EXECUTIVE SUMMARY

WASTEWATER MANAGEMENT AND DISPOSAL STUDY
INTERIM NEEDS ASSESSMENT AND ALTERNATIVES SCREENING ANALYSIS REPORT

TOWN OF EASTHAM, MASSACHUSETTS

ES.1 BACKGROUND

The Town of Eastham (Town) is undertaking this Interim Needs Assessment and Alternatives Screening Analysis Report as the first major report (Phase I) of the Town of Eastham Wastewater Management Planning Project. This study will assist the Town in developing a comprehensive strategy for wastewater treatment. This project is also being developed to support the Town's efforts to provide a reliable and safe drinking water supply to its residents and to integrate the on-going municipal drinking water supply planning project into the wastewater management and overall water resource management needs in Eastham.

This Report completes the first step of evaluating the wastewater needs in Eastham and identifying alternative solutions to meet those needs. Because the Town is waiting for the results of the scientific studies on Nauset Harbor / Salt Pond / Mill/Muddy Pond / Town Cove System (Nauset-Town Cove Estuary), Rock Harbor Estuary, and the Town's major ponds, this report is considered interim. We have identified the needs that we expect will emerge from those studies, with the intent to revise recommendations presented in the Report as part of future project phases of work.

A short list of alternative management plans have been evaluated from the full list of available technologies and management concepts. These alternative solutions are accompanied by preliminary capital costs (on a per household basis) to provide an understanding of the magnitude of cost to address the wastewater needs. After review of this report by the Town, the next step will be to complete evaluations of the alternative management plans within a Plan

Evaluation Report, and ultimately to the development of the Comprehensive Wastewater Management Plan (CWMP).

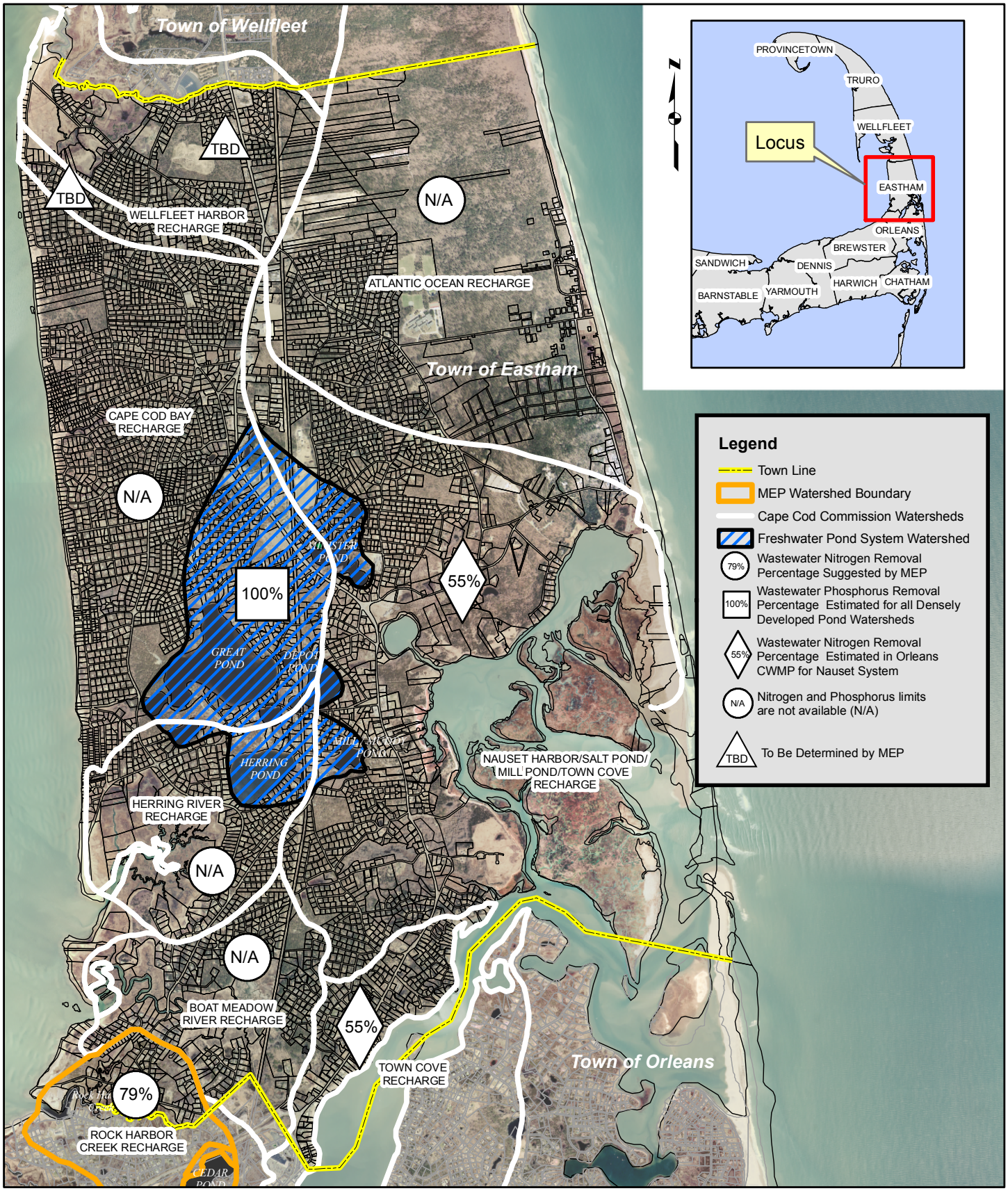
ES.2 WASTEWATER NEEDS ASSESSMENT SUMMARY

Eastham, located on the outer portion of Cape Cod, has a year-round population of approximately 5,450, and is approximately 9,100 acres in size. Approximately 3,000 acres of the Town is part of the Cape Cod National Seashore. There is a large influx of summer residents and vacationers that expand this population during the summer season. The Town is illustrated in Figure ES-1 with many of the features that define its wastewater needs.

Eastham has several areas with dense residential development characterized by small quarter-acre and eighth-acre lots. Route 6, which runs north and south through Eastham, is a major corridor with many hotels, restaurants, and other establishments that support the Town's hospitality business. All of these properties are currently served by individual drinking water supplies and individual wastewater disposal septic systems; there is no municipal drinking water supply system or wastewater collection and treatment system.[1] Based on Town sampling data, there is strong evidence that Eastham's groundwater system is becoming contaminated from the septic systems. Long-term nitrate sampling data has been summarized and was presented during Special Town Meeting on October 1, 2007 indicating a decline in drinking water quality. Evaluations completed by the MEP identify individual on-site septic systems as the largest source of nitrogen and phosphorus to the groundwater. This groundwater contamination has created a serious threat to the drinking water quality of the individual water supplies at each property as well as to the water quality and natural habitat in the freshwater ponds and marine-water estuaries in Eastham. This threat is being evaluated as both a "Human Health Need" and "Environmental Health Need" as summarized below.

<u>Human Health Needs.</u> The Town's Health Department has been analyzing drinking water samples from the individual drinking water supplies at nearly all the properties in Eastham for several years. The analyses have focused on documenting the nitrate concentrations of the private supply wells because nitrogen is an indicator of many septic system contaminants currently not being analyzed in the groundwater (phosphorus, volatile organic compounds, personal care products, pharmaceuticals, endocrine disruptors, viruses, etc.) that may be reaching the private wells and causing a public health threat.

[1] Approximately 20 houses in the southern end of Eastham are served by the Town of Orleans public water supply.



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TOWN OF EASTHAM, MASSACHUSETTS

WATERSHED DELINEATIONS AND ESTIMATED % NUTRIENT REMOVAL

FIGURE ES-1

Location: G:\Jobs\60000\61204 Eastham\Figures\Final Report 3_3_2009\61204ES-1.mxd

Job No.: 61204

Date: 12/08

Nitrate has a State and Federal drinking water limit (maximum contaminant limit or MCL) of 10 mg/L because it may cause serious illness in newborn children. As a result, the Cape Cod Commission has set a groundwater planning limit of 5 mg/L total nitrogen to protect drinking water supplies and other water resources.

The drinking water sampling program and nitrogen analysis has indicated the following findings on 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.

This wastewater and water resource need has been identified in a well documented effort led by the Town to provide a public water supply to all properties in Town. However, efforts to fund a municipal water system have failed at Town meeting. The Town needs to provide a long-term solution to ensure the health of its drinking water supply and residents.

Environmental Health Needs. The groundwater system that supplies the private drinking water systems at individual properties also provides fresh water recharge to ponds and the marine estuaries in and around Eastham. The land area that contributes groundwater recharge to each of these surface water bodies is called its watershed; these watersheds are illustrated on Figure ES-1. Nutrients (nitrogen and phosphorus) in the groundwater system and transported to the ponds and estuaries are impacting the water quality in these surface water bodies. The nutrients act as plant fertilizers and stimulate the production of algae which in time can interfere with fishing, boating, and swimming. The algae then settles to the bottom where it decays and depletes the surrounding water of oxygen. The low dissolved oxygen causes fish kills, creates odors, and contributes to other aesthetic problems. Nitrogen is generally the nutrient that causes an over-

production in marine waters, and phosphorus causes the over-production in fresh waters. Recent scientific evaluations identify wastewater nitrogen and phosphorus from individual septic systems as being the largest source of these two nutrients in all of the Cape Cod watersheds studied.

The Massachusetts Estuaries Project (MEP) is in the process of identifying the marine water nitrogen limits for several coastal estuaries in southeastern Massachusetts. Once the limits are reviewed and approved by USEPA, they will be termed "Total Maximum Daily Loads" (TMDLs) and will be regulatory limits that will be enforced by the State, Federal, and regional regulatory agencies. The draft nitrogen limit has been identified for the Rock Harbor Estuary and it indicates that 79 percent of the existing wastewater nitrogen must be removed from the watershed to meet the regulatory limit. The draft limit for the Nauset Estuary is nearing completion (expected by July 2009) and early findings suggest that 55 percent of the existing wastewater nitrogen will need to be removed to meet the future limit. These removal percentages are illustrated on Figure ES-1 in the affected watersheds.

Eastham also has watersheds that recharge Herring River, Boat Meadow River, the outer portion of Wellfleet Harbor Estuary, and directly (without flowing through an estuary) to Cape Cod Bay and the Atlantic Ocean. Currently, these water bodies do not have nitrogen limits, and due to their location and configuration, do not appear to be very sensitive (with the exception of the Wellfleet Harbor Estuary) to the existing nitrogen impacts. The MEP plans to develop a nitrogen limit for Wellfleet Harbor Estuary in the next two or three years and Figure ES-1 illustrates this area as to be determined (TBD) by MEP. Figure ES-1 illustrates the nitrogen limits for the remaining areas as not available (N/A) and potential removal values are believed to be very low or zero.

In addition, Eastham also has a freshwater watershed (several individual pond watersheds grouped into one area) that recharges through the following freshwater ponds: Great Pond, Depot Pond, Ministers Pond, Herring Pond, and Mill/Muddy Pond. These watersheds have dense residential development that is discharging phosphorus from individual septic systems to the groundwater system and this phosphorus is entering the ponds. Over time a greater flux of phosphorus will enter the ponds and cause increased algal blooms and decreased water quality. The Cape Cod Commission is completing an evaluation on these ponds. The current draft (12/08) evaluations indicate that most of the ponds investigated fail to attain minimum thresholds in the State's surface water regulations, and all of the ponds have average phosphorus

concentrations that exceed the 10 parts per billion threshold for "healthy" ponds as developed by the Cape Cod Commission.

The most common form of pond water quality remediation (for phosphorus) is an alum chemical treatment. The alum chemically precipitates the phosphorus; and while it is effective, it is not permanent, especially if phosphorus continues to feed the ponds. If this environmental need is to be met, 100 percent of the wastewater phosphorus from the watershed would need to be removed as indicated on Figure ES-1.

ES.3 SUMMARY OF THE IDENTIFICATION AND SCREENING OF ALTERNATIVE TECHNOLOGIES AND SOLUTIONS TO MEET THESE HUMAN AND ENVIRONMENTAL HEALTH NEEDS

A comprehensive group of technologies has been identified and screened to find the most practical solutions to be evaluated in detail in the next phase of this project. This identification and screening process includes a description of the technology, summary of its key advantages and disadvantages, comparison to other technologies in its group, and selection of the best one(s) for detailed evaluation. The following list illustrates the many technologies that were investigated in an effort to consider the most feasible options.

A. **Technologies Identified and Screened.**

1. **On-Site Drinking Water and Wastewater Treatment Technologies:**

- Point of use drinking water treatment systems at individual homes.
- Bottled water purchase.

2. **Individual On-Site Wastewater Treatment and Disposal Technologies Including (see Table ES-1 below):**

TABLE ES-1

INDIVIDUAL ON-SITE WASTEWATER TREATMENT AND DISPOSAL TECHNOLOGIES

TECHNOLOGY CATEGORY	TECHNOLOGY SUBCATEGORY	INDIVIDUAL TECHNOLOGY
Individual On-Site Wastewater Treatment and Disposal Technologies	Systems with MassDEP approval for general use but not credited for nitrogen removal	Title 5 septic systems
		JET aerobic systems
		Orenco intermittent sand filter
	Non-discharge systems	Tight tanks
		Waterless Toilets (Composting/Incinerating)
		Urine source separating toilets
	Approved for General Use in Nitrogen-Sensitive Areas	Recirculating sand filters
		RUCK® system
	Approved for Provisional Use in Nitrogen-Sensitive Areas	Bioclere systems
		FAST systems
		Waterloo Biofilter systems
		Amphidrome systems
		AdvanTex systems
		NITREX™ systems
	Approved for Pilot Use in Nitrogen-Sensitive Areas(1)	SeptiTech systems
		Norweco Singulair systems
		RUCK® CFT
		Cromaglass WWT systems
		Omni recirculating sand filter system
		Bio Barrier Membrane Bio-Reactor
		NITREX™-Plus

Notes:
(1) These technologies are identified but not screened due to pilot use approval by MassDEP.

3. **Community/Municipal Drinking Water Supply and Wastewater Treatment Technologies:**

- Municipal drinking water supply system.
- Small (cluster/community) wastewater treatment facilities incorporating biological nitrogen removal.
- Larger community/municipal wastewater treatment technologies.
- Technologies to remove endocrine disruptors.
- Considerations on treatment for phosphorus technologies.
- Disinfection technologies and residuals management.

4. **Collection System Technologies:**

- Gravity sewers and lift stations.
- Pressure sewers with grinder pumps.
- Septic tank effluent sewers.
- Vacuum sewers.

5. **Treated Water Recharge Technologies:**

- Sand infiltration beds.
- Subsurface infiltration.
- Spray irrigation, well injection and wick well technology.
- Ocean outfall and wetland restoration.

6. **Potential Sites for Drinking Water Supply, Wastewater Treatment and Recharge Facilities:**

- Potential sites for public drinking water supply.
- Potential sites for wastewater treatment and treated water recharge facilities.
- Wastewater treatment issues and requirements for treated water recharge at new remote sites.
- Wastewater regionalization.

7. **Flow and Loading Reduction Alternatives:**

- Reduction of household water consumption.
- Wastewater reuse and recycling.
- Reduction of wastewater loadings.
- Pharmaceutical load reduction.
- Waterless toilets.

8. **Additional Non-Wastewater Nitrogen Mitigation Alternatives:**

- Reduction of nitrogen from fertilizers and pet wastes.
- Watershed modifications and constructed wetlands for nitrogen attenuation.
- Stormwater management and treatment.
- Improved flushing.
- Modified zoning.
- Nitrate barrier wall considerations.

After screening these potential technologies and non-wastewater mitigation measures, several alternative management plans were developed for detailed evaluation for the several areas of human health and environmental health need for the next phase of the project. These alternative management plans are summarized below with typical costs on a per household basis.

ES.4 ALTERNATIVE DRINKING WATER AND WASTEWATER MANAGEMENT PLANS SELECTED FOR DETAILED EVAULATION FOR SEVERAL AREAS OF HUMAN HEALTH AND ENVIRONMENTAL HEALTH NEED

A. **Drinking Water Master Plan to Meet the Town-Wide Human Health Need.** This drinking water plan is municipal drinking water supply to meet the Town-wide human health need resulting from decreasing drinking water quality at individual on-site wells as being developed by on-going Town efforts. Average capital costs of $12,000 per household are estimated based on the total construction cost of $73 million (based on 2006 dollars) divided by 6,088 (the total 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. In addition, planning efforts currently include considering long-term agreement to purchase drinking water from the Town of Orleans water system.

B. **Alternative Wastewater Management Plans for the Rock Harbor Watershed.** Three alternative wastewater management plans have been developed to address the environmental health need of this estuary and its watershed. These plans are described below with a preliminary capital cost expressed on a per household basis.

1. **Rock Harbor 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 recharge.

This plan is feasible, depending on the availability of an acceptable treatment and recharge site, and could be part of a long-term management and remediation plan for Rock Harbor. Typical capital costs for this type of plan are $50,000 per property based on the community/municipal system recently constructed for the New Silver Beach area of Falmouth. Total capital costs for that project are approximately $10.7 million (2007 costs) to serve 230 properties.

2. **Rock Harbor 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.

This plan is expected to receive preliminary evaluation as part of the study being completed by the Town of Orleans and funded by the Cape Cod Water Protection Collaborative "Shared Watershed, Shared Responsibilities" Grant Program on regional wastewater management solutions for the area. The costs and necessary inter-municipal coordination are not yet known. 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 to serve 3,100 equivalent users. This plan is expected to have a similar cost.

3. **Rock Harbor 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.

C. **Alternative Wastewater Management Plans for the Nauset-Town Cove Estuary Need.** 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 a preliminary capital cost on a per household basis.

1. **Nauset-Town Cove Estuary 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 Rock Harbor Watershed Plan 1 at a similar typical cost.

2. **Nauset-Town Cove Estuary 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 Rock Harbor Watershed Plan 2 at a similar typical 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 supported by an expanded Town Health Department to enforce operation, maintenance and discharge compliance which would be completed by the property owner. A typical cost for this plan is $30,000 per household based on the report prepared by The

Barnstable County Department of Health and the Environment in May 2007 entitled, *Projected Use of Innovative/Alternative On-Site Sewage Treatment Systems in Eastham, Under Current Regulations and Policies*. This typical cost is between the initial capital homeowner expenditure of approximately $20,000 that must be paid upon installation and the cost ($30,000 - $40,000) of installing an I/A where there are significant site constraints. This 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 which need to achieve greater removal may increase costs.

D. **Alternative Wastewater Management Plans for the Freshwater Pond System Watershed Need.** Two alternative management plans have been determined 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 Rock Harbor Watershed Plan 1 and Nauset-Town Cove Estuary Watershed Plan 1 at a similar typical cost.

2. **Freshwater Pond System Watershed Plan 2.** This plan includes periodic treatment of the ponds that exceed threshold levels being developed by the Cape Cod Commission. The frequency and costs of these treatments is unknown and would need to be evaluated on a pond by pond basis and typically are not expressed on a per household basis.

The above alternative management plans are recommended for further evaluation after review and concurrence by Town staff and public. In addition the following Best Management Practices for Town-wide application are recommended as part of all of the plans:

- Fertilizer use education to minimize over-fertilization.
- Stormwater management practices on Town and State roadways as well as at individual homes.

ES.5 CONCLUSION AND PRIORITIZED AREAS

The alternative management plans identified above are recommended to receive additional detailed evaluation during the development of the Plan Evaluation Report as part of the next phase of the project. In an effort to prioritize areas of need, the Town should focus implementation of the following alternative drinking water and wastewater management plans as follows:

Priority 1 – Human Health Need: Public water supply for all properties in the Town of Eastham from a protected water supply source.

Priority 2 – Environmental Health Need: Wastewater and nitrogen management to meet projected nitrogen limits in the Nauset-Town Cove Estuary.

Priority 3 – Environmental Health Need: Wastewater and nitrogen management to meet projected nitrogen limits in the Rock Harbor Estuary.

Priority 4 – Environmental Health Need: Wastewater and phosphorus management to address water quality problems in the Freshwater Pond System Watershed.

These priorities will be further discussed in the Plan Evaluation Report, which will provide guidance on practical implementation for the Town of Eastham.

A public education program has also commenced to develop greater understanding on the issues, alternative management plans, and potential costs to address the human health and environmental health needs. The public education program includes the following components:

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