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WATER RESOURCES TECHNICAL REPORT ADDENDUM
VOLUME I – WATERSHED AND WATER QUALITY
OCTOBER 2007

Management of Septic Systems and
Other Decentralized Wastewater Treatment Facilities

Version - October 9, 2007

USEPA DECENTRALIZED WASTEWATER TREATMENT SYSTEMS PROGRAM

The U.S. Environmental Protection Agency (USEPA) has developed a Program Strategy for Decentralized Wastewater Treatment Systems (USEPA, 2005b) to better protect public health and water resources. National statistics indicate that onsite systems serve 25% of the nation's population wastewater needs, making them an integral part of our nation's utility infrastructure. However, these systems have also been identified as the second greatest threat to ground water quality by state water quality program staff nationwide.

USEPA acknowledges the challenges in on-site septic management in terms of placing the responsibility for septic operation and maintenance on often uninformed homeowners who lack the knowledge and support needed to adequately do the job. Compounding this lack of knowledge is the fact that regulations do not normally provide adequate legal authority to hold homeowners, or for that matter, anyone else accountable when septic system failure or misuse results in the pollution of water resources. Neglected, these systems will not function properly, and are known to cause water quality and public health problems. USEPA recommends that state and local governments develop comprehensive strategies to manage septic systems, including location, design, operation and maintenance criteria; inspections; monitoring; and financial support. Ensuring proper legal authority is provided to carry out the requirements of any such program is a key factor in developing a successful septic management program.

In its evaluation of onsite wastewater management, USEPA has identified the potential benefits of a septic management program as:

- Protection of public health and water resources;

- Protection of property values by preventing system failures;
- Conservation of ground water recharge and baseflow to streams;
- Preservation of the local tax base and reducing growth pressures; and
- Life cycle cost savings to homeowners and communities because septic systems will not need repair/replacement as often and high capital cost sewers won't need to be built.

Government action is appropriate for all of these purposes except, perhaps, preventing private costs for septic system repair and replacement. However, achieving the public objectives will result in reduced private costs overall. Septic systems can contribute to sustainable water resource management in terms of both water quality and quantity, through avoidance of water export and depletion, reducing the volume of potable water used to transport waste to centralized plants, promoting water recovery and reuse, preventing discharges from sewer overflows that can harm receiving waters and lower consumption of energy and chemicals needed for sewage treatment.

However, all wastewater treatment, including the use of septic systems must be properly planned and managed as part of a community's comprehensive planning and zoning efforts. This involves setting performance requirements for systems, limiting development in critical natural resource areas and concentrating development within designated growth areas, serviced by sewers wherever possible. This is not an easy challenge, nor is it one many have tackled, much less resolved.

The goals of such a program should be to protect public health and the environment. This includes protecting drinking water supplies, and water resources that support sensitive environmental areas, recreation, and sustainable economic growth. A community also needs to understand the impact that onsite systems can have under both existing and buildout conditions.

Factors that contribute to program success include public and political support, adequate funding, clear regulatory authority, capable staff, clear goals, appropriate guidelines, system monitoring and maintenance, certification and licensing requirements, incentives and enforcement mechanisms and public education and outreach.

In addition, to be effective, the program must consider environmental conditions, ordinances and local codes that allow adaptation to site conditions, water conservation and reuse, and controls on discharges to septic systems, operation and maintenance, and residuals management.

The USEPA Voluntary National Guidelines for Management of Onsite (Decentralized) Wastewater Systems (USEPA, 2003) provide five models that can be tailored to meet local and regional needs. The NJDEP has embraced these Guidelines (Bowers, 2001) and sees onsite wastewater disposal as a valid alternative to public sewers, as they can provide cost-effective treatment and high levels of ground water recharge. However, NJDEP also recognizes that proper design, construction, operation, maintenance and management of septic systems is needed to prevent surface and ground water contamination with nitrate, pathogens and other chemicals.

Key concepts in the USEPA Guidelines include:

- Completion of an existing septic system inventory and performance evaluation
- An increase in management comprehensiveness as the risk and complexity increase
- Requiring operating permits for large systems, clusters of systems or as otherwise deemed appropriate
- Permits for systems discharging to surface water
- Certification and licensing of practitioners
- Elimination of illicit discharges to storm drains and sewers

The following provides a generalized description of each of the five USEPA management models, as defined in the Guidelines. These provide an increasingly comprehensive system management structure as the sensitivity of the natural environment or complexity of the system increases. These models are proposed as the starting point for tailoring the septic management program to conform to the resource protection and other goals of the Regional Master Plan.

Management Model 1 - "Homeowner Awareness" Model: This model involves a minimal level of management where septic systems are owned, operated and maintained by individual property owners in areas where sites are suitable for conventional onsite systems and environmental sensitivity is low. Homeowners are reminded by the homeowner's association, municipality or other responsible entity to perform routine maintenance. The objectives of this model are to ensure all septic systems are sited, designed and constructed in accordance with the applicable ordinance(s), the regulatory authority documents that all systems are inventoried and that homeowners are informed about routine maintenance needs.

Management Model 2 - "Maintenance Contract" Model: To be used in areas of low to moderate environmental sensitivity, where sites may be marginally suitable for onsite systems due to lot sizes, soil conditions or other factors and enhanced system design may be required. Contracts with qualified technicians are needed to ensure proper and timely maintenance. This model helps assure that malfunctions are minimized, as a certified operator is required to maintain the system in accordance with an operation and maintenance manual and the homeowner must submit the operator's maintenance report to the regulatory authority. Minimum performance and alternative site acceptance criteria are established and compliance monitoring performed by the regulatory authority.

Management Model 3 - "Operating Permit" Model: This model is for use in areas of moderate environmental sensitivity (e.g., outer tiers of Wellhead Protection Areas, lake communities) where proper system operation and maintenance are critical to protect public health and natural resources, and for systems treating high strength wastes or having large capacity. Permits that include measurable performance criteria related to environmental sensitivity are issued for a specific time period and can be revoked, as renewals are based on proof of permit compliance. This model includes performance-based system designs. The objective is to ensure that systems continuously meet their performance criteria to protect public health and natural resources.

Management Model 4 - "Responsible Management Entity (RME) Operation and Maintenance" Model: To be used in areas of moderate to high environmental sensitivity, where reliable operation and maintenance is required (e.g., inner tiers of Wellhead Protection Areas, outstanding value resource waters, aquatic habitats) and for areas with large numbers

or clusters of systems. Permits are issued to a RME (e.g., county and local agencies, wastewater management or improvement districts, public authorities, public/private partnerships) to provide and proper maintenance and compliance, with the objective of ensuring systems consistently meet performance criteria to protect water resources and human health. The RME takes on the primary role for operation and maintenance, educating homeowners, developing design and construction criteria, operating and maintaining the systems, and pumping and hauling residual wastes. Permitting, compliance tracking and inspections are done by the regulatory authority.

Management Model 5 - "Responsible Management Entity (RME) Ownership" Model: This model is for use in areas of greatest environmental sensitivity where reliable management is required to protect human health and environmental resources. Permits are issued to a RME to assure proper maintenance and compliance. In addition, ownership and responsibility for the system lies with the RME. The objectives are to provide professional management of the planning, siting, design, construction, operation and maintenance of onsite systems to assure protection of high value water resources, particularly in areas designated for higher density growth. The regulatory authority is responsible for compliance and coordinating the system management program with other planning and water-related programs (e.g., TMDLs and stormwater).

OTHER STATE AND LOCAL GOVERNMENT EXPERIENCE

The NJDEP and USEPA both support the management model framework summarized above. Key to that support is the ability to tailor the model and requirements to the conditions and goals of a specific onsite wastewater management program and water quality criteria.

An example of how the framework can be tailored to specific needs is provided by the State of Massachusetts, which has developed a "Community Septic Management Program". This program includes varied options for compliance with 310 CMR 15, Minimum Requirements for the Subsurface Disposal of Sanitary Sewage, or Title 5. Options under this program include development of a comprehensive community septic management program to be implemented for an entire town or just in areas that are particularly sensitive to the effects of septic effluent or that have failing systems. Funding is available to communities to develop these programs. Loans are available to individual homeowners who upgrade systems that fail Title 5 inspections. Tax credits are also available to homeowners upgrading their individual systems.

There are other considerations included for what are called Nitrogen Sensitive Areas, determined by the Massachusetts DEP to be particularly sensitive to pollution from nitrogen in sewage. Wellhead Protection Areas and areas near public water supplies are identified as Nitrogen Sensitive Areas. Title 5 allows for the designation of Nitrogen Sensitive Areas based on scientific evidence and includes special requirements for repairing failed systems and the construction of new systems in Nitrogen Sensitive Areas.

These Title 5 provisions go beyond what most other states have done, as the Massachusetts program includes compliance with many of the same permitting, inspection, monitoring, setback and other state program requirements discussed below.

Highlights of other state programs include Florida's county-based onsite sewage program, which includes mandatory permitting of new systems, contractor licensing and innovative design and an alternative technology approval process. Alternative systems are required to be monitored and regular maintenance performed. Setbacks from sensitive resources (e.g., potable wells and wetlands) are required. Septage disposal requirements are also included in the management program.

Minnesota's program is largely county and municipality-based, with requirements for septic management ordinances, siting evaluations that include setbacks from floodplains and wellhead protection areas for new systems, scheduled maintenance and the approval, monitoring and mitigation of alternative systems.

North Carolina manages its septic system program through a combination of state, county and local health department activities. The North Carolina Department of Environment and Natural Resources (NCDENR) provides oversight and technical support to local agencies in implementing the septic system management program. Permits to construct new systems first require a site evaluation, performed by a county Environmental Health Specialist.

Any system other than a traditional septic system requires regular maintenance, to be scheduled based on the contents of the tank. NCDENR also provides evaluations of alternative technologies, and the extent of water quality impacts from high density septic systems. The Wastewater Discharge Elimination Program specifically addresses failing septic systems through funding of surveys to identify areas with failing septic systems and mitigate the impacts of these failures through system repairs. South Carolina's program is implemented through state and county health offices. Permitting, inspection, maintenance and setbacks are required.

In Vermont, the state's Department of Environmental Conservation (DEC) has primacy over septic system regulation. DEC issues permits for construction, approves any alternate technology use, requires site evaluations that are conducted by licensed wastewater professionals, and regular tank inspection and maintenance for innovative or larger (greater than 6500 gallons per day) systems.

Fairfax County, Virginia has a septic management program that requires reserve areas on new lots, setting aside land for future expansion or replacement in case of septic system failure. Use of experimental and provisional systems are limited to replacement of existing failed systems and not allowed for new construction, similar to New Jersey. Large homes are required to have a pumping system to manage the larger water volumes; for such homes, the county will restrict depths of shallow placed systems, require hydraulic conductivity testing for shallow placed systems, and limit the amount of backfill to allow for easier routine maintenance.

The potential to tailor the management framework to local and regional needs has been investigated through onsite wastewater management demonstration grant funds provided by USEPA that have supported projects across the country.

Using demonstration funding, Warren, Vermont had a goal of limiting growth and preserving its historic character. The community chose to build an alternative wastewater treatment system sized to meet the treatment needs of its existing Village Center. Extensive public outreach to overcome the idea that a septic management program would be too intrusive and expensive was effective in calming these fears. There were also concerns that

the cost of providing sewers would be prohibitively expensive. Once residents understood the critical need to protect water resources to sustain both potable supply and the natural resources that drive the tourism-based local economy, that the program could be used to control development in line with the residents' vision for the community and they were provided with access to low interest loans to repair septic systems, the program was more readily accepted. A needs analysis was critical in determining both the environmental protection and wastewater treatment needs of the community and planning their wastewater management system based on these needs.

Other New England demonstration projects provided case studies specific to the protection of natural resources, maintaining water quality, directing development to already sewered areas, promotion of tourism, wastewater management ordinances and effective public outreach and education, all with potential application in the Highlands. One demonstration study concluded that the availability of drinking water on Block Island, Rhode Island was directly related to the volume and quality of wastewater effluent discharged by septic systems. Block Island includes a federally-designated Sole Source Aquifer. Approximately 93% of its year round residents are dependent on private wells for drinking water and there are sensitive ecological and water resources.

A New Shoreham, Rhode Island study identified high risk areas, including surface water reservoir watersheds, wellhead protection areas and ecologically sensitive water resources. A build out analysis was used to determine the future risk of pollution resulting from any future development.

USEPA Region 2 has identified Onsite Wastewater Treatment System Management, Nutrient Management, Watershed Management (including water reuse and agricultural water) and animal waste management on small farms as regional water quality initiatives. Coordinating with the onsite wastewater initiative should be considered in developing the Highlands program. The other initiatives also have applicability, as they include elements that are related to overall nitrate and water quality management. Efforts are underway to support implementation of the wastewater management guidelines through research and cooperative efforts with land grant universities through the US Department of Agriculture Cooperative State Research Education and Extension Service (USDA-CSREES) Regional Water Coordination Program (RWCP) (USDA, 2007). RWCP is working with state and local governments to address failing and inadequate septic systems. An action plan that includes developing working partnerships, capacity development, professional training and public education has been prepared. The USEPA and RWCP have also conducted seminars, training and provided support for demonstration projects.

USEPA also supports the National Decentralized Water Resources Capacity Development Project, a cooperative venture with several other industry organizations to improve both training and practice in onsite wastewater management (National Decentralized Water Resources Capacity Development Project, 2007). The project is looking into barriers to the more widespread use of septic systems, including public misperception, inconsistencies in enabling legislation, lack of program coordination and the absence of effective management programs.

The National Onsite Demonstration Program was developed by USEPA and the National Environmental Services Center and has a national demonstration project database. Projects to date have addressed the protection of water quality in limestone formations, impacts of

septic systems on surface sources of drinking water, the performance of alternative treatment technologies, developing a model wastewater management district, and educational program development, all with potential application in the Highlands.

BEST MANAGEMENT PRACTICES FOR ONSITE WASTEWATER TREATMENT

All septic systems have a life cycle and all drain fields will eventually need replacement. Without regular maintenance, septic systems will eventually fail, resulting in human health and ecological threats. Regularly scheduled inspections and pump-outs can help assure proper functioning and use of the system over a longer period of time. How often this should be done varies, with inspections normally recommended every one to three years and pump-out every three to five years, depending on the number of people in the household, amount of wastewater generated, volume of solids in the wastewater, septic tank size and location of water supply wells and other sensitive features.

On a daily basis, the homeowner can take simple steps, including the efficient use of water to reduce the amount of wastewater generated that requires treatment. Fixing leaks and drips, using efficient fixtures and appliances, limiting what goes down the drain (e.g., avoiding bulky items that can clog the system and toxic chemicals that can poison the bacteria in the system), avoiding driving over or draining water to the area of the drain field and careful landscaping all help the septic system work properly. Use of garbage disposal units, water purification systems and hot tubs can contribute large quantities of liquids and/or solids to the system, agitating tank solids and overloading the drain field (ANJEC, 2002; USEPA, 2002).

ALTERNATIVE ONSITE WASTEWATER TREATMENT

Alternative treatment options can be used for either individual onsite or clustered wastewater systems and can be very simple - such as the use of composting toilets - to fairly complex systems requiring trained operators and a high level of maintenance.

Basic variations involve methods to reduce wastewater flows through leak detection and prevention and use of efficient fixtures; drain field configuration or construction to suit the site; trickling filters to treat effluent; vent filters to prevent movement of solids to the distribution box, septage treatment involving land application or delivery to a sewage treatment plant; use of small diameter sewers to collect liquid septic effluent; pretreatment; and use of lagoons, fine bubble aeration or other aerobic treatment, activated sludge treatment, intermittent and recirculating sand filters, peat filter and mound systems, constructed wetlands and other methods as a means of effluent treatment. More complex systems can incorporate sequencing batch reactors, ultraviolet, ozone or chlorine disinfection and other advanced treatment methods. Operational efficiency and water quality results using these systems vary (National Small Flows Clearinghouse, 2007).

Further investigation into the types of alternative treatment suitable for use in the Highlands is required and may need to be evaluated on a site-by-site basis, depending on the potential to impact critical water and other natural resources, site soil, geological and other

characteristics. In addition, approval for use of these alternatives must be coordinated with NJDEP and local Health Boards.

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