

Action Plan 5 Managing Onsite Wastewater Disposal Systems

Problem

The preponderance of the use of conventional septic systems poses a threat to many embayments and fresh-water ponds in the Buzzards Bay watershed. Failed and inadequate septic systems also remain a source of pathogens contributing to water quality impairments. The 1996 updates to Title 5 required that both new standards and the inspection and replacement of inadequate systems at time of property transfer. These regulations have eliminated many problem systems. However, many properties have not changed hands since 1995, and many inadequate systems remain in place. Moreover, local regulations need to be adopted to address special local environmental needs. This action plan addresses the need for improved and more effective designs for onsite wastewater treatment systems to meet the needs of protecting sensitive areas of Buzzards Bay.

The nutrient impacts of septic systems remain a significant problem, and controlling these eutrophication impacts are addressed in Action Plan 1 Managing Nitrogen Sensitive Embayments. While there will be a push to sewer many more areas in the Buzzards Bay watershed, homes in the less densely developed areas will continue to use onsite septic systems for years to come, and in some cases may need to be upgraded to nitrogen removing septic systems. The increased use of onsite wastewater systems with alternative designs will pose a management challenge for local and state government.

Goal

Goal 5.1. Prevent public health threats and environmental degradation from on-site wastewater disposal systems.

Objectives

Objective 5.1. Enforce the provisions contained in Title 5 regulations such as, siting and design, inspection and upgrades, training, maintenance, mapping and designation of nitrogen sensitive areas, etc.

Objective 5.2. Where special local conditions exist, encourage boards of health to adopt local regulations to ensure and/or improve environmental and public health protection.

Objective 5.3. Improve management and oversight by municipalities of onsite wastewater disposal systems.

Objective 5.4. In areas where advanced nutrient removal is required, encourage community scale alternative technology systems as a preference over individual alternative systems.

Approaches

To meet the goals of this action plan, installed or upgraded onsite systems must meet all state and local regulations. When appropriate, municipalities must adopt local regulations to meet special local needs to protect public health, safety, and the environment. Some of these local requirements could include more stringent setbacks, or accounting for sea level rise in nearshore areas by increasing separation to groundwater.

For watersheds of embayments listed as nitrogen impaired on the state impaired waters list, or where warranted by TMDL, or as part of local Comprehensive Water Management Plans (CWMPs) local government can require the use of nitrogen removal septic systems. Such an approach could include nitrogen discharge standards more stringent than the state specified minimum of 19 ppm. As an interim measure, towns could request that DEP designate nitrogen sensitive embayments pursuant to [310 CMR 15.000](#), Section 15.215(2).

Costs and Financing

Most of the solutions identified in this action plan have negligible costs to government, although some initiatives would increase the workload for staff, or new staff may be required. Some initiatives, like a regional online innovative system tracking system would likely cost less than \$10,000 to create, and may cost \$10,000 per town to annually staff thereafter. Management solutions that incorporate the use of innovative onsite treatment systems can add to the costs incurred by developers and property owners, but these costs will need to be evaluated and weighed against the costs of conventional sewerage.

Measuring Success

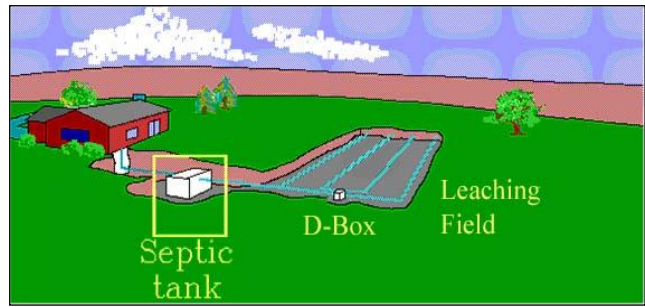
For this action plan, programmatic actions are the chief measure to track progress toward the goals of this action plan. Evaluating the effectiveness of local regulations is subjective, and each municipality must assess its needs and define the most effective regulatory solution.

Background

In the 1991 Buzzards Bay CCMP, on-site wastewater disposal systems (commonly referred to as “septic systems,” Figure 62) were identified as a concern to human health and the environment for three primary reasons. First, failed systems were contributing to elevated fecal coliforms in surface waters (especially cesspools), and high densities of functioning systems threatened public health and public and private drinking water supplies. Second, nitrogen from these wastewater disposal systems was unregulated and was often the principal source of eutrophication to many embayments around Buzzards Bay. Third, Title 5 systems were being used as a de facto growth control and land protection tool by many municipalities, but this was an unwise and ineffective strategy, and towns needed to develop land use planning approaches (like zoning) to better manage growth. Twenty-one years later, while there have been many profound changes in the laws and regulations concerning onsite wastewater systems in Massachusetts (some of which were first proposed in the 1991 Buzzards Bay CCMP) these three concerns remain.

In the 1991 CCMP, it was estimated that 43% of the population was served by onsite systems. By 2000, that percentage appears to have grown to 48% of the population and 48% of the residential units served by onsite systems in the Buzzards Bay watershed⁸⁹. This increase appeared to be the result of the fact that between 1990 and 2000, the population increased 8 to 18% in most Buzzards Bay municipalities, and most of this growth occurred in more suburban areas (often on one to two acre lots) outside the sewer service areas served by onsite wastewater systems.

In the 2000s, several communities (notably Wareham, Marion, and Mattapoisett) expanded sewerage to densely developed former seasonal village areas. By the 2010 Census data, the percentage of units served by septic systems in the watershed has again declined to 45% percent of the estimated residential units (= 51,870 of 116,205 units), and 43% of the population (108,261 of



Graphic taken from an EPA-Purdue University slideshow about septic system design and installation, and modified by the Buzzards Bay NEP into an online slide show.

Figure 62. A conventional septic system in MA consists of a septic tank, distribution box, and a soil absorption system (“leaching field”).

249,999 year-round residents in the watersheds)⁹⁰. Maps of current sewer service areas in the watershed are shown in Figure 32 and Figure 63.

In Massachusetts, the Massachusetts Sanitary Code (“Title 5” or 314 C.M.R.15.00), first promulgated in 1978, established the minimum requirements for the subsurface disposal of sanitary sewage. These regulations established design standards (as opposed to performance standards) for the construction of septic systems. The most important of these design standards limiting the installation of septic systems has been the required setback distances from protected resources, especially the separation of the base of the system to groundwater (4 feet in most soils) and surface waters (50 feet). Another constraint limiting the use of septic systems was the allowable percolation rate of the soil absorption system, where until recently, percolation rates slower than 30 minutes per inch were not allowed.

Boards of health administer most of the elements of these regulations; however, the Massachusetts Department of Environmental Protection must approve any locally approved variances from the regulations. Title 5 represents a minimum standard for onsite wastewater disposal in Massachusetts. Local boards of health may promulgate their own more stringent regulations under Massachusetts Home Rule and Chapter 111, Section 31 of the Massachusetts General Laws, to meet local needs and better protect public health and the environment⁹¹.

⁸⁹ The Buzzards Bay NEP has analyzed U.S. 2000 Census GIS data and clipped block information using watershed boundaries and sewerage area boundaries developed by the Buzzards Bay NEP (further explanation of this approach is contained in Action Plan 1 Managing Nitrogen Sensitive Embayments. As of the 2000 census, 243,400 persons live in the Buzzards Bay watershed in 108,300 residential units. Of these, our best estimate is that 56,800 units were sewerage, with a population of 126,100 persons, and 51,500 units on septic, serving a population of 117,300. This information is not based on parcel level information and should be considered approximate. It also does not include data from portions of Rhode Island included in the Westport River Drainage Basin. Part of the percent increase use of septic systems also results from a population decline in the City of New Bedford where most property is served by sewers.

⁹⁰ Buzzards Bay NEP analysis; see the additional detailed explanation of this calculation in Action Plan 1 Managing Nitrogen Sensitive Embayments. The growing discrepancy between the percentage of units (seasonal + vacant + occupied) and percentage of year round residents served by sewer appears to relate to the increased seasonal occupancy rates in some towns in the 2010 Census, notably in Bourne and Falmouth, and some population declines due to economic conditions.

⁹¹ Chapter 111, Section 31, states, “Boards of health may make reasonable health regulations.” However, this section also states that municipalities may adopt local regulations that relate to requirements for subsurface disposal of sanitary sewage as specified in the state environmental code. The state environmental code is defined in the [310 CMR 11.00](#) and [310 CMR 15.00](#) (“Title 5”)

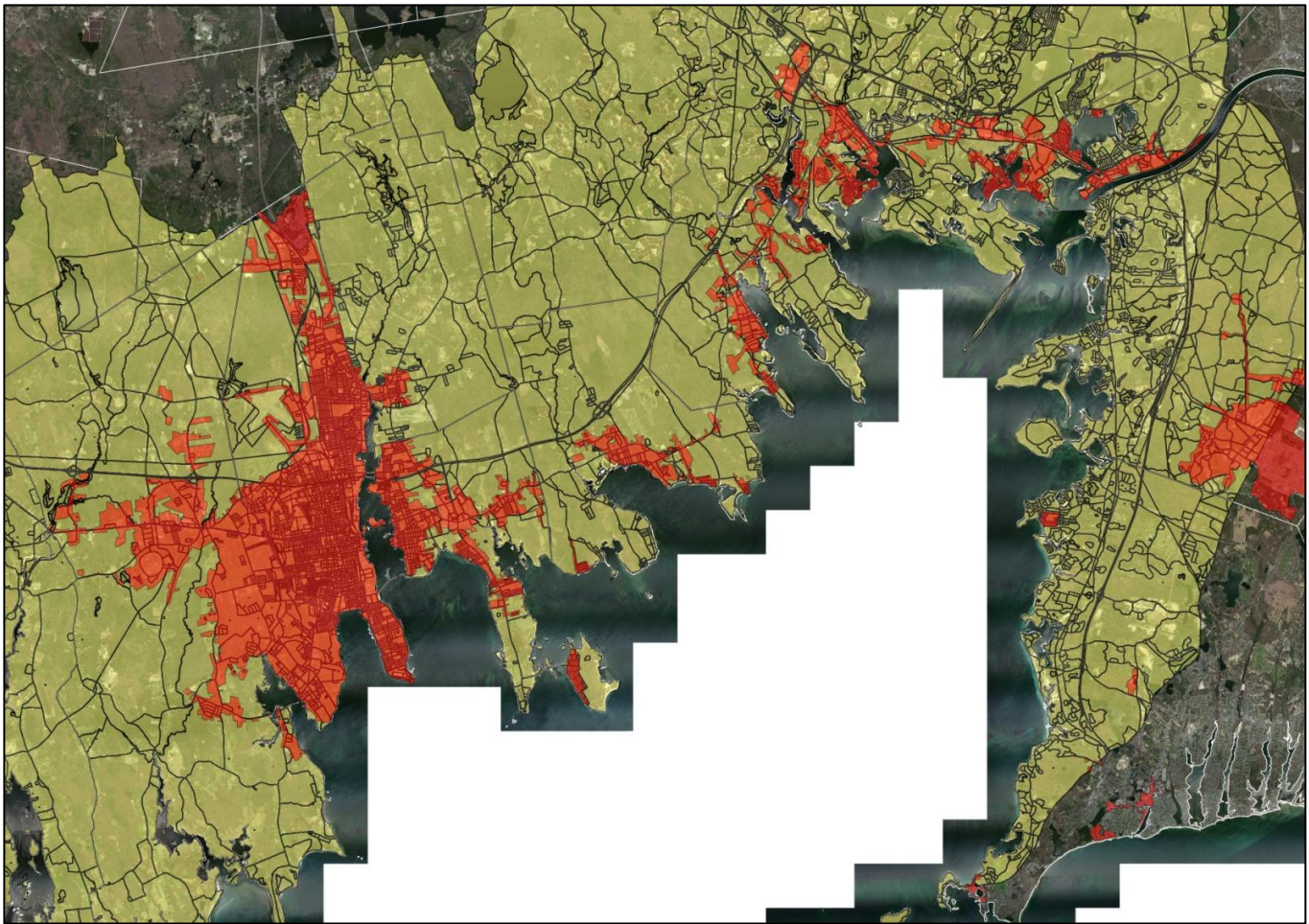


Figure 63. Aerial map (2008) of a portion of Buzzards Bay showing sewered areas (shaded red) and U.S. Census 2010 population blocks (shaded yellow) clipped to the watershed boundary.

These coverages were used to estimate units tied to sewer and septic systems as described by the methodology described in Action Plan 1 Managing Nitrogen Sensitive Embayments. The black lines show the boundaries of the yellow shaded of census blocks, and give a sense of the density of housing units in different parts of the watershed.

While there have been challenges to boards of health, the Massachusetts Supreme Court upheld the rights of the

regulations. Throughout 310 CMR 15.00 its purpose is clearly stated to “Protect Public Health and Safety and the Environment.” For example, in Section 303, wastewater disposal systems “determined by the local Approving Authority or the Department, the system is failing to protect public health and safety and the environment...” Part (2) states: “Any system shall be upgraded upon the order of the Department or the local Approving Authority if either determines that a specific circumstance exists by which any system threatens public health, safety, welfare or the environment or causes or threatens to cause damage to property or creates a nuisance.” It is well established that local boards of health can adopt more stringent standards than are allowed in 310 CMR 15.00.

A good explanation of the powers and authorities of the boards of health can be found in this Mass DPH publication: www.mass.gov/eohhs/docs/dph/emergency-prep/board-of-health-manual.pdf.

boards of health to enact more stringent local regulations.⁹²

Since the inception of Title 5, the scientific understanding of the pathways and impacts of groundwater discharges has grown significantly. This new information, coupled with recommendations from documents like the 1991 Buzzards Bay CCMP, led to a rewrite of the Title 5 regulations (1995) and new rules and policies (1994 and 1996). These rewrites and amendments included many innovations, including recommendations contained in the 1991 Buzzards Bay CCMP. The most important changes to Title 5:

- Required onsite system inspections (and upgrades if necessary to comply with Title 5) whenever a property is transferred, or when there is a change in use or an expansion of the structure.

⁹²Decision was in the case Tortorella versus the Board of Health of Bourne 39 Massachusetts Appeals Court 277. Retrieved from masscases.com/cases/app/39/39massappct277.html.

- Placed more emphasis on soils analysis when siting systems, including requiring the use of certified soils inspectors.
- Streamlined and revised the permitting of alternative and innovative onsite wastewater systems.
- Established discharge limits for nitrogen sensitive areas (440 gallons per day per acre for Zone 2 well recharge areas).

From the beginning, the Title 5 regulations attempted principally to control and limit the discharge of human pathogens in the environment. Scientists and managers generally believe these regulations protect human health from pathogenic bacteria. However, there has been an ongoing debate in the scientific community about how far viruses travel in different types of soils, and whether a four-foot separation to groundwater is adequate to address viruses, and how little separation should be allowed for innovative alternative septic systems.

The groundwater separation issue was partly addressed in the 1995 Title 5 rewrite, where a 5-foot separation was required for very fast percolating soils (<2 minutes per inch). Concerns about virus transfer to groundwater have prevented Massachusetts from adopting less than a 4-foot separation to groundwater for alternative advanced treatment septic system designs, except in remedial situations where there may be no alternative.

While the 1994, 1995, and 1996 changes to Title 5 were generally viewed as more protective of the environment and human health, in 2004 DEP again amended the regulations to allow Title 5 systems to be installed in tighter soils, with percolations as slow as 60 minutes per inch. This change was less popular with some communities because it allows the installation of septic systems in lots previously characterized as unbuildable.

Another interesting element of the Title 5 changes in the 1990s, was the fact that the new regulations allowed the use of alternative septic systems to provide enhanced treatment so that certain constraining standards could be waived (e.g., separation to groundwater and size of leaching fields). These alternatives were allowed, in particular, for the retrofit of existing homes and septic systems. Construction on new lots was constrained by requirements for sufficient reserve land in existence to allow for the construction of a conventional septic system should the alternative design septic system fail.

The outcome of all these changes was that Title 5's focus was the protection of public health and the environment, not growth control. These changes pressed municipalities to better utilize other tools, like local zoning bylaws and ordinances, to better plan future growth.

The debate in Massachusetts communities about the role of Title 5, and whether it is adequate to manage broader environmental impacts from septic systems continues today. Despite the pressures and guidance from

Buzzards Bay Success Story: SepTrack and Septic System Tracking

In the mid 1990s, the Buzzards Bay NEP took an important step to assist local boards of health in the upgrade of failing or poorly functioning septic systems and the proper long-term maintenance of septic systems through the development of SepTrack. SepTrack was a septic system tracking computer program conceived by the Buzzards Bay NEP and jointly developed with Kyran Research Associates through a contract with Massachusetts Coastal Zone Management.

SepTrack helped boards of health track the operation, maintenance and permitting of septic systems and other health related issues. To support the implementation of SepTrack, the Buzzards Bay NEP, through its municipal grant program, purchased computers for each area board of health. Finally, an intern was hired by the Buzzards Bay NEP to set up and install historic septic system information and current assessor's data in each of the bay towns.

In 1999, to address issues relating to Y2K, the Buzzards NEP paid for SepTrack databases and software upgrades for participating municipalities to ensure adequate operation and performance of the software beyond 2000.

Today, SepTrack is still used by some municipalities, while others have moved onto other database management systems. In 2004, the Town of Bourne hired a contractor to integrate the SepTrack database with a GIS software package to produce maps to track outdated or poorly functioning (frequently pumped) septic systems.

the state, boards of health continue to adopt local regulations because they feel that Title 5 does not address all the needs of local communities to protect public health and the environment. This has resulted in a myriad of local health regulations in Massachusetts.

Developers, critical of these local health regulations, lobbied for changes in Chapter 111, and have been critical of the entire Home Rule authority in Massachusetts. These concerns were well articulated in a 2002 report discussing barriers to housing development in Massachusetts and are listed below⁹³.

Process Limitations – Many towns have enacted regulations limiting the time of year soil evaluations and percolation tests are observed.

Oversizing Requirements – Some towns have increased flow allowances as calculated per Title 5 by the use of multipliers, and redefining bedrooms.

Reserve Area Requirements – Some communities have enacted regulations that require expanding setbacks between primary and reserve areas, especially for trench systems, or have required the reserve area be cleared and graded when the primary area is built, or even to be actually constructed to address future fail-

⁹³ Report of The Governor's Special Commission on Barriers to Housing Development. January 2002. archive.org/details/reportofgovernorss00mass.

ure.

Percolation Rate Limits – Some communities have limited maximum rates to 20 minutes per inch, or the previous 30 minutes per inch. Others disallow sites more rapid than 2 minutes per inch.

Limiting or Prohibiting Mounded Systems – Some communities limit or prohibit the construction of mounded disposal systems by preventing the use of fill to meet the required 4-foot separation to groundwater. Others municipalities require 4 or 6 feet of naturally occurring soils.

Limiting Innovative or Alternative Technology Systems - Some communities have local restrictions on the use of innovative or alternative Title 5 systems.

Prohibiting Shared or Community Systems - Some communities have local restrictions on the use of innovative or alternative Title 5 systems.

Despite the criticism against local health regulations by some sectors, they cannot be overturned without significant changes to state law, including a change in the state constitution to eliminate Home Rule. Because Home Rule is entrenched in so many aspects of municipal law in Massachusetts, and municipalities have resisted losing such powers in the past, local board of health regulations will likely remain a fixture in the environmental regulatory landscape.

Previous accomplishments toward the 1991 Buzzards Bay CCMP

New regulations and policies by DEP, better local training, expertise, adoption of local health regulations, and increased public awareness have improved Title 5 enforcement and forced the replacement of failed or inadequate onsite wastewater systems. These actions have helped achieve many of the objectives and recommendations in the 1991 Buzzards Bay CCMP.

The establishment of septic system “betterment” programs has been one of the most important contributing factors leading to better septic system management. The current statewide betterment program can be traced to enabling legislation passed in 1995 that was developed by the Buzzards Bay Action Committee. This legislation enabled municipalities to float bonds to help individuals finance septic system upgrades through betterments using low interest long period loans. This work led DEP to establish a similar statewide program in 1997, funded through DEP, making it easier for municipalities to create the revolving accounts necessary to implement local betterments.

However, while betterment programs eliminated many of the financial obstacles preventing septic system upgrades by the homeowner, the single most important factor causing onsite septic system upgrades was the new state requirement adopted in the 1996 Title 5 regulations that required septic system inspections at the time of property transfer. This single regulatory change has re-

Buzzards Bay Success Story: Massachusetts Alternative Septic System Test Center

In 1998, with a grant from the U.S. EPA, the Buzzards Bay NEP constructed the Massachusetts Alternative Septic System Test Center in partnership with Massachusetts DEP, and Barnstable County (Figure 64). Testing of technologies began in 1999, and in 2001, the first 6 fact sheets were issued of alternative septic system performance compared to a conventional system. In addition, in 2000, the Buzzards Bay NEP began testing for NSF International to establish national nitrogen testing protocols.

Today, the Test Center continues to test new technologies, has established a Research and Development program for vendors, holds training workshops, and has become one of the foremost facilities of its kind in the U.S.

In 2001, the Buzzards Bay NEP turned over the operation of the facility to Barnstable County. The Massachusetts Department of Environmental Protection has also agreed to continue to fund the Test Center and has placed more personnel and emphasis on the approval of alternative septic systems in Massachusetts. Today the Test Center has become nearly financially self-sustaining through grants and the collection of fees from vendors participating in the various testing programs.

sulted in a profound change in compliance with the Title 5 regulations. This is because failed septic systems became a potential financial liability for banks writing mortgages, and this financial risk ensured that lending institutions required compliance with Title 5.

Another contributor toward accomplishing many Buzzards Bay CCMP recommendations in this action plan was the fact the Buzzards Bay NEP, DEP, and other state agencies put a considerable amount of staff and financial support through grants to provide boards of health with many tools to help them adequately enforce the regulations. These tools include software for septic system tracking, grants for computers, and equipment, and training on interpreting soil profiles, and other aspects of the regulations. During a period in the 1990s, DEP also hired circuit riders to visit and assist boards of health.

Major Issues

The Title 5 regulations were originally developed to minimize the threat of pathogen discharges to people, groundwater, and surface waters, by minimizing the possible threat of either hydraulic failure of the systems (e.g. breakout of effluent because of a clogged or overwhelmed soil absorption leach field), or through the contamination of ground drinking water because of inadequate treatment of the effluent (filtration) by soils. Not until the 1990s were the cumulative impacts of nutrient (nitrogen and phosphorus) loading from septic systems considered, and the subsequent changes to the state Title 5 regulations have only addressed these latter problems in an imperfect and less than comprehensive way. In the



Figure 64. Photo of the Massachusetts Alternative Septic System Test Center.

The construction of the Massachusetts Alternative Septic System Test Center at the Massachusetts Military Reservation by the Buzzards Bay National Estuary Program, in partnership with Barnstable County Department of Health and the Environment and Massachusetts Department of Environmental Protection, was an important achievement toward implementing key goals and objectives contained in the 1991 Buzzards Bay CCMP onsite wastewater management action plan, including “to promote innovative technology that will reduce nitrogen.” Today the facility is operated by Barnstable County Department of Health and the Environment.

two sections below, we address shortcomings and needs associated with both issues.

Pathogen treatment and hydraulic integrity

Three primary constraints govern the placement of a septic system:

- 1) the elevation of the site above groundwater,
- 2) the lateral distance between the leaching component of the facility and a point of water use (well, water-course, surface waters, etc.), and
- 3) the suitability of the soils or sediments to receive and treat the liquid effluent from the wastewater disposal system.

Title 5 acknowledges the importance of the distance between wastewater discharges and depth of groundwater and the lateral intercepting points of human contact like drinking wells and surface waters. In Title 5 the first two constraints are addressed by the many setback requirements imposed by the regulations, the last constraint is addressed by soil evaluation and percolation test requirements. Debate continues as to whether the existing regulations are adequately or overly protective.

Pathogens in septic tank effluent are removed primarily through two mechanisms in the soil: physical retention or straining, and adsorption onto soil particles. The efficiency of these processes decreases as the moisture in the soil increases and drops drastically if the soil is saturated. For this reason, a minimum separation distance between the bottom of a leaching facility and groundwater has been adopted in most states. In Massachusetts, the minimum allowable distance is 4 ft. Vendors of some alternative technologies have argued that increased performance should allow for decreased separation to ground water. While the state has accepted these variances for remedial work, it has not been allowed for new construction because of uncertainties with viral transport.

The third major consideration in the placement of septic systems is the ability of the soils to allow infiltration of septic wastes. In Massachusetts, suitability is determined by examining a “deep observation hole” and performance of soil percolation tests that are witnessed by a representative of the local board of health. Today, a licensed soil evaluator must also determine the suitability of the site. The purpose of these evaluations is to determine and record the kinds of soil in the proposed leach-

ing area, depth of groundwater elevation, and permeability of the soils. Many boards of health require that these test pits be dug when groundwater is at or near its maximum elevation.

Site evaluators perform percolation tests at the proposed disposal site to determine the ability of the soil to infiltrate wastewater. Under present Massachusetts regulation, any soils with receiving rates slower than 30 minutes per inch are deemed unsuitable for on-site wastewater disposal⁹⁴. In general, the “faster” the soil, the smaller the surface area required for the leaching facility.

The contamination of surface waters from on-site wastewater disposal systems can occur in at least three ways. Perhaps the most obvious public health threat occurs when a system experiences overt failure. Failure occurs when soils can no longer receive septic tank effluent, and sewage levels rise or back-up in the system, often breaking out onto the surface of the ground. This process is often more noticeable during periods when soils are saturated or very wet from heavy rains. When a system is near shore, this sewage, which may contain both bacterial and viral pathogens, can be transported to surface waters via stormwater drainage systems or overland flow. In general, systems experiencing overt failures (pooling of sewage on the surface) are usually pumped out quickly by property owners, but these problems do not always lead to enforcement actions or septic system upgrades unless a complaint is lodged with the municipal boards of health. In some towns, because of the availability of septic system tracking programs, frequent pumpouts have triggered inspections by municipal health agents and resulted in boards of health requiring septic system repair or replacement.

Covert failures may play a more significant role in the pathogen contamination of some embayments surrounding Buzzards Bay. Many on-site systems installed before 1978 had little or no separation from groundwater. Sewage from these systems is discharged directly to the groundwater, without the benefit of filtration through unsaturated soil. These systems are often assumed to be functioning effectively because no visible wastewater appears on the ground surface, but in reality, they are adding pathogens directly to groundwater. Depending on the horizontal distance this contaminated groundwater flows before reaching surface waters, the potential for pathogens to reach coastal waters can be significant.

Another type of covert failure is the problem of overflow pipes. Before the enactment of Title 5, some property owners used these pipes as backups to prevent overt failure of systems. After Title 5 was enacted, these overflow pipes were sometimes illegally installed. These overflow pipes discharged wastewater directly into sur-

face waters, connecting ditches, streams, or wetlands. Through health agent participation in sanitary surveys with the Division of Marine Fisheries, and through other local field evaluations, many of these illegal discharges have been identified and eliminated.

A similar problem has occurred in some municipalities with sewer systems. In some municipalities (Acushnet, Dartmouth, Fairhaven, and New Bedford), household sewer pipes were attached to stormwater pipes instead of municipal sewer lines as was the case. During the late 1990s and 2000s, these communities rented, purchased, or borrowed pipe “creeper cameras” to conduct surveys to identify these illicit connections. Dozens of illicit connections have been identified and eliminated because of these efforts. Today, some overflow pipes undoubtedly still exist, and they need to be eliminated.

The possibility of viral pathogens entering Buzzards Bay from properly designed and installed on-site systems remains a concern, but is the subject of much debate. Research suggests that, although fecal indicator organisms are filtered out adequately in the leaching component of on-site wastewater disposal systems, viruses may pass through the unsaturated soil layer, reach groundwater, and travel great distances. These viruses may be a public health threat to resource areas (aquifer, shellfish area, swimming beach). The presumption remains that the existing Title 5 setback requirements from on-site wastewater disposal systems to private wells, surface water bodies, and other areas are inadequate to provide protection against virus transport.

Cumulative Nutrient Impacts

A properly functioning septic system, installed pursuant to Title 5, is not designed to remove nutrients. A conventional septic system removes less than a third of the nitrogen contained in wastewater through processes in the tank and under the leaching field (Costa et al., 2002). In most MEP TMDL reports completed for Cape Cod, cumulatively septic systems in embayment watersheds typically account for 60 to 80% of controllable watershed loads reaching these estuaries.

In the 1980s and 1990s, state regulations, and many local wetland and health regulations, were amended with language asserting presumption concerning the protectiveness of Title 5. As outlined in the current section Title 5 section 15.003 (1), “in general, full compliance with the provisions of [310 CMR 15.000](#) is presumed by the Department to be protective of the public health, safety, welfare and the environment.” Local wetland bylaws included similar language. In practice, this meant that if a board of health approved a septic system installation, a conservation commission could not reject the system under a wetlands bylaw if it was outside a resource area. This meant that the individual or cumulative impacts of septic systems on the environment could not be addressed through wetlands laws.

⁹⁴ This was revised down to 60 minutes per inch in 2004. This rule change made buildable more sites with “tight” soils.

In the 1991 Buzzards Bay CCMP, and in the early 1990s, the Buzzards Bay NEP and others encouraged DEP to amend the regulations to address the cumulative impacts of nutrient discharges from septic systems, limit the use of conventional septic systems in nitrogen sensitive areas, and encourage the permitting of alternative nitrogen removing system designs. In the 1995 to 1998 amendments to Title 5, DEP did address these issues, but only in partial ways. For example, DEP identified drinking water well recharge areas (Zone 2s) as nitrogen sensitive areas, but left open-ended what embayment watersheds were nitrogen sensitive. In these Zone 2 areas, septic systems were limited to 440 gallons per day per acre of conventional septic system effluent. This limit was established in order to prevent exceedance of a 5-ppm nitrate groundwater drinking water limit goal. However, by the 1990s it was already recognized that average groundwater nitrogen concentrations needed to be well below 5-ppm nitrate to protect coastal waters.

DEP never designated any nitrogen sensitive embayment watersheds pursuant to Title 5, and by the late 1990s and early 2000s, DEP made a policy decision that nitrogen discharges would best be established by watershed nitrogen TMDLs that would be recommended by the newly established Massachusetts Estuaries Project. However, even after TMDLs were adopted, the state did not designate any embayments as nitrogen sensitive, or establish any discharge limits per acre, as it was decided that these decisions would be best addressed by municipalities through the local Comprehensive Wastewater Management Plans. It is unclear if municipalities can petition the state to designate an embayment watershed as nitrogen sensitive, but to date, no community has made such a request.

Both the slowness in the completion of watershed nitrogen TMDL reports (see discussion in Action Plan 1 Managing Nitrogen Sensitive Embayments), and the cost of the scale of sewerage needed to meet watershed nitrogen TMDLs, has prompted boards in one town (Wareham) to pass then later repeal an article at town meeting requiring nitrogen removing septic systems and no net increases in nitrogen loading for new construction⁹⁵. Since the 1980s, the Town of Falmouth has required the use of nitrogen removal septic systems in locally defined nitrogen sensitive areas, but regulations of this type are fragmentary and do not systematically manage all existing and new sources in a way necessary to achieve a watershed TMDL.

An important criticism on the use of nitrogen removal alternative onsite wastewater systems as a widespread solution to meet watershed nitrogen TMDLs is the fact

that Title 5 approved nitrogen reducing septic systems need only meet a 19 ppm standard on effluent discharge. Moreover, a long term study by Barnstable County (Rask et al., 2010; Heufelder et al.2010) found more than 30 percent of samples from these systems exceed the 19 ppm threshold (although it must be added that many systems did far better than 19 ppm, so the average concentration of all systems was close to 14 ppm).

These observations suggest that the use of alternative wastewater systems to meet TMDLs would only be practical if standards that are more stringent are required for onsite system discharges, and a more vigorous tracking and discharge compliance system put in place for hundreds or possibly thousands of onsite systems in a watershed. Currently some alternative technologies can match larger scale centralized nitrogen removal systems efficiencies and discharge 5 ppm nitrogen or less (Heufelder, 2010). Such systems cost \$10,000 or more than other types of alternative systems that just meet the 19-ppm state minimum nitrogen discharge standard. Despite the higher costs and management obstacles, some communities on Cape Cod are studying this approach as a possible solution to TMDLs (Barnstable County Wastewater Cost Task Force, 2010).

With respect to phosphorus discharges from septic systems, these discharges primarily affect freshwater systems. Moreover, because of the nature of the iron rich soils in the region, most phosphorus in septic effluent tends to be bound to soil particles with a hundred or few hundred feet of discharges where the water table has aerobic (well oxygenated) conditions. Most regulations for onsite systems that limit phosphorus generally require a specific setback distance from surface waters or vegetated wetlands, and some managers have promoted a 300 feet setback rule of thumb⁹⁶. Only a limited amount of research has been undertaken to evaluate the time to saturate soils with reactive phosphorus from septic plumes and some for example have question if these distances are adequate (Robertson, 2007).

Local Regulations

DEP wrote the Title 5 regulations as minimum standards of protection. In recognition of this fact, some boards of health have adopted supplements to the regulations that offer extra protection to public health and enhance environmental protection. Some coastal communities have been quite aggressive in formulating supplements, but others have made few changes. Most of the Title 5 setback supplements have been developed on a town-by-town basis with little understanding as to why a specific setback was selected.

Local boards of health possess enormous authority to protect public health and the environment. Various sections of [Chapter 111](#) of Massachusetts General Laws

⁹⁵ See information posted at: buzzardsbay.org/wareham.htm. Eventually in 2013, the town's Board of Health enacted new regulations requiring all new construction within 500 feet of wetlands and surface waters, and certain retrofits, to use state approved nitrogen reducing onsite systems

⁹⁶ See, for example, the Barnstable County septic system training module 3 at: www.learntitle5.org/Module3.PDF.

directs boards of health to examine, and make regulations to protect the public health and safety from all nuisances and causes of sickness, and to destroy, remove, or prevent these nuisances as the case may require. Boards of health may also make other reasonable regulations that they believe are necessary to protect public health and safety. In addition, they have authority to prohibit activities that may result in a nuisance or are harmful to the inhabitants of the town. Some boards of health have used this authority extensively to protect public health and prohibit environmental degradation through far-reaching supplements to Title 5. These decisions have been invariably upheld when challenged in court as long as the regulation was administered fairly.

Management Approaches

Where existing onsite wastewater systems are installed, whether they are conventional passive “Title 5” systems, or an innovative system designed to address a particular environmental need or site limitation, these wastewater treatment systems must be designed, sited, installed, and maintained in a way to best protect the environment. To a large degree, changes in the state’s Title 5 regulations managing onsite systems set municipalities on a long-term path to upgrade inadequate and failed septic systems that will achieve the goals of this management plan. To meet the broader goals of this action plan (separate from TMDL limits), where onsite systems are installed or upgraded, municipal regulators must better enforce provisions of the state regulations, and where appropriate, adopt regulations to address special local needs (such as TMDLs).

All boards of health should determine if special local conditions exist which warrant the adoption of local board of health regulations for protection of the environment or public health. While Title 5 represents a good minimum state standard, local regulations are sometimes needed. For example, in 1988, because of concerns of pathogen movement in glacial soils, the Town of Bourne Board of Health required a 150-ft setback requirement for all leaching facilities from a watercourse. The first step for any enhanced local regulation is the identification of local conditions or environmental issues that require a more strict local regulation. The Buzzards Bay NEP can work with local health boards to inventory current local regulations already adopted and the special conditions or issues that warranted these enhanced local regulations.

New TMDLs will result in the expansion of sewers in Buzzards Bay, and the elimination of existing and potential new systems, and will otherwise challenge the notion of the protectiveness of the Title 5 regulations. Where TMDLs are far off, as an interim measure, the state could also designate as nitrogen sensitive areas pursuant to [310 CMR 15.000](#), Section 15.215(2). This approach could be applied to watersheds of waters on the 303(d)

lists. This approach, however, would do little to mitigate existing discharges. Moreover, the 440 gallons per acre threshold for non-nitrogen removing systems is too high a standard to support most watershed TMDLs, where a far lower standard would be needed. Still, this approach could be also be part of a local strategy where the denser developed parts of the watershed will be sewerred, and nitrogen removal onsites are the only financially practical solution in areas with large acre zoning. Such a requirement would impose nitrogen-loading limits for Chapter 40B projects, which are currently exempt from any local nitrogen regulations.

Where TMDLs have not yet been adopted, in watersheds to embayments with significant eutrophication problems, adopting other interim local regulations limiting nitrogen discharge from new homes can be considered. Installation of alternative design onsite systems with advanced nitrogen removal (e.g. < 10 ppm), or required shared community wastewater systems with advanced nitrogen removal, could be considered as an option if sewerred these areas are not viable (e.g. areas zoned greater than one acre may be prohibitively expensive to sewer), or where sewerred an area may be decades away. In these areas, shared or community scale alternative systems should be encouraged over individual alternative systems because of the economy of scale for operation, maintenance, and oversight costs.

If a municipality desires to require the use of nitrogen removal onsite systems as part of a local strategy to comply with a nitrogen TMDL, the health board could adopt local regulations that require nitrogen removal systems with performances superior to the state’s minimum standard of 19 ppm. For such an approach to work, the municipality must implement a reporting program that builds upon and fortifies existing state requirements for operation and maintenance agreements and monitoring. Municipalities can take measures to ensure that all those reports submitted to the state, are also submitted to the municipality, and to ensure that deed restrictions identifying onsite systems are also recorded in the county deeds office as required by 310 CMR 15.287. Such regulations would also need to include mechanisms to ensure compliance with the local law. State testing and O&M requirements for alternative systems generally only apply to provisional or pilot systems undergoing state review or required under a state regulation. Locally required alternative systems with “general use” certification do not have this level of state oversight or required monitoring, so local monitoring requirements must be defined to meet local regulation needs.

Enhanced tracking and record keeping of alternative design systems is a burden on municipal staff time. The workload can be ameliorated by an online operator based self-reporting system where the licensed operator reports the information into a database. The online tracking software can generate alerts to health agents and proper-

ty owners when O&M agreements lapse, or if systems are not properly reporting. This approach has been adopted by Barnstable County that has a full-time staff person overseeing the report or operation and monitoring of more than 3000 alternative design systems installed in 12 municipalities on Cape Cod.

Rather than each Buzzards Bay town outside of Barnstable County adopting its own alternative onsite tracking system, Buzzards Bay municipalities could adopt a regional web-based tracking program for innovative and alternative wastewater technologies and community systems to ensure their proper operation and maintenance. It may be appropriate for this effort to include a web-based system.

Municipalities could require designer certification for all innovative and alternative designs systems, and for all wastewater systems designed to accommodate greater than 2,000 gallons per day. This is important because municipal health agents do not have the necessary expertise to evaluate all the possible alternative septic system designs. Local regulations can also allow boards of health to hire outside expertise to review large, or innovative and alternative septic system designs at the proponent's expense. This may be an important solution in situations where the health agent is not a registered sanitarian, or the agent does not have the expertise to review infrequently encountered systems.

In nearshore areas that will be affected by sea level rise, a local regulation could require an increased separation to groundwater (5 feet instead of 4 feet) to account for a corresponding increase in groundwater potentially caused by sea level rise within the life of the system. State regulations now require the 5-foot setback for very fast soils that are common to some, but not all beach areas. Such a 5-foot setback to groundwater is consistent with a 1-foot sea level rise in the next 50 years, the practical maximum life expectancy for any onsite system.

Financial Approaches

Most of the solutions identified in this action plan have negligible costs to government, although some initiatives would increase the workload for staff, or new staff may be required. Some initiatives, like a regional online innovative system tracking system would likely cost less than \$10,000 to create, and may cost \$10,000 per town annually to staff thereafter. Management solutions that incorporate the use of innovative onsite treatment systems can add to the costs incurred by developers and property owners, but these costs will need to be evaluated and weighed against the costs of conventional sewerage.

Monitoring Progress

For this action plan, programmatic actions are the chief measure to track progress toward the goals of this action plan. Some of those actions, like the type of local

regulations needed, are subjective, and each municipality must assess its needs and the most effective solution. Long-term success will eventually contribute to improved water quality and habitat restoration.

References

- Barnstable County Wastewater Cost Task Force. 2010. Comparison of costs for wastewater management systems applicable to Cape Cod guidance to Cape Cod towns undertaking comprehensive wastewater management planning prepared for: Association to Preserve Cape Cod Cape Cod Business Roundtable Cape Cod Water Protection Collaborative. April 2010. 58 pp.
- Costa, J., G. Heufelder, S. Foss, N. P. Millham, and B. L. Howes. 2002. Nitrogen removal efficiencies of three alternative septic technologies and a conventional septic system. *Environment Cape Cod* 5(1): 15-24.
- Heufelder G., S. G. Rask, and C. Burt. 2010. Performance of innovative alternative onsite septic systems for the removal of nitrogen. In *Barnstable County, Massachusetts 1999-2007*. Barnstable County Department of Health and Environment report.
- Rask, S. G., G. R. Heufelder, H. Everson, and C. Burt. 2010. Health and Environment database management program for innovative/alternative on-site sewage treatment systems. Barnstable County Department of Health and Environment report.
- Robertson, W. D. "Irreversible phosphorus sorption in septic system plumes?" *Ground Water* 46 (2008): 51-60.