

EXECUTIVE SUMMARY

WASTEWATER MANAGEMENT PLANNING PROJECT PLAN EVALUATION REPORT

TOWN OF EASTHAM, MASSACHUSETTS

ES.1 INTRODUCTION

The Town of Eastham is undertaking this Plan Evaluation Report as the second report of the Town of Eastham Wastewater Management Planning Project. This plan is intended to assist the Town in developing a comprehensive strategy for wastewater treatment. The information in this report will also assist 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 in Eastham.

This report builds on the completed Interim Needs Assessment and Alternatives Screening Analysis Report completed in March 2009. That report evaluated the wastewater needs in Eastham and identified alternative solutions to meet those needs. Because the Town is still waiting for the results of several scientific studies on the Nauset-Town Cove Estuary, Rock Harbor Estuary, and the Town's major ponds, that report is considered interim. That interim report identified the needs that we expect will emerge from those studies, with the intent to provide revised recommendations as part of future project phases of work.

The alternative solutions identified in the earlier report have been reviewed by Town Staff, the Board of Selectmen, and the Board of Health, and their input has been incorporated into the evaluations presented in this report along with a recommended plan for wastewater management in Eastham.

ES.2 WASTEWATER NEEDS ASSESSMENT SUMMARY

The wastewater needs were evaluated and grouped into two main groups as summarized below:

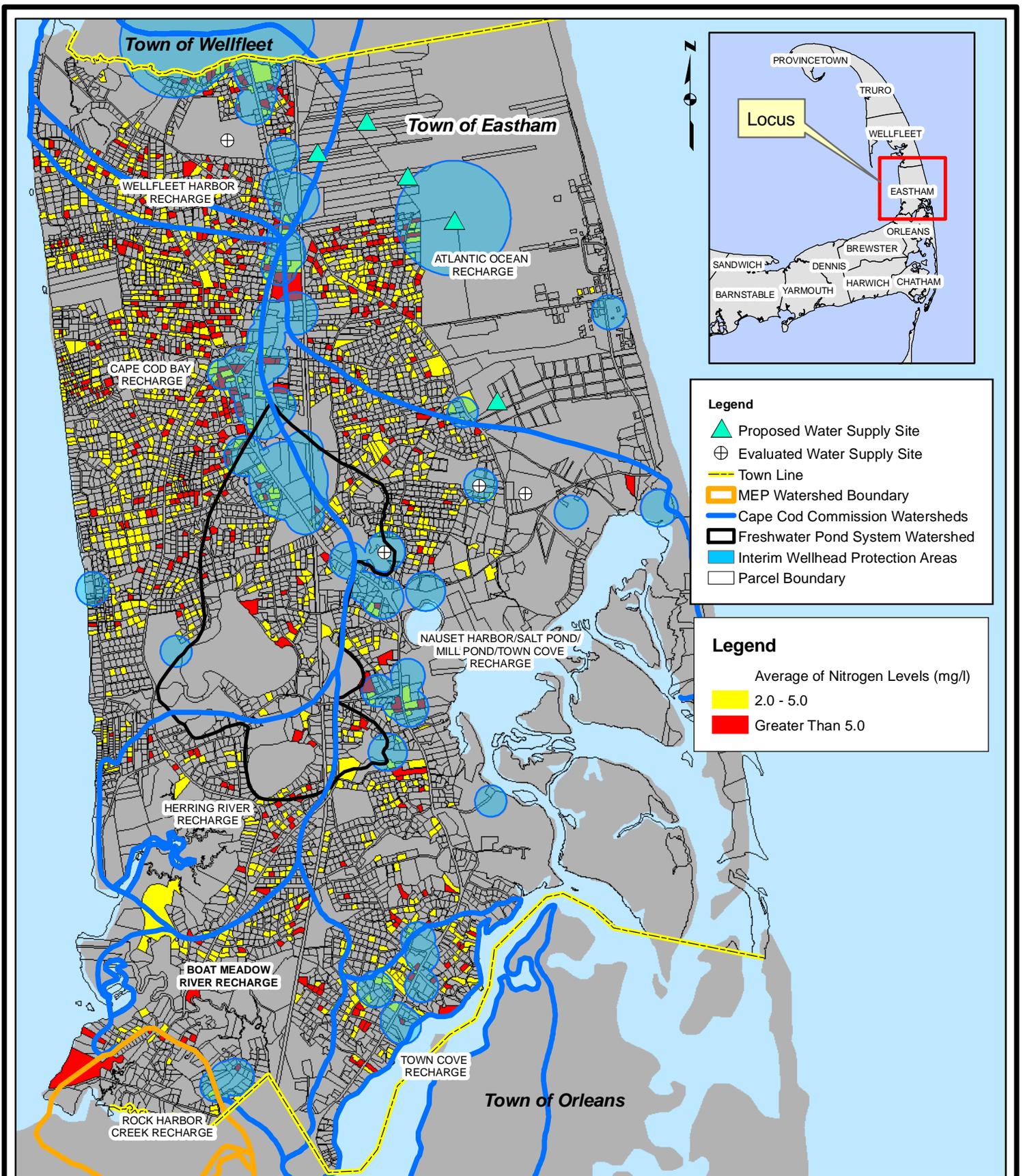
1. **Human Health Needs.** Nearly all of the properties in Town are served by individual water supply wells and individual septic systems on the same lot. These private wells are becoming impacted by septic tank effluent and other landuse activities (car washing, automotive storage, fertilizer application, pesticide use, etc.) on the small lots. The contamination is indicated by elevated nitrate levels detected in the wells. Nitrate is a human health threat; but, more importantly, it indicates the high probability that there is other contamination such as viruses, volatile organic carbons, pharmaceuticals, phosphorus, etc. within the drinking water. The elevated nitrate levels are indicated in Figure ES-1. **The Town needs to protect the public health by providing a reliable public water supply from a protected source.**

2. **Environmental Health Needs.** The groundwater system with its elevated nitrogen and phosphorus levels recharges into several coastal estuaries and freshwater ponds; the nitrogen acts as a fertilizer in the estuaries, and the phosphorus acts as a fertilizer in the ponds. This “over fertilization” stimulates the growth of algae, which in turn causes several water quality problems in these surface waters including:

- loss of water clarity which makes swimming, fishing, and boating less attractive;
- algae settling to the floor of the estuaries and ponds where it decays, kills shellfish, and can cause fish kills;
- loss of animal habitat and the production of odors from the rotting algae.

State, Federal, and regional agencies are now setting nutrient limits (called Total Maximum Daily Loads or TMDLs) on the amounts of nitrogen and phosphorus that can go into an estuary or pond; and they have delineated the watersheds to all of these surface waters as illustrated on Figure ES-2. Septic system discharges into the watersheds are the main sources of nitrogen and phosphorus to these water bodies. The limits are still being developed, but evaluations indicate:

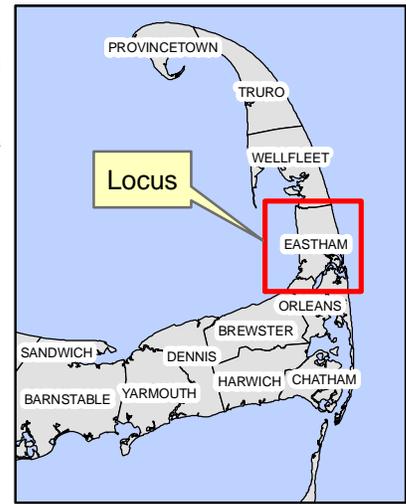
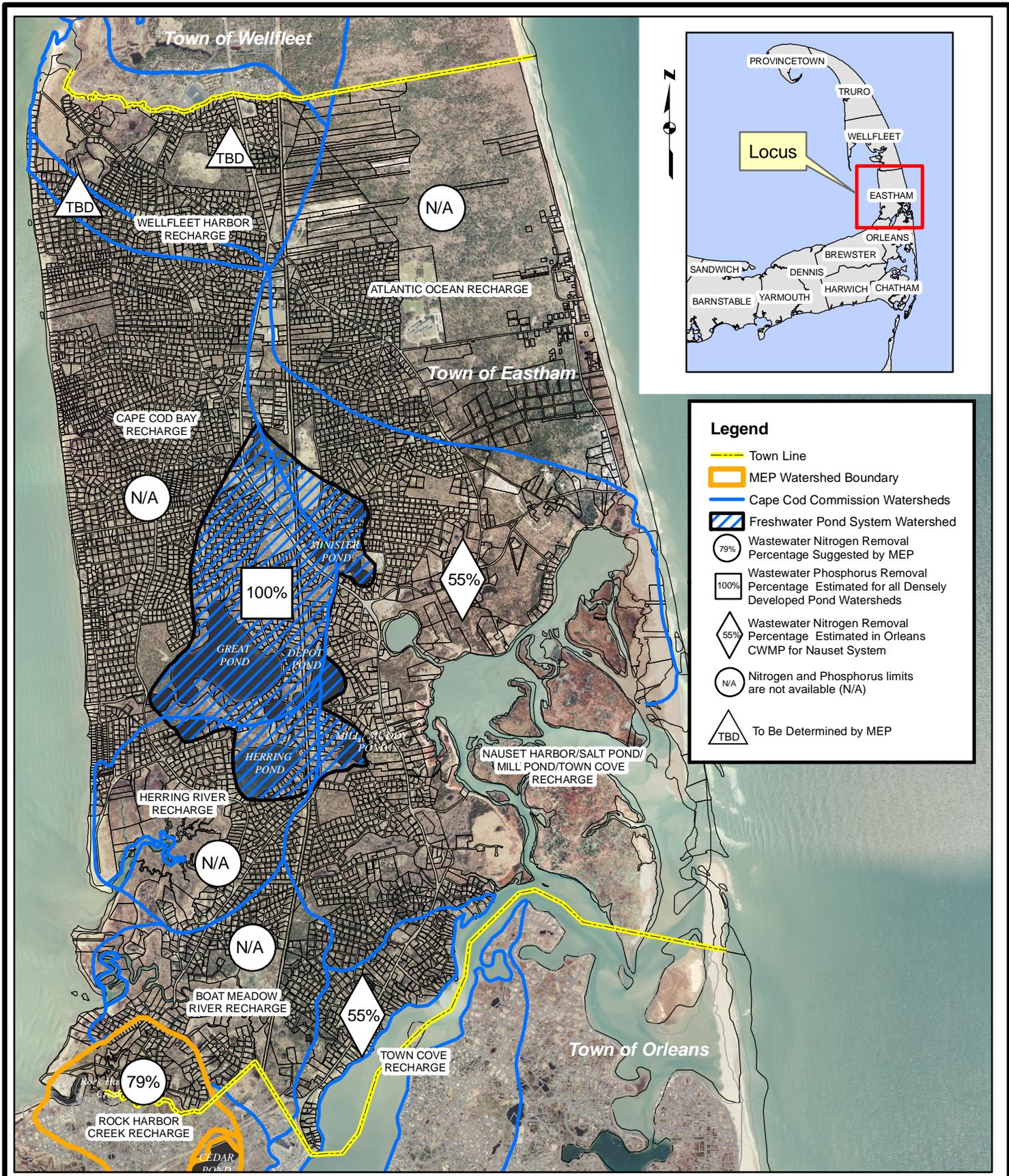
- 55 percent of the current wastewater nitrogen discharges need to be removed from the Nauset-Town Cove Estuary Watershed to restore and manage long-term water quality.



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TOWN OF EASTHAM, MASSACHUSETTS
AVERAGE OF NITRATE READINGS
(BETWEEN 1999 - 2006)

FIGURE ES-1



Legend

- Town Line
- MEP Watershed Boundary
- Cape Cod Commission Watersheds
- Freshwater Pond System Watershed
- 79% Wastewater Nitrogen Removal Percentage Suggested by MEP
- 100% Wastewater Phosphorus Removal Percentage Estimated for all Densely Developed Pond Watersheds
- 55% Wastewater Nitrogen Removal Percentage Estimated in Orleans CWMP for Nauset System
- N/A Nitrogen and Phosphorus limits are not available (N/A)
- TBD To Be Determined by MEP

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TOWN OF EASTHAM, MASSACHUSETTS

WATERSHED DELINEATIONS AND ESTIMATED % NUTRIENT REMOVAL

FIGURE ES-2

Location: G:\Jobs\60000\61204 Eastham\Figures\
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Date: 4/09

- 79 percent of the current wastewater nitrogen discharges need to be removed from the Rock Harbor Estuary Watershed to restore and manage long-term water quality.
- 100 percent of the current wastewater phosphorus discharges need to be removed from the Freshwater Pond System Watershed to restore and manage long-term water quality.

A limit has not yet been set by regulatory agencies for the Wellfleet Harbor Watershed in northern Eastham, but it is expected in two to three years. It is unknown if nutrient limits will ever be set for the other watershed areas in Town that drain to the Atlantic Ocean, Cape Cod Bay, Herring River, and Boat Meadow River. **The Town needs to remediate and protect the environmental health by removing and/or managing the excess nutrients going to the Nauset-Town Cove Estuary, Rock Harbor Estuary, and the Freshwater Ponds System.**

ES.3 SUMMARY OF ALTERNATIVE SOLUTIONS IDENTIFIED AND SCREENED TO MEET THE DRINKING WATER AND WASTEWATER NEEDS

Several alternative solutions were identified and screened in the earlier report to develop the most feasible solutions for more detailed evaluation. These alternative solutions are listed below:

1. Drinking Water Alternatives:

- Municipal water supply system from a protected source.
- Point of use drinking water treatment systems at individual homes.
- Bottled water purchase for drinking water.

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 AND CATEGORIES**

TECHNOLOGY CATEGORY	TECHNOLOGY SUBCATEGORY	INDIVIDUAL TECHNOLOGY
Individual On-Site Wastewater Treatment and Disposal Technologies ⁽¹⁾	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 ⁽²⁾	SeptiTech systems
		Norweco Singlair systems
		RUCK [®] CFT
		Cromaglass WWT systems
		Omni recirculating sand filter system
		Bio Barrier Membrane Bio-Reactor
NITREX [™] -Plus		
<p>Notes:</p> <p>(1) Most, but not all systems provide a level of nitrogen removal as noted in the technology category, however, none provide additional phosphorus removal.</p> <p>(2) These technologies are identified but not screened due to pilot use approval by MassDEP.</p>		

3. Community/Municipal Wastewater Treatment Technologies:

- Small (cluster/community) wastewater treatment facilities incorporating biological nitrogen removal.
- Larger community/municipal wastewater treatment technologies.
- Technologies to remove endocrine disruptors and the other “emerging contaminants” such as pharmaceuticals.
- Phosphorus treatment 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 regionalization with Orleans.

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.

Great effort has been made to consider all available technologies and management concepts.

After screening these alternative solutions in the Interim Needs Assessment and Alternatives Screening Analysis Report, several alternative management plans were developed for more detailed evaluation for the several areas of human health and environmental health need. These alternative management plans are summarized below:

1. The ongoing **Drinking Water Supply Plan** which is currently evaluating water supply from new wells sited in Eastham as well as water supply from the existing Town of Orleans water system.

2. A group of three alternative management plans for the Nauset-Town Cove Estuary Watershed to meet the environmental health need and estimated nitrogen limit.

- **Nauset-Town Cove Estuary Watershed Plan 1:** Sewering a portion of the properties in this watershed and wastewater treatment and recharge at a new community/municipal wastewater treatment facility at the Roach Property site in northern Eastham.
- **Nauset-Town Cove Estuary Watershed Plan 2:** Connection of this proposed sewer area to the Orleans Wastewater Treatment Facility proposed to be constructed at the Tri-Town Facility site.

- **Nauset-Town Cove Estuary Watershed Plan 3:** Individual on-site systems approved by MassDEP for nitrogen removal.

3. A group of three alternative management plans for the Rock Harbor Estuary Watershed to meet the environmental health need and nitrogen limit.

- **Rock Harbor Estuary Watershed Plan 1:** Same as Nauset-Town Cove Estuary Watershed Plan 1.
- **Rock Harbor Estuary Watershed Plan 2:** Same as Nauset-Town Cove Estuary Watershed Plan 2.
- **Rock Harbor Estuary Watershed Plan 3:** Further evaluation of possible aeration and dredging management of Rock Harbor.

4. A group of three alternative management plans for the Freshwater Pond System Watershed to meet the environmental health need and estimated phosphorus limit.

- **Freshwater Pond System Watershed Plan 1:** Same as Nauset-Town Cove Estuary Watershed Plan 1 and Rock Harbor Estuary Watershed Plan 1.
- **Freshwater Pond System Watershed Plan 2:** Same as Nauset-Town Cove Estuary Watershed Plan 2 and Rock Harbor Estuary Watershed Plan 2.
- **Freshwater Pond System Watershed Plan 3:** Periodic pond treatments to remove the phosphorus in the ponds.

It should be noted that no individual on-site systems are currently approved for phosphorus removal, thus no options using on-site septic systems were evaluated for this watershed.

Table ES-2 summarizes the general alternative solutions and the priority ranking identified to meet the human health and environmental health needs of the Town.

TABLE ES-2

**PRIORITY RANKING BASED ON AREA OF CONCERN AND
GENERAL ALTERNATIVE SOLUTIONS**

NEED		AREA OF CONCERN	PRIORITY RANKING			
			PUBLIC WATER SUPPLY	WASTEWATER MANAGEMENT	AERATION / DREDGING	POND TREATMENT
HUMAN HEALTH	<i>Drinking Water</i>	Town-Wide	1			
ENVIRONMENTAL	<i>Wastewater Nitrogen</i>	Nauset-Town Cove Estuary		2		
		Rock Harbor Estuary		3	3	
	<i>Wastewater Phosphorus</i>	Freshwater Pond System		4		4

The alternative plans discussed above were evaluated and the main findings are summarized below.

ES.4 EVALUATION OF ALTERNATIVE PLANS

A. Drinking Water Supply Plan. The ongoing water supply planning process is fully supported by our evaluations of the wastewater needs. Wastewater treatment alone will not remediate the existing human health need of safe drinking water. As discussed in the Interim Needs Assessment and Alternatives Screening Analysis Report, high nitrate levels in private wells are indicative that other contaminants also exist. While sewerage portions of Town will aid in the removal of nitrogen from entering the wells, drinking water will not be protected from other contaminants such as viruses, pharmaceuticals, etc. To ensure that the human health needs of the public are protected, drinking water needs to come from a protected supply source.

The Town has taken steps to further this plan with the May 2009 Town Meeting appropriation to test proposed well sites and evaluate the costs to connect to the Orleans Water System.

B. Evaluation of Nauset-Town Cove Estuary Watershed Plans 1, 2, and 3. These evaluations were initiated by determining the feasibility of Plan 3 (use of individual on-site systems to meet the nitrogen limit) at the buildout condition and with the highly seasonal landuse in these areas. Findings include:

- Once the buildout is projected, approximately 62 percent of the future wastewater nitrogen will need to be removed to meet the limit.
- Based on research by the Barnstable County Department of Health and Environment on the long-term performance of individual nitrogen removal systems, it is very unlikely that individual nitrogen removal systems can meet this level of long-term removal performance. This finding is further supported by the poor nitrogen removal performance when they are first started up annually in a seasonal community.
- Plan 3 is not feasible to meet these limits.

Based on this key conclusion, a proposed sewer area (common to Nauset-Town Cove Estuary Watershed Plans 1 and 2) was identified in the southern portion of the watershed to collect sufficient wastewater nitrogen to meet the nitrogen limits. This area was chosen because it is understood that the Town Cove / southern portion of the estuarine system is the most sensitive to nitrogen loading though this basis may need to be revisited once the final limit is produced. The proposed sewer area for the Nauset-Town Cove Estuary Watershed is illustrated in Figure ES-3. The two alternative treatment and discharge sites were considered with this proposed sewer area and the costs were compared as discussed in the following Section ES.5.

C. Evaluation of Rock Harbor Estuary Watershed Plans 1, 2, and 3. This evaluation began with further consideration of Plan 3; which is the possible use of alternative dredging or subsurface aeration to address the water quality problems. Rock Harbor is not a natural estuary; it is a dredged boat basin in a tidal creek, and there is some question whether the State has sufficient basis to hold the water quality of this basin to such a high standard. Massachusetts Department of Environmental Protection (MassDEP) may be willing to consider further evaluations once the nitrogen limit is finalized. The Town should continue to pursue this discussion with MassDEP.

If Plan 3 is not acceptable or feasible to MassDEP, the Town will need to rely on Plan 1 or 2, both of which include the sewerage of a portion of the watershed as illustrated in Figure ES-3. Similar to the evaluation of the Nauset-Town Cove Estuary Watershed, the two alternative

treatment and discharge sites were considered with this proposed sewered area, and the costs are compared as discussed in the following Section ES.5.

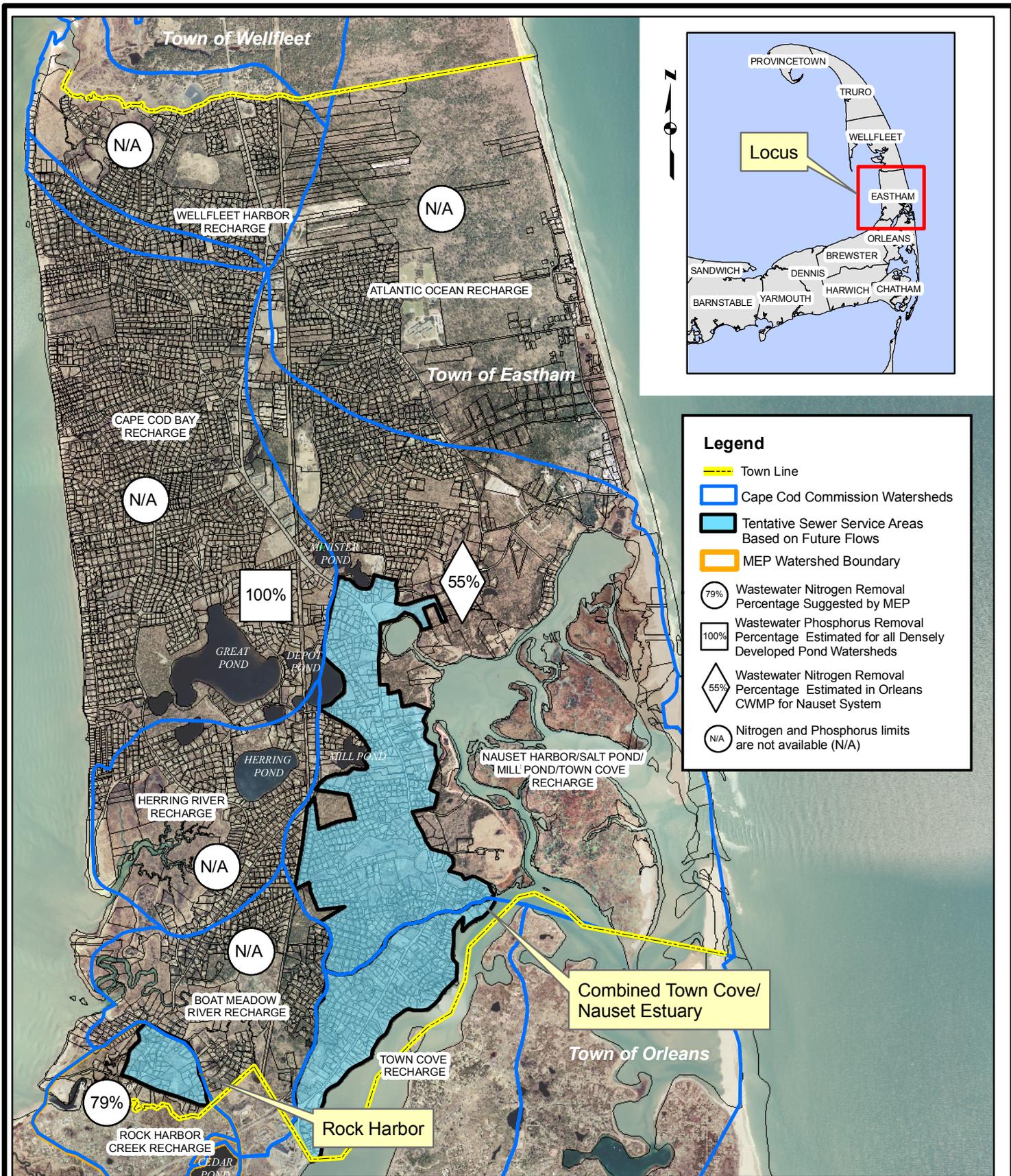
D. Evaluation of Freshwater Pond System Watershed Plans 1, 2, and 3. This evaluation was initiated by estimating the cost of Plan 3 which is the periodic “treatment” of the ponds with alum. If all the ponds need to be treated, the cost would be approximately \$900,000 for the treatment based on cost estimates for similar ponds in Chatham. If this cost was distributed to all of the properties in the watershed, the cost would be approximately \$1,500 per property. This is significantly less than the \$50,000 to \$60,000 per property that is typical of sewerage and off-site treatment and discharge envisioned for Plans 2 and 3. As a result, Plan 3 – Periodic Pond Treatment with Alum is the recommended plan for this area.

ES.5 COST COMPARISON FOR SEWERING PLANS 1 AND 2 FOR THE NAUSET-TOWN COVE ESTUARY AND ROCK HARBOR ESTUARY WATERSHEDS

A. Nauset-Town Cove Estuary and Rock Harbor Estuary Watersheds Plan 1. This costing option includes Nauset-Town Cove Estuary Watershed Plan 1 and Rock Harbor Watershed Plan 1. It includes wastewater collection from properties in these watersheds as indicated on Figure ES-4 as “tentative sewer areas”, and treatment and recharge at the proposed Town-owned Roach Property Wastewater Treatment Facility (WWTF) also identified on Figure ES-4. Costs were developed for the following wastewater facility components: collection system, pump stations and force mains to treatment, 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 ES-3 summarizes these costs.

The capital cost per property sewered (provided to give a relative measure of the financial impact of this alternative) would be approximately \$62,000 per property.

B. Nauset-Town Cove Estuary and Rock Harbor Estuary Watersheds Plan 2. This costing option includes Nauset-Town Cove Estuary Watershed Plan 2 and Rock Harbor Watershed Plan 2. This plan includes wastewater collection from properties in this watershed as indicated on Figure ES-5 as “tentative sewer areas”, and treatment and recharge at the proposed Orleans WWTF also identified on Figure ES-5. Costs were developed for the following wastewater facility components: collection system, pump stations and force mains to treatment, and treatment and recharge. Total capital costs of \$59 million are estimated for this costing



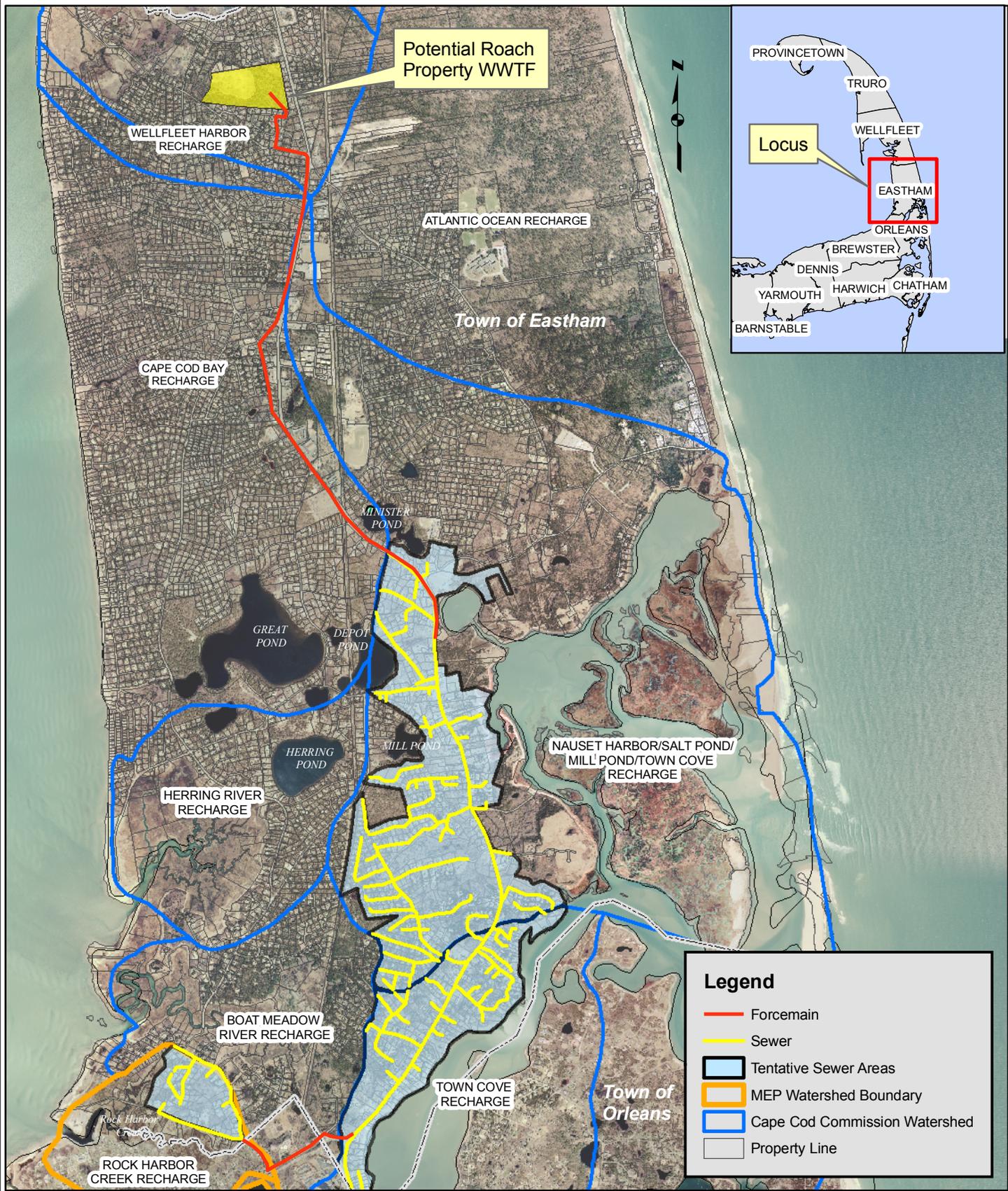
Legend

- Town Line
- Cape Cod Commission Watersheds
- Tentative Sewer Service Areas Based on Future Flows
- MEP Watershed Boundary
- 79% Wastewater Nitrogen Removal Percentage Suggested by MEP
- 100% Wastewater Phosphorus Removal Percentage Estimated for all Densely Developed Pond Watersheds
- 55% Wastewater Nitrogen Removal Percentage Estimated in Orleans CWMP for Nauset System
- N/A Nitrogen and Phosphorus limits are not available (N/A)

TOWN OF EASTHAM, MASSACHUSETTS
 TENTATIVE SEWER SERVICE AREAS



FIGURE ES-3



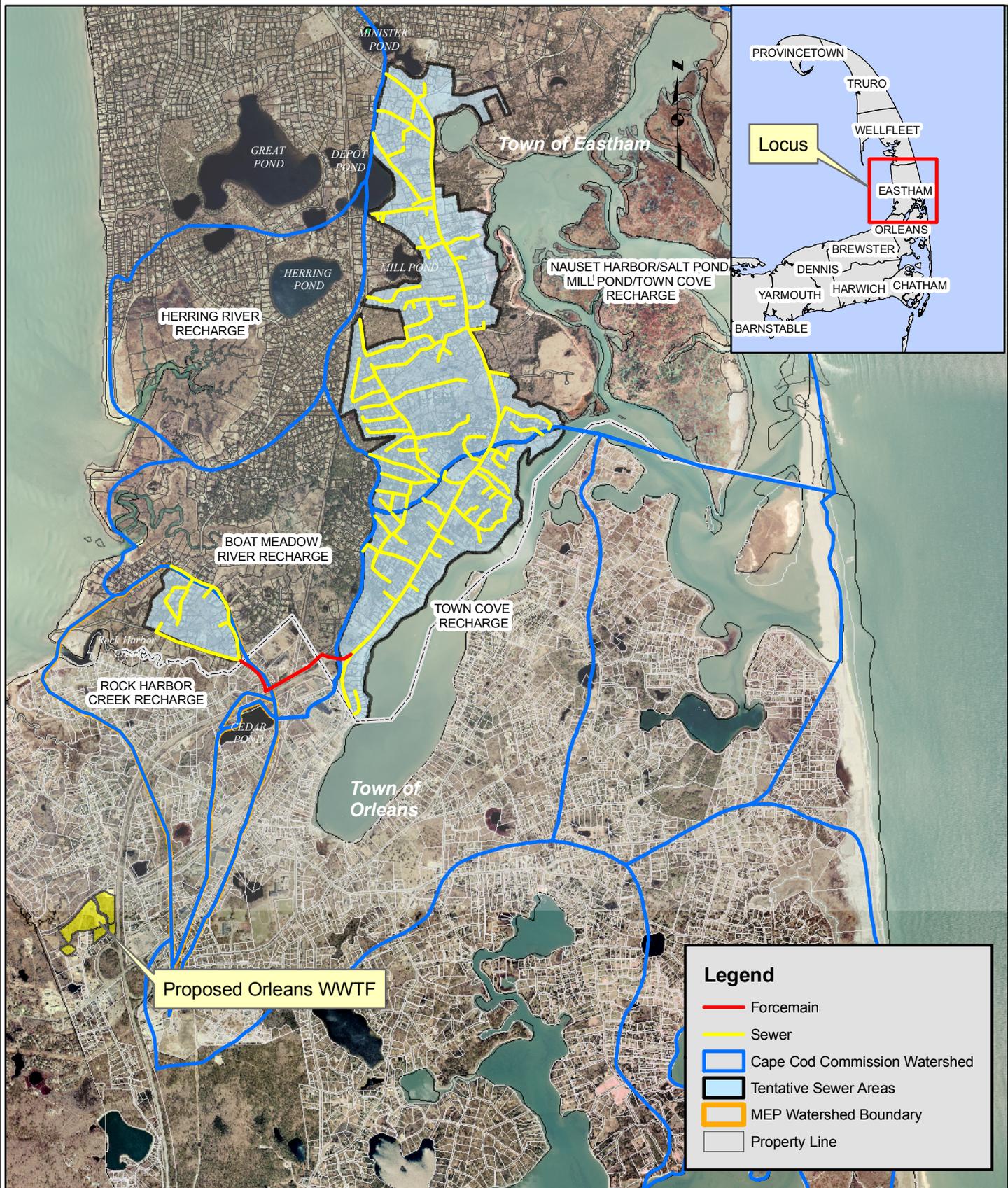
Note: Force main locations are for illustrative purposes only. Exact locations have not been determined.


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TOWN OF EASTHAM, MASSACHUSETTS

**Tentative Sewer Areas
To Potential Roach Property WWTF**

FIGURE ES-4



Note: Force main locations are for illustrative purposes only. Exact locations have not been determined.

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TOWN OF EASTHAM, MASSACHUSETTS

Tentative Sewer Areas To Proposed Orleans WWTF

FIGURE ES-5

option, with annual O&M costs estimated at \$630,000 per year. Table ES-3 summarizes these costs.

The capital cost per property sewered (provided to give a relative measure of the financial impact of this alternative) would be approximately \$59,000 per property.

TABLE ES-3

SUMMARY OF ESTIMATED COST

WASTEWATER TREATMENT COMPONENT	PLAN 1 - ROACH PROPERTY WWTF ⁽⁴⁾			PLAN 2 – ORLEANS WWTF ⁽⁵⁾		
	NAUSET-TOWN COVE ESTUARY	ROCK HARBOR ESTUARY ⁽⁷⁾	TOTAL	NAUSET-TOWN COVE ESTUARY	ROCK HARBOR ESTUARY ⁽⁷⁾	TOTAL
Collection System ⁽¹⁾	\$17,600,000	\$1,700,000	\$19,300,000	\$17,600,000	\$1,700,000	\$19,300,000
PS & FM to Treatment ⁽¹⁾	\$4,100,000	\$900,000	\$5,000,000	\$2,300,000	\$900,000	\$3,200,000
Treatment & Recharge ^(1,2)	\$14,500,000	\$900,000	\$15,400,000	\$14,500,000	\$900,000	\$15,400,000
TOTAL CONSTRUCTION COSTS	\$36,200,000	\$3,500,000	\$39,700,000	\$34,400,000	\$3,500,000	\$37,900,000
Contingency (30%)	\$10,900,000	\$1,100,000	\$12,000,000	\$10,300,000	\$1,100,000	\$11,400,000
Fiscal, Legal, Engineering (25%)	\$9,100,000	\$900,000	\$10,000,000	\$8,600,000	\$900,000	\$9,500,000
TOTAL CAPITAL COSTS⁽³⁾	\$56,000,000	\$6,000,000	\$62,000,000	\$53,000,000	\$6,000,000	\$59,000,000
Total Capital Cost on a per Property Basis ⁽⁶⁾	\$62,000			\$59,000		
Annual O&M Costs ⁽³⁾	\$710,000			\$630,000		

Notes:

- (1) Costs based on April 2009 ENR of 8548.
- (2) Costs for each area represent the flow-weighted total treatment cost. This does not necessarily represent the cost to construct an autonomous treatment facility for each area.
- (3) Additional basis on cost development is provided in Chapter 2 of this report.
- (4) Plan 1 includes the Nauset-Town Cove Estuary Watershed Plan 1 and Rock Harbor Estuary Watershed Plan 1 at the potential Roach Property WWTF.
- (5) Plan 2 includes the Nauset-Town Cove Estuary Watershed Plan 2 and Rock Harbor Estuary Watershed Plan 2 at the proposed Orleans WWTF.
- (6) The two tentative sewer areas have approximately 1,007 properties.
- (7) This portion of the Plan may be needed if discussions / evaluations with MassDEP on nitrogen limit modification and alternative dredging are not successful.

From this estimated capital cost comparison, it is found that Nauset-Town Cove Estuary and Rock Harbor Estuary Watersheds Plan 2 is less costly than Nauset-Town Cove Estuary and Rock

Harbor Estuary Watershed Plan 1 for the Town of Eastham. Table ES-3 shows a \$3 million difference in total cost from Plans 2 (proposed Orleans WWTF) and 1 (proposed Roach Property WWTF) with the primary measurable differences being the differing length and cost of the pump station and forcemain to treatment and the O&M costs. Plan 2 is expected to include a level of wastewater regionalization savings benefits as well as a cost savings with respect to treatment and recharge distance.

ES.6 COORDINATION WITH THE TOWN OF ORLEANS AND THEIR WASTEWATER PLANNING PROJECTS

Stearns & Wheler and Town of Eastham Staff have coordinated with the Town of Orleans and their ongoing wastewater planning projects that include:

- Orleans Comprehensive Wastewater Management Plan (CWMP) Project initiated in 2005 and estimated for completion in 2009 or 2010. (The Town's Draft CWMP is available on the Orleans website via the Wastewater Management Plan Steering Committee at:
http://www.town.orleans.ma.us/Pages/OrleansMA_BComm/wastewater.)
- Cape Cod Water Protection Collaborative funded Wastewater Regionalization Study initiated in 2007 and estimated for completion in 2009.

Meetings have been convened and the two Towns have briefed and coordinated with each other on their wastewater planning activities, especially as their activities affect their neighboring Town. Stearns & Wheler has had direct communications with Wright-Pierce (Orleans' wastewater consultant) on wastewater flow and wastewater facility cost estimates. The wastewater flows estimated by the two consultants are very similar. The wastewater facility costs have some similarities and differences that are discussed below.

- Costs developed by Stearns & Wheler are more conservative because we use a 30 percent contingency factor and a 25 percent factor to estimate fiscal, legal, and engineering costs for easements, financial bonding costs, and design and construction services. Wright-Pierce uses a 40 percent factor that covers all of these contingency, fiscal, legal, and engineering costs.
- Stearns & Wheler's costs are referenced to 2009 values and Wright-Pierce's costs are referenced to 2008 values.

- Once the factors are equalized, the costs are more similar, but Stearns & Wheeler's costs are still about 15 percent higher. Discussion between Stearns & Wheeler and Wright-Pierce indicate:
 - Different estimating methodologies and factors.
 - Both sets of costs are valid given the design uncertainties (number of pump stations, easements needed, sewer-depth, etc.) of the two areas at this time.

At this point there is a difference on the magnitude of the estimated costs, but there is agreement on which alternative plan is the most cost effective. Both planning efforts agree that wastewater collection and treatment at the proposed Orleans WWTF is the most cost effective and should be pursued as the long-term plan.

There is a need to refine the cost estimate based on preliminary design of the facilities which will more accurately identify:

- Sewer locations, sizes, and depths.
- Number and location of pump stations.
- Needed easements.
- Properties that will need individual home grinder-pumps.

The Town of Eastham should continue to coordinate with the Town of Orleans to develop a regional solution for Eastham and Orleans as well as the other Towns that may be interested in joining in a regional facility. The timeline and next steps for this coordination is detailed in the following section.

It is noted that the Cape Cod Water Protection Collaborative funded regionalized study is also investigating the possibility of sewerage additional properties in Orleans with possible establishment of a nitrogen credit program between the two Towns to share the nitrogen (wastewater) management costs while focusing the sewerage in Orleans. This is an innovative approach which has successful application in Connecticut to meet the Long Island Sound nitrogen limit. These investigations continue and are expected to be presented in the final regionalization report.

ES.7 CONCLUSION

The wastewater needs have been developed and categorized into the following two groups:

1. **Human Health Needs.**
2. **Environmental Health Needs.**

The human health wastewater needs are very clear and are best met with the development of a public water supply system from a protected water source. As stated previously, wastewater collection and treatment alone will not solve the current drinking water quality problems of the Town. The Town is proceeding with the development of a Drinking Water Supply Plan to implement that system, and the May 2009 Town Meeting appropriated funding for the needed evaluations to continue that planning process.

The environmental health wastewater needs are also clear, but additional time is needed for the State and Federal agencies to finalize the nitrogen limits for the Nauset-Town Cove Estuary, Rock Harbor Estuary, and the phosphorus limits for the Freshwater Pond System. We have estimated these limits based on draft reports from these agencies; and significant wastewater flows (and associated nitrogen and phosphorus loadings) are needed to be removed to meet the limits. Several wastewater and nutrient management plans/approaches have been evaluated, and the following are the most cost effective and feasible:

- Wastewater collection and advanced treatment is needed for portions of the Nauset-Town Cove Estuary Watersheds.
- Additional discussions are needed with MassDEP on the nitrogen limits and possible further evaluations of alternative dredging techniques and/or tidal flushing and/or aeration techniques to address the limits. If these discussions and/or evaluations are not successful, wastewater collection and advanced treatment is needed for portions of this watershed.
- The most cost effective treatment site is the Orleans WWTF proposed for the Tri-Town Septage Facility site.
- The phosphorus loading problems associated with the freshwater ponds should be addressed by treatment with alum to bind the phosphorus that is already in the ponds and prevent it from acting as a fertilizer. (This is the same approach recently used for Long Pond in Brewster and Harwich).

Table ES-4 summarizes the alternative management plans evaluated for the various areas of concern. The recommended alternative management plan is highlighted for each area of concern. The Rock Harbor Estuary has two highlighted plans because Plan 3 needs to be discussed with MassDEP to determine if a lower nitrogen limit is warranted (due to Rock Harbor being a dredged boat basin) and if the limit could be met through alternative dredging and or aeration methods. Table ES-5 then summarizes the recommended alternative management plans in each area of concern and relates them back to the primary needs.

TABLE ES-4

SUMMARY OF RECOMMENDED ALTERNATIVE MANAGEMENT PLANS

AREA OF CONCERN	ALTERNATIVE MANAGEMENT PLAN	DRINKING WATER SUPPLY ⁽¹⁾	ROACH PROPERTY WWTF ⁽²⁾	ORLEANS WWTF ⁽³⁾	I/A SYSTEMS ⁽⁴⁾	DREDGING / AERATION ⁽⁵⁾	POND TREATMENT ⁽⁶⁾
<i>TOWN-WIDE (TW)</i>	<i>TW Drinking Water Supply Plan</i>	X					
<i>NAUSET-TOWN COVE ESTUARY (NE)</i>	NE Watershed Plan 1		X				
	<i>NE Watershed Plan 2</i>			X			
	NE Watershed Plan 3				X		
<i>ROCK HARBOR ESTUARY (RH)</i>	NE Watershed Plan 1		X				
	<i>RH Watershed Plan 2</i>			X			
	<i>RH Watershed Plan 3</i>					X	
<i>FRESHWATER POND SYSTEM (FP)</i>	FP Watershed Plan 1		X				
	FP Watershed Plan 2			X			
	<i>FP Watershed Plan 3</i>						X

Notes:

- (1) Town to establish public water supply from a protected source; either from new wells within Eastham or from Orleans.
- (2) Sewering properties in the watershed (area of concern) and wastewater treatment and recharge at a new community/municipal wastewater treatment facility at the proposed Roach Property WWTF in northern Eastham.
- (3) Sewering properties in the watershed (area of concern) and wastewater treatment and recharge at the Orleans WWTF - proposed to be constructed at the Tri-Town Septage Treatment Facility site.
- (4) Individual on-site systems approved by MassDEP for nitrogen removal.
- (5) Further evaluation of possible aeration and dredging management of Rock Harbor.
- (6) Periodic pond treatments with alum.

TABLE ES-5

SUMMARY OF ALTERNATIVE MANAGEMENT PLANS AND PRIMARY NEEDS

AREA OF CONCERN	ALTERNATIVE MANAGEMENT PLAN	PRIMARY NEED		
		DRINKING WATER	WW NITROGEN	WW PHOSPHORUS
<i>TOWN-WIDE (TW)</i>	<i>TW Drinking Water Supply Plan</i>	X		
<i>NAUSET-TOWN COVE ESTUARY (NE)</i>	<i>NE Watershed Plan 2</i>		X	
<i>ROCK HARBOR ESTUARY (RH)</i>	<i>RH Watershed Plan 2</i>		X	
<i>FRESHWATER POND SYSTEM⁽¹⁾ (FP)</i>	<i>FP Watershed Plan 3</i>			X

The recommended approach for the Town of Eastham is a combination of providing Town-wide drinking water supply and service, sewerage for portions of Nauset-Town Cove Estuary, and further discussions with MassDEP on the Rock Harbor nitrogen limit (with a back-up plan to sewer portions of this watershed) as identified in Figure ES-5 with treatment and recharge at the proposed Orleans WWTF; and addressing phosphorus issues by periodically treating the ponds with alum.

These recommended approaches need to be coupled with the best management practices (BMP) for stormwater management, lawn care, and general environmental stewardship as discussed and detailed in the Interim Needs Assessment and Alternatives Screening Analysis Report. The BMP activities have been initiated by the Town Highway Department on Town roads and need to be initiated by all property owners.

The Town needs to proceed quickly with the Drinking Water Supply planning and implementation activities because the need is so clear.

There is more time to properly plan and budget for the recommended approaches to meet the environmental health needs due to the following facts:

- The Federal and State agencies may take one or more years to finalize the nitrogen limits.
- Orleans may take one or more years to finalize its CWMP.

- The area of Orleans where Eastham's wastewater flows would connect to the Orleans system is not scheduled for construction until the later phases of their 15 to 20 year phased program.
- Additional studies are needed to determine which ponds and lakes need to be treated with alum.

The following next steps are recommended to proceed with the main findings of this planning project and report and address the human health and environmental health wastewater needs.

1. Proceed with the Drinking Water Supply planning and implementation.
2. Review the wastewater related findings and recommendations of this report at a future Town Meeting and gain Town support.
3. Continue to coordinate with the Town of Orleans as they complete their CWMP and Wastewater Regionalization Study.
4. Continue to coordinate with MassDEP as they finalize the nitrogen limits for Nauset-Town Cove Estuary and Rock Harbor Estuary and determine their willingness to consider alternative dredging and/or tidal flushing methods to meet the limit for Rock Harbor.
5. Once the limits are set, finalize the wastewater flows and the portions of these two estuarine watersheds that should be connected to the proposed Orleans WWTF, and request Orleans to plan for that additional flow.
6. Finalize estimated costs after completing preliminary design of the collection system and connection to the Orleans system.
7. Continue with the pond water quality evaluations to determine pond treatment timing and approvals.
8. Summarize the findings of these actions in a Town of Eastham Comprehensive Wastewater Management Plan in compliance with State and regional requirements to gain regulatory approval of the plan and become eligible for zero percent loans as allowed by recent legislation.

These next steps are estimated to take two to four years depending on the early success of steps 1, 2, and 3.

It is early in the planning stage to precisely estimate costs for the recommended actions to meet the human-health and environmental-health needs; but it is important for Town residents to begin to understand the magnitude of these costs. The estimated capital costs per property are listed below to initiate that understanding.

- Town-wide water system at approximately \$13,000 per property based on information developed by Environmental Partners Group and presented at the 2008 Town Meeting and scaled to 2009 values.
- Wastewater collection and advanced treatment at approximately \$59,000 per property for the properties sewered in the Nauset-Town Cove Estuary Watershed and possibly for the properties in the Rock Harbor Estuary Watershed.
- Alum treatment of the freshwater ponds at approximately \$1,500 per property in the Freshwater Ponds System Watershed.

It is noted that capital costs are not typically paid solely by the properties served. More planning, preliminary design, and financial analysis will be needed to refine these costs and develop annual costs for the properties served as well as for the Town as a whole.