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Regional Wastewater Management Plan
Overview

JANUARY 2013

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Overview

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Cape Cod currently faces one of the greatest environmental and economic challenges to threaten our peninsula in decades: wastewater management. Under the current regulatory system, Cape Cod towns have wrestled individually with how to manage the effects of nitrogen from septic systems on water quality in our groundwater and estuaries.

The Cape Cod Commission, as the region's land use and regulatory agency, is in the unique position to provide leadership in addressing this collective, shared problem. The Cape Cod Commission Act established the Commission as a department of Barnstable County government in 1990. Among other goals, the Act charged the Commission with protecting the region's natural, economic, and scenic resources. The current system of regulatory review requires that the Commission review and permit individual town Comprehensive Wastewater Management Plans (CWMPs). However, preparation of town-by-town CWMPs has resulted in fragmented approaches, ambiguous objectives, and publicly unaccepted solutions. The Commission is in an appropriate position to facilitate regional solutions to the Cape's shared wastewater management problems, and to implement a more efficient and effective regulatory environment for plan review.

The Cape Cod Regional Wastewater Management Plan (RWMP) does not present a single solution for managing wastewater Cape-wide. Instead, it presents a policy framework and provides tools and resources for identifying potential solutions for each watershed. The structure of the Plan allows for communities to choose how to address wastewater locally, through an engaging and inclusive process, in a way that best suits the needs and character of their watershed.

The summary that follows provides an outline of the problem and the RWMP with links to more detailed information, tools, and resources. The Plan is a living document that will be modified and updated frequently to reflect new knowledge, information, and work product generated as part of this wastewater planning effort.

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The Problem

There are 105 watersheds on Cape Cod. Fifty-seven of these discharge groundwater into coastal embayments that have restricted flushing because of their morphology, volume or tidal range. As a result, these embayments are especially sensitive to the nutrient nitrogen.

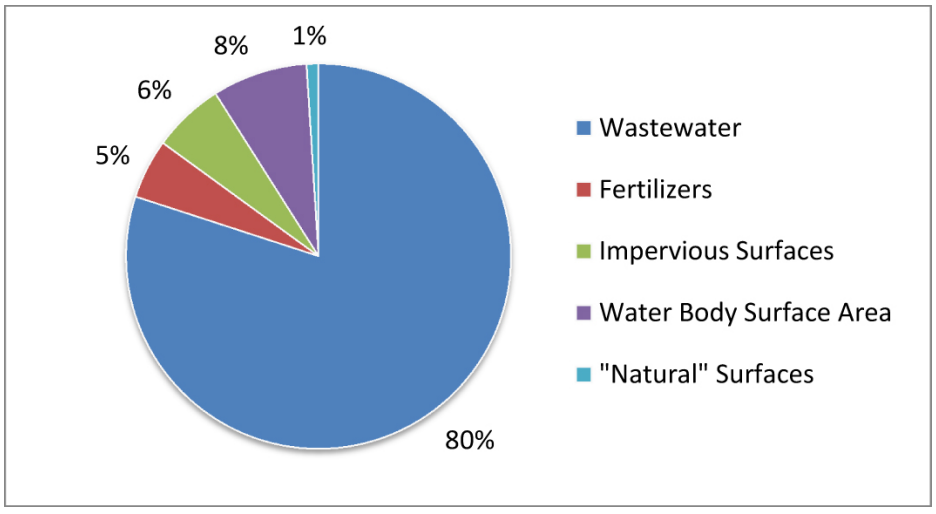
As the population has increased on Cape Cod, so has the amount of nitrogen entering our coastal waters. In just one generation, we have seen eelgrass replaced by thick mats of algae, diminished shellfisheries, and decreasing dissolved-oxygen concentrations—occasionally leading to massive fish and shellfish kills.

A number of sources of nitrogen enter our coastal waters, but wastewater is by far the largest source. As Figure OV-1 shows, on average about 80% of the nitrogen that enters our groundwater comes from wastewater.

The vast majority of properties on Cape Cod rely on on-site septic systems to treat wastewater, and these systems are responsible for about 85% (or about 8.2 billion gallons per year) of the total wastewater flow on Cape Cod. But, conventional on-site septic systems are designed to remove pathogens, not nitrogen, and so today we are confronting the enormous challenge of improving wastewater treatment in order to restore the quality of our waters.

FIGURE OV-1: Average Cape-wide Sources of Nitrogen

(based on information collected from the Massachusetts Estuaries Project)



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Shared Resources and a Shared Problem

The severe degradation of the quality of our coastal waters is a Cape-wide problem. The watersheds to the coastal embayments comprise close to 80% of the entire land area of Cape Cod, and two or more towns (Figure OV-2) share more than half of the embayment watersheds. Current regulations require that comprehensive wastewater management planning take place at the municipal level—despite the shared nature of the region's water resources and the shared nature of the problem confronting us. The current municipal planning process has resulted in a number of wastewater infrastructure projects being voted down at town meeting because

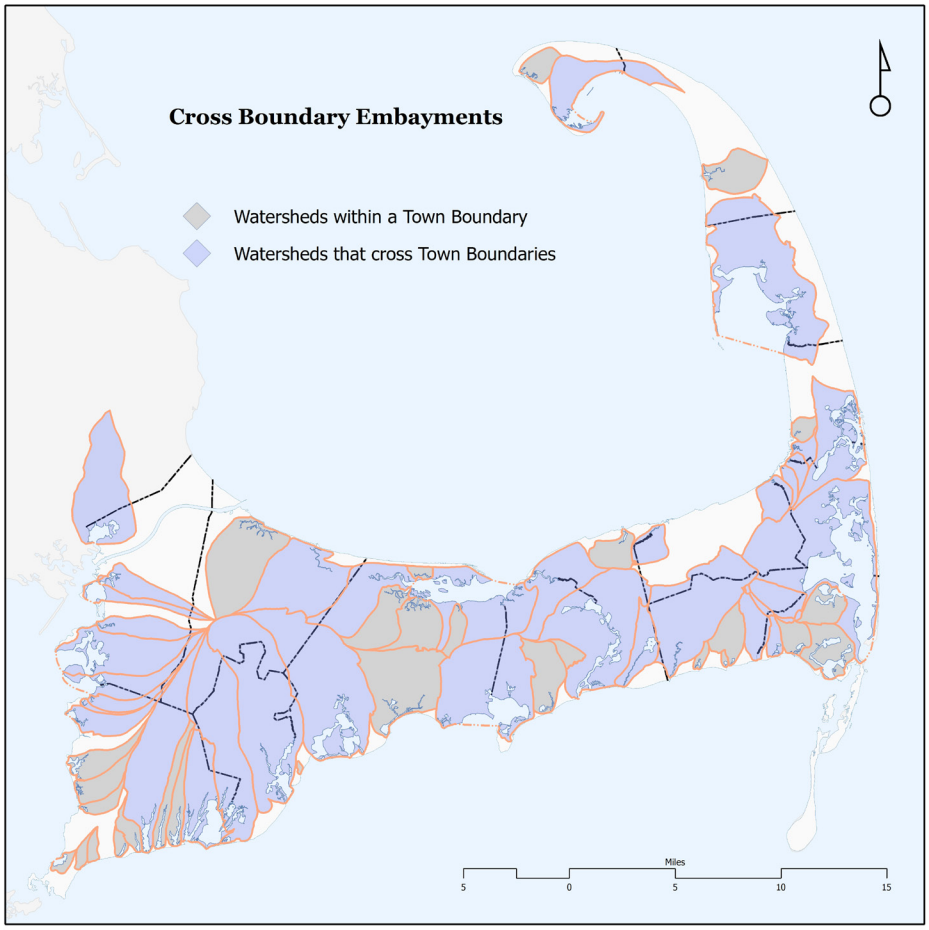

FIGURE OV-2: Cross-boundary Embayment Watersheds

Watershed in blue are shared by two or more towns, while watersheds in gray are within a single town.

the cost of large-scale infrastructure projects is simply deemed unaffordable at the municipal level.

As the region and communities continue to grapple with the need for adequate wastewater infrastructure, two lawsuits making their way through the courts threaten a stricter approach to wastewater management on Cape Cod. Considering the legal environment and the regulatory environment, there are several potential outcomes for wastewater management on Cape Cod.

If there is a federally mandated program delivered by the court as a result of the lawsuits:

- The solution would be based on existing regulatory tools and processes that were developed decades ago to manage a point-source pollution problem, rather than a diffuse, groundwater-driven problem.
- This approach would utilize conventional technologies and would likely result in a network of infrastructure that is more expansive than what is needed.

If the court does not deliver a federally mandated solution:

- Communities could continue to dispose of wastewater using existing on-site infrastructure. However, the quality of Cape Cod's water resources would continue to degrade and impact the local economy through decreasing tourism and declining values of coastal properties. The resulting increased tax burden would be shifted to the inland areas of Cape Cod, directly impacting the middle-class working citizens of the region.
- The towns could continue to develop Comprehensive Wastewater Management Plans, resulting in individual municipal solutions. These may be uncoordinated in watersheds that are shared by more than one town and result in construction of more infrastructure than is necessary to restore water quality.

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Principles of the Cape Cod Regional Wastewater Management Plan

The RWMP offers a new vision for Cape Cod by tackling the complex issue of wastewater management through the combination of (1) a comprehensive evaluation of cost-effective approaches to restore our impacted waters, and (2) smart growth initiatives to maintain Cape Cod's economic vitality. The plan is purposefully Cape-wide in scope in recognition of the hydrogeology of our peninsula—our sole source aquifer and shared water resources—and the limits of the region's ability to afford the very large cost associated with meeting the nitrogen-loading limits of Total Maximum Daily Loads (TMDLs).

The guiding principles of the RWMP are to:

- Develop and implement watershed-based plans.
- Utilize existing wastewater infrastructure.
- Sewer as few areas as necessary.
- Build appropriate infrastructure, taking advantage of natural attenuation and other alternative strategies and recognizing the potential impacts of climate change.
- Manage growth such that additional growth occurs only where planned.
- Share the costs as equitably as possible to ensure affordability.

These principles ensure that water quality goals can be met now and in the future and that the most cost-effective and efficient solutions for the region are realized. They are accompanied by a series of goals, strategies, and measures underlying implementation of the RWMP.

The process established by the Cape Cod Regional Wastewater Management Plan is based on watersheds. The RWMP:

- Allows for a process to prioritize watersheds that need to be addressed most quickly;
- Provides opportunity for alternative approaches;
- Facilitates the use of shared infrastructure that is appropriately sized;

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- Allows for wastewater collection in areas where it makes the most sense, based on parcel connection density and percent nitrogen removal required; and,
- Gives consideration to affordability and community character.

Cape Cod is not like other areas of Massachusetts where significant wastewater infrastructure already exists. As such, the RWMP does not recommend the creation of a single treatment plant as exists in Boston, nor does it recommend the creation of a new taxing authority. Instead, the plan supports watershed-level planning and a watershed-based stakeholder public process that facilitates inter-municipal coordination.

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Components of the Cape Cod Regional Wastewater Management Plan

The RWMP provides information and guidance for communities undertaking wastewater planning and supports the development of a public engagement process that will utilize newly developed, interactive tools and resources.

The RWMP provides additional information regarding Commission regulatory and consistency reviews for wastewater planning and infrastructure development. This includes a guidance document regarding the Commission's Development of Regional Impact review of Comprehensive Wastewater Management Plans. The plan also provides guidance about how the Commission will determine consistency with the RWMP for towns seeking to establish "flow neutrality" to be eligible for zero-rate-of-interest State Revolving Fund loans.

The RWMP provides information on:

- Cape Cod's watersheds, population, current land uses, buildout potential, volume of wastewater flows, and TMDLs
- Treatment technologies (conventional technologies and alternative approaches), including, where available, regulatory requirements and efficacies of each, as well as the circumstances under which various options are likely to be most successful
- Comparative costs of different wastewater infrastructure options and the conditions favoring different technologies

In addition, the RWMP provides guidance and policies on:

- Development of Comprehensive Wastewater Management Plans (CWMPs)
- Regulatory framework
- Growth-management techniques
- Accessing zero-percent-interest State Revolving Fund loans

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DATA COLLECTION, INTEGRATION, AND ANALYSIS

Information collected and analysis undertaken for regional wastewater planning includes:

- Assessing and Parcel Data – With the help of MassGIS, Commission staff obtained the most recent data for all Cape Cod towns, standardized the local interpretation of state class codes, and utilized the data to establish existing development and perform a Cape-wide buildout.
- Water Use – With data from the region's water purveyors, Commission staff assembled parcel-level water use data for Cape Cod. These data allowed for an accurate characterization of Cape Cod water use, assisted in identifying the number of total dwelling units, and provided the basis to estimate parcel-specific wastewater generation. See the Environmental Assessment section on Water Quality for more information.
- Cape-wide Buildout Analysis – Using the data described above, Commission staff conducted a Cape-wide buildout analysis to quantify the growth potential in the region and to understand the spatial distribution of future growth and its potential impact on water quality. See the Environmental Assessment section on Land Use for more information.
- Sewer-Collection Density Grid – A sewer-collection density grid was generated for use in those areas where a sewer might be necessary. The algorithm calculates the ratios of road lengths to parcels for discrete quarter-mile-square areas to prioritize wastewater collection in low-ratio (high-density) areas, thereby minimizing collection costs, which can account for 60% to 70% of wastewater infrastructure costs.

UNDERSTANDING TREATMENT OPTIONS

Commission staff and consultants have collected information on alternative and conventional treatment approaches, technologies, and costs. A conventional approach is not working for Cape Cod. The region needs to identify a mosaic of solutions that are effective and affordable. Different technologies will be appropriate depending on specific circumstances, such as the amount of nitrogen to be removed, the density of existing or expected development, the natural attenuation in the watershed,

and the approach desired by the stakeholders in each watershed. A list of approaches for consideration has been developed and ongoing work includes identifying case studies, nitrogen removal capacity, and total capital and operation-and-maintenance (O&M) costs, where available, as well as siting and land use criteria for implementation of each approach. For a list of technologies being considered, please see the Technology Assessment sections on Conventional Infrastructure and Green Infrastructure and Alternative Approaches. Where case studies are not available, the Commission will provide siting criteria for selecting pilot project sites for new technologies and approaches.

As the region moves forward with planning, it must be understood that conventional treatment will be needed in some watersheds. The Commission anticipates that approximately 50% of existing homes may remain on Title 5 if areas in need of additional treatment are targeted in the most efficient way possible. The implementation of an adaptive management approach will allow for plans to be revisited as new information becomes available, and to respond to new opportunities as they arise.

UNDERSTANDING COSTS AND AFFORDABILITY

CAPE-WIDE COST ANALYSIS

In an effort to be prepared to respond to the outcome of pending lawsuits, the Commission has worked with a consultant to identify a cost-effective solution that could be implemented within the current regulatory structure. The analysis makes assumptions about future growth and development and provides estimates of the capital costs and O&M costs associated with infrastructure for existing and future wastewater needs. A coordinated, watershed-based approach that utilizes a mosaic of technologies and approaches is preferred; however, given current legal realities, it is in the best interest of the region to have an implementable solution that meets existing regulatory requirements and is the most cost-effective traditional approach.

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AFFORDABILITY AND REVENUE ANALYSIS

The Cape Cod Commission has worked with a consultant to identify the affordability of wastewater infrastructure for Cape Cod taxpayers and compared that with the cost estimates from the Cape-wide cost analysis. Based on the analysis done to date, the Commission is recommending that 50% of the cost of a Cape-wide project be funded by federal and/or state resources. Creative financing will be needed to pay for the remaining 50% of the cost. In the larger discussion of this analysis a list of potential options for identifying new and targeted sources of revenue is addressed.

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Watershed Planning Tools and Resources

More detailed information about each of the tools and resources available through the RWMP can be found on the tools and resources webpage.

WATERSHED MVP (MULTI-VARIANT PLANNER)

Watershed MVP is an innovative, web-based, scenario-planning application that allows technical experts and the general public to compare various wastewater treatment options at scales ranging from the neighborhood, watershed, and sub-regional levels. Watershed MVP presents parcel-based data and calculations for land use, water use, and build-out that allow the user to quickly evaluate wastewater treatment options and provide a comparative cost analysis for different approaches. While this application is a powerful technical tool, it is also an effective decision-making tool making public participation easier and democracy more convenient. It aids in re-engaging "the majority," driving public discussions toward the lowest-cost, most-sustainable solutions to the Cape's wastewater problems.

Several of the data layers and information (GIS mapping, land use, water use, and costs associated with various treatment technologies) described above have been incorporated into the Watershed MVP application. When completed, the application will have the capability to:

- Identify potential locations for siting wastewater treatment technologies of different scales;
- Compare various wastewater treatment options on scales ranging from individual neighborhoods, watersheds, towns, and sub-regions of the entire Cape Cod region;
- Test assumptions about different approaches to improving water quality throughout Cape Cod; and,
- Provide a comparative cost analysis for different approaches.

Use of the Watershed MVP along with research on alternative approaches and other available data should make it possible to identify a number of potential solutions for each impacted watershed. Solutions might include "faster, better, and cheaper" options: (a) the faster approach—one that will remediate the necessary nitrogen in the shortest time frame; (b) the cheaper approach—one that will remediate nitrogen at the lowest cost to individual taxpayers; and, (c) the better approach— one that will be the most sustainable, both environmentally and financially, over the long term.

GREEN INFRASTRUCTURE SITING CRITERIA

The Cape Cod Commission has been working with Tetra Tech, through EPA's 2012 Green Infrastructure Community Partners Project, to develop a screening process to identify site opportunities for green infrastructure and low-impact development (LID) techniques. The screening process began with a desktop investigation of potential sites by utilizing a siting-criteria matrix developed by the Commission, assessing both positive siting criteria and potential constraints. The siting-criteria matrix consists of multiple GIS-based data layers and a collection of potential green infrastructure and LID technologies.

This matrix is currently being used to identify pilot project sites within the Lewis Bay and Parkers River watersheds with a goal of developing a design for two green infrastructure and/or LID projects. In the future, these siting criteria can be utilized to identify areas across the region that might be appropriate for pilot projects evaluating new technologies and approaches.

RATE MODEL

The Cape Cod Commission has been working to develop a financial model that considers a number of global inputs and assumptions about developed parcels, parcels to be sewered in any given scenario, and capital and O&M costs for various treatment options, as well as customer characteristics and financial inputs, such as inflation rate and debt service. These assumptions are being used to generate projected annual costs

and projected costs per parcel over a period of time with the ability to modify assumptions about how costs will be spread over time. This model was initially developed for Cape-wide scenario planning, but is being further refined to run scenarios based on geographic areas selected by Watershed MVP.

SYSTEMS DYNAMICS MODEL

The Cape Cod Commission has partnered with the MIT Engineering School's System Design and Management Program looking at the nutrient-loading problem currently experienced in the estuaries of Cape Cod. The project was to design a systems model—a computer-aided approach to understanding the dynamics of a natural, built, or social system—that evaluates the impacts of different forms of wastewater treatment on the nutrient loading in the region's estuaries. This model can be used at the watershed, sub-watershed, or regional level. Unlike linear modeling, systems models capture the interdependence and mutual interaction of different variables in the system. The model developed to date, which will be expanded with help from EPA, focuses on treatment of wastewater using Title 5 systems, Innovative/Alternative systems (denitrifying septic, primarily), and sewer systems.

GAME-BASED PLANNING TOOLS

The Cape Cod Commission is considering adapting a game-based planning tool—something like Community PlanIt, developed by the Engagement Game Lab at Emerson University—to aid in educating the public, garnering support from communities, and encouraging participation in developing planning scenarios for addressing wastewater Cape-wide. Game-based planning tools are a platform for learning that provides a flexible way for presenting local planning ideas while also gathering feedback on these plans from the community. Using these types of tools, players participate in the planning process whenever they want (within the time frame of the game) from wherever they are, allowing for participation by a wider range of individuals. The Commission expects to use these types of tools as it moves forward in developing a community engagement

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process to allow for more participation in developing watershed-based wastewater management plans.

MODEL AGREEMENTS

To better address the shared nature of the region's water resources, memoranda of understanding (MOUs) and inter-municipal agreements (IMAs) will be needed in watersheds throughout Cape Cod. To expedite the process of developing these agreements, the Commission is developing model MOUs and IMAs that specifically address watershed and wastewater management issues.

Next Steps

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Several steps need to be taken to move forward with a targeted watershed approach to planning and management. First and foremost, the community needs to be engaged in developing plans that best suit their needs and the needs of the impacted embayments. The region must move past the restrictive nature of the current regulatory framework to develop solutions on a watershed basis rather than a municipal basis. In the coming months the Commission will implement a watershed-based, public participation process to help citizens better understand the alternatives available to their communities. This process will be targeted at impacted embayments, free of municipal lines, and engage residents from each town with a connection to the water body. See the RWMP section on Watershed Solutions for more detailed information.

As part of this Cape-wide approach the Commission will utilize the tools and resources developed as part of the RWMP to identify alternatives for each watershed. It is the goal of the Commission to be able to provide communities with at least three initial solutions to consider as they begin planning: a faster approach (one that will remediate nitrogen in impacted embayments most quickly), the better approach (one that is most sustainable, remediating the most nitrogen over the longest period of time with little additional impact to the ratepayer), and the cheaper approach (one that remediates the necessary nitrogen at the least possible cost).

It is vital that communities engage with regulators from the outset in developing a new and innovative management approach. A strong relationship with regulators and some targeted, demonstrated progress in watersheds where infrastructure should be prioritized may allow for some flexibility in areas for scaled affordable approaches and piloting new technologies. Investigating new technologies, utilizing a range of tools and resources, and engaging communities in a larger public discussion will aid Cape Cod in identifying the most effective and efficient solutions for managing wastewater.