

Chapter 2

Evaluation of Alternative Plans

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EVALUATION OF ALTERNATIVE PLANS

2.1 INTRODUCTION

Alternative wastewater management plans were selected for detailed evaluation for several areas of human health and environmental health need. The following chapter sections summarize evaluations of these plans. Prioritization and implementation considerations of the recommended plans are discussed in Chapter 3.

2.2 SUMMARY OF DRINKING WATER SUPPLY PLAN TO MEET TOWN-WIDE HUMAN HEALTH NEED

As discussed in the Interim Needs Assessment and Alternatives Screening Analysis Report, the drinking water sampling program and nitrogen analysis has indicated the following findings about the individual water supplies in Eastham for nitrate concentrations:

- The number of households with nitrate levels above 5 mg/L has increased over time.
- The number of households with nitrate levels less than 2 mg/L has declined over this same period.
- Also, the number of households above 10 mg/L has increased.

Drinking water standards have not been set for all of the potential contaminants in wastewater especially the “emerging contaminants of concern” such as personal care products, pharmaceuticals, and endocrine disruptors. Analysis of these contaminants is very expensive; therefore, the nitrate analysis is used as an indicator that these other contaminants may be present at the affected private water supplies.

Several alternatives were identified to meet the human health threat of these contaminants including:

- Development of a municipal water supply system from a protected water source.
- Individual home treatment of private water supplies with a reverse osmosis (or other type) device.
- Purchase of bottled water.

Evaluations in the Interim Needs Assessment and Alternatives Screening Analysis Report determined that individual home treatment of a private water supply and/or purchase of bottled water were not feasible long-term solutions for the human health need. The development of a municipal water supply system from a protected water source was identified as the best solution for the Town. Continuation of the ongoing Water Supply Plan was recommended.

As discussed in the Interim Needs Assessment and Alternatives Screening Analysis Report, average capital costs of \$12,000 per household were estimated for public water supply based on the total construction cost of \$73 million (based on 2006 dollars) divided by 6,000 (the total number of parcels to be served). The total construction costs were developed as part of the Municipal Water Distribution System Master Plan by Environmental Partners Group and presented at the October 2007 Special Town Meeting. The average capital cost of \$12,000 per household does not include betterment, bonding, and other costs also discussed at the Town Meeting. This average cost is expected to increase to approximately \$13,000 per property in 2009 due to inflationary trends.

More site specific costs will be evaluated by Environmental Partners Group as they proceed with the Drinking Water Supply Plans.

2.3 EVALUATION OF ALTERNATIVE WASTEWATER MANAGEMENT PLANS TO MEET THE ENVIRONMENTAL HEALTH NEED

As discussed in the Interim Needs Assessment and Alternatives Screening Analysis Report, state and regional regulatory agencies are setting nutrient limits for marine and fresh water bodies to address eutrophication of these waters. Wastewater is the largest source of nitrogen and phosphorus that impact the marine and fresh water bodies.

Scientific studies (described in detail in the Interim Needs Assessment and Alternatives Screening Analysis Report) have found that large percentages of the wastewater flow currently being discharged through the existing septic systems needs better treatment to meet the nutrient

limits. Wastewater (and the associated nutrients) needs better treatment in the watersheds to the following waterbodies:

- Nauset-Town Cove Estuary
- Rock Harbor Estuary
- The Town's main freshwater ponds

The plans identified in the Interim Needs Assessment and Alternatives Screening Analysis Report are evaluated in the chapter sections that follow.

A. Preliminary Evaluation of Alternative Wastewater Management Plans for the Nauset-Town Cove Estuary Watershed. Three alternative management plans have been developed to address the environmental health need of this estuary and its watershed. These plans are described below with preliminary evaluations of feasibility and capital cost on a per household basis.

1. **Nauset-Town Cove Estuary Watershed Plan 1.** This plan includes the following components:

- Sewer extension to a portion of the properties in the watershed.
- Construction of a new community/municipal wastewater treatment facility outside the watershed for treatment and discharge.

This plan is feasible to meet the nutrient limits depending on the availability of an acceptable treatment and recharge site; and this plan could be part of a long-term management and remediation plan for Nauset-Town Cove Estuary. Typical capital costs for this type of plan are \$50,000 per property (2007 costs) based on the community/municipal system recently constructed for the New Silver Beach area of Falmouth.

2. **Nauset-Town Cove Estuary Watershed Plan 2.** This plan includes the following components:

- Sewer extension to a portion of the properties in the watershed.
- Connection of this sewer system to the Orleans Wastewater Treatment Facility proposed to be constructed at the Tri-Town Facility site.

This plan is feasible depending on the ability to enter into an agreement with the Town of Orleans. The Town of Orleans is completing the Cape Cod Water Protection Collaborative funded study on regional wastewater management solutions for the area. The necessary inter-municipal agreements, cost sharing mechanisms, and overall coordination are not known at this time. It is noted that the Draft CWMP developed for Orleans also has an estimated capital cost of \$50,000 per household based on a total capital cost of \$148.2 million (2008 costs) to serve 3,100 equivalent users.

This plan is expected to have a similar cost.

3. **Nauset-Town Cove Estuary Watershed Plan 3.** This plan includes the following components:

- Individual on-site systems approved by MassDEP for nitrogen removal.
- Support by an expanded Town Health Department to enforce operation, maintenance and discharge compliance which would be completed by the individual property owners.

A typical cost for this plan is \$30,000 per household based on the May 2007 Barnstable County Department of Health and the Environment (BCDHE) report entitled, *Projected Use of Innovative/Alternative On-Site Sewage Treatment Systems in Eastham, Under Current Regulations and Policies*. This report provides a range of costs from \$20,000 to \$40,000 and indicates that an individual system cost will depend on many variable site constraints. This cost represents a typical cost for an I/A system which is expected to achieve an effluent wastewater nitrogen concentration of 19 mg/L. I/A systems that need to achieve greater removal are expected to have greater costs.

As shown in Table 2-1, I/As must be able to reach an average effluent nitrogen concentration of 10 mg/L to reach the wastewater loading goal based on the projected nitrogen limits and existing wastewater flows. When buildout projections are considered to estimate future flows, the I/As must then be able to produce an even lower effluent nitrogen concentration of 5 mg/L to reach the wastewater loading goal. The studies performed by the BCDHE indicate that I/As cannot consistently meet these levels of performance.

Table 2-2 summarizes documented effluent nitrogen concentrations of the I/A systems based on the BCDHE report entitled, *Performance of Innovative Alternative Onsite Septic Systems for the Removal of Nitrogen in Barnstable County, Massachusetts 1999-2007*. The technologies currently approved for piloting use have not been included since they are limited in the number that can be applied; however these newer technologies will have similar advantages and disadvantages as those summarized in Table 2-2. Table 2-3 summarizes the performance of installed I/A systems in Eastham. The BCHE report on I/A systems, and Tables 2-2 and 2-3 indicate that these technologies do not demonstrate an ability to consistently meet these stringent standards at this time. There is some potential for a couple of systems, but the best performance that they have achieved does not demonstrate long-term compliance. Also it is noted that these systems are typically designed with a focus on removing organic solids, suspended solids, and nitrogen. Most do not remove phosphorus (without added process tanks), and they are not easily upgraded for future treatment requirements that may occur, especially when sites are of limited size. Foreseeable future requirements may include:

- More stringent nitrogen TMDLs (i.e. higher level of nitrogen removal).
- Phosphorus TMDLs for the watersheds to ponds and lakes.
- Virus removal.
- Removal of pharmaceutical products (endocrine disruptors) that persist after traditional treatment in septic systems and in many wastewater treatment facilities.

I/A selection would also be up to the discretion of the homeowner to choose the appropriate MassDEP approved technology. A primary consideration with individual I/A systems is the maintenance requirement and cost. Improper maintenance, significant down times due to seasonal use, and owner inexperience all contribute to questionable performance and possible system failures. Seasonality of property and septic system use affects the performance of the biological processes that the I/As require to reach specified effluent levels.

Individual on-site systems approved by MassDEP for nitrogen removal would need to be supported by an expanded Town Health Department to enforce operation, maintenance, and discharge compliance which would be completed by the property owner.

While some uncertainty exists on the final nitrogen limits of the Nauset Estuary, it is clear that I/A system installations will not be able to reliably meet the currently proposed limits, and this alternative plan is believed to be infeasible.

4. **Summary of Finding of the Preliminary Evaluation of Alternative Plans for the Nauset-Town Cove Estuary Watershed.** Plans No. 1 and 2 are believed to be feasible if the treatment and recharge sites are available. Plan No. 3 is believed to be infeasible due to the past performance of the I/A technologies. More site specific cost evaluations will be completed on sewer extension in this watershed with treatment and recharge at either the potential Roach Property WWTF (Plan 1) or the proposed Orleans WWTF (Plan 2). These more site specific cost evaluations will be completed with similar plans for the Rock Harbor Watershed in Chapter Section 2.3D.

B. Preliminary Evaluation of Alternative Wastewater Management Plans for the Rock Harbor Watershed. Three alternative wastewater management plans were developed in the Interim Needs Assessment and Alternatives Screening Analysis Report to address the environmental health need of this estuary and its watershed. These plans are described below with preliminary evaluations of feasibility and capital costs expressed on a per household basis.

1. **Rock Harbor Estuary Watershed Plan 1.** This plan includes the following components:
 - Sewer extension to a portion of the properties in the watershed.
 - Construction of a new community/municipal wastewater treatment facility outside the watershed for treatment and recharge.

These components would be the same as previously discussed in the Nauset-Town Cove Watershed Plan 1 at a similar typical cost.

2. **Rock Harbor Estuary Watershed Plan 2.** This plan includes the following components:
 - Sewer extension to a portion of the properties in the watershed.
 - Connection of this sewer system to the Orleans Wastewater Treatment Facility proposed to be constructed at the Tri-Town Facility site.

These components would be the same as previously discussed in the Nauset-Town Cove Estuary Watershed Plan 2 at a similar typical cost.

3. **Rock Harbor Estuary Watershed Plan 3.** This plan would be further evaluation of ideas introduced by Brian Howes of MEP for possible aeration and dredging management of Rock Harbor. This type of management may be possible for Rock Harbor because it is not a natural estuary; it is a tidal creek that is continually dredged to maintain a boat basin. The feasibility of this plan is unknown and would require additional evaluation possibly as a MassDEP pilot study. This plan should be pursued with MassDEP to determine its acceptability. If it is determined to be infeasible, this area will need sewer extension and advanced treatment as identified for Plan No. 1 and 2.

4. **Summary of Finding of the Preliminary Evaluation of Alternative Plans for the Rock Harbor Watershed.** Plan No. 3 needs input from MassDEP regarding the suitability of the nitrogen limit as well as the acceptability of alternative dredging or aeration as a possible long-term solution. Plans No. 1 and 2 are believed to be feasible if the treatment and recharge sites are available. More site specific costs will be evaluated on sewer extensions to this watershed with treatment and recharge at either the potential Roach Property WWTF (Plan 1) or the proposed Orleans WWTF (Plan 2). These more site specific cost evaluations will be completed with similar plans for the Nauset-Town Cove Estuary Watershed in Chapter Section 2.3D.

C. Evaluation of Alternative Wastewater Management Plans for the Freshwater Pond System Watershed. Three alternative management plans have been identified to address the environmental health needs of the ponds and their watersheds. These plans are described below:

1. **Freshwater Pond System Watershed Plan 1.** This plan includes the following components:

- Sewer extension to the properties in the watershed.
- Construction of a new community/municipal wastewater treatment facility outside the watershed for treatment and discharge.

These components would be the same as previously discussed in the Nauset-Town Cove Estuary Watershed Plan 1 and Rock Harbor Estuary Watershed Plan 1 at a similar typical cost.

2. **Freshwater Pond System Watershed Plan 2.** This plan includes the following components:

- Sewer extension to the properties in the watershed.
- Connection of this sewer system to the Orleans Wastewater Treatment Facility proposed to be constructed at the Tri-Town Facility site.

These components would be the same as previously discussed in the Nauset-Town Cove Estuary Watershed Plan 2 and Rock Harbor Estuary Watershed Plan 2 at a similar typical cost.

3. **Freshwater Pond System Watershed Plan 3.** This plan includes periodic treatment of the ponds that exceed phosphorus threshold levels being developed by the Cape Cod Commission. The frequency and costs of these treatments will need to be evaluated on a pond by pond basis, but they are expected to be significantly less than installing sewers and providing advanced wastewater treatment.

There are approximately 605 parcels within the Freshwater Pond System Watershed. Alum treatment of all of the freshwater ponds is estimated to cost approximately \$900,000 based on the costs per acre to treat Stillwater Pond and Lovers Lake in the Town of Chatham. When capital costs are estimated on a cost per household for the properties in this watershed, alum treatment is estimated to be approximately \$1,500 per household. This is significantly less than the typical cost of \$50,000 per household for wastewater treatment.

Comparing the costs of sewerage the watershed with the costs of alum treatment, it becomes clear that alum treatment is the more cost effective way to precipitate (manage) phosphorus at the ponds, even if required on a periodic basis. Although this alternative is not treating the source of the phosphorus, it will restore the environmental health of the freshwater ponds more cost-effectively and more quickly.

4. **Best Management Practices (BMP) for Phosphorus Management.** In addition, the following Best Management Practices for Town-wide application are recommended as part of all of these plans:

- Fertilizer use education to minimize over-fertilization and runoff to the ponds.

- Stormwater management practices on Town and State roadways as well as at individual homes.

D. Site Specific Cost Development for the Alternative Plans Utilizing Wastewater Collection and Advanced Treatment. The preliminary costs developed on a per household basis are discussed above in Sections A through C for the alternative wastewater management plans. More site specific evaluations of these alternative wastewater management plans (with costs referenced to 2009 values) are discussed below.

1. **Nauset-Town Cove Estuary and Rock Harbor Estuary Watersheds Plan 1.** This cost evaluation includes Nauset-Town Cove Estuary Watershed Plan 1 combined with Rock Harbor Estuary Watershed Plan 1. It includes wastewater collection from properties in these two watersheds as indicated on Figure 2-1 as “tentative sewer areas” and treatment and recharge at the proposed Town-owned Roach Property Wastewater Treatment Facility (WWTF) also identified on Figure 2-1. Costs were developed for the following wastewater facility components: collection system, pump stations and force mains to treatment facility, and treatment and recharge. Total capital costs of \$62 million are estimated for this costing option, with annual operation and maintenance (O&M) costs estimated at \$710,000 per year. Table 2-4 summarizes these costs.

2. **Nauset-Town Cove Estuary and Rock Harbor Estuary Watersheds Plan 2.** This cost evaluation includes Nauset-Town Cove Estuary Watershed Plan 2 and Rock Harbor Estuary Watershed Plan 2. This plan includes wastewater collection from properties in this watershed as indicated on Figure 2-2 as “tentative sewer areas” and treatment and recharge at the proposed Orleans WWTF also identified on Figure 2-2. Costs were developed for the following wastewater facility components: collection system, pump stations and force mains to treatment facility, and treatment and recharge. Total capital costs of \$59 million are estimated for this costing option, with annual O&M costs estimated at \$630,000 per year. Table 2-4 summarizes these costs.

3. **Cost Comparison.** Table 2-5 illustrates the cost comparison of these two combined plans (Plan 1 for the Nauset-Town Cove Estuary in combination with Plan 1 for the Rock Harbor Estuary, and Plan 2 for the Nauset-Town Cove Estuary in combination with Plan 2 for the Rock Harbor Estuary). The capital cost for connection to the proposed Orleans WWTF (Plan 2) would be approximately \$59,000 per property. These costs are higher than the \$50,000 per property

costs used in the preliminary costs evaluations (based on observations for the New Silver Beach WWTF in Falmouth and the Orleans CWMP costs) for the following reasons:

- They contain a 30% contingency factor.
- They are referenced to 2009 values while the New Silver Beach costs were referenced to 2006 values, and the Orleans CWMP costs were referenced to 2008 values.
- The distances between the collection areas and the treatment plant sites are different.
- The collection area is more densely developed in the New Silver Beach area of Falmouth than the treatment sewer areas identified for Falmouth.

It is noted that this extent of sewer extension may not be needed for the Rock Harbor Estuary Watershed. The area that needs sewer extension will depend on the outcome of discussions with MassDEP as recommended for the Rock Harbor Estuary Plan No. 3.

The costs for Sewer Extension and Advanced Treatment Plan No. 2 is less than for Plan No. 1 and is recommended for continuing discussions with the Town of Orleans.

E. Comparison of Non-Monetary Factors for the Alternative Plans Utilizing Wastewater Collection and Advanced Treatment. The feasibility and eventual acceptability of an alternative depends not only on cost factors, but also on non-monetary considerations including environmental impacts and effects on Town facilities and neighborhoods. Initial evaluation of non-monetary criteria was identified in the Interim Needs Assessment and Alternatives Screening Analysis Report and is continued below for the alternative plans that utilize wastewater collection and advanced treatment. A more detailed evaluation of environmental impacts will be evaluated during the CWMP process.

1. **System Performance and Operability.** Wastewater treatment systems operate and perform better with larger and more consistent flows. Larger treatment facilities have better trained staff and greater supervision than smaller treatment facilities. Larger facilities also receive more regulatory scrutiny than smaller facilities.

Plan No. 2 would utilize a larger facility that is connected to several year-round uses (schools, year-round residences, etc.) that would make its operation and performance better than Plan No. 1.

2. **Regulatory Requirements.** Chapter 3 of the Interim Needs Assessment and Alternatives Screening Analysis Report outlined Federal, State, and regional regulatory issues including Town of Eastham regulations and bylaws.

Chapter 13 of the Interim Needs Assessment and Alternatives Screening Analysis Report discusses additional non-wastewater nitrogen mitigation alternatives. Fertilizer management, landscape design modifications, and animal waste management are all ways the public can reduce nitrogen contributions to the estuaries. As part of the public education piece of this project, information will be provided to the public on actions the typical resident can take to further environmental responsibility. Stormwater Best Management Practices (BMPs) are also recommended for implementation by the Town to properly direct and treat stormwater prior to direct discharge into estuarine areas. Requirements to keep (treat and infiltrate) stormwater on the private properties where it is generated is another aspect of the public education piece.

As the Town proceeds with their wastewater planning, the Town should begin work on a “growth-neutral” bylaw. This bylaw would limit the possible “uncontrolled” growth that may occur as a result of sewer installation (or water supply line installation). Having a “growth-neutral” bylaw in place is required for any project seeking funding under the Massachusetts Clean Water State Revolving Fund Program. This regulation gives the Commonwealth the authority and responsibilities to select, approve and regulate water pollution abatement projects receiving financial assistance under the State Revolving Fund Program. In 2006, modifications to the regulations were proposed and then promulgated in 2007, integrating smart growth principles into the regulations. Eligible projects include comprehensive wastewater management planning or the design and construction costs associated with implementing planning recommendations for water pollution abatement.

3. **Public Acceptability.** It is always difficult to site a new WWTF. Plan No. 2 is expected to have greater public acceptance because the WWTF is being sited at an existing regionally owned and managed septage treatment facility. It is not a completely new site such as the Roach Property site.

As part of this Wastewater Management Planning Project, a public education program has also commenced to enhance the Town’s planning efforts. The public education program includes the following components:

1. Televised presentations to the Board of Selectmen and Board of Health.
2. Town Meeting presentation.
3. Project Newsletters.
4. Poster production to be used in public spaces and at public workshops.
5. Public presentations and workshops for interested members of the public.

It is anticipated that once the public better understands the human health and environmental health needs the Town of Eastham is facing, public support will be positive. The costs of wastewater remediation are high and even daunting to many Cape Cod residents, but nitrogen loading reductions are necessary and likely enforceable in the near future by regulatory agencies. The cost of doing nothing will inevitably far exceed the costs to the human health and environmental health needs of the residents of Eastham.

F. Estimated Costs if Sewer Extension and Advanced Wastewater Treatment Were Needed Town-Wide. Sewer extensions and wastewater treatment is currently not needed town-wide, but there has been an interest by members of the Eastham public to estimate that cost and compare it to the current cost estimate developed by Environmental Partners Group for a town-wide Water Supply System.

A town-wide wastewater system for Eastham is estimated by averaging the per-property costs for Plans 1 and 2 as shown in Table 2-5 and arriving at an estimated cost of \$60,000 per property (referenced to 2009 values). A capital cost of \$360,000,000 is estimated for the 6,000 properties in Eastham. This cost is similar to the total capital cost estimated for town-wide sewer extension in Chatham.

The town-wide water system was estimated at \$73,000,000 (2006 values) by Environmental Partners Group and presented at the October 2007 Town Meeting. This cost (when scaled to 2009 values) would become approximately \$80,000,000.

The capital cost of a town-wide wastewater system would be approximately 4.5 times the capital cost of a town-wide water supply system.