Subsurface Systems

background

According to the 2000 census, 65% of New Hampshire's housing units, or about 400,000, relied on septic systems for wastewater disposal. For new development, the figure is higher; about 80% of new housing units have septic systems. (DES, 2008a)

When onsite systems do not function properly it is likely that either they were installed before current standards were in effect (1967) or they were not properly designed, sited, constructed or maintained. DES estimates that between 8 and 10 percent of current septic system approvals address repair or replacement of existing systems (DES, 2008a). As a result of a law (RSA 485-A:39) passed in 1993, evaluation of systems within 200 feet of a great pond or fourth order or higher river is required before the property changes hands; however, upgrading substandard systems is not required.

While directly observable impacts of septic systems on water quality are difficult to quantify, several watershed studies have modeled the impact of septic systems with respect to nutrient contamination. According to the Draft Great Bay Nitrogen Nonpoint Source Study (DES, 2013) septic systems contribute 27% of the nonpoint source nitrogen load to Great Bay, which is roughly equivalent to each of the other two major sources (atmospheric deposition and chemical fertilizer). This calculation was determined from a detailed analysis of the number of septic systems in the watershed, a nitrogen generation rate of 10.6 pounds per person, and the distance of septic systems from the estuary.

Several recent watershed-based plans estimated phosphorus contributions from septic systems based on a count of septic systems in the watershed, number of people per housing unit, seasonal occupancy, pounds of phosphorus per person using the system, and soil retention rates. It found the following percent contributions of phosphorus from septic systems:

- Baboosic Lake 43% (NHDES, 2008b.)
- Cobbetts Pond 22% (Cobbett's Pond Improvement Association, 2010.)
- Pawtuckaway Lake 27% (NHDES, 2008b.)

DES is responsible for both subsurface system regulation (RSA 485-A:29) and licensing of designers and installers (RSA 485-A:35 and 36). Septic system installation has been regulated since 1967; licensing of designers and installers since 1979. The state's controlling role in subsurface systems has made for consistently high standards in force throughout the state.

Since 1994, RSA 485-A:29, I has provided a regulatory process for innovative/alternative septic systems, which allows for review and approval of designs that are not specified in the subsurface system rules. The review process entails submittal of detailed technical specifications and operational data which DES reviews to determine whether the technology will be at least as protective of the environment and will function as reliably as or better than a conventional septic system.

There has been increased attention nationally on nitrogen loading from septic systems, particularly on Cape Cod due to groundwater contamination and the Chesapeake Bay watershed due to eutrophication of the Bay. In 2013, EPA produced a model program for septic system management

in the Chesapeake Bay watershed (http://executiveorder.chesapeakebay.net/130627_Ches_Bay_Tech_Assist_Manual.pdf) that quanti□es some of the options for alternative septic systems in terms of nitrogen reduction and costs.

The model program recommends a tiered, risk-based approach for nitrogen management, where nitrogen reduction goals are recommended based on the proximity of a site to a water body of concern, recognizing that there is a greater potential for attenuation of nitrogen for septic systems located farther from the nitrogen-limited water body. Table 15, reproduced from the EPA model program, describes the tiered management system approach. Table 16, also from the EPA model program, compares conventional systems with advanced treatment systems in terms of nitrogen removal and costs.

With each model, the complexity of requirements and management options increases. The □rst model is roughly equivalent to the current system of management in New Hampshire. The second model introduces nitrogen removal goals and system maintenance requirements. The third model includes operating permits with operation and maintenance provided by a quali□ed service provider. The fourth and □fth models require a responsible management entity to operate or own the system, respectively.

Table 15. Summary of septic system management approaches*

Model #	Description	Comments
1	Homeowner Awareness	Homeowner management of existing systems is promoted through outreach and education programs. Appropriate for conventional systems which provide very limited nitrogen removal.
2	Maintenance Contracts	A property owner contracts with a quali□ed service provider to ensure O&M is conducted and nitrogen removal goals are met.
3	Operating Permits	The regulatory agency issues a limited-term operating permit to the property owner that requires sustained performance levels for nitrogen reduction. O&M is performed by a quali□ed service provider with regular monitoring. This provides a greater level of oversight and accountability compared to Model #2.
4	Responsible Management Entity (RME) O&M	Frequent and highly reliable O&M is the responsibility of a management entity, further increasing the level of accountability. This approach is appropriate for clustered systems or complex treatment systems providing high levels of nitrogen reduction.
5	RME Ownership	Ownership passes to the management entity which is responsible for all management aspects, similar to publicly owned treatment works, providing a high level of assurance that nitrogen removal goals are met.

* Source: U.S. Environmental Protection Agency. A Model Program for Onsite Management in the Chesapeake Bay Watershed. June 2013

Table 16. Examples of Nitrogen Load Reductions Achievable Through Advanced Treatment*

Type of System	Nitrogen discharge[1] Concentration (mg/l)	Load reduction Provided	Loading (Per Person/yr)		Nitrogen reduction (Per Person/yr)		Treatment Cost for upgrading System
			kg	Lb	kg	LB	
Conventional System	39	0%	4	9	0	0	N/A
Advanced Treatment[2]	20	49%	2	5	2	4	$4,000 - $10,000
Advanced Treatment with Denitrification[3]	10	74%	1	2	3	7	$10,000 - $15,000

* Source: U.S. Environmental Protection Agency. A Model Program for Onsite Management in the Chesapeake Bay Watershed. June 2013

[1] This is the concentration of wastewater effluent as it enters the drainfield.

[2] Advanced treatment system refers to a system that includes a septic tank, an aeration system, and a recirculation system into the septic tank, or equivalent.

[3] Advanced treatment system with denitrification refers to a septic tank, an aeration system, and an anoxic environment separate from the septic tank, or equivalent.

The EPA model program recommends varying approaches to septic system management depending on the distance from the septic system to the bay or to the tidal portion of tributaries to the bay. According to the Draft Great Bay Nitrogen Nonpoint Source Study (DES, 2013), all of the nitrogen delivered to groundwater from septic systems within 200 meters (about 650 feet) is delivered to Great Bay.

For freshwater bodies, phosphorus is the nutrient of concern delivered by septic systems. Phosphorus is not removed by conventional onsite systems, but rather is adsorbed to varying degrees by the soil and plant roots through which the treated effluent passes on its way to surface waters. When the adsorption capacity of the soil is reached, phosphorus export will occur. This problem is typical of densely developed shoreland areas near lakes and ponds. Increasing the distance from the leach field to the water body will provide greater adsorption of phosphorus by the soil.

Measures to Control NPS Pollution

Regulatory Programs

- Design and Installation Criteria: RSA 485-A and administrative rules Env-Wq 1000 require that septic systems be designed and installed according to criteria designed to mitigate nitrate contamination in groundwater. DES must review and approve designs and issue operational permits for all individual systems. All subdivisions creating lots less than 5 acres in size must be approved by DES to insure that new lots can accommodate proper septic systems.
- Licensing of Designers and Installers: RSA 485-A and Administrative Rules Env-Wq 1000 require that all septic systems are designed by licensed designers and are installed by licensed installers.

Non-regulatory programs

- Training: Granite State Designers and Installers provide training opportunities for septic system designers and installers.

Table 17. Subsurface Systems Goals, Objectives, and Milestones

Subsurface Sytems Goal 1	Stormwater from developed lands is managed in such a way that water quality is not degraded.						
Objective	Milestone	Schedule					Measure of Success
		2015	2016	2017	2018	2019	
Objective 1 Demonstrate alternative technologies that reduce nitrogen export to Great Bay.	Milestone 1.1 Test the installation of a permeable reactive barrier system within the 650 foot buffer of Great Bay or its tidal tributaries. Partners: Rockingham County Conservation District, Strafford County Conservation District, GSDI						Permeable Reactive Barrier installed.
	Milestone 1.2 Collect two years of monitoring data measuring the effectiveness of the permeable reactive barrier system. Partners: Rockingham County Conservation District, Strafford County Conservation District, GSDI						Monitoring report.
	Milestone 1.3 Identify candidate sites and willing landowners for installation of other types of de-nitrifying systems in the Great Bay watershed. Partners: Rockingham County Conservation District, Strafford County Conservation District, GSDI						BMP installation sites identified.
Objective 2 Allow for the approval of de-nitrifying septic systems within the Alternative Technology rules,	Milestone 2.1 Draft rules addressing de-nitrification. Partners: GSDI, SWA, PREP						Rules drafted.
	Milestone 2.2 Adopt rules. Partners: GSDI, SWA, PREP						Rules adopted.

table 17 (cont). subsurface systems goals, objectives, and milestones

Subsurface Sytems Goal 2	Reduce phosphorus pollution from septic systems.						
Objective	Milestone	Schedule					Measure of Success
		2015	2016	2017	2018	2019	
Objective 1 Address phosphorus pollution in impaired lake watersheds.	Milestone 1.1 Determine the effectiveness of the Baboosic Lake cluster septic system as measured through collection of volunteer monitoring data. Partners: Town of Amherst, UNH Lakes Lay Monitoring Program						Declining phosphorus trend shown in annual LLMP reports.
	Milestone 1.2 Identify candidate sites for installation of community septic systems that would reduce phosphorus loading to impaired lakes. Partners: GSDI, watershed organizations, NHMA, SRF, NHHOA, NHBOA						Candidate sites identified.
	Milestone 1.3 Select a candidate site with willing landowners to implement a community septic system in an impaired lake watershed that has a watershed-based restoration plan. Partners: GSDI, watershed organizations, NHMA, SRF, NHHOA, NHBOA						Site identified.
	Milestone 1.4 Design the community system. Partners: GSDI, watershed organizations, NHMA, SRF						System designed.
	Milestone 1.5 Secure funding and install the community system. Partners: GSDI, watershed organizations, NHMA, SRF						System installed.

Table 17 (cont). Subsurface Systems Goals, Objectives, and Milestones

Subsurface Sytems Goal 3	Provide increased opportunities for septic system replacement and development of community systems.						
Objective	Milestone	Schedule					Measure of Success
		2015	2016	2017	2018	2019	
Objective 1 Continue making SRF loans and State Aid Grants available for septic systems.	Milestone 1.1 Account for water quality benefits in SRF funding decisions. Partners: SRF						SRF program criteria give funding priority to projects with the most water quality benefit.
	Milestone 1.2 Market SRF funding to potential applicants. Partners: SRF, GSDI, NHMA, NHHOA, NHBOA, SWA, PREP						Increased number of applicants for SRF funds to implement community septic system projects.
Objective 2 Determine the feasibility of creating septic system management districts or utilities.	Milestone 2.1 Review existing districts or utilities in California, Connecticut, and Texas. Partners: GSDI, NHMA, SWA, PREP						Report evaluating legal structure of septic system authorities in other states.
	Milestone 2.2 Determine authority in existing state law and whether new authority is needed. Partners: GSDI, NHMA, SWA, PREP						Report assessing current legal authority for septic system utilities and recommending new authorities.
	Milestone 2.3 Determine interest among stakeholders in pursuing utility development. Partners: GSDI, NHMA, SWA, PREP						Interest determined by 2019.

table 17 (cont). subsurface systems goals, objectives, and milestones

Objective	Milestone	Schedule 2015	2016	2017	2018	2019	Measure of Success
Objective 3 Determine whether incentives could better support development of community septic systems.	Milestone 3.1 Assess the current septic system rules to determine the incentives and disincentives with respect to community systems. Partners: GSDI, NHMA, SWA, PREP, NHHOA, NHBOA						Assessment report.
	Milestone 3.2 Draft recommended administrative rules to provide more incentives for community systems. Partners: GSDI, NHMA, SWA, PREP, NHHOA, NHBOA						Draft rules.
Subsurface Sytems Goal 4	Implement a rigorous site assessment process for waterfront septic systems.						
Objective	Milestone	Schedule 2015	2016	2017	2018	2019	Measure of Success
Objective 1 Determine the feasibility of amending the RSA 485-A:39 site assessment process to incorporate a full inspection of the existing system.	Milestone 1.1 Develop procedures requiring an in-ground inspection of waterfront septic systems at the time of sale, if feasible. Partners: GSDI, NHMA, SWA, PREP, NHHOA, NHBOA						Draft procedures.
	Milestone 1.2 Determine the feasibility of adopting inspection procedures in rule or statute. Partners: GSDI, NHMA, SWA, PREP, NHHOA, NHBOA						Feasibility report.
Objective 2 Develop a process to assess septic systems on properties converted from seasonal to year-round use.	Milestone 2.1 Determine the existing process for addressing seasonal conversions. Partners: GSDI, NHMA, SWA, PREP, NHHOA, NHBOA						Assessment report.
	Milestone 2.2 Draft applicable rule changes governing seasonal conversions. Partners: GSDI, NHMA, SWA, PREP, NHHOA, NHBOA						Draft Rules.