspections, soil borings, and review of system records, plat maps, and other local records to determine whether individual systems currently comply with the state's Rules for individual systems (Chapter 7080).

As part of the Wastewater and Storm Water Assistance program codified in Chapter 7077 of the Minnesota Administrative Rules, facility plans for unsewered areas must include an alternatives analysis that follows the hierarchy set forth in the Rule. The rule emphasizes evaluating existing onsite systems first. Alternatives are considered in the following priority order, though alternatives can also be combined:

- Replace existing malfunctioning onsite systems with new ones on each lot, with centralized management to provide monitoring, operation, maintenance, and replacement.
- Combine properties with malfunctioning onsite systems into clustered, soil-based wastewater treatment systems with centralized management.
- Connect properties with malfunctioning systems to an existing treatment facility with available capacity and centralized management.
- Connect properties with malfunctioning systems to an existing treatment facility with centralized management that requires additional capacity through an expansion.
- Develop a new wastewater collection and treatment facility with centralized management, then connect households with malfunctioning onsite systems.

Minnesota also has a financing program that targets wastewater treatment improvements in small unsewered communities. The Small Community Wastewater Treatment Program provides loans and grants to assist local governments in identifying solutions for non-complying onsite systems, and constructing replacement onsite systems, new systems, or small clusters that will be publicly owned and operated. This program has a capacity building facet that boosts local administrators' abilities to understand decentralized systems, increasing the likelihood that systems will be properly managed in the future.

"Since the need is great and funding is limited, the program should be designed to fund projects in a manner that balances community needs, economics, and MPCA's mission to help Minnesotans protect their environment."

–MPCA, 2003

FOR MORE INFORMATION

Recommendations for funding program improvements (2003):
www.pca.state.mn.us/publications/reports/lr-wq-srf-1sy03.pdf
Small Community Wastewater Needs Report (2008):
www.pca.state.mn.us/publications/wq-wwtp1-06.pdf
MN Rule Chapter 7077, Wastewater and Storm Water Treatment Assistance:
www.revisor.leg.state.mn.us/rules/?id=7077
MN Rule Chapter 7080, Individual Subsurface Sewage Treatment Systems:
www.revisor.leg.state.mn.us/rules/?id=7080
Priority list scoring worksheet for unsewered areas:
www.pca.state.mn.us/publications/wq-wwtp2-35.doc
Small Community Wastewater Treatment Program:
www.deed.state.mn.us/Community/assistance/pfa.htm
Bill Dunn, MPCA Wastewater and Stormwater Financial Assistance Programs Coordinator, tel 651-757-2324, bill.dunn@state.mn.us

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Water reuse for new development

BUILDING BLOCK

Construct new systems that use and reuse water resources efficiently and close to where water is needed.

The state of North Carolina has long been a leader in implementing alternative wastewater treatment technologies to handle new growth and development. For instance, the increased use of alternative and advanced systems at the site scale was an integral component of the rebuilding of homes in coastal areas after hurricanes devastated large portions of the state's coastal resort communities in the mid-1990s. Now, water reuse at the development scale is being increasingly recognized as an essential component of the sustainable water environment in the state. Recent legislation promulgated by the State Senate requires water and energy efficiency in design of public higher learning institutes.

STRONG REGULATIONS SUPPORT REUSE

North Carolina's rules governing reclaimed water systems (15A NCAC 02T) describe both water quality standards for treated water and process requirements for reliability and redundancy. Recent amendments to the state's stormwater rules (15A NCAC 02H) also recognize some benefits associated with the reuse of harvested rainwater and stormwater. Where alternative water supplies are utilized to supplant potable uses (for instance, using roof-harvested rainwater for toilet flushing), the North Carolina Water Quality Agency considers the projects to be "beneficial use".

Water quality standards and process standards are both required in the water reuse rule, and should be required wherever beneficial reuse is proposed. Quality standards for the treated water reflect the level of risk associated with particular use the reclaimed water is intended to meet. Thus, the intended use of the water is determined early in the design process through collaboration with stakeholders and end users. Once the intended use is known, risk associated with that end use can be determined--and from the risk; appropriate standards are set. When the proposed use of reclaimed water carries

McKim and Creed

The treatment system and pond shown here are part of a 100,000 gpd water reuse system serving a sound-front community in North Carolina.

a high potential for human contact (for instance, treated domestic waste water used for lawn irrigation), the highest standards for both water quality and treatment system redundancy/reliability are applied to protect the public against both bacteriological and chemical contaminants.

REUSE APPLIED IN RESIDENTIAL SUBDIVISIONS

North Carolina's regulatory programs have enabled the development of several new waterfront communities in eastern North Carolina, where water generated onsite is treated and utilized onsite. The innovative, multiple-barrier treatment systems for these communities range in size from 0.1 MGD to 0.5 MGD. The treatment facilities use biological nutrient removal processes in combination with hollow fiber membrane filtration and UV disinfection to produce high quality water. The reclaimed water has a variety of on-site uses, including maintaining water levels in amenity lakes and water features, and irrigation of common areas. These coastal locations have a high risk of hurricane exposure, so each facility has dual treatment trains, full stand-by emergency power, and 5-day lined upset basins. The close proximity of the treatment systems to surrounding residential properties meant that additional precautions to improve aesthetics and minimize odors were also needed.

"Water management systems of the future will require elements of reclamation and reuse to assure a sustainable supply is available for present and future generations."

--Bob Rubin, Ph.D., McKim & Creed

"OFF THE GRID" AT THE UNIVERSITY OF NORTH CAROLINA

Senate Bill 1946, passed by the Legislature in 2008, mandates water and energy efficiency in all new and remodeled publicly owned higher education facilities. Indoor potable water use will need to be 20 percent less than that set by the fixture performance requirements of the building code, and new construction must show "that the calculated sum of the outdoor potable water use and the harvested stormwater use" be 50 percent less than that set by the building code.

The Carolina North Campus, a mixed-use research and academic campus proposed for two miles north of the main campus of the University of North Carolina-Chapel Hill, will more than meet these standards. Systems on the campus will treat stormwater in working landscapes, collect and store runoff from rooftops, and utilize biological nutrient removal to produce highly treated reclaimed water. The reclaimed wastewater will be blended with rooftop runoff prior to microfiltration and disinfection with both ultraviolet radiation and chlorine. The treated water will be distributed through a dedicated non-potable distribution system that will provide all water necessary for fire protection, cooling tower and boiler makeup water for the new central energy facility, toilet flush water for all new buildings, and irrigation water for recreational fields and high-value landscaping. This fully integrated water management program is possible because standards can be enforced that reduce risk associated with water reuse.

FOR MORE INFORMATION

North Carolina Rules for Waste Not Discharged to Surface Water (15A NCAC 02T): ncrules.state.nc.us/ncac.asp
Coastal Stormwater Rule Information: h2o.enr.state.nc.us/su/coastal.htm
NC Senate Bill 1946: www.ncleg.net/Sessions/2007/Bills/Senate/PDF/S1946v6.pdf
An example of a residential-subdivision reclaimed water project: www.mckimcreed.com/apps/pages/projects/project_detail.jsf?projectId=103
UNC Carolina North Campus: research.unc.edu/cn/index.php

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Utility management for complex systems

BUILDING BLOCK

Maintain strong systems of public accountability where development-scale wastewater treatment systems are owned, operated, and managed by privately owned utility companies.

Cluster wastewater systems with subsurface drip dispersal have, in the last decade, become an increasingly common means of accommodating new development outside sewered areas in Tennessee. Only three operating permits for such systems were issued in 1999, but over 80 were issued in 2007, and the numbers are expected to keep increasing. Many of these systems are owned and operated by publicly regulated, privately owned utility companies.

BECOMING A REGULATED UTILITY

When the Pickney Brothers first applied for approval for their company, Tennessee Wastewater Systems, Inc. (TNWW), to operate as a for-profit utility in the late 1980's, they applied to the Tennessee Regulatory Authority (TRA), the state's public service commission. Under Tennessee law, they were required to demonstrate they had the "financial and technical expertise" to do the job, and to provide a letter confirming that their services as a utility were requested. At the time, no particular proof of financial viability was needed; however, privately owned utilities are now required to bond to the TRA as part of the certification process.

DEFINED SERVICE AREAS AND RATE CASES

Regulated utilities in Tennessee have the authority to enforce payment for services rendered and have service areas designated by the TRA. Thus, they have no competition within the developments they serve. However, regulated utilities must bring successful rate cases before the TRA to get approval for setting or changing the rates charged for their services. As the first regulated utility for decentralized wastewater services in Tennessee to take a rate case before the TRA, TNWW had to learn from their mistakes as they went, and initially struggled to be taken seriously. The first rate case, brought in the early 1990s, took over three years to be approved—and though the process is easier now it

High-quality systems and reliable management have allowed clustered, dense development outside sewered areas in Tennessee.

still represents a significant investment of time and money. By being the first such entity and through maintaining quality performance, however, they were able to gain a major share of the decentralized utility market before others became aware of the opportunity.

SKILLS FOR SUCCESS

Even with the benefit of defined, certificated service areas, the economics of getting started were challenging. The management of TNWW were starting from scratch, so unlike with the construction of many centralized sewer systems, they had no way to capitalize their investments or subsidize rates for customers. It took many years for the business to realize a profit; during this time, TNWW staff kept their "day jobs" as engineers and system designers. This technical expertise, along with efficient operation and maintenance practices and strong business skills, has been essential to the organization's success.

"We have proven that a properly managed distributed wastewater system is permanent infrastructure. It's not a development that's waiting for a central sewer to show up."

--Charles Pickney
President, TNWW

UTILITY MANAGEMENT ENSURES PERMANENT INFRASTRUCTURE

In Tennessee, the developer hires an engineering construction company to install a system to the utility's standards, and then the utility takes over control of the system. The utility owns, operates, and maintains the system, acting as an EPA Model Five Responsible Management Entity. The business of the utility is regulated by the Tennessee Regulatory Authority, and the wastewater treatment systems are permitted by the Tennessee Department of Environmental Conservation Division of Water Pollution Control.

Property owners receive a monthly bill, as they would for any other utility service. The rate customers are billed represents the amount needed to cover life cycle costs (O&M and future system replacement), utility administrative costs, and a profit of about 6.5%. The Public Service Commission requires about half of the monthly rate to be allocated to escrow for equipment and system replacement.

FOR MORE INFORMATION

Tennessee Department of Environmental Conservation, Division of Water Pollution Control: www.state.tn.us/environment/wpc/
Tennessee Regulatory Authority: www.state.tn.us/tra/
U.S. EPA Decentralized Wastewater Management Guidelines: www.epa.gov/owm/septic/pubs/septic_guidelines.pdf
Tennessee Wastewater Systems, Inc.: www.tennesseewastewater.com/tnww/
Guidance for Establishing Successful Responsible Management Entities: www.werf.org/rme

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