

Chapter 1

Introduction

CHAPTER 1

INTRODUCTION

1.1 REPORT BACKGROUND AND PURPOSE

This Alternatives Screening Analysis Report is the second of four reports that will be produced for the Town of Barnstable (Town) Comprehensive Wastewater Management Planning (CWMP) Project. The first of these reports was the Needs Assessment Report dated May 2011, which documented the wastewater and nitrogen-management needs for the Town. The third report will be the Draft Comprehensive Wastewater Management Plan and Draft Environmental Impact Report (DCWMP/DEIR) which will provide a detailed evaluation of the alternative plans identified in this Alternatives Screening Analysis Report. The DCWMP/DEIR Document will receive formal Commonwealth environmental review, and the comments will be addressed in the fourth report: the Final Comprehensive Wastewater Management Plan and Final Environmental Impact Report (FCWMP/FEIR).

The purpose of the Alternatives Screening Analysis Report is to identify and screen alternative wastewater and nutrient management technologies and solutions so that a group of alternative management plans can be formulated to meet the Town's wastewater and nutrient management needs.

1.2 PROJECT PURPOSE AND PLANNING AREA

The purpose of the Comprehensive Wastewater Management Planning (CWMP) Project is to provide an environmentally and economically sound plan for wastewater treatment and nutrient management in the Town of Barnstable (Town) for the next 20 years. The CWMP Project will assess the wastewater and nutrient-related needs in the Town; evaluate appropriate mitigation measures for those needs; and develop a recommended plan for improved management systems. The primary purpose of the project is to develop a plan to:

- › Protect public health and address Board of Health concerns.
- › Protect the water supply.
- › Protect and remediate pond water quality.
- › Meet the nitrogen Total Maximum Daily Load (TMDL) limits for the marine waters in and around Barnstable.
- › Address new regulations and public health concerns about Contaminants of Emerging Concern (CEC) including pharmaceuticals, personal care products, and endocrine disrupting compounds.
- › Plan for and maintain flexibility to meet future Massachusetts Department of Environmental Protection (MassDEP) and United States Environmental Protection Agency (USEPA) requirements.
- › Incorporate the wastewater infrastructure and facilities planning into a cohesive document.

The Town of Barnstable is located in the middle portion of Cape Cod as shown in Figure 1-1. This figure also identifies the watersheds to Popponesset Bay, Rushy Marsh, Three Bay System, Centerville River System, Halls Creek, Lewis Bay, and Barnstable Harbor which are the primary estuarine waters in Barnstable. This figure also illustrates the many freshwater ponds that will be considered in this planning project; and it illustrates the seven villages that comprise the Town: Hyannis, Barnstable, Centerville, Osterville, Marstons Mills, Cotuit, and West Barnstable. It also illustrates the wastewater management facilities owned and operated by the Town.

1.3 PROJECT ISSUES AND BACKGROUND

The Town of Barnstable is faced with several nutrient management and wastewater-related problems as it plans to protect its water resources and plans for growth and economic development. Nitrogen loadings into the Town's coastal watersheds are causing an overproduction of algae in several coastal estuaries and are impacting the water quality and marine resources in the estuaries. Recently completed studies by the Massachusetts Estuaries Project (MEP) indicate most (75 to 85 percent) of the nitrogen originates from wastewater sources. The other sources that comprise the remaining 15 to 25 percent include lawn and agricultural fertilizers, road and roof runoff, and precipitation from the sky. These reports have recommended extensive wastewater nitrogen removal to meet specific nitrogen limits that have been developed for the waterbodies. The limits are called Total Maximum Daily Loads (TMDLs).

The Town draws its public water supplies from the groundwater system under the land area of the Town. This groundwater system (for all of Cape Cod) has been designated as a Sole Source Aquifer by USEPA, and as such is a highly protected resource. Current discharges from individual septic systems and from wastewater treatment facilities have the potential to impact this drinking water supply, and there are new MassDEP regulations that must be met to protect the resource.

The Town has many freshwater ponds and lakes which provide fishing, swimming, and other aesthetic resources. Phosphorus loadings into the pond watershed areas (mainly from individual septic systems) are causing an overproduction of algae in several ponds and are impacting the water quality in these ponds. Recently completed studies have documented these impacts and the need to remediate these impacts. The studies have identified that phosphorus moves into a pond from its watershed with surface water runoff and groundwater flow. Once it is in the pond it accumulates in the sediments. Under certain conditions it can be released and cause large algal blooms that impact the environmental health, human health, and recreational value of these resources. Several ponds appear to be exceeding their nutrient balances.

Several previous and ongoing projects have developed valuable information that will be referenced and used in this CWMP project. These previous projects are briefly described below.

A. Background on the 2007 Wastewater Facilities Plan and Subsequent Implementation.

In 1993 the Town initiated a Wastewater Facilities Plan that was completed in 2007. It was a detailed evaluation and planning process that was completed to address wastewater impacts to the Towns water resources. It focused on the ability of individual septic systems to meet the State's sanitary code (Title 5 regulations) and the impacts from failing (and even properly working) systems on the groundwater used for drinking water supplies, and other public health issues. The plan recommended the following upgrades to the Hyannis Water Pollution Control Facility (WPCF) and its collection system:

1. Treatment upgrade and expansion to meet the new (imposed in 1990) nitrogen discharge limit of 10 milligrams per liter (mg/L) total nitrogen, and to improve plant performance and operability.

2. Modified sludge management practices that were required due to the closure of the Town's landfill in Marstons Mills.
3. Sewer system modifications, improvements, and pump station improvements to correct bottlenecks and to allow for sewer system expansions.
4. Water system expansion to several wastewater Areas of Concern (AOC) where it was determined that extending public water supply to these areas best solved the wastewater problems.
5. Sewer system expansion to several documented wastewater AOC where it was determined that the wastewater problems at these areas would be best solved by connecting these areas to the Hyannis WPCF.
6. Additional sludge management improvements as the wastewater (and sludge production) increases in the future.
7. Future development of a new treated water recharge (remote from the Hyannis WPCF) at a 6.9-acre site located along Route 132 near Exit 6 of Route 6.
8. Defer addressing wastewater AOC located in the central and western portions of Town until the nitrogen limits were developed for the Town's coastal estuaries with the intent of incorporating and addressing these wastewater concerns into the current CWMP.

Items 1 through 4 and portions of Item 5 have been implemented. There are additional sewer extensions (of Item 5) that will be implemented during the next 10 years. Items 6 and 7 will be implemented as the sewer extensions of Item 5 proceed. The wastewater AOC (identified in Item 8) that were not addressed will be addressed in this CWMP Project because the Town now has many of the needed nitrogen limits.

The Executive Summary of the 2007 WWFP is attached in Appendix 1-1 and provides a complete summary of that Project. It is expected that the 2007 WWFP project will provide significant information to allow the CWMP Project to proceed efficiently and consistently. The specific findings of the 2007 WWFP are described in greater detail in Chapter 2, Data Review.

B. Background on Massachusetts Estuaries Project (MEP) Evaluations and Development of Nitrogen TMDLs. The MEP is a collaborative effort between several federal, state, regional, and municipal agencies to develop nitrogen thresholds and limits for a group of approximately 90 estuaries in southeastern Massachusetts. The main agencies involved include:

1. Massachusetts Department of Environmental Protection (MassDEP).
2. University of Massachusetts (UMass) School of Marine Science and Technology (SMAST).
3. United States Geological Survey (USGS).
4. Cape Cod Commission (CCC).
5. Applied Coastal Research and Engineering, Inc. (ACRE).
6. Several municipalities that surround the estuaries including the Town of Barnstable.

The nitrogen limits are developed for the estuaries through the following evaluation steps:

1. The watershed of each estuary is delineated by USGS with the use of their regional groundwater flow model.
2. The nitrogen loading to the watershed of each estuary is calculated by CCC and/or SMAST for each of the major nitrogen sources.
3. Sediment cores are collected and estimates of nitrogen loadings from the sediments to the estuary waters are calculated.
4. Detailed surveys of each estuary are completed to quantify the condition and extent of several biological parameters, including eel grass coverage, benthic life forms, etc., and to correlate environmental conditions in healthy areas of the estuary with a nitrogen concentration that is associated with these healthy conditions. This step (with other inputs and considerations) identifies the threshold nitrogen concentration for each estuary.

5. A water quality model is developed for each estuary based on tidal mixing and flushing of the estuary and the nitrogen loads from the watersheds and sediments. The model is calibrated with several parameters, including averages of long-term water quality monitoring data.
6. The model is then run with different watershed loading values to estimate the resulting estuaries' nitrogen concentration for the following scenarios:
 - a. Existing conditions.
 - b. Buildout conditions.
 - c. "No anthropogenic loading" condition, which is the condition of no nitrogen loadings from wastewater, fertilizers, or stormwater sources.
 - d. "Nitrogen threshold" condition which simulates the upper limit of nitrogen loading that can go into the estuary and still have the water quality meet the nitrogen threshold concentration (identified above in Step 4) at one or more key locations (sentinel stations) in the estuary.
 - e. Additional alternative scenarios as requested by the municipality or as needed.

Once the nitrogen thresholds and limits are developed and presented for each estuary in a technical report produced by the MEP, MassDEP then prepares a draft TMDL report that presents the nitrogen limits as TMDLs for approval by United States Environmental Protection Agency (USEPA). Several of these documents have been produced for the Town of Barnstable, as listed below:

1. MEP Technical Report for Popponesset Bay; MEP, September 2004.
2. MassDEP TMDL Report for Popponesset Bay; MassDEP, April 10, 2006.
3. MEP Technical Report for Rushy Marsh; MEP, April 2006 (No TMDL Report has been developed).

4. MEP Technical Report for Three Bay System; MEP, April 2006.
5. MassDEP TMDL Report for Three Bay System; MassDEP, September 7, 2007.
6. MEP Technical Report for Centerville River System; MEP, November 2006.
7. MassDEP TMDL Report for Centerville River System; MassDEP, January 29, 2008.
8. MEP Technical Report for Lewis Bay (and Halls Creek); MEP, December 2008.

The Town is awaiting the TMDL report for Lewis Bay and the Technical and TMDL Reports for Barnstable Harbor. No TMDL Report is expected for Rushy Marsh because it is so small.

USEPA then reviews these reports and accepts the nitrogen limits as TMDLs which, once accepted, have regulatory status by USEPA and MassDEP.

The main findings of these evaluations and reports indicate that a large percentage of the existing nitrogen loading to the estuarine watersheds must be removed to restore the water quality and habitat of the estuaries. Most of the nitrogen comes from individual septic systems in the watersheds. The findings of these reports were reviewed in detail in the Needs Assessment Report in Chapter 5, Existing and Future Conditions in the Town of Barnstable.

C. Background on Water Quality Conditions of the Groundwater System and the Town's Freshwater Ponds. Many reports and evaluations have been completed on the groundwater system and the Town's freshwater ponds. These water resources have also been impacted by nutrients and other contaminants.

Nitrogen is a major concern in the groundwater because it has a state and federal drinking water standard of 10 mg/L to protect public health. There are also many drinking water standards for specific contaminants that can enter the groundwater when there is improper land use. There has recently been concern about pharmaceuticals, personal care products, and "endocrine disruptors" that are being observed in the groundwater system and are coming from wastewater sources. Drinking water standards have not yet been developed for these categories of manmade compounds. These categories are often called Contaminants of Emerging Concern (CEC) because they have no limits yet and they may pose human-health and/or environmental-health

concerns. MassDEP has started to regulate these CECs by requiring a stringent discharge limit of Total Organic Carbon (TOC) for wastewater treatment facility discharges in Zone II areas (areas that can contribute groundwater to public water supply wells). The CECs are typically comprised of organic carbon; therefore, when the TOC concentration in treated water is low, then CEC concentrations will be low or non-detectable.

Phosphorous is typically the nutrient of concern for freshwater ponds. It is the “limiting nutrient” (similar to nitrogen for marine waters), which means that it is the essential plant (algae) nutrient that is in short supply, so that when it is added it will produce an over-abundance of algae, which will impact water quality. Recent studies in Barnstable and across Cape Cod have indicated that wastewater discharge in the watersheds of these ponds is the largest source of phosphorous. Other sources include lawn and agricultural fertilizers, road and roof runoff, and precipitation from the sky.

The groundwater system and the Town’s many freshwater ponds are as equally important as the Town’s marine waters to the quality of life in Barnstable. Their water quality will be evaluated and addressed as part of this planning project.

D. Bacterial TMDL’s Needs. The following surface water bodies have bacterial TMDLs that may be caused by wastewater, stormwater runoff, and/or animals living in (or frequenting) the waterbodies:

- › Barnstable Harbor
- › Bumps River
- › Hyannis Harbor
- › Lewis Bay
- › Marsapin Creek
- › Mill Creek
- › Seapuit River

Wastewater, stormwater, and land-use management solutions will consider these TMDLs.

E. Regional Wastewater Management Efforts. Several regional wastewater management planning efforts are underway to define and implement wastewater and nitrogen mitigation efforts on Cape Cod. These efforts are identified below.

1. Cape Cod Commission and Barnstable County regional efforts, including:
 - a. Formation and coordination of the Cape Cod Water Protection Collaborative.
 - b. Development of a regional wastewater management plan.
 - c. Coordination with USGS and Cape Cod towns to provide groundwater modeling services to towns involved with wastewater planning activities.
 - d. Funding assistance and guidance documents for wastewater projects as listed below:
 - 1) *“Enhancing Wastewater Management on Cape Cod: Planning, Administrative, and Legal Tools,”* Wright-Pierce, July 2004.
 - 2) *“Sewer Modeling and Preliminary Design Evaluations, Guidance Document and Case Study Report, Popponesset Bay Watershed,”* Mashpee, MA and Stearns & Wheler, November 2005.
 - 3) *“Effluent Disposal and Reuse Planning: Guidance Document and Case Study Report,”* Town of Barnstable and Stearns & Wheler, 2005.
 - 4) *“Small Community-Size Wastewater Treatment Technologies Evaluation,”* Town of Yarmouth and Tighe and Bond, June 2005.
 - 5) *“Innovative Septic System Management Project,”* Town of Eastham and BCDHE, 2007.
 - 6) *“Evaluation of Wastewater Management Options for Freshwater Ponds Guidance Document and Case Study Report for the Great Sand Lakes,”* Town of Harwich and Stearns & Wheler, May 2007.

- 7) *“Groundwater Modeling to Support Comprehensive Wastewater Management Planning; Guidance Document and Case Study Report,”* Town of Falmouth and Stearns & Wheeler, June 2009.
- 8) *“On-Site System GIS Mapping and Management Project,”* Town of Bourne and Norfolk RAM, 2004.
- 9) *“Tri-Town Septage Facility Evaluation Project,”* Town of Orleans and Wright-Pierce, August 2005.
- 10) *“Cape Cod Pond and Lake Atlas,”* CCC, May 2003.
- 11) *“Comparison of Costs for Wastewater Management Systems Applicable to Cape Cod: Guidance to Cape Cod Towns Undertaking Comprehensive Wastewater Management Planning.”* Barnstable County Wastewater Task Force, April 2010.

e. Creation of the Cape Keepers Public Education Program.

The Cape Cod Water Protection Collaborative (CCWPC) has recently (February 2010) become active in supporting shared watershed/solution concepts for the following areas:

- » Lewis Bay Watershed and possibly sharing wastewater management solutions and costs for Barnstable and Yarmouth.
- » Popponesset Bay Watershed and possibly sharing wastewater management solutions and costs for Barnstable, Mashpee, and Sandwich.
- » Falmouth, Mashpee, Bourne, and Sandwich regional treatment opportunities at the Massachusetts Military Reserve (MMR).

They will support these concepts through subcommittee meetings, technical assistance, and regulatory support.

The CCWPC is also trying to advance the regulatory acceptance of wetland and watershed modifications as part of a town’s plan for nitrogen management. They plan to create a

special review process with the State regulatory agencies to streamline the review of the following types of wetland/watershed modifications:

- » Sediment removal from behind dams to facilitate greater nitrogen attenuation in ponds. Mill Pond in Marstons Mills is planned to be a test case.
 - » Tidal restriction removal at coastal ponds/estuaries to increase tidal flushing and reduce nitrogen sensitivity. Enlargement of culverts at Bournes Pond in Falmouth and Parkers River in Yarmouth are planned to be test cases for this type of project.
 - » Flooding of fallow cranberry bogs to create ponds and facilitate increased nitrogen attenuation in the watershed. No specific test cases have been identified for this type of project.
2. Association to Preserve Cape Cod (APCC), CCC, and Waquoit Bay National Estuarine Research Reserve (NERR) specialty conferences on wastewater issues.
 3. Legislative passage of the 2008 Environmental Board Act (as supported by Cape Cod Water Protection Collaborative and Senator Robert O’Leary) to help fund and find solutions to Cape Cod’s wastewater and nutrient-related problems.
 4. Barnstable County Department of Health and Environment (BCDHE) efforts to provide public health technical assistance and to oversee the Alternative On-Site Septic System Test Center to test innovative septic system technologies and management scenarios.
 5. Decentralized wastewater treatment seminars and information outreach by technology vendors and advocates to ensure that these technologies are considered in the wastewater planning process.

F. Wastewater and Nutrient Management Planning Projects in Neighboring Towns.

Barnstable shares estuarine watersheds (illustrated in Figure 1-1) with the following towns:

- » Yarmouth for Lewis Bay.
- » Mashpee for Popponesset Bay and a small portion of the Three Bays System.
- » Sandwich for Popponesset Bay, the Three Bays System, and Barnstable Harbor.

Yarmouth and Mashpee both have ongoing wastewater and nutrient management planning projects. Sandwich is planning to start a wastewater and nutrient management planning project later in 2011. The ongoing planning projects for Yarmouth and Mashpee are identified below.

1. Town of Yarmouth Integrated Water Resources Management Planning (IWRMP) Project.

This project was initiated in 2004 to develop a plan to address wastewater and nitrogen loading issues along Route 28; in the watersheds to Lewis Bay, Parkers River, and Bass River; and in water supply areas. This project has considered possible regional wastewater treatment solutions with the Town of Barnstable. A Draft Comprehensive Wastewater Management Plan was filed and approved by the Massachusetts Environmental Protection Act (MEPA) review process in 2010. The final plan is expected to be approved in 2011. Coordination between the two towns continues.

2. Town of Mashpee Watershed Nitrogen Management Planning (WNMP) Project. This project was initiated in 2000 to address nitrogen loading problems in Popponesset Bay and Waquoit Bay. A portion of this project area is in the Town of Barnstable because the Popponesset Bay Watershed extends into Barnstable. Coordination between the two towns continues.

1.4 TOWN OF BARNSTABLE VISION AND GOALS AS ARTICULATED IN THE BARNSTABLE COMPREHENSIVE PLAN

The Barnstable Comprehensive Plan (2007) is the most recent Local Comprehensive Plan completed by the Town in compliance with Cape Cod Commission guidelines. It articulates a Town vision and Comprehensive Plan Goals that will help guide the formation of this CWMP.

A. **Vision.** “The seven diverse yet interconnected villages of Barnstable form one community that is an integral part of Cape Cod. As the town in 2008 has been shaped by its past, through this plan Barnstable will shape a sustainable future. The town will preserve its history, environment and community for future generations through active stewardship of community character and quality of life while balancing growth, infrastructure and natural systems.”

B. **Comprehensive Plan Goals.** The following goals are stated for the Comprehensive Plan:

1. Sustain diverse villages and livable neighborhoods for year round residents while providing housing opportunities for all.
2. Preserve, protect and enhance sensitive natural habitats and systems.
3. Provide town services and infrastructure through an efficient, planned and prioritized process.
4. Support and manage the regional resources and services unique to Cape Cod.
5. Preserve and enhance historic and maritime character, public viewsheds and cultural landscapes.
6. Enhance pedestrian activity in historic village centers.
7. Preserve and enhance access to public spaces including the waterfront.
8. Foster and support the creative economy which includes history, culture and arts.
9. Promote traffic reduction, traffic management, alternate transportation modes, property interconnections, and travel demand management.
10. Foster and support public transit while planning for associated parking, pedestrian and bicycle travel needs.
11. Allow development review to be more efficient for applicants and town regulatory bodies in a predictable and fair manner.
12. Develop and support a process to encourage private investments and support appropriate economic development.
13. Fully integrate implementation of plan goals, actions and strategies into the municipal budget and capital planning process.

1.5 PROJECT SCOPE

The project has been divided into seven phases. A brief listing of the tasks associated with each phase of this project follows, and the complete Project Scope for the project as submitted for MassDEP review is included in Appendix 1-2.

A. Phase I – Environmental Monitoring and Modeling, and Development of Nutrient Limit Targets.

1. Perform water quality monitoring of coastal embayments and ponds.
2. Collect additional environmental parameters.
3. Assess the nutrient related health of the coastal embayments and ponds.
4. Perform embayment flushing analyses and hydrodynamic model development.
5. Develop existing and future nitrogen loadings to coastal embayments.
6. Perform water quality modeling.
7. Develop nitrogen loading targets.
8. Prepare nutrient loading assessment reports (MEP Technical Reports).

B. Phase II – Nutrient Management Needs Assessment.

1. Review and summarize Town issues and data.
2. Review and summarize regulatory issues affecting nutrient management planning.
3. Evaluate, summarize, and describe existing conditions in Town.
4. Identify the goals and objectives of the Town related to nutrient management.

5. Evaluate, summarize, and describe future conditions in Town.
6. Identify nutrient related areas of concern and prepare Nutrient Management Needs Assessment Report.

C. Phase III - Identification and Screening of Alternative Solutions and Sites.

1. Identify, review and summarize alternative solutions to meet the Town's nutrient management needs.
2. Screen the alternative solutions to identify the most feasible ones for detailed evaluation.
3. Identify and screen potential sites for nutrient management facilities.
4. Group feasible solutions and sites into alternative nutrient management scenarios.
5. Prepare the Nutrient Management Alternatives Screening Analysis Report.

D. Phase IV – Detailed Evaluation and Development of the Nutrient Management Plan.

1. Perform subsurface and/or environmental investigations and modeling for potential nutrient management sites.
2. Prepare a methodology of the planned detailed evaluations for project and regulatory review.
3. Perform present-worth evaluations of the alternative nutrient management scenarios.
4. Perform non-monetary evaluations of the alternative scenarios.
5. Perform an environmental impact analysis of the alternative scenarios.
6. Evaluate the present-worth analysis with the non-monetary evaluation and the environmental impact analysis to select the most appropriate management scenario.

7. Develop and present the recommended Nutrient Management Plan, and prepare the Nutrient Management Plan and Draft Environmental Impact Report (DEIR).
8. Submit the Nutrient Management Plan and DEIR for regulatory and public reviews.

E. Phase V - Resolution of Remaining Issues and Project Completion.

1. Resolve remaining issues.
2. Modify the DEIR to prepare the Nutrient Management Plan and Final Environmental Impact Report (FEIR), and submit it for public and regulatory review.

F. Phase VI – Environmental and Public Review Process.

1. Establish and utilize a Citizens Advisory Committee.
2. Establish and utilize a Technical Advisory Committee.
3. Prepare and conduct a public participation program.
4. Prepare, submit, and coordinate the public review of the Environmental Notification Form and Development of Regional Impact Document.
5. Coordinate public review of the other project documents.
6. Coordinate and attend meetings and public hearings.

G. Project Management and Funding

1. Develop and administer State Revolving Fund loan applications and agreements.
2. Develop and administer contract agreements for specialized services.
3. Provide overall project management and coordination.

As mentioned earlier, the full Project Scope is attached in Appendix 1-5. It was originally prepared in August 2001, submitted and approved by MassDEP in 2005, and updated and used in a State Revolving Fund (SRF) funding application in August 2008. The full Project Scope provides narrative text about the purpose and approach of the major tasks and identifies the tasks that have been completed as of 2008.

1.6 SUMMARY OF PHASE I ACTIVITIES

Phase I is the environmental monitoring and modeling, and development of nutrient limit targets. This phase started several years ago with the marine, pond, and groundwater monitoring to develop baseline understanding for these water resources.

The Massachusetts Estuaries Project was engaged in this effort and they have developed the estuarine nitrogen limits as described earlier in this chapter. The Town is still waiting for the nitrogen limits for the Barnstable Harbor estuary.

Elizabeth Moran, Ph.D. of EcoLogic LLC was engaged as part of this effort and she has developed the Barnstable Action Plan report as described (and attached as an appendix) in the Needs Assessment Report.

The Cape Cod Commission was engaged as part of this effort to review the groundwater Zones of Contribution (ZOC) delineations to the public water supply wells as discussed earlier in this chapter. This effort is proceeding.

The Needs Assessment completed a detailed review of the regulations governing water resource management in Barnstable. One new regulation (March 2009) that will have a large effect on Barnstable and this project is the new Total Organic Carbon (TOC) limit for treated water recharges into public water supply Zones of Contribution (also called Zone II areas). Both the Hyannis WPCF and the Marstons Mills WWTF recharge their treated waters into these Zone II areas, and are expected to need treatment process upgrades to meet a recharge limit of 3 mg/L TOC or less.

Monitoring of these water resources will continue throughout this project. A long-term monitoring plan will be a recommendation of the CWMP because water quality monitoring will

be needed to verify that the wastewater and nutrient management recommendations have produced a positive remedial effect on these water resources in the future.

1.7 SUMMARY OF PHASE II ACTIVITIES

Phase II is the needs assessment portion of the project and these activities were summarized in the Needs Assessment Report dated May 2010. The main findings are briefly summarized below.

A. Need for Funding Policy for Town Clean Water Projects. The extension of sewers in the eastern portion of the Town as recommended by the 2007 WWFP has been slowed by the Town's historic policy/practice that sewer extension costs be paid by the properties being served by the sewers through property betterments. Residents in the Stewarts Creek and Wequaquet Lake sewer extension areas have argued against this policy/practice. As a result, the Town has been investigating alternative funding methods for the Clean Water Projects.

B. Estuarine Water Quality Needs. The impacts and nitrogen limits to estuarine water quality have been researched and documented by the Massachusetts Estuaries Project and MassDEP for Popponesset Bay, Rushy Marsh Pond, Three Bays System, Centerville River System, Halls Creek, and Lewis Bay. The impacts and nitrogen limits to the estuarine water quality in Barnstable Harbor have not yet been researched and documented and are expected in the next one to two years.

The nitrogen limits developed to date are depicted on Figure 1-2 for the existing conditions. This figure illustrates the percent of existing wastewater nitrogen load that must be removed to meet the nitrogen total maximum daily load (TMDL) limits for each watershed. It is based on detailed modelling completed by the Massachusetts Estuaries Project as summarized in the Draft Needs Assessment Report. The removal percentages illustrated are for the whole watershed, but the detailed modelling indicates that the watershed removals are most efficiently attained by focusing the removal in specific sub-watershed areas. The removals also need to be coordinated with goals to protect drinking water as well as pond waters.

Figure 1-2 also illustrates the following additional information that will be coordinated with the nitrogen removal evaluations:

- » Existing sewer system coverage in eastern Barnstable

- » Planned sewer extensions as approved in the 2007 WWFP.

It is important to recognize that there is still additional build-out potential in these watersheds that could add additional nitrogen. This means that the future wastewater nitrogen that needs to be removed will be greater than the existing. The Needs Assessment Report summarized an estimate of the wastewater nitrogen percentage removals needed for the buildout condition.

Wastewater has been found by the MEP to be the largest source of nitrogen to the Town's estuaries. Typically, it comprises 75 percent to 85 percent of the nitrogen load from the watershed. Fertilizers and runoff from roads and roofs are the other two controllable nitrogen sources and typically comprise 5 percent to 10 percent of the watershed nitrogen loadings. This distribution is site specific for each watershed. Though wastewater (septic systems) is by far the largest source in Barnstable, fertilizers and runoff should be managed to reduce their loadings or, at the least, prevent the loads from these sources to increase. These sources are typically managed through "best management practices" that are typically implemented through increased awareness of these sources and public education. Public education on proper management of these two nitrogen sources is needed.

C. Pond Water Quality Needs. Phosphorus is typically the limiting nutrient for fresh water systems; therefore, it is the nutrient that stimulates excess algae production and produces water quality problems in ponds. There are no phosphorus TMDLs for Barnstable's ponds, but there has been much monitoring and analysis of pond data in the past.

As part of the Needs Assessment phase of the Project, the pond data was evaluated, and an Action Plan was developed. The evaluation, findings, and main recommended actions were summarized in the Needs Assessment Report. Many of the ponds are showing signs of water quality impact, and the Action Plan provides a prioritization of the pond water quality needs and step by step recommendation.

D. Groundwater Quality and Drinking Water Supplies. The drinking water quality, as indicated by the water supply annual reports is good. The 2007 WWFP investigated nitrogen impacts to the water supplies and found that most were well protected. Three zones of contribution to water supplies in the eastern portion of the Town were recommended for sewer extension to further protect the water supplies.

Nitrogen discharges from septic systems previously were the main concern to the water supply zones of contribution. More recently, concerns have been raised about a new category of water contaminant called Contaminants of Emerging Concern (CECs). This general category includes three subgroups – endocrine disrupting compounds, pharmaceuticals, and personal care products. These compounds and potential contaminants are not currently regulated by the federal government because their toxicity is not well understood. Many of these compounds originate from the medications and personal care products that we use and discharge to our septic systems and wastewater treatment facilities.

Advanced wastewater treatment facilities, such as the Hyannis Water Pollution Control Facility and the Marstons Mills Wastewater Treatment Facility, are believed to provide better removals of these compounds than individual septic systems, but there is a lack of data on the performance of individual septic systems for these contaminants.

MassDEP revised their groundwater discharge regulations in March 2009 to require that all treatment facilities with flows greater than 10,000 gallons per day remove the total organic carbon (TOC) component of their wastewaters to less than 3 mg/L if the discharge is greater than a two-year travel time from the well, and less than 1 mg/L if the travel time is less than two years. TOC is not a contaminant by itself, but it is a surrogate of the CECs because most of the CECs are comprised of organic carbon. Research indicates that if the TOC concentration is low, the concentrations of the CEC will be low or non-detectable. This regulatory change has a large impact on the Hyannis Water Pollution Control Facility and the Marstons Mills Wastewater Treatment Facility, both of which discharge their treated waters to zones of contribution to public water supply wells with travel times greater than two years.

E. Wastewater Treatment and Recharge Facilities and Related Needs. Most of the properties in the Town are served by individual on-site septic systems that have been documented as contributing the largest percentage of nitrogen (75 to 85 percent) to the coastal estuaries. Nitrogen discharges from these systems need to be remediated to meet the nitrogen TMDLs. These systems also discharge large quantities of phosphorus that impacts water quality in the freshwater ponds. Phosphorus discharges from these systems need to be remediated to address pond water quality impacts.

A group of 71 individual Innovative and Alternative (I/A) septic systems as regulated by MassDEP and the Title V regulations are operating in Barnstable. These systems are typically

designed to remove approximately 50 percent of the nitrogen in the wastewater and meet a limit of 19 mg/L total nitrogen. Research at the Otis On-Site Septic System Test Facility at the Massachusetts Military Reservation indicates that these systems typically can meet this limit when they are properly designed and operated with a consistent wastewater flow. Data analysis by the Barnstable County Department of Health and Environment on the I/A systems actually installed at Cape Cod properties indicates that approximately 50 percent of the installed systems meet the 19 mg/L limit.

There are two privately owned wastewater treatment facilities in Barnstable located at the Cotuit Landings Stop & Shop and at the Cape Regency Skilled Nursing and Rehabilitation Center. They are sized for approximately 20,000 gpd, and both have demonstrated good nitrogen removal performance to meet their discharge limit of 10 mg/L total nitrogen.

The Town owns and operates three treatment facilities:

- › Hyannis WPCF
- › Marstons Mills WWTF
- › Red Lily Pond Cluster System

These treatment facilities and their collection systems are illustrated on Figure 1-1, and they are performing well to meet their treatment and discharge requirements. Their capacity condition, and performance were evaluated and summarized in the Needs Assessment Report.

F Informational Needs to Complete the CWMP Project. The information needs to complete the CWMP Project are listed below:

- › Nitrogen TMDL limits for Barnstable Harbor to be developed by the Massachusetts Estuaries Project and MassDEP.
- › Lewis Bay TMDL report (the Town has received the Massachusetts Estuary Project Technical Report for this estuary but still needs the TMDL Report.
- › Information on the nitrogen load sensitivity once the culvert replacement and dredging is completed at Stewarts Creek in the Lewis Bay Watershed.
- › Collaborative input from the neighboring towns of Mashpee, Sandwich and Yarmouth and the Cape Cod Water Protection Collaborative on reducing nitrogen

- loading to the shared watersheds of Popponeset Bay, Three Bays System, Barnstable Harbor, and Lewis Bay
- » Informational needs related to the Barnstable Ponds Action Plan including needed sampling and analysis data.
 - » Possible revisions to water supply well zones of contribution being completed by the Cape Cod Commission with coordination with the water purveyors and MassDEP.
 - » Refinement of the sand infiltration bed capacity at the Hyannis WPCF based on a hydraulic load test to assist in future treated water recharge evaluation.
 - » Expansion of the sewer system computer model to assist in future wastewater collection evaluations.

The full Needs Assessment Report provides much detail on the evaluations completed and the wastewater and nutrient management needs identified.

1.8 PLANNED PUBLIC REVIEW

Several public outreach and review components are planned and have been initiated for this project. A Citizens Advisory Group has been established to provide oversight and assist with public outreach. Participants in this group (and their affiliations or titles) are listed below.

- » Barnstable Representatives:
 - Philip Boudreau, Chairman
 - Rod Anderson
 - Milton Berglund
 - Oliver P. Cipollini, Jr.
 - Lindsey Counsell
 - Stewart Goodwin
 - Gail Maguire
 - Wayne Miller
 - Susan Rask
 - Donald Schwinn
 - George Zoto
- » Neighboring Town Representatives:
 - John G. Keenan, Jr., Sandwich
 - Michael R. Richardson, Mashpee

- Doug Peabody, Yarmouth

Coordination meetings have been (and will be) held with MassDEP and CCC staff to coordinate efforts and keep the associated agencies informed. Progress meetings have been and will be convened with interested community groups in the Town. Phase reports (such as this Alternatives Screening Analysis Report) will be produced through the project to allow interim reviews of the project efforts and public and regulatory comment. The Town website has been expanded to allow access to Project information and documents.

1.9 PLANNED ENVIRONMENTAL REVIEW

As identified in the project scope listing, the approach for the environmental review process is to file an ENF document at the end of Phase III to initiate the MEPA and CCC DRI Joint Environmental Review Process. This ENF will summarize the findings of Phases I, II, and III and focus the review on the alternative management scenarios developed at the end of Phase III and their associated environmental impacts and benefits. The ENF will detail how these alternative management scenarios will be evaluated. The subsequent environmental evaluations will be summarized in the Draft Comprehensive Wastewater Management Plan and Draft Environmental Impact Report (DCWMP/DEIR) and in the Final Comprehensive Wastewater Management Plan and Final Environmental Impact Report (FCWMP/FEIR).

1.10 PLANNING PERIOD

The Comprehensive Wastewater Management Plan will provide a recommended plan for wastewater facilities and nutrient management recommendations in Town for the 20-year planning period of 2015 to 2035. This is an approximate period that would start following newly constructed wastewater facilities resulting from the plan. The plan will also be developed with a planning horizon based on the estimated potential buildout of the Town.

1.11 PURPOSE AND ORGANIZATION OF THE ALTERNATIVES SCREENING ANALYSIS REPORT

The Alternatives Screening Analysis Report is developed to summarize Phase 3 components of the Project scope. The report is divided into 9 chapters. Chapter 1 presents general introductory information about the Comprehensive Wastewater and Nutrient Management Planning Project

and the Alternatives Screening Analysis Report. Chapter 2 describes the approach and criteria used for screening alternative treatment technologies and solutions. Chapters 3, 4, 5, and 6 identify and screen individual on-site system and cluster system alternatives, alternatives for centralized and satellite wastewater treatment technologies and sites, treated water recharge technologies and alternative sites, and collection system technologies, respectively. Chapter 7 presents flow and loading reduction opportunities. Chapter 8 identifies additional non-wastewater nitrogen mitigation alternatives. Chapter 9 identifies the development of alternative wastewater and nutrient management plans (scenarios) and the next steps to evaluate solutions for the wastewater and nitrogen management needs.