National Community Decentralized Wastewater Demonstration Project
Skaneateles Lake, New York
Study Report

Prepared for the United States Environmental Protection Agency, Office of Wastewater Management, Washington, D.C., by the City of Syracuse, Department of Water, Syracuse, New York, March 2010

Citations

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The following equipment manufacturers donated onsite wastewater treatment equipment to the Demonstration Project:

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Franklin, OH 45005
www.consolidatedtreatment.com

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www.premiertech.com

Quanics, Inc.
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Syracuse, NY 13211
www.roth-global.net

Salcor, Inc.
P.O. Box 1090
Fallbrook, CA 92088

SJE-Rhombus Controls
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www.sjerhombus.com

Sunnycrest Precast Concrete &
Accessories
58 Prospect Street
Auburn, New York 13021
www.sunnycrest.com

Tuf-Tite Corporation
1200 Flex Court
Lake Zurich, IL 60047
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Wastewater Technologies, Inc.
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Milton, Vermont 05468
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Kingston, RI 02881

Table Rock National Decentralized Demonstration Project
Table Rock Lake Water Quality, Inc.
2 Kissee Avenue
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Abstract

Onsite wastewater treatment systems (OWTS) are the most appropriate and cost-effective means of protecting water quality in many communities around the country, but a nationwide effort is required to upgrade aging technology with modern, proven advances that will better protect public health and the environment. Onsite systems that depend on the use of site soil for treatment are inadequate at sites with challenging conditions (e.g., shallow depth to bedrock, shallow groundwater table, low permeability soils, inadequate soil depth, etc.), and frequently cannot meet the regulatory rules that protect watersheds.

The Skaneateles Lake Demonstration Project was established to demonstrate the use of new, commercially available alternative onsite wastewater treatment technologies in the Skaneateles Lake watershed, a critical source of drinking water for the City of Syracuse. Alternative OWTS were installed to replace failing legacy systems at lakefront sites that did not meet new construction standards. Conventional drain fields were not an option at these sites due to site characteristics including very steep slopes, shallow depth to groundwater or bedrock, and/or poor soils for biological treatment. New enhanced treatment units (ETU's) are being applied to onsite systems, resulting in higher treatment levels and measurable reliability. Long term success of using ETU's is contingent upon having an oversight management program supported by regulatory enforcement. This project extends numerous proactive and ongoing measures to protect the Skaneateles Lake watershed, and is exemplary to local and national goals of proving, managing and transferring current and future OWTS technologies.

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Executive Summary

Skaneateles Lake has been the primary drinking water source for the City of Syracuse and surrounding communities for over two centuries. More than 250,000 people depend on the lake for a clean, unfiltered supply of drinking water. To secure this unfiltered, clean water for our future, it was imperative that we consider the improved onsite wastewater treatment system technologies available to us while achieving significantly reduced cost savings.

Due to the Lake's excellent water quality, the New York State Department of Health (NYSDOH) has granted filtration waivers to the City of Syracuse and the Village of Skaneateles, allowing them to avoid building a costly treatment plant. In 2004, the NYSDOH granted the waiver indefinitely based on the continued success of water quality monitoring and watershed protection programs.

The stakes are indeed high-- in the 1990's, the cost of constructing a centralized filtration plant was estimated at between $64 and $76 million dollars while the operation and maintenance of such a plant would cost millions of additional dollars each year. The watershed's low-density development and challenging topography make onsite wastewater treatment systems the most appropriate, least costly treatment option for protecting the lake from sewage contamination.

Properly managed OWTS have proven to be a viable, long-term cost effective alternative to centralized wastewater facilities. Conventional septic systems along the lakefront are failing with age, improper installation/operation, and lack of maintenance. Septic system failure poses a risk to public health and is a potential contamination source to surface water.

Funded by EPA's National Onsite Demonstration Program the Skaneateles Lake Demonstration Project was established to demonstrate the use of commercially available alternative onsite wastewater treatment technologies in the Skaneateles Lake watershed to protect public health, ensure water quality, and sustain the environment.

The Skaneateles Lake Demonstration Project's main objectives and results were:

1. **Identify and replace failing and/or inadequate onsite treatment systems at representative lakefront sites with a variety of new, alternative systems not common to the region, and to evaluate their effectiveness.**

Demonstration sites within the Skaneateles Lake watershed were chosen for their challenging site conditions including high groundwater table, poor soils for biological treatment, and steep slopes. The commonality of site conditions was considered during selection of the project sites so that the approach used to demonstrate onsite wastewater treatment technology would be readily transferable to similar sites within the Skaneateles Lake watershed, or other sites in New York State or the nation.

Commercially available advanced onsite systems included the use of pre-engineered

enhanced treatment units (ETU's), time dosing and recirculation, and were selected based on their proven track record for achieving adequate treatment at similar sites throughout North America. Many of the technologies installed at the demonstration site are the first of their kind in New York State. ETU's allow pre-treatment of wastewater to occur in a tank, resulting in higher treatment levels and consistently achieving significant reductions of Biochemical Oxygen Demand (BOD) and pathogenic organisms.

A total of nineteen systems have been installed using media including: peat fiber, textile, textile/peat, aerocell foam cubes, and polystyrene peanuts. In addition, innovative dispersal techniques have been introduced including shallow narrow low-pressure trenches, bottomless sand filter, and drip irrigation. Many of the systems and components were donated by manufacturers who were motivated by the opportunity to prove and communicate the technological results of their products to the public.

At the time of this report, of the sites were monitored for at least one full year.

2. Develop a uniform regulatory framework for all jurisdictions within the watershed.

Long term success of using ETU's is contingent upon having an oversight management program supported by regulatory enforcement. Regulators from the counties of Cayuga, Cortland, and Onondaga, the three counties within the watershed, are taking a uniform approach for the review and approval of alternative OWTS designs proposed in the watershed. This framework encompasses the requirements for the design, installation, maintenance, and regulatory oversight of all OWTS. The Syracuse Department of Water initiated a management policy to track maintenance activities at alternative system sites to promote system performance and extended life. The management for this policy provides reasonable assurance that the result will yield overall long term cost savings and environmental protection that secures the pristine drinking water supply from Skaneateles Lake.

3. Promote awareness, education, experience and training.

EPA's 1997 Report to Congress regarding decentralized wastewater treatment options, identified the lack of knowledge and misperceptions on the part of public health officials, regulators, engineers, designers, inspectors, and the public as a major barrier to expanding the use of decentralized OWTS. The Skaneateles Lake Demonstration Project has been an effective training tool for professionals, and has engaged site owners and the community to promote awareness regarding onsite wastewater treatment and the onsite options currently available to us.

This report documents the project from site selection through design, installation, monitoring, regulatory management and education. This project adds to the growing body of research supporting the feasibility of advanced, cost-efficient onsite technologies to protect precious water resources for generations to come. Report to Congress 1997: http://www.epa.gov/owm/septic/pubs/septic_rtc_all.pdf

1 Background and Setting

Skaneateles Lake is one of the cleanest lakes in the country. The water sparkles many shades of blue depending on the reflection from the sun. The lake's high transparency level, which averages 9 meters (30 feet) deep, allows blue-green wavelengths of light to penetrate deep into the lake, giving the water its famed blue glow.

Skaneateles Lake is located19 miles south of Syracuse, New York, and is roughly 15 miles long and a mile wide. It has a surface area of 13.6 square miles and a maximum depth of 300 feet, making Skaneateles Lake the fourth largest and third deepest of the group of 11 lakes that are Finger Lakes. The lake has a relatively small watershed of about 59 square miles.

The lake was formed during the Pleistocene Era, (beginning about 2 million years ago and ending 10,000 years ago)by glacial scour and morainic damming. The lake basin is very steeply sloped in a "U" shape with a small littoral zone. Approximately 80% of the lake's volume is below a depth of 30 feet. The lake's land to surface water ratio is very small: 4.36 square miles of watershed land per 1.0 square mile of lake surface. This significantly limits the potential for contaminants and nutrients from the land to be transported via stormwater runoff and enter the lake. Similarly, all of the tributaries enter the lake originate in the same valley as the lake.

For these reasons Skaneateles Lake has very low biological activity and is classified as oligotrophic. As such, the entire food chain including plant species and fish are largely not present as compared to typical freshwater bodies classified as eutrophic or hypertrophic. Skaneateles Lake's low biological productivity and large capacity make it ideal for use as a drinking water supply.

Since 1894, the City of Syracuse and surrounding communities have used Skaneateles Lake as a source of drinking water. Today, an average daily flow of approximately 43 million gallons provides potable drinking water for a population of some 250,000 people.

Under the State Sanitary Code Subpart 5-1,the New York State Department of Health (NYSDOH) has authority to require pre-treatment of water for public water systems. Surface water systems like the Skaneateles Lake water supply come under the Surface Water Treatment Rule that requires sand filtration and disinfection of the water before it is distributed for public use.

Due to the exceptionally good water quality in Skaneateles Lake, in 1999 the NYSDOH was able to grant the City of Syracuse and Village of Skaneateles a 5-year filtration avoidance extension. As a result of the continued success of the water quality monitoring program and the watershed protection efforts for the Lake's drinking water supply, in 2004, the NYSDOH issued the City of Syracuse an indefinite waiver for the filtration avoidance. Certainly, in the event that contaminants find their way into and are detected in the water supply, the filtration avoidance will have to be reviewed. The indefinite

waiver provides the motivation for continued protection since it is well known that the cost of building a filtration plant would likely exceed $80 million for construction alone.

1.1 Watershed Overview

The 59.3 square mile Skaneateles Lake watershed area has a total population of roughly 4,900 people who reside in 2,184 dwellings. Of these residential dwellings, 1,007 are located along the Lake's shoreline.

Based on a geographic information system (GIS) land cover survey, land use is currently 48.2% agricultural, 40.2% open/forest, 5.4% residential, 4.7% brush, 0.8% other development, 0.4% ponds, and 0.2% commercial. The watershed is located in parts of one village (Village of Skaneateles), seven townships (Town of Marcellus, Town of Niles, Town of Owasco, Town of Scott, Town of Sempronious, Town of Skaneateles, and the Town of Spafford), and three counties (Cayuga, Cortland, and Onondaga). The Town of Marcellus and the Town of Owasco account for less than 300 acres (or <1.0% of the total watershed area).

With nearly half of the watershed land area used for agriculture the successful Skaneateles Lake Watershed Agricultural Program (SLWAP), a voluntary program established in 1994, has been instrumental to ensuring that farms in the watershed use best management practices (BMPs) for protecting the water quality from some 150 tributaries that drain into the lake.

The Village of Skaneateles, at the north end of the lake, operates a publicly owned treatment works (POTW) that provides an estimated 1,200 residences with sanitary utilities. This POTW discharges downstream from the outlet of Skaneateles Lake and does not pose a threat to in-lake water quality.

Of the 1,007 Lake's shoreline dwellings, only 275 of these properties are served by Village sewers. The remaining residences in the watershed have OWTS to treat sanitary waste generated in the home. An estimated 1,750 homes located in the Skaneateles Lake watershed use conventional OWTS. This is a potential problem we are very conscious about since most conventional septic systems are not maintained and the functional lifetime of a typical household septic system is approximately 20 years. Unfortunately, more than 25% of the OWTS in the watershed were installed prior to 1975 and most likely need to be updated. The problem is particularly troubling along the lakefront because the steep slopes and changing water levels can lead to direct discharges into the lake as homeowners experience no backup of water or other signs of septic failure. These aging and failing OWTS represent a significant concern to lake water quality and present both challenges and opportunities for advanced OWTS solutions as we now understand that conventional systems are not appropriate for many of the residences in the watershed.

1.2 Watershed Characteristics

Much of the lake's shoreline is steeply sloped, especially at the southern end of the lake where cliffs can exceed 100 feet in height. Generally, the elevation is higher and the slopes are steeper in the southern portion of the watershed as compared to the northern area. The highest elevation is found in the southeastern watershed at 1980 feet above sea level. Watershed acreage calculated by using a Geographic Information System is 37,724 acres or 58.94 square miles. To the north and south of the lake are low-lying areas that represent a continuation of the lake valley. The southern end is mostly wetlands, bordered by topography created by glacial deltas and beaches, and followed by morainic hummocky topography. The Lake outlet to the north, Skaneateles Creek, proceeds north out of the immediate lake watershed area.

[GIS map of watershed?] Here would be a good place to put it. …….

Soils located in the watershed are typically gravel to medium-textured silt loams that were formed in glacial till. Slopes are generally 2-25%, but can exceed 55% in the southern portion of the watershed. The soils are poorly to moderately well drained, and very slowly to slowly permeable. All of the soils pose a severe risk of erosion if left bare, with increasing degree of slope compounding the potential for soil loss.

The high seasonal groundwater, shallow depth to bedrock, steep topography, poorly drained soils, regulatory distance requirements, and individual lot size all present challenges when considering the use of onsite systems. For these reasons, it is to our advantage to utilize the technological advances in onsite wastewater treatment especially because we know that conventional systems would not be able to deliver an adequate performance that is expected for a new system.

1.3 Watershed Protection

The City of Syracuse has used Skaneateles Lake as a drinking water supply since 1894 and has a long history of protecting the watershed. In order to maintain the filtration waivers, specific Watershed Rules and Regulations, updated in 2004, were established to protect multiple uses of the lake, including water supply, recreation, and tourism. Restrictions on land use limit development and altogether prohibit manufacturing and industrial uses. The results of these watershed controls have proved beneficial as the crystal clear water continues to sparkle in the lake.

The City of Syracuse's comprehensive watershed protection program consists of considerable investment of resources in the following programs:

- Watershed Agricultural Program
- Watershed Land Protection Program
- Watershed Inspection Program

- Wastewater Treatment Works Management Program
- Water Quality Education Program

A detailed discussion of the above-referenced watershed programs is presented below.

1.3.1 Watershed Agricultural Program

The City of Syracuse contracts with the Onondaga County Soil and Water Conservation District to implement the Skaneateles Lake Watershed Agricultural Program (SLWAP). The Watershed Agricultural Program was founded in 1994 with the intent of establishing and maintaining Best Management Practices (BMPs) to keep pollutants from running off farms into the lake's tributaries. The BMPs are designed to prevent pathogen and nutrient movement to the lake, address potential soil erosion and sediment control issues, and implement pesticide control measures. The Agricultural Program currently has 54 out of a total of 60 eligible farms enrolled in the program, comprising an estimated 95% of the agricultural land within the watershed. Forty-four Whole Farm Plans (WFPs) have been completed to date. The Agricultural Program has considerably reduced soil erosion and nitrogen and phosphorous runoff. An annual site reconnaissance is completed at each of the participating farms by Agricultural Program personnel to identify compliance with the WFP. (Can we say anything about the 6 farms that do not participate???___)

1.3.2 Land Protection Program

The Skaneateles Lake Watershed Land Protection Program (SLWLPP) was established in 1997 in an effort to preserve the high level of water quality in Skaneateles Lake. The SLWLPP is a partnership between the City of Syracuse and watershed landowners and its primary objective is to protect environmentally sensitive areas in the watershed (e.g., wetlands, stream corridors, forests, and farmland). Through this partnership, willing landowners sell conservation easements to the SLWLPP. These conservation easements are voluntary legal agreements that restrict the development and subdivision of the property. The private property that is protected by a conservation easement stays in the possession of the property owner. Landowners retain the use of their property as long as there is nothing done to the property that would impact water quality. Conservation easements are conveyed with the land so any future property owners are required to follow the terms of the land conservation agreement.

1.3.3 Watershed Inspection Program

The City of Syracuse conducts a Watershed Inspection Program to identify violations of the Skaneateles Watershed Rules and Regulations, NYSDOH and county Sanitary Codes, New York State Department of Environmental Conservation (NYSDEC) Environmental Conservation Law (ECL), Navigation Law, Transportation and Vehicle and Traffic Law (where appropriate) and local rules and regulations (redundant?. The inspection program is conducted by two full-time City of Syracuse personnel, a Water Department Sanitarian and a Watershed Inspector, who routinely patrol the watershed to identify violations of

the above-referenced statutory regulations. Patrolling the watershed includes walking properties, looking under structures, inspecting for sewage system problems, and investigating construction activities of any kind. When required, a boat detail is implemented for those areas that are difficult to access by truck or foot. During the summer months, patrolling the watershed common during the weekends when homeowners are more likely to be completing construction activities. Regulated activities generally include: construction and/or repair of dwellings, wastewater treatment works, and shoreline structures. The City of Syracuse DOW personnel meet with Environmental Conservation Officers, Building Inspectors, and County Public Health Technicians as needed.

1.3.4 Wastewater Treatment Works Management Program

The Wastewater Treatment Works Management Program includes the review and inspection of proposed new OWTS, changes to existing OWTS, and ongoing dye testing surveys. The program has evolved since the 1890's, when properties operated privies prior to the establishment of the original Watershed Rules and Regulations in 1896.

Sanitary Camp Pail Service

The DOW sponsored pail service was initiated during 1908. Waste generated from privies during the summer months and placed in five-gallon, galvanized steel containers is collected by DOW personnel. The buckets are replaced with clean, disinfected containers. The waste is temporarily stored in a 2,000 gallon holding tank until it is ultimately transported for treatment at a nearby wastewater treatment plant.

Since the 1990's the City of Syracuse has been phasing out the pail service and DOW has purchased and installed some 75 composting toilets to replace camp privies. There remain only 10 properties with privies which are likely to receive new waterless composting toilets or install an onsite system.
The operation and maintenance of the composting toilet is the responsibility of the property owner. The composting toilets require removal of the compost on an annual basis (most commonly at the end of the summer season). Homeowners are responsible to place compost from the toilets in a covered container that is picked up by the DOW and transported to a central composting site within the watershed.

Inspection and Review

Enforcement of Sanitary Code violations is the responsibility of the respective county health departments. Watershed Inspectors identify approximately half a dozen violations of the Watershed Rules and Regulations on an annual basis. Violations of NYSDOH and/or County Sanitary Code are generally the result of failed OWTS. When the City of Syracuse issues a violation notice, the property owner has ten working days to reply and declare their intent to make the necessary repairs. If there is no response, or if the

property owner refuses to abate the problem, the violation is forwarded to the respective county health department for enforcement.

All proposed OWTS for new construction require a plan designed by a licensed Professional Engineer http://www.op.nysed.gov/pelic.htm. Plans are submitted to the City of Syracuse's DOW for review and comment. If acceptable, the plans are forwarded to the respective county health department for approval or rejection based on county ordinances and Section 201(1)(I) of the Public Health Law, Appendix 75-A of Part 75 of the Administrative Rules and Regulations contained in New York State Code 10 NYCRR 75 guidelines.

On an annual basis, an average of approximately two dozen proposals for new construction of OWTS are reviewed as well as an additional dozen or more proposals submitted for repairs to existing OWTS. Watershed personnel also witness percolation tests, conduct backfill inspections on repairs, and assist County Sanitarians and design engineers with final inspections during construction. The City of Syracuse DOW maintains up to date records for each OWTS located in the watershed, including design plans and as-built sketches.

Looking forward from this Demonstration Project, the DOW now requires that for replacement septic systems that can't meet new construction standards, an ETU must be installed. If the dispersal field has to be located within 100 feet of the lake, some sort of disinfection will be required, including sand filtration, chlorination/dechlorinaion, or use of ultraviolet light.

Dye Testing Survey

Each summer seasonal personnel conduct an on-going dye testing survey. The program includes dye testing the watershed's onsite systems to identify those that are failing. A failing septic system is characterized by the visual presence of septage at the ground surface or the visual identification of dye identified outside the dwelling during a dye test. Homeowners complete a questionnaire during dye testing inspections to ascertain user and treatment system information including: the number of people inhabiting the dwelling, the number of bedrooms/bathrooms, age and capacity of the treatment system, most recent maintenance, and water-consuming appliances used. A sketch locating the system components is also made and the premise is inspected for any unusual or questionable conditions (i.e., construction activities, standing water over a leaching area, septic odors, leaking storage drums, etc.). Conditions identified during the dye testing survey are reported to a Watershed Inspector for follow up investigation, if necessary.

Tracking Maintenance of Alternative OWTS

The DOW conducts an annual file review for all sites with Secondary Treatment Units. A field inspection is performed in the absence of maintenance records for the site. If the existing system is not functioning due to neglect or age, DOW issues a Notice of

Violation and pursues correction of the problem until the public health hazard or potential source of water pollution is eliminated.

1.3.5 Water Quality Education Program

DOW publishes an annual Drinking Water Report informing customers and users of the City of Syracuse water system with useful information about the water system, the quality of the water, and the important issues affecting the water supply. This report is prepared pursuant to regulations and guidelines of both the United States Environmental Protection Agency (USEPA) and the NYS Department of Health (DOH).
http://www.syracuse.ny.us/pdfs/Water/WaterNewsletter2009.pdf

The Agricultural and Land Protection programs conduct ongoing educational activities involving professionals, officials and landowners concerning water quality issues.
The Cornell Cooperative Extension (CCE) also offers public outreach tools to residents of the Skaneateles Lake Watershed as part of its national Water Quality Extension Program http://waterquality.cce.cornell.edu/. In addition, DOW has partnered with the Tri-County Skaneateles Lake Pure Water Association, a not-for-profit association of watershed residents that inform citizens about water quality issues and watershed protection. http://www.skaneateleslake.org/links.html The Skaneateles Lake Demonstration Project's education and outreach component is a natural and timely extension of all of these activities.

2 Alternative Onsite Wastewater Demonstration

In April 1997, at the request of Congress, EPA reported on the feasibility of decentralized treatment not only as a viable alternative to centralized wastewater but also as a lesser-cost option for the many communities around the nation with wastewater treatment needs. The agency concluded that, "Adequately managed decentralized wastewater systems are a cost-effective and long-term option for meeting public health and water quality goals." The report also indicates that decentralized systems are a permanent part of our nation's wastewater infrastructure.

Septic system failure poses a risk to public health and a potential contamination source to surface water and groundwater. Conventional systems typically consist of a septic tank, distribution box, and leach field that depends on soil bedding material as the media for biological activity to occur. History has proven that conventional septic systems are prone to failure with age, improper installation/operation, and maintenance.

Properly managed OWTS have proven to be a viable, long-term cost effective alternative to centralized wastewater facilities. Advances in alternative technology for the treatment of onsite waste have improved the selection of systems available to homeowners while providing increased protection to water resources in a variety of site conditions. Many

alternative systems use a combination of prescriptive and performance-based approaches to treatment. Systems that do not require use of site soil for treatment operate on a performance-basis and are therefore able to achieve treatment at sites with challenging conditions (e.g., inadequate soil depth, shallow groundwater table, low permeability soils, inadequate lot size, etc.). Advances in the onsite wastewater treatment industry have led to the commercial production of pre-engineered enhanced treatment units. New enhanced treatment units (ETU) are being applied to onsite systems, resulting in higher treatment levels and measurable reliability.

As the existing regulatory framework has changed, it is becoming more apparent that advanced alternative OWTS are the only viable option for both new construction and the remediation or replacement of aging and failing OWTS for many communities.
In order for such systems to gain approval by state and county health departments, acceptance by homeowners, and familiarity on the part of engineers and contractors, the EPA and the OWTS industry recognize the need for model projects to serve as research test beds while disseminating knowledge about alternative onsite systems to professionals, regulators and the public.

To facilitate this goal, EPA has funded a series of National Onsite Demonstration Projects (NODP) assisting communities around the country address wastewater treatment problems in environmentally sensitive areas. The Skaneateles Lake Decentralized Wastewater Demonstration Project benefited from the experiences of previously established NODP sites, including the La Pine National Decentralized Demonstration Project http://www.deschutes.org/deq/, the University of Rhode Island Training Center's Block Island and Greenhill Pond National Decentralized Wastewater Demonstration Project and the Table Rock Lake Onsite Wastewater Demonstration Project. http://www.uri.edu/ce/wq/RESOURCES/wastewater/Research_Assessment/Demo_Systems/index.htm.

This section details the major tasks of the Skaneateles Lake Demonstration Project, discussing each task's objectives, methods and results.

2.1 Task 1: Site Selection

Objective:

Select watershed sites with failing/inadequate onsite treatment systems and challenging site conditions suitable for the demonstration project Considerations include watershed-wide representation, demonstration of a variety of challenges and solutions, ensuring future maintenance of any installed OWTS, and anticipated benefits of the system.

Methods:

The City of Syracuse used GIS to identify areas with site conditions that are typically challenging for conventional OWTS. In order to promote watershed-wide involvement in

the Demonstration Project, an effort was made to select one project site in each of the major watershed townships. Selecting sites in each town was intended to generate local interest and town involvement but it also provided a location to conduct on-site training in each of the major watershed towns.

The project team developed the following selection criteria to identify challenging sites within the Skaneateles Lake watershed as candidates for participation in the Demonstration Project:

- Lakefront properties
- Sites with existing dry wells within 100 feet of the lake
- Sites not conducive to conventional soil absorption field (i.e., poor soil for biological treatment, shallow depth to groundwater/bedrock, steep slope)
- Sites with a history of onsite system failures
- Sites where the existing onsite system does not meet current requirements for new construction outlined in Appendix 75-A of New York State Code 10 NYCRR 75 http://www.health.state.ny.us/environmental/water/drinking/appendix_75a.htm.

In addition, the commonality of the site conditions was considered during selection of the project sites so the demonstrated onsite wastewater treatment technology or approach would be readily transferable to other sites within the Skaneateles Lake watershed, other similar sites in New York State, or indeed, around the country.

The homeowners of the properties matching the site selection criteria agreed to receive ownership of an installed OWTS in exchange for entering into an agreement with the City of Syracuse's Department of Water. Property owners were informed about the long-term costs associated with the operation and maintenance of the proposed system and acknowledged a willingness to maintain a service contract with an authorized maintenance provider. The Property Owner Agreement is ongoing, continuous and a binding obligation on the property owner and upon the property owner's successors and assigns. The agreement outlines the following items and responsibilities of each party.

Department of Water responsibilities include:

- Design of the advanced OWTS
- Coordinate approval with applicable regulatory agencies
- Obtaining the OWTS equipment
- Conducting construction observation during the installation
- Site demonstration and training

Property owner responsibilities include:

- Maintaining a service contract with a maintenance provider approved by the Department of Water and determined by the equipment manufacture/vendor to be qualified to perform all of the necessary maintenance activities. The maintenance contract will be kept current for the duration of the useful life of the treatment

system. Homeowners will provide copies of all service contract renewals to the DOW.

- Informing the DOWof any concerns or problems with the operation of the system and the performance of any maintenance by the service provider.

- Agreeing to maintain access to the onsite system for DOW personnel to conduct monitoring and training activities for a period of 3 years following system startup.

- Maintaining general water and sanitary use records for a period of three years (e.g., occupancy records for the dwelling). The property owner will be provided an Operation and Maintenance Manual and specific training by the equipment vendor in the general design, function, maintenance, and monitoring of the system. At the discretion of the Project Team, owners will also be given the opportunity to participate in Community Outreach and Education activities.

Results:

The 19 sites that ultimately benefited from this demonstration project represent only 10% of lakefront properties for which advanced OWTS are likely the only option, underscoring the urgency of the project.

Most of the selected sites had an existing dry well located within 100 feet of the lake, providing no treatment. Due to poor soil characteristics, topography and small lot sizes, each site required some level of pre-treatment prior to final dispersal. Anticipated benefits included eliminating drywells within 100 feet of the lake, installation of units with a compact dispersal area smaller than the soil absorption field required for a conventional system, and improved accountability, control, and oversight.

Previous systems also suffered from improper maintenance. Advanced OWTS require proper maintenance for successful treatment. At each of the demonstration project sites, the property owner is responsible for long term system operation and maintenance and committed to maintaining a service contract with an authorized maintenance provider. Each owner is aware of the long term costs associated with their new treatment system.

In the event that the system is not maintained according to the manufacturers' recommendations, the City of Syracuse Department of Water will exercise the authority to inspect the onsite system and if appropriate, issue a notice of non-compliance if the system is not properly functioning.

The selected sites represent a variety of towns, topography, soil characteristics, and challenges circling the lake. They include seasonal and year-round residences, 2- and 3-home clusters, a farm and a lakefront restaurant.

2.2 Task 2: Technology Selection

Objective:

Select alternative waste treatment technologies that can readily be installed in places where site characteristics matched those identified during the site selection process. These treatment technologies must have a proven track record of providing advanced secondary treatment levels at similar sites. The overall water quality goal is having treated wastewater effluent concentrations of 10 mg/L for five-day biochemical oxygen demand (BOD5) and total suspended solids, as well as a 2-log reduction of total and fecal coliform at the downgradient hydraulic boundary of the property. Emphasis placed on selecting technologies that are cost effective and could be readily used anywhere across the country.

Methods:

Project team engineers reviewed the industry literature, attended manufacturers' presentations and workshops, and visited NODP sites around the Northern Hemisphere. Information provided by the National Small Flows Clearinghouse http://www.nesc.wvu.edu/wastewater.cfm was also useful during the technology selection process.

The technology selection team established the following criteria in investigating and selecting commercially available advanced OWTS options:

- Ability to design systems according to manufacturer recommendations including soil loading rates;
- Preferably NSF Std 40 and/or EPA/ETV approved;
- Pre-engineered;
- Small footprint;
- In-tank treatment;
- Proven record of performance and secondary treatment levels;
- Transferable to other sites;
- Easy maintenance;
- Cost Expectations: $20,000 (equipment & installation) and Annual O&M $300/yr;
- Manufacturer must have a desire to establish a local dealer presence; and
- Manufacturer oversight during installation and training opportunities during installation and scheduled maintenance.

Results:

Most of the commercially available ETU's chosen for the Skaneateles Lake Demonstration Project consists of a treatment tank filled with natural or synthetic media that provides an environment where attached-growth bacteria live. The majority of the

biological reduction occurs in the controlled tank environment. Untreated wastewater is applied to the top of the media. Microorganisms that live on the media extract soluble organics from the wastewater as it drains from the unit. The treatment media structure has a high surface area, making it a very efficient use of space. These treatment units have a small footprint and can be placed in a relatively small area. The pre-treated effluent must still be discharged onsite, but at a higher loading rate per square foot than septic tank effluent, reducing the size of the drainfield.

A variety of treatment media were selected, including: peat fiber, textile, textile/peat, aerocell foam cubes, and polystyrene peanuts. In addition, innovative dispersal techniques have been introduced including shallow narrow low-pressure trenches, bottomless sand filter, and drip irrigation.

Many of the alternative OWTS demonstrated are the first of their kind in New York State, providing unprecedented opportunities for training, experience and evaluation for regional regulators, engineers, contractors, homeowners and the watershed community, as well as exposure for selected manufacturers. Equipment manufacturers participating in the project were required to have representation during the design, installation, and maintenance activities. Certain manufacturers of onsite wastewater treatment equipment were declined participation because they did not have adequate support documentation, were not well established in the Industry, and/or did not want to establish a local dealer network

2.3 Task 3: Design, Installation and Maintenance

Objectives:

Follow manufacturers written criteria for design (including soil loading rates), installation, and maintenance to achieve treatment objectives; follow County Department of Health ordinances and New York State Public Health Law as closely as practicable; emphasize simplicity and standardization of designs in accordance with the project's demonstration goals.

Methods:

The project was conducted on the premise of following manufacturer recommendations and verifying vendor claims. Although the alternative OWTS are designed by a licensed Professional Engineer following County Department of Health ordinances and New York State Public Health Law as close as practicable, the designs closely followed the equipment manufacturers written recommendations for design, installation, operation, and maintenance.

The Project Manager was responsible for oversight of all designs and modifications, liaising with all concerned parties to anticipate and resolve any practical and regulatory issues, as well as simplifying and standardizing design drawings.

The technical committee reviewed all of the project designs. Members representing the county health departments in the watershed agreed on standardization of regulations where applicable. Since much of the equipment is new to the region, the review committee allowed that code exemptions could be made based on sufficient evidence of secondary treatment levels. Other specific exemptions could be based on additional requirements to the homeowner (e.g., agreeing never to install a paved driveway). Consistent with the research and development objective for this project, any deviations from existing codes would also require proactive observation (e.g., installation of additional monitoring points).

Equipment manufacturers/vendors provided technical support throughout the design process and provided documents to support history of performance, installation instructions, and projected operation and maintenance costs for system servicing a single-family residence.

Results:

Separation Distance

The process of designing and implementing individual site enhancements testifies to the importance of this project. In almost every case, the designer encountered situations where separation distances could not be met. Likewise, the sites original septic system did not meet the design criteria fundamental to that type of system. That is – the site conditions did not meet the system requirements.

Time Dosing

It was determined that sites with limited overall hydraulic loading capacity or relatively small size are very well suited for time dosing of treated effluent. Spreading out the distribution of the day's treated wastewater uniformly over a 24-hour period has proven to be very effective. The majority of the systems installed during the Demonstration Project took advantage of the benefits of time-dosing in reducing stress on the dispersal area.

The additional equipment needed for a system to use time dose dispersal includes properly sized pump chamber (for new construction, New York State requires a volume equal to or exceeding the daily design flow), float, and pump assembly.

Advance Treatment

ETU's proved to be essential in achieving prescribed treatment levels. Simply put, pre-treatment takes the biomat and puts it in a box, replacing at least 50% of drainfield needs. There it can be maintained, serviced, monitored, and easily sampled, unlike a conventional drainfield. Beyond that, nitrogen/nutrient reduction can be achieved that is not possible in many soils.

2.4 Task 4: Data Collection and Monitoring

Objectives:

Evaluate the performance of each waste treatment system using pre-construction and post-construction water quality to evaluate environmental conditions, with BOD, TSS, TC, FC as primary criteria. Verify vendor claims as to installation/construction, operation and maintenance, capital and operational costs, aesthetics and reliability.

Methods:

At the start of the project, the technical committee comprised of NYSDOH, NYSDEC, county Health Department and DOW regulatory personnel considered the treatment evaluation criteria for Field Sampling and Monitoring of SLDP OWTS sites.

Because Skaneateles Lake is an unfiltered water supply for the City of Syracuse, we agreed that any water percolating to the lake should meet drinking water standards.

Our evaluation plan for the alternative OWTS encompassed the following criteria:

- Performance (i.e., effectiveness at reducing concentrations of pollutants of concern);
- Ease in design, construction, operation, and maintenance;
- Capital and operational costs;
- Aesthetics (visual, noise, nuisance odors); and
- Reliability.

The SLDP team evaluated each system based on system performance. (i.e., how well the system reduces target pollutants in human waste), cost, reliability and the level of required operator attention. Performance evaluation was based on sampling and analysis for BOD_5, TSS, nitrite/nitrate, ammonia, phosphorus, Total Kjeldahl Nitrogen (TKN), and e.coli/total coliform.

Baseline background site monitoring data was collected during the site selection process. Each installation incorporated sampling ports before each of the treatment components (e.g., trash compartment, post-treatment unit, and downgradient of dispersal field). A minimum two-month startup period was allowed following system installation activities to allow the system to equilibrate. Following the startup period, effluent water samples from the treatment system and/or groundwater samples downgradient of the system were collected for analysis before and after each of the treatment system components on a monthly basis for at least one year using sampling wells, lysimeters or other sampling mechanisms. The full year of monitoring allows for an assessment of the impact seasonal variations might have on system performance

Field sample chain-of-custody procedures were followed to ensure that samples were not tampered with from the time of sample collection through time of transport to the

analytical laboratory. Laboratory personnel collected all samples and maintained "custody of samples" until the samples were logged into the laboratory. A Field Sampling and Monitoring Plan (FSAMP) that outlines the monitoring program to evaluate the alternative OWTS performance is provided as Appendix C.

The Project Manager was responsible for monitoring field performance. Field performance audits included an evaluation of field measurements and field meter calibrations to verify that measurements were taken according to the FSAMP and preventative maintenance was performed on both field and laboratory instruments. Field instrumentation used during the Demonstration Project included meters to measure pH, conductivity, dissolved oxygen, temperature, turbidity, and water level. Prior to any field sampling, each piece of field equipment was inspected and, if not operational, serviced prior to use. All meters requiring charging or batteries were fully charged or supplied with fresh batteries prior to use.

Data collection and analytical activities are designed to support the following evaluations:

- Determine the presence and extent of chemical constituents in groundwater at the site before and after installation of the alternative OWTS;
- Characterize surface/subsurface soil and groundwater impacts; and
- Evaluate OWTS performance based on sample analysis of system effluent.

The property owner using the system agreed to monitor and log comments on any limitations associated with the use of the alternative OWTS, aesthetics, noise, and observation of nuisance odors.

2.5 Task 5: Regulatory Management

Objective:

Develop a coordinated regulatory framework for all jurisdictions within the watershed, covering requirements for design, installation, maintenance, and regulatory oversight of OWTS.

Methods:

The Skaneateles Lake Demonstration Project involved regulatory officials from 3 county health departments, NYSDOH, NYSDEC and the City of Syracuse DOW. A major objective of this project was to foster interagency cooperation and provide a consistent level of protection throughout the watershed.

The Demonstration Project Technical Committee has worked towards establishing a

uniform, coordinated, cooperative watershed management regulatory framework for all jurisdictions within the watershed.

Reflecting the standards applied to the SLDP, updated regulatory oversight should include:

- ETU's should be required for renovations that cannot meet Appendix 75-A
- ETU's should be NSF Std. 40 listed
- Manufacture should have written instructions, local representation and trained service providers
- Engineers should have formal training on design of ETU's
- Installer and service provider should be trained by manufacturer
- Maintenance must be contracted, tracked and reported by manufacturer/dealer/service provider
- Syracuse Water Dept. should track maintenance of alternative OWTS
- County Health Departments and DOW should provide enforcement if needed

Results:

A major outcome of the project has been its value in informing updated policies and regulations among all jurisdictions in the watershed.

Watershed regulatory authorities have begun requiring that replacement systems at lakefront sites that cannot meet new construction standards have an ETU. The pretreated effluent must also be subjected to disinfection if the sub-surface dispersal area is within 100 feet of the lake. Professional Engineers submitting alternative OWTS designs must have documented training related to the specific system being proposed.
The installation of innovative alternative systems must be completed by a manufacturer-trained installer or under the direct supervision of a representative of the equipment manufacturer. Design plans must clearly state that design, installation, operation and maintenance are to be completed according to manufacturers' written instructions for the life of the system and the regulator must be notified in advance of maintenance visits.

During the demonstration project, the Department of Water introduced a management program to track the maintenance activities at each of the alternative system sites. The management program will promote better system performance and environmental protection and an extended life of the system, resulting in overall long term cost savings.

On 2/4/2009, the NYSDOH introduced a Notice of Proposed Rulemaking http://w3.health.state.ny.us/dbspace/propregs.nsf/4ac955878100677485256 9bd00512fda/50ade4e1c0f09d7885257540007201fe?OpenDocument amending Appendix 75-A of Part 75 of Title 10 NYCRR to allow and regulate the use of ETU's and gravelless systems as alternatives to conventional OWTS.

Expected to be adopted this year, the amendment recognizes that: "The Existing regulations need to be updated to recognize new OWTS technologies that provide

acceptable or enhanced treatment of household wastewater, additional options and economic benefits for homeowners, and environmental benefits for communities.

2.6 Task 6: Outreach and Training

Objective:

Promote awareness of alternative OWTS among property owners and communities; provide educational and training opportunities for professionals and regulators; disseminate information gained by this project locally, regionally and nationally.

Methods:

As discussed throughout this report, a major premise of the Demonstration Project was to serve as a firsthand vehicle to educate professionals working in the onsite industry and increase public access to advanced OWTS for protecting the watershed and public health.

Education and training were key to each phase of the project, including:

- Providing educational opportunities for Technical Committee members to learn about the latest products commercially available in the alternative onsite wastewater industry.

- Training system installers and service providers, health department personnel, Code Enforcement Officers and watershed inspectors on the design, installation, and maintenance of the wastewater treatment technologies being demonstrated.

- Involving the communities in the watershed to gain public support for the goals articulated for the program and promote awareness of available onsite wastewater treatment options.

Results:

The project site has hosted numerous field tours and training events including ½- day, full day, and 2-day seminars on all aspects of design, installation, operation, and maintenance of the systems. The target audiences included homeowners, regulators, designers, code enforcement officers, installer/maintenance providers, and realtors. These training opportunities continue during scheduled maintenance of the systems.

The project sites are also the subject of continuing education courses instructed by the Project Manager, conducted via the New York Onsite Wastewater Treatment Training Network http://www.delhi.edu/bcs/otn_wastewater/, hosted by SUNY Delhi.

The project and individual sites have been the subject of articles in both the trade press and local media. Reprints of several of these articles are found in Appendix #?

Following publication, this report will be disseminated via the DOW website, USEPA and industry Web pages.

A brochure summarizing the project aimed at lay audiences, and an accompanying website, are also in the design stages.

3 Conclusions and Recommendations

The NYSDOH estimates that 48 of New York's 62 counties have a sizable population (more than 25%) that rely on OWTS'sEPA's 1997 report estimated that decentralized OWTS served approximately 25% of the US population, and represented some 37% of new development. While certain estimates have been disputed, we do know that as conventional OWTS are replaced and new systems are installed, circumstances such as limited lot sizes, soil conditions, topography and environmentally sensitive conditions increasingly make advanced OWTS the only optionto protect public health and the environment. It is imperative that regulatory agencies and the OWTS industry take the lead in transferring new, proven, and commercially available technologies into the public domain.

The Skaneateles Lake Demonstration Project began with very minimal knowledge on the part of regulators, professionals, service providers and homeowners. Today, the effort stands as an ongoing demonstration of the more promising and feasible advanced OWTS.

3.1 Lessons Learned

Major premises of this project were that poorly percolating soils make onsite wastewater treatment a challenge for the majority of the Skaneateles Lake watershed, that maintaining the lake's filtration waivers make treatment levels a top priority, and that advanced OWTS can provide adequate treatment at lakefront sites. Indeed, the advantages of utilizing pre-treatment, recirculating treatment systems, and timed equalized dosing are quickly realized when dealing with slowly percolating soils.
Because conventional systems often became hazardous due to improper maintenance, the project demanded a proactive approach to ensuring and tracking the maintenance of alternative OWTS.

Updated regulations will help to advance the transition from conventional to alternative OWTS. Many of the project sites presented extreme challenges and required creativity, flexibility and cooperation on the part of regulators, owners and contractors to resolve. The experience gained will serve all parties as alternative OWTS's continue to be introduced in the watershed.

While homeowner engagement was an anticipated problem, the fact is that the homeowners were surprisingly interested in the new systems and willing to learn what they should and should not do to to ensure system performance. We suspect that SLDP homeowners were open to maintenance agreements due to the highly educated demographic of the socioeconomic group that owns property on Skaneateles Lake. With over 92% of the land in the Skaneateles Lake watershed privately owned, homeowner education on watershed conservation has been a longstanding priority.

3.2 Long Term Objectives

This report does not represent the end of the Demonstration Project. Long term objectives include demonstrating the longevity of the treatment system equipment and treatment media; observing the uniformity of the regulatory oversight structure into the future and the mandate for perpetual maintenance; and ongoing education and outreach opportunities.

Articles / Email referenced:

Filtration Waiver - http://www.highbeam.com/doc/1G1-118828149.html

Optimizing the Riparian Buffer – Harold Brook in the Skaneateles Lake Watershed
This paper explains two optimization models that a water authority can use to determine the "best" parcels for inclusion in a riparian buffer.
http://www.gsu.edu/~wwwenv/waterPDF/W2002009.pdf

National Environmental Services Center: http://www.nesc.wvu.edu/wastewater.cfm

1997 Response to Congress on Use of Decentralzied Wastewater Treatment Systems Document addresses a Congressional House Appropriation Committee's request:
http://www.epa.gov/owm/septic/pubs/septic_rtc_all.pdf

Report to Congress (2003) – Paying for Water Quality: Managing Funding Programs to Achieve Greatest Environmental Benefit:
http://www.epa.gov/OW-OWM.html/cwfinance/cwsrf/rtc0703.pdf (I added this)_

A preliminary water Quality Study of Selected Finger Lakes, New York - http://fli.hws.edu/pdf/Data_Halfman_Bush.pdf.

Annual Drinking Water Quality Report for 2004 - http://www.syracuse.ny.us/Pdfs/water/WATER%20QUALITY%20REPORT%202005-final%20for%20Website.pdf