

Attachment 1

Project Narrative

Environmental Notification Form Document Project Narrative

Comprehensive Wastewater Management
Planning Project
Town of Barnstable, Massachusetts



1 Introduction and Background

This Environmental Notification Form (ENF) is prepared for the Comprehensive Wastewater Management Planning (CWMP) Project for the Town of Barnstable as illustrated on Figure ES-1¹. This project will result in the preparation of Draft and Final Comprehensive Wastewater Management Plan and Environmental Impact Report (CWMP/EIR) documents. Once the Final CWMP/EIR is approved, the Town can implement improved wastewater and nitrogen management facilities.

The purpose of this ENF Document is to summarize the progress completed on the CWMP Project to date and to identify the evaluations and environmental review process that the Town will complete to produce the Draft and Final CWMP/EIR documents.

The distribution list for the ENF Document is attached in Attachment 3.

2 Project Background

2.1 Project Purpose

The purpose of the 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.

2.2 Project Setting and Key Issues

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.

¹ All figures are attached in Attachment No. 2



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 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.

2.3 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 Attachment 4.

2.3.1 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).

This portion of the Project has been ongoing since 2001. The work has been contracted primarily to the University of Massachusetts (UMass) Scholl of Marine Science and Technology (SMAST) as part



of the Massachusetts Estuaries Project (MEP). Town volunteers and staff have provided sample collection and water quality analysis.

2.3.2 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.

This portion of the Project is complete and an electronic copy of the Needs Assessment Report is included on a compact disc (CD) in Attachment 5 of this ENF document. The Needs Assessment is summarized later in this Project Narrative.

2.3.3 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.

This portion of the Project is complete and an electronic copy of the Alternatives Identification and Screening Report is included on a compact disc (CD) in Attachment 4 of this ENF document. The Alternatives Identification and Screening is summarized later in this Project Narrative.

2.3.4 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 Plan, and prepare the Draft Comprehensive Wastewater Management Plan (CWMP) and Draft Environmental Impact Report (DEIR).
8. Submit the Draft CWMP and DEIR for regulatory and public reviews.

This portion of the Project is the next phase and will commence after review of this ENF.

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

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

This portion of the Project will commence after review of the Draft CWMP and DEIR.

2.3.6 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.

This portion of the Project was started in 2010 with the formation of the CAC as described later in this Project Narrative.

2.3.7 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.

This portion of the Project was started in 2008 with application for the State Revolving Loan program.

As mentioned earlier, the full Project Scope is attached in Attachment 4. 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.



2.4 Planned Public Review

Several public outreach and review components are planned and have been initiated for this project. A Citizens Advisory Committee 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
 - Rob Anderson
 - Milton Berglund
 - Oliver P. Cipollini, Jr.
 - Lindsey Counsell
 - Stewart Goodwin
 - Gail Maguire
 - Wayne Miller
 - Peter Sullivan
 - Donald Schwinn
 - George Zoto
- Neighboring Town Representatives:
 - John G. Kennan, 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 the Needs Assessment Report and Alternative Screening Analysis Report which are included on the CD) will be produced through the project to allow interim reviews of the project efforts and public and regulatory comment. A website has been created to allow access to Project information and documents and can be accessed at www.town.barnstable.ma.us/Boards/CitizenAdvisory/default.asp.

2.5 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 summarizes the findings of Phases I, II, and III and focuses the review on the alternative management scenarios developed at the end of Phase III and their associated environmental impacts and benefits. This ENF and the attached Project Scope details how these alternative management scenarios will be evaluated. The subsequent environmental evaluations will be summarized in the Draft Comprehensive Wastewater Management Plan (CWMP) and Draft Environmental Impact Report (DEIR) and in the Final CWMP and Final Environmental Impact Report (FEIR).

2.6 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.

3 Summary of Needs

The full Needs Assessment Report, dated May 2011, is included on the CD in Attachment 5. The major findings and conclusions of the evaluations of the Needs Assessment are summarized below.

3.1 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.

3.2 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. 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 ES-2 also illustrates the following additional information that will be used in the nitrogen removal evaluations:

- Existing sewer system coverage in eastern Barnstable
- Previously planned sewer extensions (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.

3.3 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 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 recommendations.

3.4 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 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 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.

3.5 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 ES-1, and their “needs” are summarized below:

3.5.1 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.

3.5.2 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.



3.5.3 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.

3.6 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.

4 Summary of Identification and Screening of Alternative Solutions and Sites

As identified in Section 2.3, the identification and screening of alternative solutions and sites is the third phase of the project. The purpose of this phase is to investigate all practical solutions and select the most feasible for detailed evaluation. Alternative technologies, solutions, and sites were identified and screened in the following major categories:

- Alternatives for new municipal treatment facilities and sites



- Alternatives for expansion of the existing Falmouth WWTF
- Treated water recharge technologies and alternative sites
- Collection system technologies
- Decentralized treatment and disposal alternatives
- Flow and loading reduction alternatives
- Additional non-wastewater nitrogen mitigation alternatives

Many technologies and solutions were evaluated for each of these categories, as detailed in the Alternatives Screening Analysis Report attached in Attachment 5 and summarized in the following text.

4.1 Feasible Technologies, Solutions, and Sites

The following list identifies the most feasible alternative technologies, solutions, and sites to be further evaluated and discussed in the next phase of the study.

Alternative technologies and solutions were identified and screened in the following major categories:

- **Individual on-site system and cluster system alternatives**
- **Secondary/advanced treatment technologies to attain Biological Nitrogen Removal (BNR) and/or Enhanced Nitrogen Removal (ENR) standards of 6 and/or 3 mg/L total nitrogen (respectively) in the effluent on average**
- **Technologies to achieve less than 3 mg/L Total Organic Carbon in the effluent on average**
- **Technologies to achieve less than 3 mg/L total nitrogen in the effluent on average**
- **Phosphorus removal technologies/processes**
- **Disinfection technologies**
- **Residuals management technologies and reuse/disposal alternatives**
- **Treated water recharge technologies**
- **Potential sites for recharge facilities as well as for treatment facilities**
- **Collection system technologies**
- **Wastewater flow and loading technologies**
- **Additional non-wastewater nutrient mitigation alternatives**

Many technologies and solutions were evaluated for each of these categories, as detailed in following chapters. The following list identifies the alternative technologies and scenarios that are most feasible and will be further evaluated and discussed in the next phase of the study.



1. Individual On-Site System and Cluster System Alternatives
 - **Decentralized treatment alternatives that are approved by the MassDEP as part of their innovative and alternative (I/A) technology program for areas outside any satellite or centralized sewer service areas in Barnstable.**
2. Secondary/Advanced Treatment Technologies to attain Biological Nutrient Removal (BNR) and/or Enhanced Nitrogen Removal (ENR) standards of 6 and/or 3 mg/L total nitrogen (respectively) in the effluent on average:
 - **Multiple stage processes (MLE, Bardenpho, etc.) for nitrogen and phosphorus, or nitrogen removal**
 - **Membrane bioreactors utilizing many of these same multiple stage processes**
 - **Oxidation ditches**
 - **Sequencing batch reactors**
 - **Denitrifying filters**
 - **Biological aerated filters**
 - **Amphidrome® process (only for small satellite systems)**
 - **Fixed-film enhanced processes**
3. Technologies to achieve less than 3 mg/l Total Organic Carbon in the effluent on average:
 - **Granular activated carbon adsorption (GAC)**
 - **Membrane filtration of reverse osmosis and nano filtration**
 - **Advanced oxidation as a polishing step for side stream treatment**
4. Technologies to Achieve less than 3 mg/L total nitrogen in the effluent on average.
 - **Granular activated carbon adsorption**
 - **Ion exchange**
 - **Membrane filtration**
 - **Advanced oxidation for side stream treatment**
5. Phosphorus removal technologies/processes if phosphorus impacts to freshwater ponds and lakes become an issue.
 - **Multiple stage biological processes for biological phosphorus removal**
 - **Chemical precipitation processes**



- **Filtration processes to remove fine precipitates**
- 6. Disinfection with ultraviolet light.
- 7. Additional Non-Wastewater Mitigation Alternatives.
 - **Appurtenant processes of screening and grit removal**
 - **Septage and trap grease segregation from wastewater for thickening and transportation to a regional reuse/disposal facility**
 - **Sludge thickening and transportation to a regional reuse/disposal facility**
 - **Sludge minimization technologies**
- 8. Treated water recharge technologies.
 - **Sand infiltration beds**
 - **Subsurface infiltration**
 - **Spray irrigation and drip irrigation**
 - **Ocean outfall**
 - **Well injection and wick well technologies of accepted by MassDEP and if total organic carbon treatment is provided to less than 1 mg/L**
 - **Wetland restoration**
- 9. Collection System Technologies.
 - **Gravity sewers and lift stations**
 - **Pressure sewers and grinder pumps**
 - **Vacuum sewers for possible expansion of existing vacuum system**
- 10. Wastewater flow and loading reduction alternatives.
 - **Infiltration and Inflow (I/I) reduction to sewers**
 - **Reduction of household water consumption**
 - **Continued use of groundwater rate structure to discourage greater water consumption and wastewater generation**
 - **Wastewater reuse and recycling**
 - **Wastewater loading regulations through reduced use of garbage disposal units and (as possible) industrial/commercial separation of non-sanitary wastes and disposal as solid waste**



- **Waterless toilets for isolated areas of Barnstable by informed individuals willing to take on the responsibility of these systems**
11. Additional non-wastewater nutrient mitigation alternatives.
- **Fertilizer management**
 - **Pet/animal waste management**
 - **Improved landscape design practices to minimize the need for fertilizer, pesticides, and herbicides**
 - **Watershed modifications and constructed wetlands for nutrient management**
 - **Stormwater management and treatment**
 - **Estuarine inlet modifications for increased tidal flushing**
 - **Pond treatment to improve pond water quality**
 - **Modified zoning or sewer use regulation to meet growth/flow neutral requirements/goals**
 - **Expanded shellfish aquaculture**

The feasible alternatives and technologies listed above have been combined and grouped into the following alternative plans:

1. Alternative Plan No. 1: Decentralized Plan A

This plan would be the first of 2 decentralized wastewater management concepts and would utilize the following main components:

- **Continued use of Title 5 septic systems as allowed in areas where nitrogen TMDLs do not require wastewater nitrogen removal.**
- **Implementation of individual nitrogen removal systems to areas where 25% wastewater nitrogen removal (or less) is required**
- **Multiple satellite systems and development of remote recharge sites for the areas where additional nitrogen removal is needed.**
- **Expansion of Hyannis WPCF, sewer extension to eastern portions of Town, and development of remote recharge sites**

2. Alternative Plan No. 2: Decentralized Plan B

This plan would be the second of decentralized wastewater management concepts and would utilize the following main components:



- **Continued use of Title 5 septic systems as allowed in areas where nitrogen TMDLs do not require wastewater nitrogen removal.**
- **Construction of up to two new satellite treatment facilities in the western part of Town, and development of associated sewer extensions and recharge sites recharge sites.**
- **Expansion of the Hyannis WPCF, sewer extensions to eastern portions of Town, and development of remote recharge sites.**

3. Alternative Plan No. 3: Centralized Plan A

This plan would be the first of 2 centralized wastewater management concepts and would utilize the following main components:

- **Continued use of Title 5 septic systems as allowed in areas where nitrogen TMDLs do not require wastewater nitrogen removal.**
- **Expansion of the Hyannis WPCF, sewer extension to all portions of Town needing wastewater nitrogen removal, and development of remote recharge sites.**

4. Alternative Plan No. 4: Centralized Plan B

This plan would be the second of the centralized wastewater management concepts and would utilize the following main components:

- **Use of an ocean outfall from the Hyannis WPCF.**
- **Continued use of Title 5 septic systems as allowed in areas where nitrogen TMDLs do not require wastewater nitrogen removal.**
- **Expansion of the Hyannis WPCF, sewer extension to all portions of Town needing wastewater nitrogen removal, and development.**

5. Alternative Plan No. 5: Development of New Public Water Supply Sites to Mitigate Impacts to Current Water

This plan would work to relocate water supplies in Town and would utilize components of the decentralized and centralized plans/concepts No 1-4. It would utilize the following main components:

- **Development of new public water supply sites and Zone II Water Supply Protection Areas which would allow impacted water supply wells to be abandoned**
- **Possible use of the abandoned water supply areas for treated water recharge**
- **Continued use of Title 5 septic systems as allowed in areas where nitrogen TMDLs do not require wastewater nitrogen removal.**
- **Expansion of the Hyannis WPCF, sewer extension to portions of Eastern Barnstable needing wastewater nitrogen removal, and development of remote recharge sites.**



- **Development of up to 2 new satellite treatment facilities and associated sewer extensions and recharge sites in portions of Western Barnstable**

6. Additional items Common to all Alternative Plans.

The following non-wastewater nitrogen management components would be part of all Alternative Management Plans:

- **Fertilizer and pet waste management through education and county initiatives**
- **Stormwater management through best management practices and education to homeowners,**
- **Sediment removal at Mill Pond to increase Nitrogen Attenuation for the Marstons Mills River watershed**
- **Estuarine inlet opening and maintenance for Rushy Marsh Pond**
- **New zoning or land use bylaw to create growth neutral requirements for sewer extensions where Growth Centers are not identified. This will need to comply with MassDEP requirements to gain eligibility for 0% low interest loans as allowed by the 2009 Environmental Bond Bill legislation.**
- **Expanded use of aquaculture in the estuaries to reduce nitrogen concentrations and to promote local fisheries**

7. No Action Alternative.

The No Action alternative was presented in the Draft Needs Assessment Report to identify the consequences of doing nothing. Under the No Action alternative, degradation of Popponesset Bay, Three Bay System, Centerville River System, and Lewis Bay will continue from the excessive nitrogen loading in the watersheds to these water bodies, primarily from the on-site septic systems. The MEP technical reports used colored maps to illustrate how the nitrogen concentrations would increase from their current levels to the projected buildout levels defined by current zoning. The increased nitrogen would promote further algal blooms, fish kills, eel grass loss, and other impacts to the habitat of the marine estuaries.

A portion of the Eastern side of Barnstable probably would be sewerred as allowed by the 2007 Wastewater Facilities Plan.

If the Town did not demonstrate progress to meet the nitrogen TMDLs, MassDEP would most likely initiate an enforcement action against the Town as allowed by state law.

If the Town did not demonstrate progress to meet the new TOC discharge limit, MassDEP would most likely initiate an enforcement action against the Hyannis WPCF and the Marstons Mills WWTF as allowed by state law

If progress is not made on the Barnstable Ponds Action Plan, pond water quality will decline.



5 Future Evaluations to Identify a Recommended Plan

The first phase of the CWMP Project was the development of nutrient limits. The second major phase of the Project was the identification of the wastewater and nutrient management needs as documented by the Needs Assessment Report. The third major phase of the project was the identification and screening of alternative solutions to meet the wastewater needs as documented in the Alternatives Screening Analysis Report. The next phase of the Project (Phase IV) will provide a detailed evaluation of the screened alternatives retained for further evaluation. Detailed evaluation will include cost effectiveness comparisons using present-worth evaluation and evaluation of non-monetary factors. Prior to initiating Phase IV, specific subtasks of Phase VI are needed. These tasks are listed below with the Phase IV tasks.

5.1 Subtasks of Phase VI – Environmental and Public Review Process

- 5.1.1. Prepare and conduct a public participation program.
- 5.1.2. Prepare, submit, and coordinate the public review of the Environmental Notification Form (ENF) and Development of Regional Impact (DRI) Document.

5.2 After review of the ENF and DRI Documents, proceed with Phase IV – Detailed Evaluation and Development of the Nutrient Management Plan.

- 5.2.1. Perform subsurface and/or environmental investigations and modeling for potential nutrient management sites.
- 5.2.2. Prepare a methodology of the planned detailed evaluations for project and regulatory review.
- 5.2.3. Perform present-worth evaluations of the alternative nutrient management scenarios.
- 5.2.4. Perform non-monetary evaluations of the alternative scenarios.
- 5.2.5. Perform an environmental impact analysis of the alternative scenarios.
- 5.2.6. Evaluate the present-worth analysis with the non-monetary evaluation and the environmental impact analysis to select the most appropriate management scenario.
- 5.2.7. Develop and present the recommended Nutrient Management Plan, and prepare the Nutrient Management Plan and Draft Environmental Impact Report (DEIR).
- 5.2.8. Submit the Nutrient Management Plan and DEIR for regulatory and public reviews.

Water quality modeling by the Massachusetts Estuaries Project (MEP) team will be integrated into these detailed evaluations.

This modeling was recently initiated for Lewis Bay as part of regional evaluations to meet the nitrogen TMDLs in that water body. The water quality modeling for the other estuaries will typically be initiated in items 4 and 5 (listed above) to identify nitrogen management performance of the alternative scenarios.

This water quality modeling work will be guided by a Working Group comprised of the following individuals and organizations:

- **Dale Saad, Ph.D., Barnstable DPW**
- **Ed Eichner, UMass SMAST**



- **Brian Howes, Ph.D., UMass SMAST**
- **Tom Cambareri, Cape Cod Commission**
- **Nathan Weeks, P.E., GHD Inc.**

6 Inter-Municipal Cooperation

Inter-municipal discussions and cooperation are ongoing between Barnstable and the towns of Yarmouth, Mashpee, and Sandwich who share several of the estuarine watersheds that have nitrogen TMDLs. These cooperative efforts include:

- **Invitation of the three towns to be members of the Citizens Advisory Committee.**
- **Regional wastewater evaluations with the Town of Yarmouth as discussed in section 1.2E of this report and further documented in Appendix 1-4 of the Needs Assessment Report.**
- **Water quality modeling of Lewis Bay as discussed in the previous chapter section.**
- **Regional wastewater evaluations as part of the Mashpee Watershed Nitrogen Management Planning Project.**

Additional discussion and cooperation is planned with the Town of Sandwich as they initiate their CWMP Project later in 2011.

The detailed evaluations of the CWMP Project will explore the possible inter-municipal agreements that may be needed for regional wastewater facilities, shared water quality monitoring, and TMDL compliance. These evaluations will include the Town's Growth Management and Legal Departments.

The recommended plan will identify the inter-municipal agreements needed for implementation.