

CHAPTER 7

RECOMMENDED PLAN

7.1 SUMMARY OF 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 these watersheds. The 20-year period is 2015 to 2035, which is the estimated time period for implementation of sewer extensions to the Phase 1 and 2 Areas. The non-wastewater nitrogen management solutions are also recommended for implementation during this 20-year period with the goal of hastening the return of improved water quality and minimizing the additional sewerage needed beyond the Phase 1 and 2 Areas.

Approximately half way through the 20-year period (approximately 2025), adaptive management evaluations will be reviewed with a second CWMP to meet the nitrogen TMDLs in the next 20-year period of 2035 to 2055.

The recommended plan (Alternative Scenario 3B) allows for reuse of the treated water and includes the major components discussed below:

A. Phased Construction of a New WWTF at the MMR Otis AFB Site. This component includes construction of a modern, expandable WWTF to meet the reuse-water quality standards of 3 mg/L total nitrogen (TN) and 3 mg/L total organic carbon (TOC). This WWTF would include the following technologies and strategies:

1. WWTF headworks for wastewater pretreatment (screenings and grit removal).
2. Membrane bioreactor (MBR) in a Bardenpho configuration with the following process components:
 - anaerobic zone for biological phosphorus removal

- pre-anoxic zone for first stage biological nitrogen removal
 - aerobic zone for nitrification and organic carbon removal
 - post-anoxic zone for second stage biological nitrogen removal (to less than 3 mg/L)
 - membrane separation tank with re-aeration
3. Granular activated carbon (GAC) contactors to adsorb remaining soluble organic carbon components to meet the reuse standard of 3 mg/L TOC or less.
 4. Disinfection.

This construction project would utilize a modular approach to allow expansion to proceed in multiple phases and with the flexibility to add equipment, such as membrane modules, as needed to meet flow requirements.

The proposed wastewater treatment plant site layout is illustrated in Figure 4-10.

The WWTF will be sized to treat approximately 1.8 million gallons per day mgd on an annual average with a maximum month average of 3.3 mgd at the design year of 2035.

Space will be reserved for additional treatment process expansion to accommodate wastewater flows from the Phase 3 Area (area north of the Phase 1 and 2 areas in Falmouth needed to meet the nitrogen TMDLs) and possible flows from Mashpee, Sandwich, Bourne, and increased land use at the MMR resulting from redevelopment of that State facility. Also, space will be reserved in case reverse osmosis technology needs to be added to the facility based on performance testing.

B. Phased Construction of the Wastewater Collection System. The wastewater collection system for the Phase 1 and 2 areas has been planned to allow a collection system for each major peninsular area (Areas A through F as illustrated on Figure 4-1).

It is envisioned that the collection system would be implemented from the west and proceed to the east. Phase 1 implementation includes Sewer Service Areas A and B as illustrated on Figure

4-1 and is planned for 2015 to 2025. (Implementation of portions of Sewer Area B that are outside of the Little pond watershed may not be implemented until after 2025 because areas outside coastal pond watersheds do not contribute nitrogen load to a coastal pond and are therefore not the highest nitrogen management priority.) Phase 2 implementation includes Sewer Service Areas C, D, E, and F as illustrated on Figure 4-1 and is planned for 2025 to 2035. The West Falmouth Planned Sewer Extension Area and Scranton Avenue Planned Sewer Area illustrated in Figure 4-1 will also be implemented during Phase 1 implementation.

C. Phased Construction of Treated Water Recharge Facilities. These facilities include the following components and backup contingencies:

1. Pump station at the MMR WWTF site with water conditioning after disinfection processes.
2. Treated-water force main to the recharge/reuse locations.
3. A series of recharge wells located along Route 151 in the Town-owned right-of-way (ROW). Each well location would have an underground valve vault and small (approximately 6' x 6') building for the local control panel and operation and maintenance storage.
4. Sand infiltration beds for conventional treated water infiltration as a backup infiltration facility and as needed when the WWTF is being started up. The existing sand infiltration beds currently used by the Otis AFB WWTF are envisioned for this use (pending approval by the MMR). If the MMR infiltration site is ultimately not available, new infiltration beds could be constructed at the Falmouth County club site to provide backup recharge capacity.

Treated water recharge wells along the Route 151 corridor will allow the water to be recharged across the Planning Area (from which the wastewater originated) and to allow flexible water resource management in the future. This method of treated water recharge is used by the Air Force at the MMR facility and it has proven to be feasible and cost effective.

These facilities are illustrated on Figure 4-12.

Discussions are needed with MassDEP on the implementation of this type of recharge system with the treated water expected from the new WWTF described earlier. As described in Chapter 4, MassDEP recently (early 2009) developed a 1 mg/L TOC limit for treated waters recharged in this manner because the water does not have the benefit of treatment in the unsaturated zone. The regulations allow some modifications to the limits for special circumstances. The Town plans to enter into discussions with MassDEP during the review of this DEIR due to the special circumstances of this large scale surface-water and groundwater remediation project.

D. Non-Wastewater Management Components.

1. **Stormwater Management.** After septic system discharges, stormwater (water flowing off of impervious surfaces) is estimated to be the second largest source of nitrogen to the estuaries. The best way to manage this water is direct it to vegetated and wetland areas where the nitrogen can be biologically utilized and/or converted to nitrogen gas before the water reaches the estuaries. There is much public information on this general type of best management practice, and the public, local boards and review agencies should continue to implement these practices as part of normal maintenance, repair, and new construction activities. The Town roads maintenance group and engineering division have an ongoing program to implement these best management practices. In recent years, funding for these projects has been cut. Funding for this program needs to be increased to remediate current direct stormwater discharges to the estuaries, as well as upgrade and maintain all road drainage recharges to the groundwater system.

2. **Fertilizer Management.** The Town of Falmouth, with the assistance of the Falmouth Association Concerned with Estuaries and Salt Ponds (FACES) and the Falmouth Ashumet Plume Committee, has been a leader in developing public outreach and education materials for proper fertilizer management. It is suggested that the Town utilize this work and support county/regional efforts of fertilizer management through the County Department of Health and the Environment and/or County Cooperative Extension to extend this effort county-wide. It is widely recognized that this type of educational program needs to be applied county-wide because the need extends across Town borders. Communications with Andrew Gottlieb of the Cape Cod Water Protection Collaborative, George Heufelder of the Health and Environment Department, and William Clark of the County Cooperative Extension regarding the establishment of a county-wide fertilizer management program are ongoing.

3. **Pond Inlet Widening to Improve Tidal Flushing.** Evaluations indicate that widening the inlets to Little Pond and Bournes Pond can increase tidal flushing, and thereby reduce the amount of wastewater nitrogen removal (sewering) needed in the watershed. (It is noted that the MEP concluded that inlet widening would not improve tidal flushing or improve water quality for any of the other estuaries in the Planning Area.) These techniques can also result in a more immediate water-quality improvement than sewerage. However, they require additional water quality modeling and impact evaluation to determine that properties bordering these ponds will not be adversely impacted by increased tidal ranges. These studies are relatively inexpensive and should proceed as part of an adaptive management approach to improve water quality in the short term and reduce the total future sewerage area.

4. **Watershed Modifications for Increased Nitrogen Attenuation.** Evaluations indicate that modifications to watershed components and wetlands, such as abandoned cranberry bogs, can naturally remove nitrogen before the groundwater reaches the estuaries. Several meetings with the Coonamessett River Restoration Committee have been used to integrate these nitrogen management goals into the broader goals of the committee. Recommendations have been discussed for this watershed and are proceeding as allowed by funding opportunities. Also, discussions with the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) indicate that they are incorporating these goals into their work with active cranberry bogs in Falmouth.

7.2 ESTIMATED COSTS AND FINANCING PLANS

The Town's DPW staff and Town Manager have conducted preliminary evaluations of mechanisms for financing implementation of the Recommended Plan. Preliminary alternative scenarios were presented to the Board of Selectmen in FY 09 to outline the financial options and to develop a multi-year capital plan. These discussions are continuing based on the costs and phasing presented for the Recommended Plan.

The Town plans to utilize the State's SRF (State Revolving Fund) to gain low interest loans to implement these facilities. The program typically provides 2 percent loans and will provide 0 percent loans (as allowed by the 2009 Environmental Bond Act) to municipalities that meet

specific criteria. The Town plans to apply for a 0 percent loan and has taken the necessary steps to be eligible for the funds.

This recommended plan is a large capital investment in the Town’s infrastructure and will be carefully implemented to initiate the nitrogen mitigation to meet the nitrogen TMDLs while minimizing costs and impacts. Phase 1 and 2 will be implemented in the 20-year planning period of this plan (2015 to 2035). Phase 3 nitrogen mitigation will be implemented in the 20 years that follow, 2035 to 2055.

The estimated costs for the Phase 1 and 2 wastewater facilities are summarized in the following Table 7-1.

TABLE 7-1
**PHASE 1 AND 2 COST SUMMARY FOR THE
RECOMMENDED WASTEWATER FACILITIES**

COMPONENT	CAPITAL COST ⁽¹⁾ (\$ MILLIONS)
Construction	
Collection System ⁽²⁾	210
WWTF	51
Recharge Facility	8
Total Construction	270
Contingency	67
Fiscal Legal and Engineering	67
Total Wastewater Capital Costs	400

Notes:

- (1) All costs are rounded to two significant digits and are referenced to a benchmark date of July 2009.
- (2) The costs do not include the cost of house connections from the house to the sewer in the road right-of-way. These costs have been observed to range from \$2,000 to \$5,000 for the recent sewer connections at the New Silver Beach project.

The average cost per household for both annual user charges and capital costs has not been calculated yet due to ongoing capital improvement planning (CIP) and ongoing discussions on the percentages of the project that will be carried by the Town’s general fund (property taxes) and the percentage that will be carried by property betterments. For the New Silver Beach

Wastewater Project, the Town utilized a 30% /70% cost sharing of capital costs between the Town property tax rate (30%) and betterment charges (70%) for properties being sewerred.

If the Town decides to assess betterments it will need to develop a methodology for cost sharing among residential, commercial and industrial properties in the sewer service area (i.e. establishment of an equivalent sewer unit based, for example, on flow.

The estimated cost for a house to connect to the sewer in the road right-of-way would depend upon distance from home to street, existing plumbing and septic system layout, and other factors. In the New Silver Beach area sewer connection costs have generally ranged from \$2,000 to \$5,000.

The costs to meet the nitrogen TMDLs in the Phase 3 time period of 2035 to 2055 will depend on the success of the Phase 1 and 2 implementation, as well as the implementation of non-wastewater nitrogen management recommendations. If the TMDLs need to be met solely with sewerding, advanced treatment, and treated water recharge along Route 151, then the following additional costs for the Phase 3 implementation are indicated.

TABLE 7-2

PHASE 3 ADDITIONAL COSTS FOR WASTEWATER FACILITIES

COMPONENT	CAPITAL COST ⁽¹⁾ (\$ MILLIONS)
Construction	
Collection System	110
WWTF	19
Recharge Facility	2
Total Construction	130
Contingency	33
Fiscal Legal and Engineering	33
Total Costs	200

Notes:

(1) These costs are in addition to the Phase 1 and 2 costs and are referenced to a benchmark date of July 2009.

Capital costs have also been estimated for the non-wastewater recommendations that would proceed as part of an adaptive management strategy. These costs are summarized below.

TABLE 7-3

PHASE 1 AND 2 ESTIMATED COSTS FOR NON-WASTEWATER RECOMMENDATIONS

COMPONENT	CAPITAL COST (\$ MILLIONS)
Stormwater Improvements	
Coastal Drainage Operating Budget	3 ⁽¹⁾
NPDES Operating Budget	1.5 ⁽²⁾
Fertilizer Management	N/A ⁽³⁾
Pond Inlet Widening	
Modelling and Environmental Impact Evaluation for Conceptual Design	0.025
Potential Costs for New Culverts and Bridge	7
Total	\$12

Notes:

- (1) Based on \$150,000/year appropriation for 20 years for the Coastal Drainage operating budget.
- (2) Based on \$75,000/year appropriation for 20 years to the NPDES operating budget.
- (3) It is assumed that fertilizer management will be implemented at the County level.

7.3 PLANNED IMPLEMENTATION TIMING

The completion of the CWMP will require agreement between the Town of Falmouth and the MMR to site the new WWTF at the proposed location. These discussions are proceeding. Pending successful discussions with the MMR, the following CWMP completion milestones are indicated:

- December 21, 2009 to February 19, 2010: MEPA Review of Draft CWMP/DEIR (This time period provides for a 2 week review extension)
- April, 2010 to June, 2010: MEPA review of Final CWMP/DEIR
- June 2010 to September 2010: Cape Cod Commission Review
- August 16, 2010: SRF submittal of low interest loan application

With the successful application and listing on the SRF intended Use Plan, the following implementation steps are indicated for Phase 1 and 2 Areas as illustrated on Figure 4-12.

A. Phase 1 Implementation.

- 2011 to 2025: Implementation of MMR WWTF and recharge system, and implementation of the collection system for:
 - Area A
 - West Falmouth Harbor Area
 - Scranton Avenue Area
 - Area B

B. Phase 2 Implementation.

- 2025 to 2035: Implementation of expansion of the WWTF and recharge facilities, and expansion of the collection system to
 - Area C
 - Area D
 - Area E
 - Area F

This Phase 1 and Phase 2 schedule is designed to have the new WWTF operational in 2015, and all sewer areas connected by 2035. Portions of the collection system could be accelerated as Town funding allows.

Area A has large commercial establishments that may want to connect more quickly. This area could be designed to connect to the existing collection system and then switched to a new WWTF at the MMR once that plant is operational.

The Town should keep the implementation schedule as flexible as possible to take advantage of other projects (water main replacement, paving, private redevelopment, etc.) that may save construction costs and avoid duplicate construction impacts.

7.4 EMBAYMENT MONITORING

The overriding need to extend sewers 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 sewer extension and nitrogen remediation efforts are effective. These monitoring programs are developed as part of the Discharge Permit Application Process which occurs after approval of the FCWMP/FEIR. Budgetary costs for this monitoring are included in the cost summaries for the recommended plan.

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 5 years.

The embayment monitoring program is expected to include the following requirements based on a program being developed for Chatham as part of their discharge permit:

- 5 sample events per summer season (2 in July, 2 in August, and 1 in September), at 1 to 3 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 5 year frequency.

7.5 GROUNDWATER MONITORING

A Groundwater Monitoring program will also be developed as part of the Groundwater Discharge Permit Process and budgetary costs for this monitoring have been included in the cost summaries. There are many monitoring wells in the planning area that will be used to avoid duplication of efforts and save costs.

7.6 ADAPTIVE MANAGEMENT PLAN

It is understood that ongoing and proposed environmental monitoring activities may observe environmental changes (hopefully for the better, but possibly to the worse) and that mid-course corrections to the plan's implementation may be needed. This understanding of possible mid-course correction is called "Adaptive Management." The following text summarizes the major components of the Adaptive Management Plan which is the approach to monitor implementation and the results of implementation, and make modifications as needed. It is understood that this plan will be updated as time proceeds.

1. **Implementation of the CWMP.** The CWMP will be implemented as indicated in the recommended plan portion of this Chapter. The Phase 1 and 2 wastewater facilities will be implemented over a 20-year period (approximately 2015 to 2035) and the Phase 3 wastewater facilities will be implemented in the following 20 years (approximately 2035 to 2055).

2. **Documentation of Capital Expenditures.** The primary CWMP compliance tool used by MassDEP will be verifying that the Town has applied to the SRF program for low interest loans. MassDEP's support of the SRF applications will be needed to facilitate implementation.

3. **Compliance with the Groundwater Discharge Permit.** The design for the Wastewater Management Facilities will be accompanied by a MassDEP discharge permit application. MassDEP will review the application information and develop a draft discharge

permit for public review. Once the permit is finalized, the Town will need to comply with the various treatment, sampling, and reporting requirements specified in the permit. Compliance with the groundwater discharge permit will be a major component of the CWMP compliance and progress toward meeting the TMDLs.

4. **Performance Testing of Treatment and Recharge Technologies.** Some of the technologies proposed for the treatment and recharge facilities are new approaches for municipal wastewater treatment in Massachusetts. They have been used very successfully for other water treatment applications. Performance testing of the first 2 recharge wells is planned to closely monitor the performance of this technology with the water that is being produced by the treatment process. This technology requires very clean water to avoid plugging of the soils at the point of recharge. It also requires a compatible chemistry of the recharged water to avoid soil plugging. If plugging occurs with the product water of the new WWTF, modification to the treatment process and water conditioning system will be made in an adaptive management manner.

5. **Reporting on Groundwater Elevation and Groundwater Quality Monitoring in the Vicinity of the Recharge.** This monitoring and reporting will be part of the Groundwater Discharge Permit requirements, and the Discharge Permit will identify the monitoring plan as discussed previously.

6. **Reporting on Estuarine Water Quality Monitoring.** Similar to groundwater monitoring, estuarine water quality monitoring will be completed in accordance with the monitoring program developed as part of the groundwater discharge permit as discussed previously.

7. **Pond Water Quality Monitoring and Reporting.** As identified in the Needs Assessment, the Town does not have much freshwater pond water quality data that could help guide decisions on wastewater infrastructure implementation. A freshwater pond monitoring program is typically established by volunteers as supported by the Town and analytical services supported by the CCC and SMAST. The Town should encourage the formation of freshwater pond monitoring groups to collect these samples and work with CCC and SMAST to analyze the samples. As the data becomes available, possible changes to wastewater implementation will be considered as part of Adaptive Management.

8. **Reporting on Habitat Assessments.** Assessments will be needed periodically to monitor the changes to the estuarine habitat. Typically they are required by MassDEP and CCC at a 5-year frequency and will be detailed in the groundwater discharge permit as discussed previously.

9. **Continued Coordination with the Neighboring Towns and MMR.** Falmouth will continue to coordinate with the neighboring Towns and MMR to implement components of this plan to meet the TMDLs.

10. **Periodic Watershed Assessments and Other Evaluations.** Watershed assessments will be completed periodically (every 5 to 10 years) to tabulate water consumption, estimated septic system discharges, WWTF recharge and treatment performance, and nitrogen loadings from the non-wastewater sources to summarize changes of nitrogen loads to the estuaries over time. These nitrogen loading summaries will be compared to the water quality monitoring trends to investigate possible correlations between water quality and nitrogen loading. Other evaluations of nitrogen and/or phosphorus loading will be completed as needed.

11. **Possible Changes to this Plan as Part of Adaptive Management.** This plan is still being developed. Changes will occur as the Town moves forward with its wastewater implementation program. The WWTF Discharge Permit needs to be renewed every 5 years (by regulatory statute) and will provide a formal opportunity for permitted change. The Cape Cod Commission (CCC) approval process typically builds upon this plan. The Town looks forward to working with the key stakeholders to utilize this adaptive management tool.

7.7 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 the wastewater management system. The following chapter describes the proposed mitigation measures during construction to minimize any environmental impacts of this plan.