# EXECUTIVE SUMMARY
# COMPREHENSIVE WASTEWATER MANAGEMENT PLANNING PROJECT

# NEEDS ASSESSMENT REPORT
# TOWN OF BARNSTABLE, MASSACHUSETTS

## ES.1 PROJECT BACKGROUND

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. This Plan is meant to be consistent with the Town's Local Comprehensive Plan (LCP) which has the goals of:

- Preserve, protect and enhance sensitive natural habitats and systems.
- Provide Town services and infrastructure through an efficient, planned and prioritized process.
- Sustain diverse villages and livable neighborhoods for year round residents while providing housing opportunities for all.

This Needs Assessment Report completes the second of five major phases of the CWMP Project and provides the framework and necessary background information to quantify and understand the wastewater and nutrient management needs in Barnstable. Subsequent phases will utilize this information to identify, screen and evaluate alternative solutions to meet these needs. The first phase was the development of nutrient limits for the Town's coastal estuaries, which has been underway for several years and is summarized in this report.

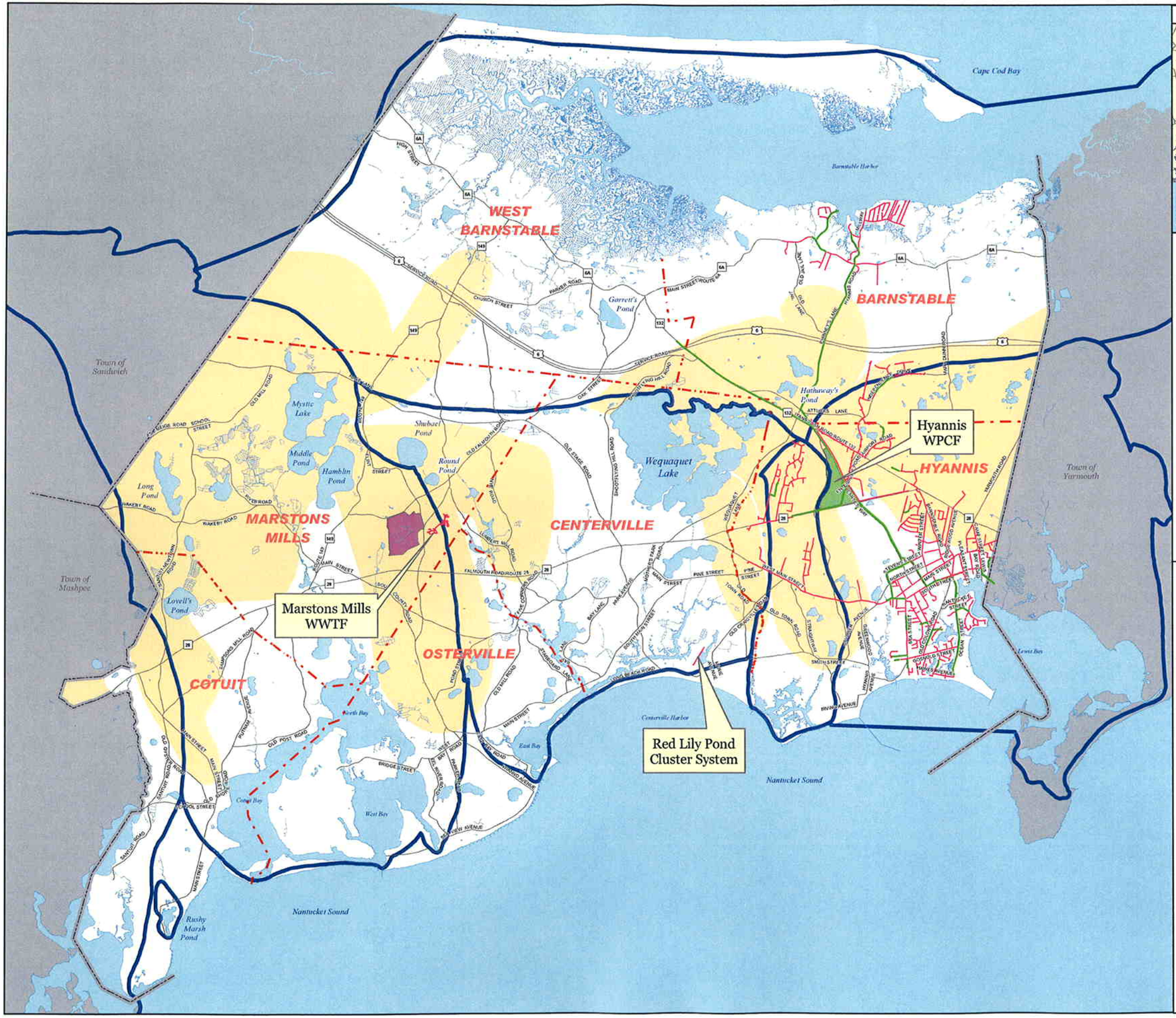
In this Needs Assessment Report, existing and future land use is summarized and projected to the design year 2035. This design year is 20 years after 2015, which is the projected starting point of the implementation of this Plan. We hope to complete this planning project and be started with implementation by 2015.

This Needs Assessment Report was completed through the coordinated efforts of the Town of Barnstable Department of Public Works (DPW) and Growth Management Department (GMD), and Stearns & Wheler LLC serving as the project consultant. Valuable assistance has been provide from the Town's Geographic Information System (GIS) Department, the Cape Cod Commission, and the Massachusetts Department of Environmental Protection (MassDEP) as well as several working groups comprised of Town staff, Stearns & Wheler staff and Town volunteers.

The Town of Barnstable is located in the middle portion of Cape Cod as shown in Figure ES-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.

The Town's water resources: groundwater, drinking water, pond water, and estuarine water form the basis of the Town's human health, environmental health, and economic prosperity. All of these water resources are interconnected and must be properly managed for sustainable development and to meet the three LCP goals listed above.

The Town 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



# TOWN OF BARNSTABLE
## MASSACHUSETTS

Comprehensive Wastewater and Nutrient Management Plan

## Project Location
### Figure ES-1

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**TOWN OF BARNSTABLE GEOGRAPHIC INFORMATION SYSTEMS UNIT**

FIGURE PREPARED FOR STEARNS & WHELER GHD

removal to meet specific nitrogen limits that have been developed for the water bodies. 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 them.

## ES.2 FINDINGS AND CONCLUSIONS

The Needs Assessment is designed to identify the Town's specific water-resource, wastewater, and nutrient-management problems and needs. The major findings and conclusions of the various evaluations of the Needs Assessment are summarized below.

A. **Wastewater and Nutrient Management Planning History in Barnstable.** The Town initiated its last wastewater planning process in 1993 with the 20-year planning period of 1994 to 2014. The project was completed in 2007 with state approval of the Final Wastewater Facilities Plan and Final Environmental Impact Report, March 2007 (2007 WWFP). The main focus of that planning project was to address surface and groundwater problems caused by failing septic systems (and even systems that were operating properly but were still impacting drinking waters). The following list briefly summarizes the main recommendations of that project.

- Upgrade and expand the Hyannis Water Pollution Control Facility.
- Extend sewers to the Wastewater Areas of Concern (AOC) in the eastern portion of the Town to address the water quality problems in these areas.

- Defer decision on many of the AOCs in the western portion of the Town until nitrogen limits are set by the State and federal governments with the intent of addressing those nitrogen limits through the current CWMP Project.
- Address wastewater problems in several AOCs with Board of Health solutions and public water supply.

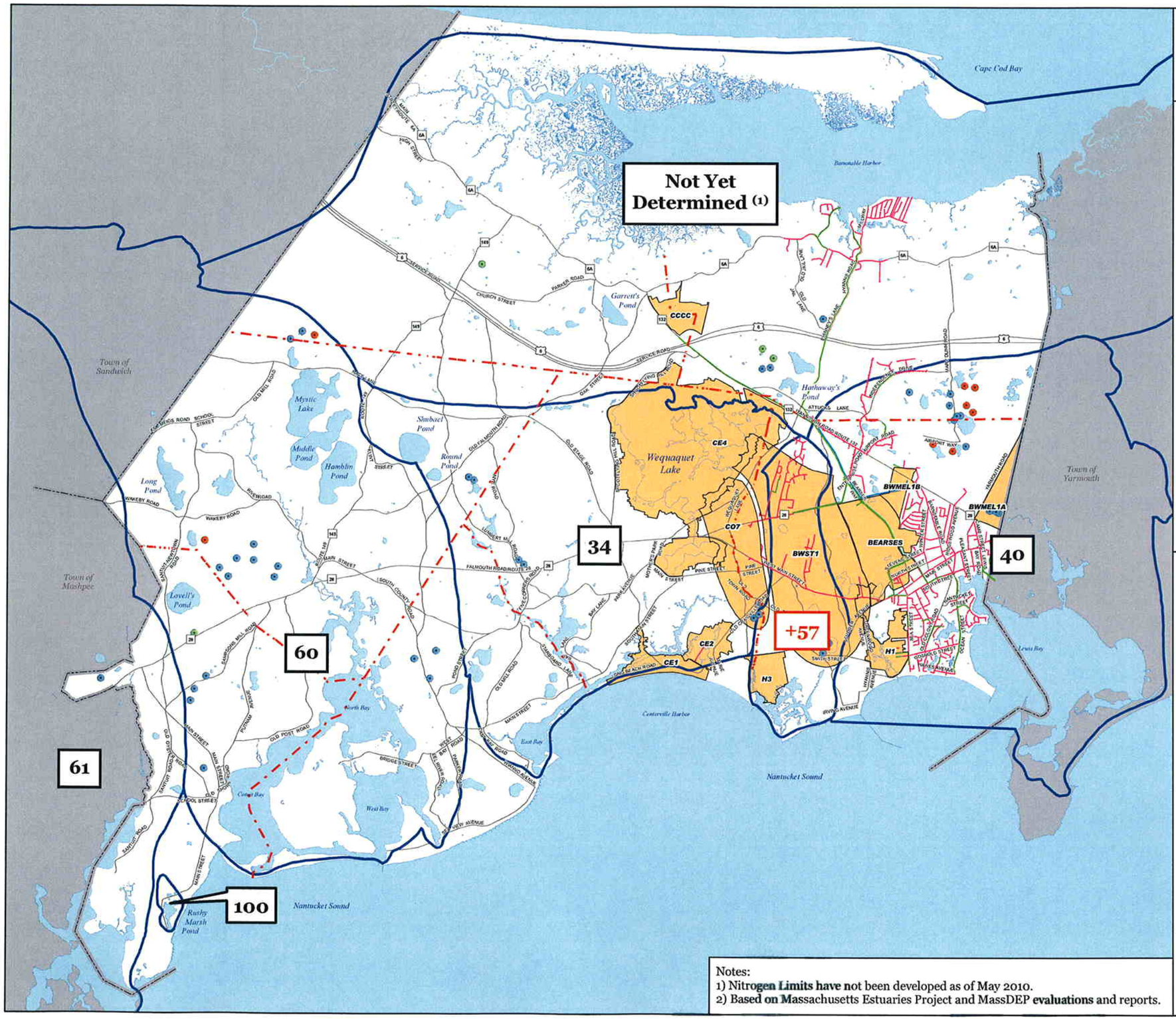
Many of the recommendations have been completed, including:

- Upgrade and expansion of the Hyannis WPCF.
- Initial sewer extensions in the eastern portion of the Town.
- Board of Health solutions and extension of public water supply to the AOCs that need these types of solutions.
- Developed nutrient limits of most of the Town's coastal estuaries.

The extension of sewers in the eastern portion of the Town 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. Several residents in 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 but are expected in the next one to two years.

The nitrogen limits developed to date are depicted on Figure ES-2. 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 later in this 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-




34 Percent Septic System Nitrogen Removal Suggested by MEP

+57 Percent Additional Nitrogen That Could Be Added (Suggested by MEP)

- Planned Sewer Extension
- Marine Watersheds
- Existing Sewer Force Main
- Existing Gravity Sewer
- Existing Vacuum Sewer
- Existing Well
- Proven Future Well
- Proposed Future Well
- Major Roads
- Fire District / Village Lines
- Town Boundary
- Water Bodies

# TOWN OF BARNSTABLE
## MASSACHUSETTS

Comprehensive Wastewater and Nutrient Management Plan

Existing Septic System Nitrogen Removal Needed To Meet the TMDLs (2)

**Figure ES-2**

Miles
0 0.25 0.5 1 1.5 2

CWNMP_NitrogenRemoval_11x17.mxd J.A.B. 7/27/2010

**TOWN OF BARNSTABLE GEOGRAPHIC INFORMATION SYSTEMS UNIT**

FIGURE PREPARED FOR STEARNS & WHELER GHD

watershed areas. The removals also need to be coordinated with goals to protect drinking water as well as pond waters.

Figure ES-2 also illustrates the following additional information that will be used in 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.

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 from 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 this Needs Assessment phase of the Project, the pond data was evaluated, and an Action Plan was developed. The evaluation, findings, and main recommended actions are summarized in this 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 recommendations.

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. These are the BWST1, CO7, and BEMELIA areas illustrated on Figure ES-2.

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 containments.

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 low levels if the discharge is into a Zone of Contribution to public water supply wells. The treatment levels must be less than 3 mg/L if the discharge has a travel time greater than two-years to 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 5 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 only one half to two thirds 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 their "needs" are summarized below:

1. **Hyannis WPCF.** The Hyannis WPCF treats an average flow of 1.46 million gallons per day (mgd) and a maximum-month average flow of 1.94 mgd. It has recently been upgraded and expanded and has a maximum-month capacity of 4.2 mgd. The treatment facility has

excellent performance and averages 5 mg/L total nitrogen in the treated water as compared to a MassDEP discharge limit of 10 mg/L.

MassDEP has recently (March 2009) revised their groundwater discharge regulations to require a total organic carbon (TOC) limit in the treated water because the recharge is in a zone of contribution to public water supply wells. This project will need to develop a plan (as part of the CWMP) to meet these new TOC limits.

The capacity of the sand infiltration beds has been estimated based on text-book information that may not be accurate for the sandy soil conditions at the site. Therefore, the sand bed capacity may be even greater. A hydraulic loading test in the sand beds would provide a more empirical measure of the capacity of these beds which may become important in the future if some of the bed areas need to be used for new treatment facilities. A hydraulic load test needs to be completed to better estimate the capacity of the sand infiltration beds.

The Hyannis WPCF has a collection system that has grown over time, and its ability to accept more flow is not clearly defined. A computer model was developed for the Hyannis Growth Incentive Zone (GIZ) area of Hyannis when the Town was evaluating that area for the GIZ. The existing computer model should be expanded to cover the whole collection system. This will allow a better understanding of its capacity and how the existing system can be most efficiently expanded to pick up additional flow.

2. **Marstons Mills WWTF.** The Marstons Mills WWTF serves an elementary school, a middle school, and a residential development of 30 homes. The WWTF was recently upgraded and is performing well. Similar to the Hyannis WPCF, its recharge is in a zone of contribution to a public water supply well and, as such, the WWTF will need to increase its treatment to meet the new TOC discharge limit (discussed earlier in this chapter) of 3 mg/L.

3. **Red Lily Pond Cluster System.** This cluster system serves several homes adjacent to Red Lily Pond and Elizabeth Lake. It does not have a discharge permit, and its treatment performance is expected to be similar to a conventional Title 5 septic system.

F. **Informational Needs to Complete the CWMP Project.** This report summarizes the wastewater and nutrient management needs in Town. Some of these are informational needs for

the Project Team to continue and complete the CWMP Project. The main information needs are listed below:

- Nitrogen TMDL limits for Barnstable Harbor to be developed by the Massachusetts Estuaries Project and MassDEP.

- Information on the nitrogen load sensitivity once the culvert replacement and dredging is completed at Stewarts Creek in the Lewis bay Watershed.

- Nitrogen TMDL Report for Lewis Bay (the Town has received the Massachusetts Estuary Project Technical Report for this estuary but still needs the TMDL Report).

- Revised funding policy for Clean Water Projects in Barnstable.

- 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 Popponesset 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.

These information needs should be considered and addressed as the project proceeds.