



6 Recommended Plan

The Recommended Plan is a comprehensive strategy for wastewater and nitrogen management for a 20-year period with a 40-year perspective on the ultimate build-out for the Town and the need to meet the nitrogen TMDLs in cooperation with the neighboring towns that share the Waquoit Bay watershed. The 20-year period is from 2015 to 2035, which is the estimated time-period for the Little Pond sewer extension, WWTF upgrades, new treated-water recharge facility implementation, completion of the demonstration projects, and implementation of the feasible non-traditional technologies in the High-Priority Nitrogen Mitigation Areas.

The Recommended Plan is summarized below:

6.1 Demonstration Projects of Non-Traditional Wastewater and Nitrogen Management Technologies and Approaches

A group of five demonstration projects has been funded by Town Meeting. These projects have been initiated and are ongoing. Their progress as of June 30, 2013, is summarized below. These demonstration projects are evaluations independent of this CWMP/FEIR/TWMP and will enter the MEPA review process at a later time if they trigger MEPA thresholds. If proven feasible, these technologies and management processes will be added to this Plan through the Adaptive Management component.

6.1.1 Shellfish Aquaculture Demonstration Project to Harvest/Mitigate Excessive Nitrogen in the Estuaries

This technology and nitrogen management concept would promote nitrogen uptake in the estuaries by shellfish that could be harvested to remove nitrogen from the system. The first phase of the project has been scoped, and Woods Hole Group has been engaged as the project consultant. The following initial tasks have been completed:

- Viability Test (summer 2012).
- Conservation Commission Notice of Intent (NOI) hearing, and Order of Conditions issued on May 10, 2013.
- Staffing, equipment and shellfish purchased, and seed installed in Town upweller.
- Installation of oysters into Little Pond for first year of the Demonstration Project began on July 3, 2013, and is ongoing.
- Monitoring Plan formalized with MassDEP and Falmouth Conservation Commission.

A full description of this project is provided in Chapter 3, Section 3.2.

6.1.2 Inlet Widening of Bournes Pond

This technology would increase tidal exchange with Vineyard Sound to reduce the amount of nitrogen that would need to be removed from the watersheds through sewerage or other wastewater or nitrogen management approaches. A focused demonstration project has been developed, and the first phase of the project has been scoped. GHD (supported by Applied Coastal Research & Engineer and BETA Group) has been engaged as the project consultant, and has completed a Technical Memorandum which



presents preliminary design evaluations for an enlarged inlet and new bridge over Bournes Pond, as well as an analysis of the nitrogen-removal benefits of a larger inlet as determined by water-quality modeling.

A full description of this project is provided in Chapter 3, Section 3.3. Design funds were approved at Spring 2013 Town Meeting.

6.1.3 Eco-Toilet Project: Composting and Urine-Diverting Toilets

This wastewater management approach will demonstrate the nitrogen-removal capability as well as installation feasibility and cost-effectiveness of eco-toilets. These technologies separate the fecal and urine components from the septage stream of an individual property, enabling transport outside the watershed and/or reuse of these materials in an environmentally beneficial way. The first phase has been scoped, and Science Wares, Inc. has been engaged as the project consultant. The first phase of the Eco-Toilet Demonstration Program is underway, with approximately 15 property owners committed to replacing all of their standard fixtures with either composting or urine-diverting toilets. The Barnstable County Department of Health and Environment has been contracted to provide baseline and ongoing monitoring of these installations.

A full description of this project is provided Chapter 3, Section 3.4.

6.1.4 Permeable Reactive Barriers (PRBs)

This technology provides nitrogen treatment in the groundwater system by having it flow through a reactive barrier that converts soluble nitrogen to nitrogen gas, which is released into the atmosphere. The first phase of the project has been scoped, and CDM Smith has been engaged as the project consultant. The following initial tasks have been completed:

- Delivery of Technical Memorandum (TM) #1 detailing the evaluation criteria and TM #2 outlining preliminary site selection (18 sites).
- From 18 sites, two have been short-listed, one in West Falmouth and one in Seacoast Shores, East Falmouth.

A full description of this project is provided in Chapter 3, Section 3.5.

6.1.5 Improved Stormwater Management

This stormwater and nitrogen management approach would provide hydraulic retention, bioretention, infiltration, and other best management practices (BMPs) to mitigate the nutrients, sediments, and biological vectors (pathogens, fecal coliform, etc.) discharged by stormwater to the waterbodies and to their watersheds. The Town Engineering Department and Conservation Commission are in the process of developing a Town-wide approach to stormwater management. Within the next year, the WQMC will work with appropriate Town departments and boards to determine the most appropriate location within the Little Pond watershed for a stormwater demonstration project.

A full description of this process is provided in Chapter 3, Section 3.6.

6.1.6 Baseline Monitoring

Non-traditional wastewater management strategies will require baseline monitoring to demonstrate success. MassDEP has indicated that three years of monitoring will be required to assist in the determination of a nitrogen-reduction credit for each demonstration project. In addition, Adaptive



Management decisions will be made based on monitoring results. For each of the demonstration projects, the Town will be tracking the data carefully, and evaluating the monitoring results as soon as they become available. For example, the Town will begin looking at Little Pond in November 2013, when the data from the monitoring for the Shellfish Demonstration Project has been collected. It is expected that after the three years of monitoring, MassDEP will be able to formalize nitrogen removal credits for each alternative.

A full description of this process is provided in Chapter 3, Section 3.11.

6.2 Traditional Wastewater Management

6.2.1 Sewer Extension to the Lower Watershed of Little Pond

The proposed Little Pond Sewer Service Area is illustrated on Figure 4-8, and the system would collect wastewater from approximately 1,400 existing parcels. It would be a combination of gravity and low-pressure sewers and would include two new wastewater lift (pump) stations to convey the wastewater to the existing collection system and ultimately to the Blacksmith Shop Road WWTF.

This sewer extension would significantly reduce the nitrogen loading to Little Pond. Water quality modeling indicates that this reduction would reduce the nitrogen concentration at the sentinel station of Little Pond from 0.837 mg/L to 0.495 mg/L. Although this reduction does not meet the TMDL threshold concentration of 0.450 mg/L, it is a major reduction. It will be augmented by additional removals provided by the non-traditional nitrogen methods to be proven by the demonstration projects, such as the aquaculture project started in 2013.

6.2.2 Upgrade of the Blacksmith Shop Road WWTF

The Blacksmith Shop Road WWTF has recently received a new effluent discharge permit which requires several improvements to its flow metering system and nitrogen removal optimization. The WWTF has a capacity of 1.2-million gallons per day (mgd) which is sufficient for the additional flow that would be collected from the Little Pond Sewer Service Area. This upgrade will provide the improvements needed to current and future operations for the new discharge permit.

6.2.3 Construction of the New Treated-Water Recharge Site

A new treated-water recharge site is recommended at Site 7, which is north of the West Falmouth Harbor watershed, as illustrated on Figure 2-2. The eastern portion of the site is planned specifically for development to provide up to 0.26 mgd of capacity for the flow that would come from the Little Pond Sewer Service Area as outlined in a Technical Memorandum included in Appendix 4-32. The proposed facility at the east end of the site is illustrated in Figure 4-12.

6.2.4 Ocean Outfall

The WQMC will continue to investigate the long-term option of discharge of treated effluent through an ocean outfall. As described more fully in Chapter 3, Section 3.9, tertiary treatment of wastewater produces an effluent with very low nitrogen, and the flow volume is quite small in proportion to the natural discharge of millions of gallons of groundwater to marine waters on a daily basis. An outfall discharge has the advantage of bypassing already-impacted watersheds, estuaries, and coastal ponds where the addition of more nitrogen from a land discharge site has a greater environmental impact.



6.3 Estimated Costs and Financing Plan

6.3.1 Summary of Capital Costs for Wastewater Management Facilities

Capital costs for the wastewater management facilities component of the CWMP as evaluated and discussed in Chapter 4 are summarized below.

Table 6-1 Capital Costs for Recommended Wastewater Facilities

Cost Component	Capital Costs ¹ (\$)
Collection System	\$28,000,000
Recharge Facilities	\$2,000,000
Total Construction Costs	\$30,000,000
Contingency	\$6,000,000
Fiscal, Legal, and Engineering	\$8,000,000
Collection/Recharge Capital Costs	\$44,000,000
WWTF Improvements Capital Costs ²	5,200,000
Total Capital Costs	\$49,000,000

1. Costs rounded to two significant figures, and adjusted for estimated mid-point of construction (which varies for collection, recharge, and WWTF) as identified in Chapter 4 tables, and provides an update to Table 7-1 as presented in the Draft CWMP/DEIR.
2. Costs developed since the July 2012 Draft CWMP/DEIR was prepared, and include design, construction, construction engineering, and contingency.

It is noted that Article 24 of the April 2013 Town Meeting funded \$4.5 million for engineering during design, and \$800,000 for WWTF improvements. Balance of Capital Costs to be voted: \$43,700,000.

6.3.2 Financing Plan

6.3.2.1 Background

The Town of Falmouth is committed to the lengthy process of achieving Total Maximum Daily Load (TMDL) limits in the coastal ponds within the High-Priority Nitrogen Mitigation Area and in West Falmouth Harbor, using a variety of approaches to manage nitrogen inputs. All management alternatives have engineering, permitting, and construction costs. Financing the capital costs of these projects poses a major hurdle to any municipality in current economic times. The ensuing operation and maintenance costs will add further expense to already strained annual budgets.

The Town of Falmouth has comprehensive and varied capital needs involving both critical infrastructure and equipment replacement. These needs underscore the importance of viewing long-term capital financing in a broad, responsible context, and maintaining a healthy financial balance on behalf of the Town's taxpayers. The Town's most recent Capital Improvement Plan (CIP) is attached in Appendix 6-1. In order to fund the capital costs of the various nitrogen management projects identified in this CWMP as well as responsibly addressing the Town's other primary capital responsibilities; Falmouth proposes to use two strategies. The first and fundamental strategy is to consider issuing "new" debt when an "old" debt is paid off. In past decades, Falmouth voters have approved various "debt exclusions" under the provisions of Proposition 2 ½, so called. As that excluded debt is paid off, "new" excluded debt can be issued after a



two-thirds vote of Town Meeting and a majority vote by ballot, this without raising the tax rate. The capital projects funded by the “new” debt would be carefully selected given Falmouth’s comprehensive capital needs.

The illustration of “Estimated Costs and Financing Plans” shown in Table 6-2 simply identifies a financial opportunity. Projects within the CWMP including sewer extension to the Little Pond Sewer Service Area, shellfish aquaculture, permeable reactive barriers, eco-toilets, denitrifying septic systems, stormwater remediation, and other capital investment in nutrient removal will be sequenced as the regulatory, design, construction, voter authority, and fiscal opportunities allow.

The second funding strategy is to use the State Revolving Fund (SRF) loan program for the construction costs of the nitrogen management projects. The SRF loan process has specific eligibility requirements, a fixed annual timetable for deciding awards, a competitive selection procedure to receive an award, and a limit as to how much can be awarded to a given community in any one year. All of these constraints need to be taken into account in planning projects to improve water quality.

The SRF loans are of two types: a zero-percent loan that has significant additional eligibility requirements, or the standard 2-percent loan, an interest rate that is less than most municipalities would have to pay if borrowing on their own. Falmouth will explore the benefits and drawbacks of applying for the zero-percent loan versus the 2-percent loan. It should be stressed that without those loans, it is certain that Falmouth will not be able to finance the necessary construction costs to meet TMDLs in the coastal ponds within the Planning Area of this CWMP. The timing of issuing-new-debt-to-replace-old-debt and the receipt of an SRF loan are key to Falmouth’s capacity to fund the various projects needed to meet the TMDLs.

6.3.2.2 Financial Planning and Key Milestones: 2011 to 2020

Table 6-2 Estimated Costs and Financing Plans lays out the big picture on financing, ballot votes, and the State Revolving Fund process. Although the Table focuses on the events that must take place between 2011 and 2020, Table 6-2 also provides the necessary information for financing improvements for all the coastal ponds within the Planning Area out to the year 2040. Within all of these timeframes, the Town intends to act as quickly as possible, using Adaptive Management, to implement alternatives that have proven capable of reducing nitrogen loads in a consistent and cost-effective manner.

Items 1 through 16 on Table 6-2 list all of the presently-identified critical milestones that must be met in order to design, permit, and construct the first stage of projects to meet the TMDLs in the Planning Area. Item 1 was already voted in 2011: \$2.77 million dollars of excluded debt in Article 17 to fund planning and design of demonstration projects for permeable reactive barriers, inlet widening, eco-toilets, aquaculture, baseline monitoring of water quality, preliminary sewer design, de-nitrifying septic systems, some additional MEP studies, and a Draft CWMP for Oyster Pond watershed.

Item 2 has already been accomplished: submittal of a Draft CWMP/DEIR to MEPA and the Cape Cod Commission in September 2012. The Secretary issued his Certificate on November 14, 2012 and determined that the Draft was “adequate”.

Item 3: The Town issued Requests for Proposals for an engineering firm to complete the CWMP process; and provide preliminary design services and evaluations for the sewer system for Little Pond Lower Watershed, the widening of Bourne’s Pond, and the preparation of the SRF application. The contract was awarded to GHD in November 2012.



Item 4: On April 10, 2013 Town Meeting approved Article 24, \$5.6 million of excluded debt to fund design of a wastewater collection system for the Little Pond Sewer Service Area, widen Bourne's Pond inlet from 50-feet to 90-feet, make improvements to the WWTF, some of which were required by the DEP Settlement, and develop a discharge site for the treated effluent. On May 21st, the voters passed the ballot question.

Item 5 is the subject of this CWMP/FEIR/TWMP, a process that will unfold over the next 12 months: completion of this document, submittal to MEPA/CCC, issuance of the Secretary's final Certificate, and a hearing before the Cape Cod Commission as part of the joint review process. As part of the funding strategy for nutrient management, Falmouth will file a State Revolving Fund (SRF) Project Evaluation Form (PEF) by August 31, 2013, seeking a low-interest loan from the State.

Item 6 is the submittal of the SRF PEF discussed above.

Item 7 is an important part of the current and long-range thinking of how the Town addresses its nitrogen issues, both inside and outside of the Planning Area. There will be an on-going program of Comparative Cost Evaluations of all the nutrient management strategies that the Town can employ. These evaluations will specifically look at the cost per pound of nitrogen removed by various technologies: eco-toilets, permeable reactive barriers, inlet widening, aquaculture, sewers, and any other technologies that may be developed. This evaluation will be an iterative process, folding in new data and information as it becomes available. Conclusions will be based on solid data, gathered as part of the monitoring program.

Items 8 and 9 are planned as four Articles for the 2013 Fall Town Meeting Warrant. They are part of the overall nutrient management project and will be the subject of public meetings during the summer and fall of 2013. In order to qualify for a zero-percent State Revolving Fund loan, Town Meeting must pass a "flow neutral" by-law. Town Meeting will also consider whether homes within the sewered area can be exempted from connecting to the sewer if they install eco-toilets, the so-called 'checkerboarding' concept. Town Meeting must vote a "betterment" percent for capital costs associated with installation of the sewer collection system. This vote will determine what percent of the capital costs will be paid by the property owner directly 'bettered' by the sewer, and what percent will be paid by the taxpayers of the Town. The last Article will ask for authorization to file Special Legislation so that the homeowner's portion of betterment can be tailored to the specific needs of Falmouth's Plan. This legislation would lower the yearly payments of the homeowner.

Item 10: In January 2014, the State will publish the SRF list of projects that it intends to fund in the next funding cycle. The Falmouth projects will be ranked along with all other projects in the State seeking funding assistance. Falmouth will be asking for funding for a 'multi-year' project.

Item 11 focuses on the next 'window of opportunity' for issuing new debt to replace old debt. The 'window' may be used for a variety of needed Town projects. Town Meeting will vote the construction dollars for a 20-year bond for the Little Pond Sewer Service Area and widening of Bourne's Pond Inlet, *contingent on receiving a SRF loan*. Depending on whether the 'flow-neutral bylaw' passes or not, the SRF loan request will be at zero- or 2-percent. A ballot vote is also necessary to approve the bonding as debt exclusion. The tax rate will remain stable.

Item 12 focuses on the Town's need to pass Chapter 312, Acts of 2008, Section 10 as part of the plan to receive SRF loans. This vote will be on the April 2014 Warrant along with the construction bonding request.

TABLE 6-2

Estimated Costs and Financing Plans

Item	Action Item	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1	\$2.77M for Design and Demonstration Projects; Ballot Vote	X									
2	Draft CWMP/DEIR Submittal		X								
3	Execute Contract, selected engineering firm		X								
4	\$5.6M Construction Design, Ballot Vote			X							
5	Final CWMP/FEIR/TWMP; Sec Certif; CCC Hearing										
6	SRF PEF Application Submittal			X							
7	Comparative Cost Evaluations										
8	Flow Neutral Bylaw; Checkerboarding Article			X							
9	Twn Mtg Sets Betterment %; Special Legislation			X							
10	Obtain Listing on the SRF Intend Use Plan				X						
11	\$90M Town Vote 30 year Bond for Construction Contingent on 0% or 2% SRF loan; Ballot Vote				X						
12	Town Meeting vote to accept CH 312, Acts of 2008, Sec. 10				X						
13	SRF Full Application Submitted - all required items must be in place					X					
14	Detailed Design for Bid Documents										
15	State SRF Commitment; Bid Approval Little Pond						X				
16	SRF-Funded Construct'n Projects; Adaptive Mgmt										
Program Funding and Timetable 2020 - 2040											
	Evaluate Results of Remediation to Date:										
	Plan Next Construction Projects										
	\$60M Town Vote - Spring 2025										
	Town Construction of \$60M (2025-2030)										
	\$40M Town Vote - Spring 2030										
	Town Construction of \$40M (2030-2035)										
	\$100M SRF Town Vote - Spring 2035										
	Town Construction of SRF \$100M (2035-2040)										

Notes CWMP = Comprehensive Wastewater Management Plan
 DEIR = Draft Environmental Impact Review
 TWMP = Targetted Watershed Management Plan
 SRF = State Revolving Fund
 PEF = Project Evaluation Form



Item 13 - 15: By October 15, 2014 a full SRF [Item 13] application will be submitted with all required items in place. Detailed design and bid documents will be in progress [Item 14] with submittals to the State as progress reports. In January 2015, [Item 15] the State will decide to commit funds and issue an Approval to Bid for construction of the Little Pond Sewer Service Area and associated upgrades at the WWTF.

Item 16: Construction will begin July 2015, first on the Little Pond sewer extension project for an estimated two years, and subsequently on the Bourne's Pond Inlet Widening when the permitting for that project is complete.

6.3.2.3 Financial Planning and Key Milestones: 2020 to 2040

By 2020, construction of the projects chosen to manage nitrogen in some of the coastal ponds of the Planning Area should be completed. Falmouth will then evaluate the results of the various projects constructed so far, decide on priorities for the next project, and prepare design and seek SRF funding if it exists. Construction would start in 2025. The same process would continue with funding opportunities in 2030 and 2035. The success of the projects constructed during the decade from 2011 to 2020 will help to determine the best course of action to take in subsequent years until the nitrogen management issues of all of Falmouth's coastal ponds have been addressed.

6.4 CWMP Project Completion and Implementation Timing

6.4.1 Background

The information provided in Table 6-3 is a more detailed accounting of the many projects that will take place during the decade from 2011 to 2020. The 'start' and 'finish' dates are best estimates, not exact dates—of the mini-steps needed to complete each task or project. The Water Quality Management Committee (WQMC) and the Falmouth Board of Selectmen will make their best efforts to meet this timetable, but there is always the potential for unforeseen delays or missing information. The timetable for some projects is also dependent on timely feedback from agencies and regulators. This timetable will be used as a tool to track progress on the various water quality management initiatives underway in Falmouth.

6.4.2 Process of Approving the CWMP/EIR/TWMP (Items 1 through 8)

The Town submitted a DCWMP/DEIR to EOEEA in September of 2012. A Certificate from the Secretary of Environmental Affairs was issued on November 14, 2012. The Town responded to comments and has revised the document accordingly.

The process will continue as outlined in Table 6-3, items 4 through 8.

6.4.3 Nitrogen Control Bylaw for Fertilizer (Items 9 through 13)

In July 2012, the WQMC began working with their technical consultant from Science Wares, Inc. to draft a Fertilizer Bylaw. This bylaw was developed through a process that included multiple meetings with stakeholder groups (landscapers, environmentalists, golf course superintendents) as well as coordination with the State's Department of Agricultural Resources. This bylaw was adopted at Fall 2012 Town Meeting.

Subsequent to the adoption of this bylaw, the lawn care lobby launched a campaign to defeat its acceptance by the state Attorney General's Office (AGO). The AGO rejected Falmouth's bylaw on May 15,



2013. The Town's legislative delegates filed corrective legislation that recently passed enabling the Town's Nitrogen Control Bylaw to remain in effect.

6.4.4 Baseline Monitoring Plan for Water Quality (Items 14 through 19)

Article 17 of the spring 2011 Annual Town Meeting (Article 17) provided funding to review existing data and conduct additional baseline monitoring as needed. Data on the environmental health of Falmouth's south coast estuaries has been collected subsequent to the dataset used for the MEP Reports for West Falmouth Harbor (2004), Little Pond (2004), as well as Great, Green, and Bourne Pond (2003) up to 2011.

Falmouth has contracted with SMAST to provide this historic baseline data and provide a Technical Report. This report will evaluate the data, present and discuss data analysis, identify data gaps, assess trends, discuss implications of the different water quality parameters, and gauge the present state of each estuary relative to the MEP nitrogen thresholds analysis. Where relevant, the baseline and trends related to TMDL compliance will be discussed.

In addition, Falmouth has developed a Scope of Work in conjunction with SMAST and the Falmouth Conservation Commission for Little Pond as part of the Shellfish Demonstration Project. This monitoring includes both bi-weekly sampling analysis of: temperature, total nitrogen (nitrate + nitrite, ammonia, dissolved organic nitrogen, particulate organic nitrogen), chlorophyll-a, pheophytin-a, orthophosphate, salinity, dissolved oxygen, transparency (Secchi depth), and other parameters as specified in the in the Quality Assurance Project Plan (QAPP) developed for the MEP reports, as well as hourly monitoring of dissolved oxygen (DO), turbidity, chlorophyll a (via fluorescence) temperature and pH, for a two-month period using in-situ data collection instrumentation.

SMAST has been continuing baseline monitoring of Bourne Pond, Great Pond, and Green Pond in 2012 and beyond through PondWatch. In addition, a Scope of Work and Implementation Plan for monitoring at Bourne Pond, Great Pond, and Green Pond that is tailored to the implementation of demonstration projects will be developed.

MassDEP has indicated that three years of monitoring will be required to assist in the determination of a nitrogen-reduction credit for each demonstration project. In addition, Adaptive Management decisions will be made based on monitoring results. For each of the demonstration projects, the Town will be tracking the data carefully, and evaluating the monitoring results as soon as they become available. For example, the Town will begin looking at Little Pond in November 2013, when the data from the monitoring for the Shellfish Demonstration Project has been collected. It is expected that after the three years of monitoring, MassDEP will be able to formalize nitrogen-removal credits for each alternative.

6.4.5 Sewer Extension to the Lower Watershed of Little Pond (Items 20 through 36)

Article 17 provided funding for preliminary sewer design and engineering. The contract with GHD Inc. for Engineering Services and Inlet Widening was finalized on October 1, 2012. Preliminary Design for the sewer extension to the lower watershed of Little Pond was completed on December 30, 2012.

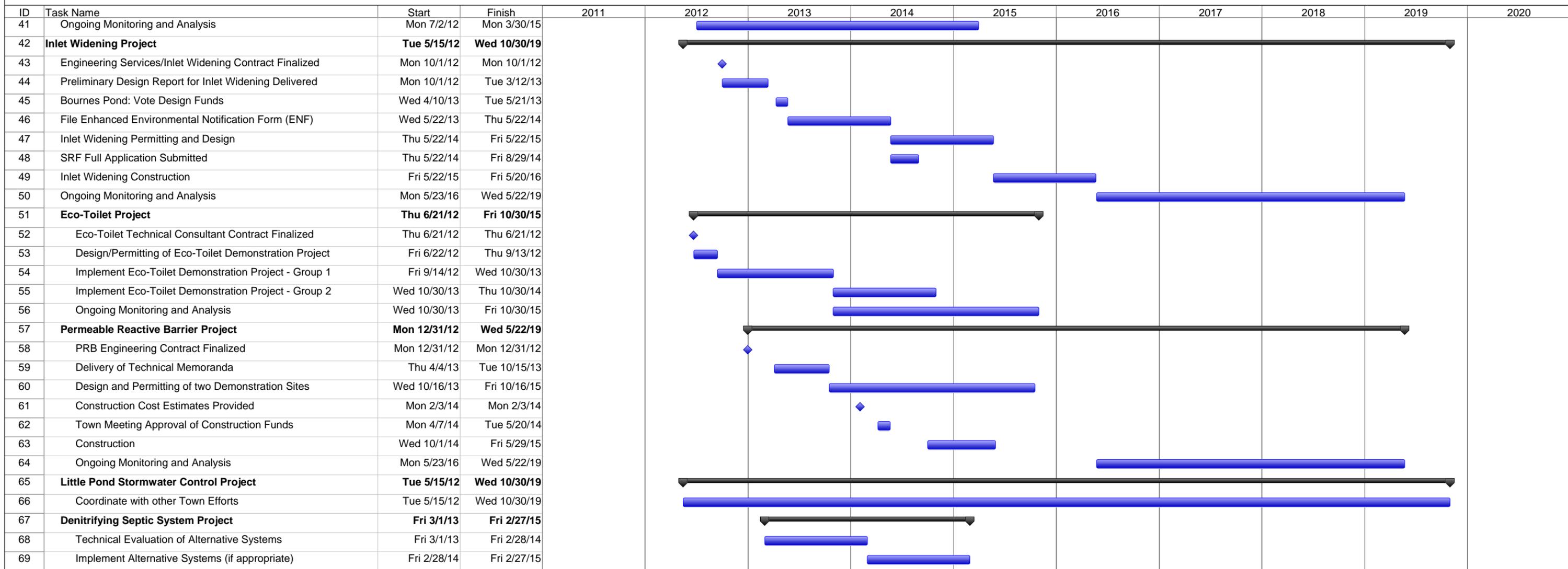
At Spring 2013 Town Meeting, funds for detailed design of the Little Pond Sewer Service Area were unanimously approved. The May 21, 2013 ballot vote also passed. Design of that sewer extension will proceed to allow the design documents to be submitted for SRF review by the October 2014 timeframe.

**TABLE 6-3
PROJECT COMPLETION AND IMPLEMENTATION TIMETABLE**

ID	Task Name	Start	Finish	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1	Process of Approving the CWMP/EIR/TWMP	Wed 8/15/12	Tue 7/22/14		[Timeline bar from 2012 to 2014]								
2	Town Submits DCWMP/DEIR/TWMP to EOEEA	Wed 8/15/12	Wed 11/7/12		[Task bar]								
3	EOEEA Issues Certificate and Comments	Wed 11/7/12	Wed 11/7/12		◆								
4	WQMC sends Final CWMP to Selectmen	Wed 11/7/12	Tue 7/16/13		[Task bar]								
5	Selectmen Approve Final CWMP	Fri 7/19/13	Mon 9/30/13			[Task bar]							
6	Submit Final CWMP to EOEEA	Tue 10/1/13	Mon 10/7/13			[Task bar]							
7	Secretary Issues Certificate	Tue 10/8/13	Fri 3/21/14			[Task bar]							
8	Cape Cod Commission Hearing Process	Mon 3/24/14	Tue 7/22/14				[Task bar]						
9	Nitrogen Control Bylaw for Fertilizer	Thu 7/19/12	Mon 4/7/14		[Timeline bar from 2012 to 2014]								
10	Develop and Vote Fertilizer Bylaw	Thu 7/19/12	Tue 11/13/12		[Task bar]								
11	Attorney General Rejects Bylaw	Wed 5/15/13	Wed 5/15/13			◆							
12	Corrective Legislation Implemented	Wed 7/17/13	Wed 7/17/13			◆							
13	Town Votes Revised Bylaw - NOT USED	Mon 4/7/14	Mon 4/7/14				◆						
14	Baseline Monitoring Plan for Water Quality	Thu 10/4/12	Mon 12/31/18		[Timeline bar from 2012 to 2018]								
15	Contract SMAST for Baseline Data/Analysis (up to 2011)	Thu 10/4/12	Fri 8/30/13		[Task bar]								
16	Scope of Work/Implement Little Pond Monitoring	Thu 10/4/12	Fri 3/28/14		[Task bar]								
17	Scope of Work/Implement Bourne Pond Monitoring	Thu 1/2/14	Fri 10/31/14				[Task bar]						
18	Scope of Work/Implement Great and Green Pond Monitoring	Fri 1/2/15	Fri 10/30/15					[Task bar]					
19	Ongoing Evaluation of Monitoring Results	Fri 11/1/13	Mon 12/31/18					[Task bar from 2013 to 2018]					
20	Sewer Extension to the Lower Watershed of Little Pond	Mon 10/1/12	Wed 10/30/19		[Timeline bar from 2012 to 2019]								
21	Engineering Services Contract Finalized	Mon 10/1/12	Mon 10/1/12		◆								
22	Preliminary Design Report for LLP Sewer Delivered	Mon 10/1/12	Fri 12/28/12		[Task bar]								
23	Little Pond Sewer: Vote Design Funds	Wed 4/10/13	Tue 5/21/13			[Task bar]							
24	Little Pond Sewer System Design	Wed 5/22/13	Thu 5/22/14			[Task bar]							
25	File SRF Project Evaluation Form	Mon 9/2/13	Mon 9/2/13			◆							
26	Develop and Vote Flow Neutral Bylaw	Wed 5/22/13	Thu 11/7/13			[Task bar]							
27	Develop and Vote Betterment	Wed 5/22/13	Thu 11/7/13			[Task bar]							
28	Develop and Vote Special Legislation for Betterment	Wed 5/22/13	Thu 11/7/13			[Task bar]							
29	File Special Legislation for Betterment	Fri 11/8/13	Fri 11/7/14				[Task bar]						
30	Develop and Vote "Checkerboarding"	Wed 5/22/13	Thu 11/7/13			[Task bar]							
31	Vote Construction of Little Pond Sewer	Mon 4/7/14	Wed 5/21/14				[Task bar]						
32	SRF Full Application Submitted	Thu 5/22/14	Fri 8/29/14				[Task bar]						
33	Detailed Design for Bid Documents	Thu 5/22/14	Tue 6/30/15				[Task bar]						
34	State SRF Commitment: Bid Approval for Little Pond	Thu 1/15/15	Thu 1/15/15					◆					
35	SRF Construction Project of Little Pond Sewer	Wed 7/1/15	Fri 6/30/17					[Task bar from 2015 to 2017]					
36	Ongoing Monitoring and Analysis	Mon 5/2/16	Wed 10/30/19						[Task bar from 2016 to 2019]				
37	Shellfish Aquaculture Demonstration Project	Mon 7/2/12	Mon 3/30/15		[Timeline bar from 2012 to 2015]								
38	Shellfish Consulting Contract Finalized	Fri 10/5/12	Fri 10/5/12		◆								
39	Design/Permitting of Shellfish Demo Project	Fri 10/5/12	Fri 5/10/13		[Task bar]								
40	Implementation of Shellfish Demo Project - Year 1	Wed 5/22/13	Wed 10/30/13			[Task bar]							

Project: Draft Schedule 6-4-2012 with u Date: Wed 7/24/13	Task		Rolled Up Progress		Inactive Task		Manual Summary Rollup		Deadline	
	Milestone	◆	Split		Inactive Milestone	◇	Manual Summary			
	Summary		External Tasks		Inactive Summary		Start-only			
	Rolled Up Task		Project Summary		Manual Task		Finish-only			
	Rolled Up Milestone	◇	Group By Summary		Duration-only		Progress			

**TABLE 6-3
PROJECT COMPLETION AND IMPLEMENTATION TIMETABLE**



Project: Draft Schedule 6-4-2012 with u Date: Wed 7/24/13	Task	[Blue bar]	Rolled Up Progress	[Thick black bar]	Inactive Task	[White bar]	Manual Summary Rollup	[Blue bar]	Deadline	↓
	Milestone	◆	Split	[Dotted blue bar]	Inactive Milestone	◇	Manual Summary	[Thick black bar]		
	Summary	[Thick black bar]	External Tasks	[Grey bar]	Inactive Summary	[White bar]	Start-only	[C-shape]		
	Rolled Up Task	[Blue bar]	Project Summary	[Grey bar]	Manual Task	[Green bar]	Finish-only	[J-shape]		
	Rolled Up Milestone	◇	Group By Summary	[Thick black bar]	Duration-only	[Light blue bar]	Progress	[Thick black bar]		



6.4.6 Shellfish Aquaculture Demonstration Project (Items 37 through 41)

Article 17 provided funding to develop a Shellfish Demonstration Project. The purpose of this project is to determine the effectiveness of oyster aquaculture to attenuate the excessive nitrogen load in Little Pond, one of the Town's most heavily impacted estuaries. Through a water-quality monitoring program, combined with assessments of nitrogen uptake into oyster growth, an estimate will be made of the nitrogen reduction attributable to oyster aquaculture. MassDEP has indicated that three years of monitoring will be required to assist in the determination of a nitrogen reduction credit for oyster aquaculture. Once established, these credits could be used to implement oyster aquaculture projects to meet nitrogen TMDL thresholds for both Little Pond and other degraded estuaries.

Woods Hole Group (WHG) was hired as a consultant to the Shellfish Demonstration Project. WHG has prepared Technical Memoranda (TM) including presenting the results of the shellfish viability test that was conducted in the summer of 2012, presenting the results of a Standing Stock Assessment of Little Pond, and providing planning estimates of the nitrogen uptake of various shellfish species. WHG also provided a TM outlining project specifications and cost estimates.

All permits will be obtained prior to implementation of the three-year Shellfish Demonstration Project. A total of 2.5 million oysters will be grown in two batches (early and late) during the summer of 2013. This project is currently underway, with the first batch of seed oyster installed in the Town upweller on June 3, 2013. These seed will be grown, tested, and relayed to Little Pond in late June 2013. The second batch of seed will be tested, grown in an upweller, and relayed to Little Pond by late July 2013.

A Monitoring Plan for the first year has been developed that has been reviewed by MassDEP, which has no objections. In addition, the Falmouth Conservation Commission reviewed this plan as part of the Notice of Intent hearing, and formalized its approval within their Order of Conditions (MassDEP Permit #25-3915). See Appendix 3-1.

6.4.7 Inlet Widening Project (Items 42 through 50)

Article 17 provided funding to investigate inlet widening at Bournes and/or Little Pond. A contract with GHD Inc. for Engineering Services and Inlet Widening was finalized on October 1, 2012.

GHD has completed a Technical Memorandum (BP-TM-1) which presents preliminary design evaluations for an enlarged inlet and new bridge over Bournes Pond, as well as an analysis of the nitrogen removal benefits of a larger inlet as determined by water-quality modeling. GHD is assisted by Applied Coastal Research and Engineering (ACRE) who is providing hydrodynamic and water-quality modeling to determine the optimized size of the proposed new inlet and identify the nitrogen removal benefits of a larger opening; and BETA Group Inc. who provided preliminary design information on the proposed new bridge and roadway changes.

Design and permitting costs of a widening of Bournes Pond inlet is estimated to be \$700,000, of which \$400,000 will be paid from Article 17. Spring 2013 Annual Town Meeting unanimously approved funding the balance (\$300,000). Ballot approval was on May 21, 2013.

The following tasks have been completed:

- Evaluation of alternative designs for a new Bournes Pond inlet opening and bridge.
- Cost development for the preferred alternative, which is an opening with a new bridge with a 90-foot opening as opposed to the current 50-foot opening.



- Hydrodynamic and water quality modeling to estimate the effective nitrogen removal of the new inlet.
- Cost comparison with traditional wastewater management to remove the same amount of nitrogen.
- Conclusion that this non-traditional nitrogen management method is very cost effective. Inlet opening is less than half of the cost of sewer extension and wastewater treatment to remove the same amount of nitrogen.

The next steps of this project include:

- Coordination with a broader group of stakeholders.
- Development and review of the needed documents to gain MEPA and local approvals.
- Development and review of additional needed local, State and Federal permits.
- Project implementation.
- Monitoring of water quality changes attributable to the new opening.

6.4.8 Eco-Toilet Project (Items 51 through 56)

Article 17 provided funding to investigate the use of composting and urine-diverting toilets (eco-toilets) and denitrifying septic systems in order to determine the cost and feasibility of their installation and operation, their public acceptability, and the level of nitrogen removal achievable. The Falmouth Board of Selectmen have authorized \$80,000 to provide incentives for an initial set of up to 15 eco-toilet installations (Demonstration Group I), and the Town has signed a Memorandum of Agreement with the Barnstable Department of Health and Environment (BCDHE) to establish the pre-installation nitrogen concentration of the septic tank effluent, and perform monthly monitoring of the septic tank effluent that results after an eco-toilet has been installed. Falmouth has also contracted with Science Wares, Inc. as a technical consultant to assist in the design and implementation of an eco-toilet demonstration program.

A significant barrier to implementation was identified. Urine-diverting fixtures, source separators and other pilot-stage urine-diverting toilet technologies do not currently have a Product Acceptance number from the State Board of Plumbers and Gas Fitters, and are therefore illegal to install in the State. Science Wares worked with the local plumbing inspector, State plumbing board, and BCDHE to obtain a variance for Test Site Status for up to 40 test sites to enable urine-diverting fixtures to be installed. This has paved the way for significantly more installations than would have been feasible with composting toilets alone.

The first phase of this program (Demonstration Group I) is well underway. Approximately 15 property owners have committed to replace all of the standard toilets in their home with eco-toilets and allow two years of monitoring. Board of Health and building permits have been granted for three standard composting-toilet installations, with more to be approved by the end of June. In addition, approximately six urine-diverting installations are in the design and permitting stage. All installations are expected to be complete by December 2013, with monthly monitoring by BCDHE to commence concurrently. MassDEP has suggested that data from a total of 62 installations will be necessary to establish regulatory credit for the nitrogen removal capacity of eco-toilets. The Town is actively identifying additional participants to meet this regulatory requirement.



6.4.9 Permeable Reactive Barrier Project (Items 57 through 64)

Article 17 provided funding to develop a demonstration project for Permeable Reactive Barriers (PRBs). On December 31, 2012, CDM Smith was hired to design and permit PRBs in up to two locations, one in the West Falmouth Harbor watershed and the other in the High Priority Mitigation Area in East Falmouth.

CDM Smith has completed two Technical Memoranda (TMs) and has presented their findings to the WQMC working group, State and local regulatory agencies, and at a public meeting of the WQMC. These TMs include the evaluation criteria and preliminary site selection for the PRB pilot project. Subsequent TMs will address details of permitting, surface and groundwater monitoring, and final site selection and design.

6.4.10 Little Pond Stormwater Control Project (Items 65 through 66)

Falmouth's Engineering Department is responsible for implementing the Phase II requirements for the Town's NPDES permit and has been moving forward with compliance. Efforts within the Little Pond watershed include updating outfall maps for the Little Pond watershed to identify all of the stormwater runoff into Little Pond, a public education campaign, and street cleaning.

Preliminary evaluations have begun to determine appropriate Best Management Practices (BMP) for this watershed, such as bio-retention. This evaluation process is being informed by EPA's Green Infrastructure objectives and other current research results such as University of New Hampshire Stormwater Center (UNHSC) project to optimize nitrogen removal from stormwater treatment systems. The Town, through its Engineering Department, other appropriate departments and boards, as well as technical consultants, will pursue feasible BMP solutions as part of the sewer construction for this watershed.

In addition, the Falmouth Conservation Commission is revising their Stormwater Regulations. Nitrogen-reduction BMP requirements will be part of this update. Data on the nitrogen loading from the outfall at Narragansett Street within the Little Pond watershed will be collected as part of the Shellfish Demonstration Project.

6.4.11 Denitrifying Septic System Project (Items 67 through 69)

Article 17 provided funding to investigate the use of composting and urine-diverting toilets (eco-toilets) and denitrifying septic systems. The WQMC is working closely with Barnstable County Department of Health and Environment (BCDHE) to evaluate technologies that are promising based on published studies, and results from the BCDHE database of Innovative/Alternative (I/A) septic systems. In addition, BCDHE is planning to implement a pilot project for a passive, non-proprietary denitrification system. The findings of this project as well as the technical evaluations will guide future efforts to implement I/A systems.

6.5 Embayment Monitoring

The overriding need to provide improved wastewater and nitrogen management is to remediate the current nitrogen loading to coastal estuaries as identified by the nitrogen TMDLs. MassDEP will require embayment monitoring, which may include monitoring of water quality, eel grass coverage, and benthic infauna habitat, to verify that the wastewater and nitrogen management efforts are effective. These monitoring programs are developed as part of the Discharge Permit Application Process which occurs after approval of the FCWMP/FEIR.



Discussions with MassDEP have recognized the following key items about such a program:

- The ultimate goal is to restore the marine habitat to the levels that are the basis of the TMDLs.
- The attainment of the threshold nitrogen concentrations at the estuary sentinel stations are an indicator of the condition that habitat can repair itself.
- Some aspects of habitat restoration, such as re-growth of eel grass, may not be possible due to other factors such as past deposition of organic solids, on-going boat traffic, etc.
- The embayment monitoring will be a long-term effort and will need to be a team effort between the communities within the embayment watersheds and MassDEP.
- MassDEP plans to continue its eel grass survey program which provides aerial surveys every five years.

The embayment monitoring program is expected to be subject to MassDEP review. The following are an indication of possible monitoring requirements based on requirements in another Cape Cod town:

- Five sample events per summer season (two in July, two in August, and one in September), at one to three sample locations per estuary, for the following parameters:
 - Particulate Organic Nitrogen (PON)
 - Dissolved Organic Nitrogen (DON)
 - Dissolved Inorganic Nitrogen (DIN)
 - Dissolved Oxygen (DO)
 - Chlorophyll-a
 - Secchi Depth
 - Salinity
 - Total Suspended Solids (TSS)
- Benthic infauna survey of the estuaries conducted approximately at a five-year frequency.

This is the embayment monitoring that is expected for TMDL compliance. It is possible that more detailed water quality monitoring could be required to demonstrate the feasibility of one or more demonstration projects. These monitoring programs will be reviewed as part of the demonstration project independently of this CWMP/FEIR/TWMP.

6.6 Groundwater Monitoring

A Groundwater Monitoring program will also be developed as part of the Groundwater Discharge Permit Process. The Blacksmith Shop Road Site has an extensive groundwater monitoring system. Additional groundwater monitoring will be placed at new facilities at Site 7 and an appropriate monitoring plan will be established at that time. This plan may include evaluating Contaminants of Emerging Concern.



6.7 Crocker Pond Monitoring

Historic monitoring data for Crocker Pond were evaluated as discussed in Chapter 4 and detailed in Appendix 4-33. The following baseline water quality monitoring is recommended for Crocker Pond for the conventional nutrient-related and aquatic habitat parameters.

Table 6-4 Baseline Monitoring for Crocker Pond

Parameter	Rationale	Sampling Protocol
Water Temperature and Dissolve Oxygen (DO) Profile	Aquatic habitat, evidence of DO depletion	Sample at 1-meter intervals at deepest point in pond (June, July, and August)
Nearshore (littoral zone) habitat plant community, algal abundance, sediment types	Establish baseline, consider whether recreational access is impaired	Single survey, July
Trophic state parameters: total P, total N, chlorophyll-a, Secchi disk transparency	Baseline productivity level, extend data set (last sampling in 2007)	Two depths: surface and deep water (7 meters). Sample in August for consistency with existing data
Current recreational access points and protected lands	Document how resource is currently used	Field observations and mapping

Water quality monitoring as part of the Cape Cod Commission Ponds and Lakes (PALs) program is also recommended.

6.8 Adaptive Management Plan

This CWMP and its implementation as illustrated in Tables 6-2 and 6-3 is designed for Adaptive Management. As the demonstration projects are implemented and demonstrate nitrogen removal performance and costs, they will be evaluated for more extensive use. If they prove to be feasible to be used for TMDL compliance, the CWMP will be modified for their inclusion.

A standard set of evaluation criteria will be used to compare all wastewater and nitrogen management methods (traditional and non-traditional) on a “level playing field.” The WQMC conducted a workshop on April 7, 2012 to consider expanding/modifying the criteria to be used during Adaptive Management evaluations from the criteria used as part of the Alternatives Screening Analysis. The criteria were grouped for several themes as summarized in the following Table 6-5.



Table 6-5 Evaluation Criteria Summary from WQMC Workshop in April 2012

Evaluation Criteria Theme	Previous Criteria Used	Proposed Criteria for Adaptive Management Evaluations
Social	<ul style="list-style-type: none"> • Anticipated public acceptance • Potential land requirements 	<ul style="list-style-type: none"> • Achieves multiple benefits including public health, jobs, tourism, economy, ecology • Open to alternatives • Public acceptability including perception of impacts to property value • Voter acceptability • Level of disruption to individual properties • Institutionally viable (planning, engineering & finance)
Environmental	<ul style="list-style-type: none"> • Effluent quality to protect aquatic ecosystems • Potential for air emissions (odor and noise) 	<ul style="list-style-type: none"> • Protect ecological value: restoration of water quality and habitat in ponds and estuaries • “Robustness” for meeting standards: attention to nitrogen, phosphorus, emerging constituents, carbon and other alterations and stressors • Avoid externalization • Work up from the estuary biological metrics for a health aquatic environment • Energy efficiency - life cycle energy use
Economic	<ul style="list-style-type: none"> • Capital cost • Operating costs 	<ul style="list-style-type: none"> • Capital and operating costs • Cost per pound of nitrogen removed • Advance the low-hanging fruit • Affordability within available tax limits • Indirect costs and benefits (e.g. job creation) • Total property owner cost • Capacity to pay taxes • Amenability to types of financing (e.g. betterment) • Ease of distributing costs
Ease of Implementation	<ul style="list-style-type: none"> • Ease of implementation • Ease of operation and maintenance 	<ul style="list-style-type: none"> • Don’t be constrained by current regulations
Resource Use	<ul style="list-style-type: none"> • Energy use 	<ul style="list-style-type: none"> • Maximize resource recovery and minimize non-renewable resource use (water, nutrients, energy)



Evaluation Criteria Theme	Previous Criteria Used	Proposed Criteria for Adaptive Management Evaluations
Ease of Regulatory Approvals	<ul style="list-style-type: none"> Meeting regulatory requirements 	<ul style="list-style-type: none"> Compliance with regulations and TMDL as a floor Measure compliance at the sentinel level not by percentage of properties sewered Necessary regulatory changes identified for each alternative
Resilience/Adaptability	<ul style="list-style-type: none"> Flexibility 	<ul style="list-style-type: none"> Resilience to climate change/aging population Able to manage uncertainty (modular, spaced) Flexible to growth

It is noted that the Cape Cod Commission DRI review process that will follow the FEIR review process typically requires the development of a separate Adaptive Management Plan. These criteria will be refined as part of that development process. The financing and implementation plans presented earlier in this Chapter will form the basis of that plan.

6.9 Considerations on Town Plans for TMDL Compliance at West Falmouth Harbor

The Modified Groundwater Discharge Permit (attached in Appendix 1-5) requires that the CWMP include a plan and schedule for bringing water quality in West Falmouth Harbor into compliance with the West Falmouth TMDL and Surface Water Quality Standards by December 2, 2016 or as soon thereafter as possible.

Water quality modeling by S Mast as contracted by Buzzards Bay Coalition and completed in February 2007 (described in Chapter 7, section 7.6.3) found that approximately 0.5 mgd (at 3 mg/L total nitrogen) could be recharged at the WWTF and still meet the nitrogen TMDL even if no sewer extension is made to portions of the watershed west of Route 28. Subsequent to this evaluation, the WWTF effluent discharge permit (Appendix 1-5) was approved to allow a recharge up to 0.57 mgd at 3 mg/L total nitrogen. The Town plans to limit the recharge to the watershed as allowed by the discharge permit with the goal of not discharging more than 0.5 mgd to the watershed on an average annual basis.

The Town plans to proceed with a PRB in West Falmouth Harbor Watershed as part of the PRB Demonstration Project as identified in Chapter 3. This is expected to provide further nitrogen mitigation.

The Town also envisions the use of expanded aquaculture in West Falmouth Harbor as a holding area (with further nitrogen uptake) for the oysters raised in Little Pond as part of the current demonstration project.

The Town plans to meet the TMDL water quality standards in West Falmouth Harbor as soon as possible and will work with MassDEP and Buzzards Bay Coalition to meet that goal.

6.10 Mitigation of Potential Construction Impacts

Even though this Plan is developed to address the serious environmental impact of septic tank effluent causing eutrophication in the estuaries, possible environmental impacts could occur during construction of



new wastewater management facilities. Chapter 8 describes the proposed mitigation measures during construction to minimize any environmental impacts of this plan.