

# **Nauset & Cape Cod Bay Marsh Group**



## **Baseline Conditions & Needs Assessment**

# **What is the 208 Plan?**

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# Clean Water Act Section 208



The Commission was directed to update the 1978 Plan

The Commonwealth provided \$3 million to fund the project

# Focus on 21<sup>st</sup> Century Problems

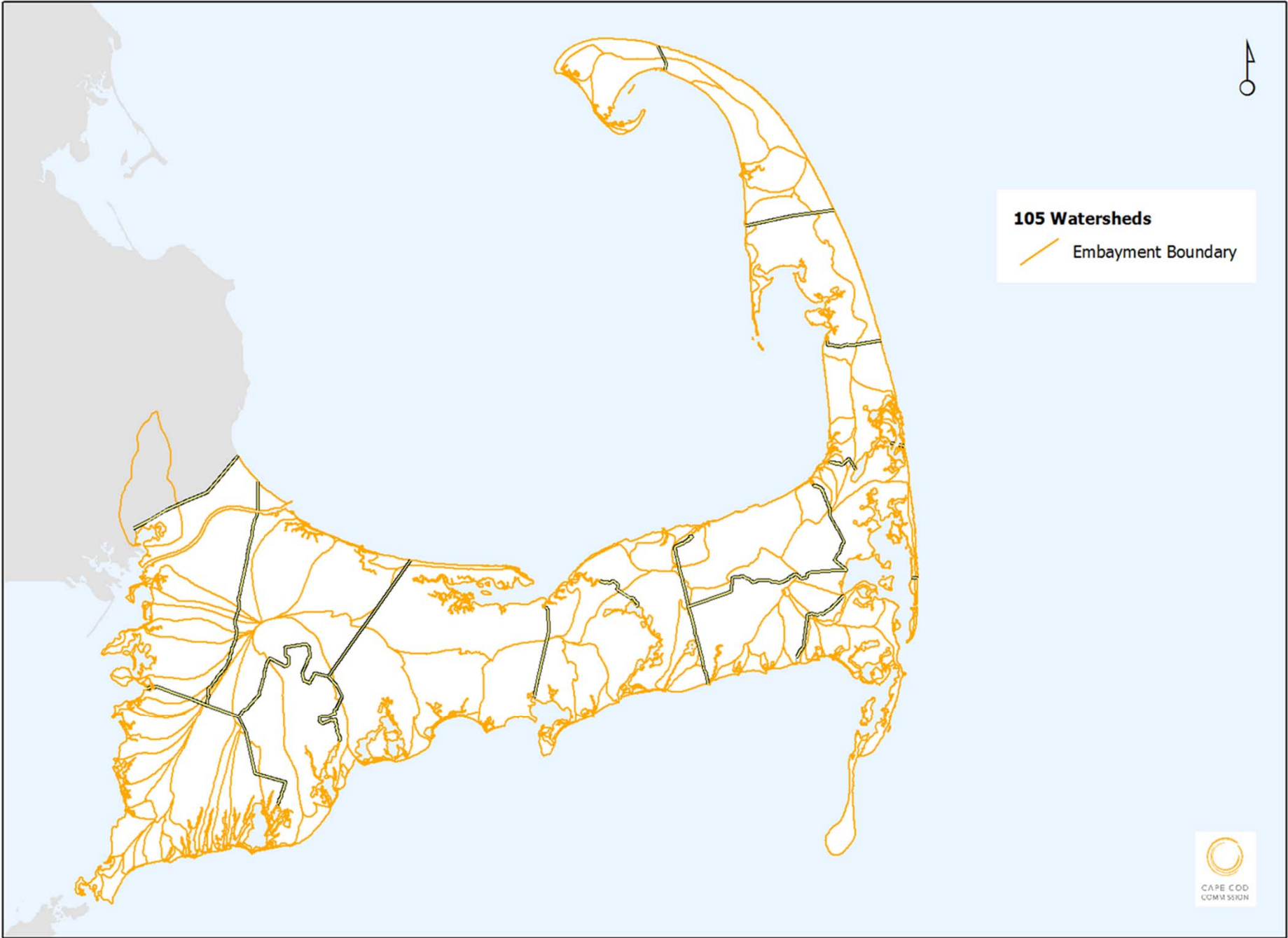


Nitrogen:  
Saline Waters

Phosphorus:  
Fresh Waters

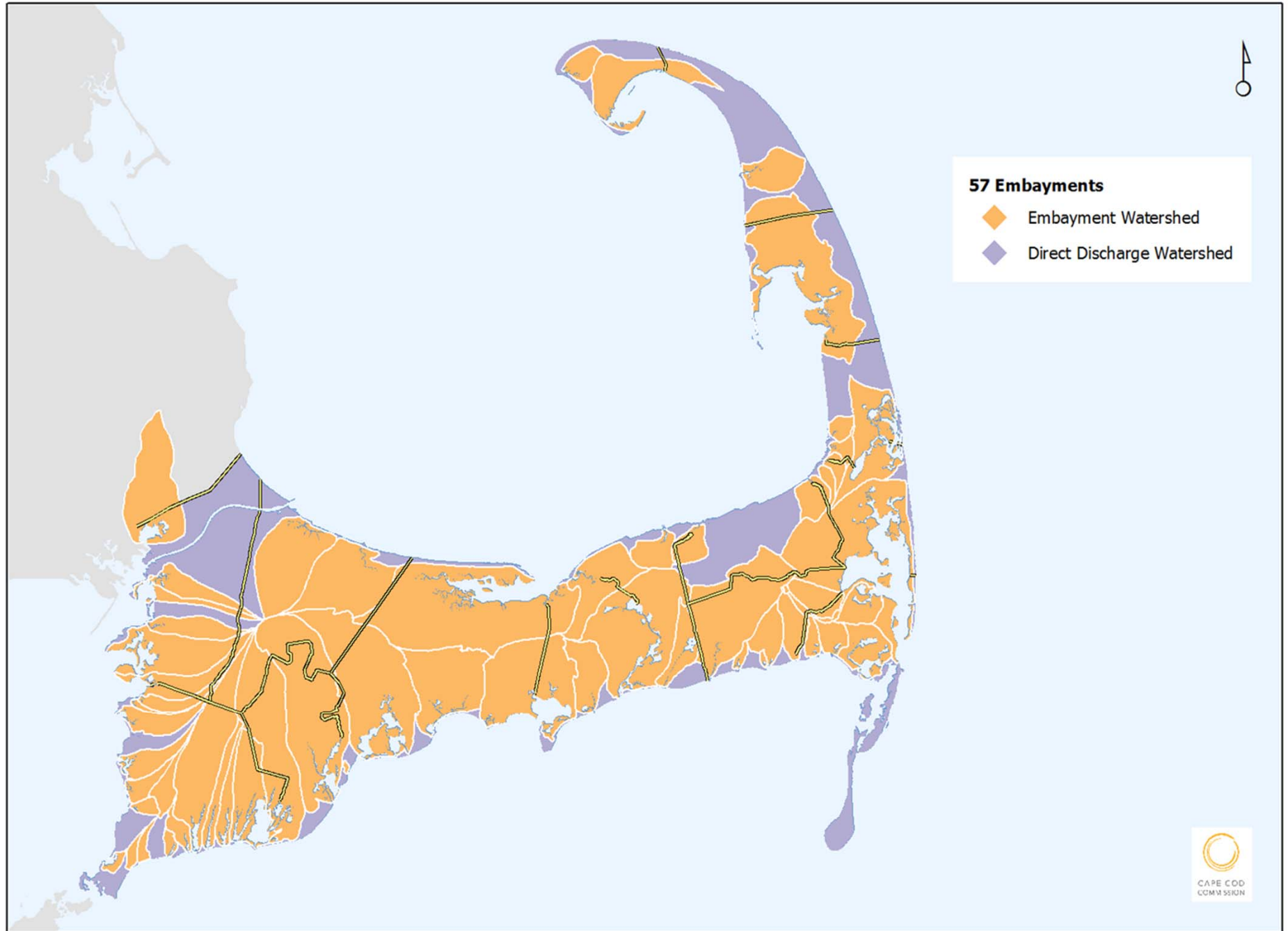
Growth &  
Title 5  
Limitations





**105 Watersheds**  
— Embayment Boundary

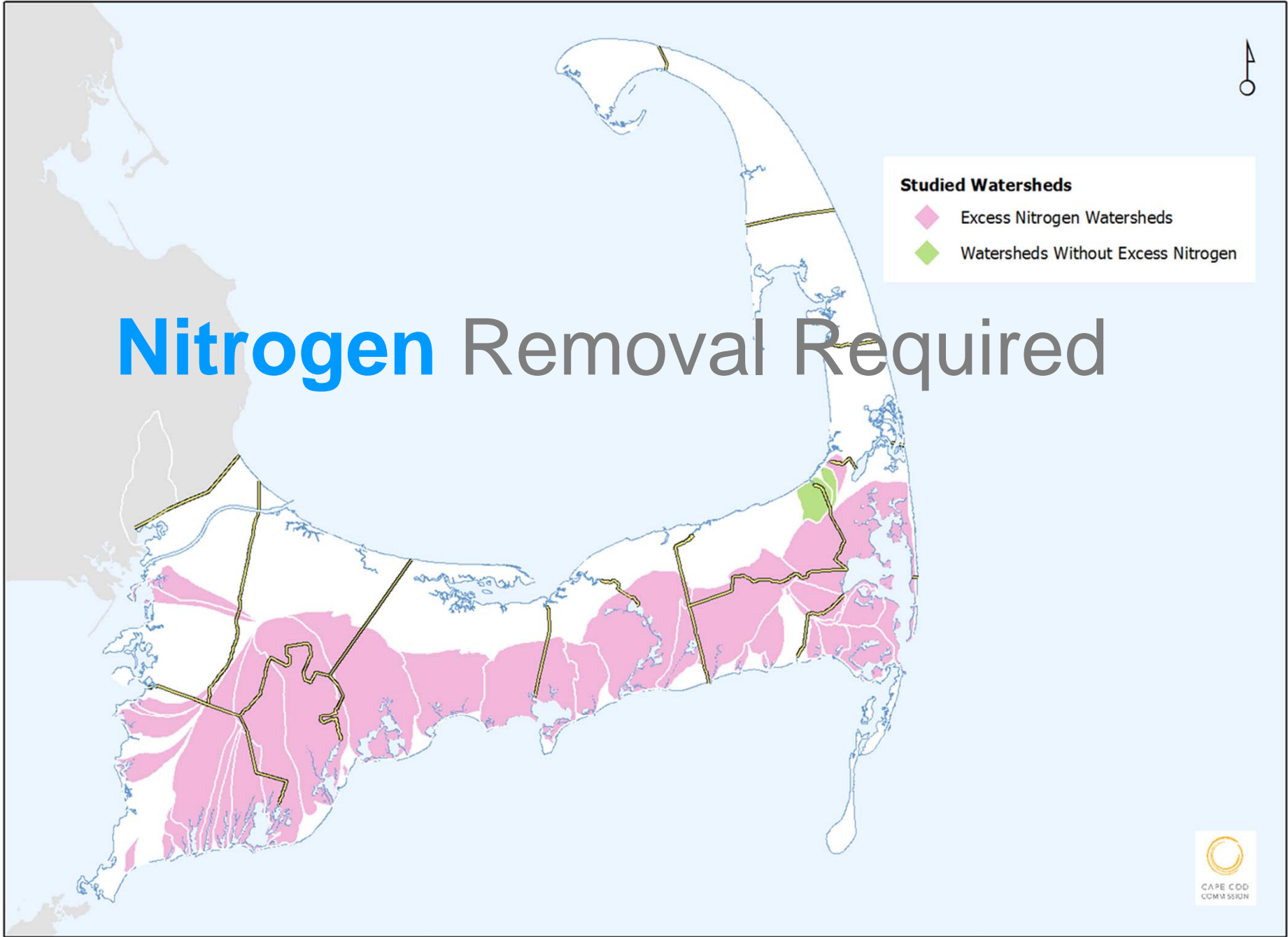


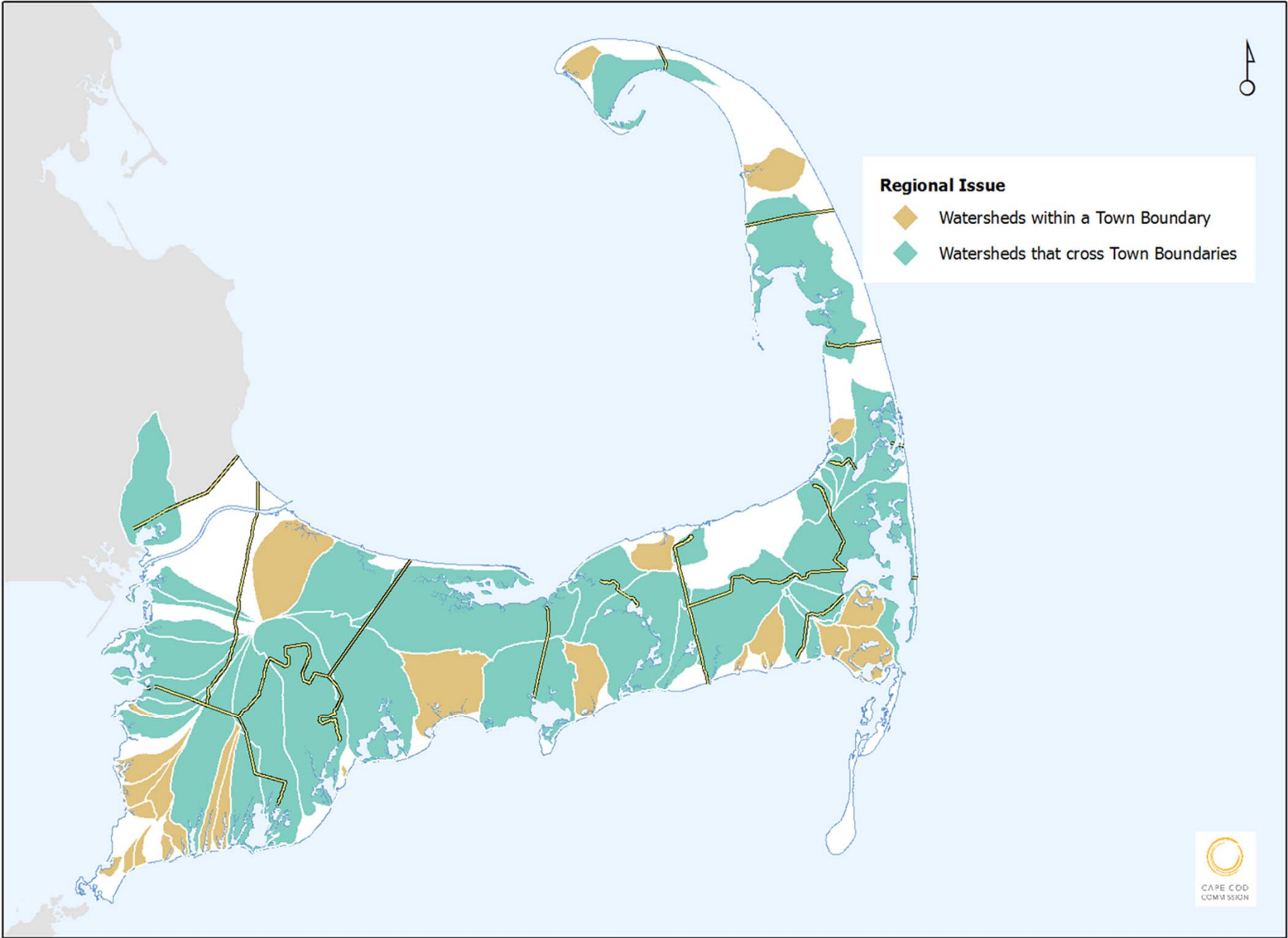


# Nitrogen Removal Required

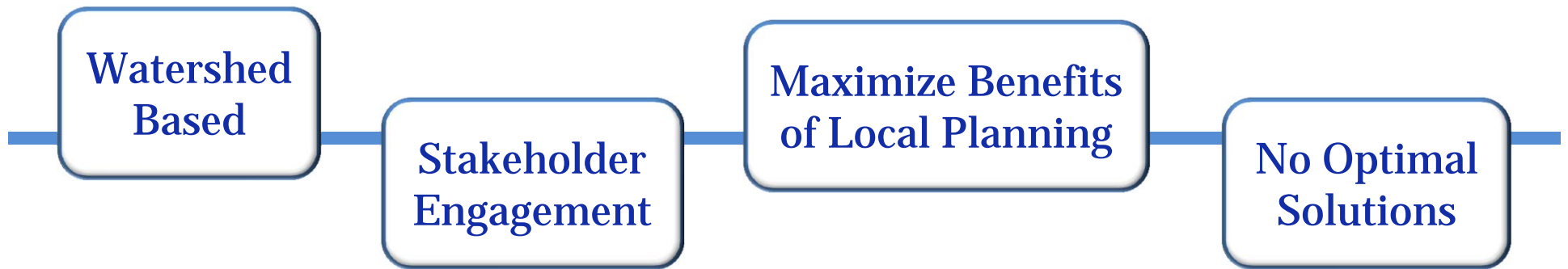
## Studied Watersheds

- ◆ Excess Nitrogen Watersheds
- ◆ Watersheds Without Excess Nitrogen





# Approach to the 208 Plan Update



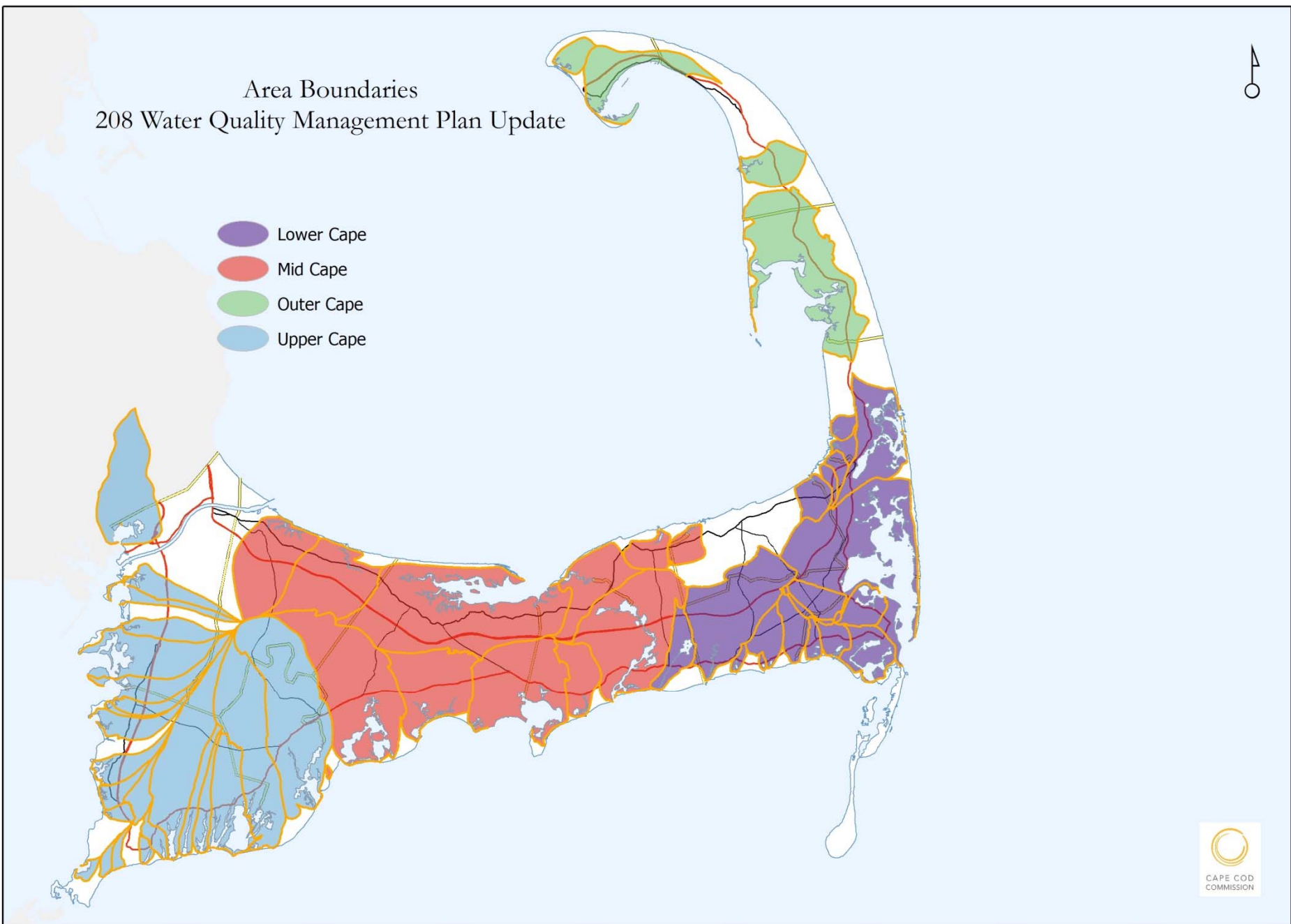
## **Goal:**

To generate a series of approaches in each watershed that will meet water quality standards



Area Boundaries  
208 Water Quality Management Plan Update

- Lower Cape
- Mid Cape
- Outer Cape
- Upper Cape



# Subgroup Boundaries 208 Water Quality Management Plan Update



## Lower Cape

- Herring River
- Pleasant Bay
- Stage Harbor Group
- Nauset and Cape Cod Bay Marsh Group

## Mid Cape

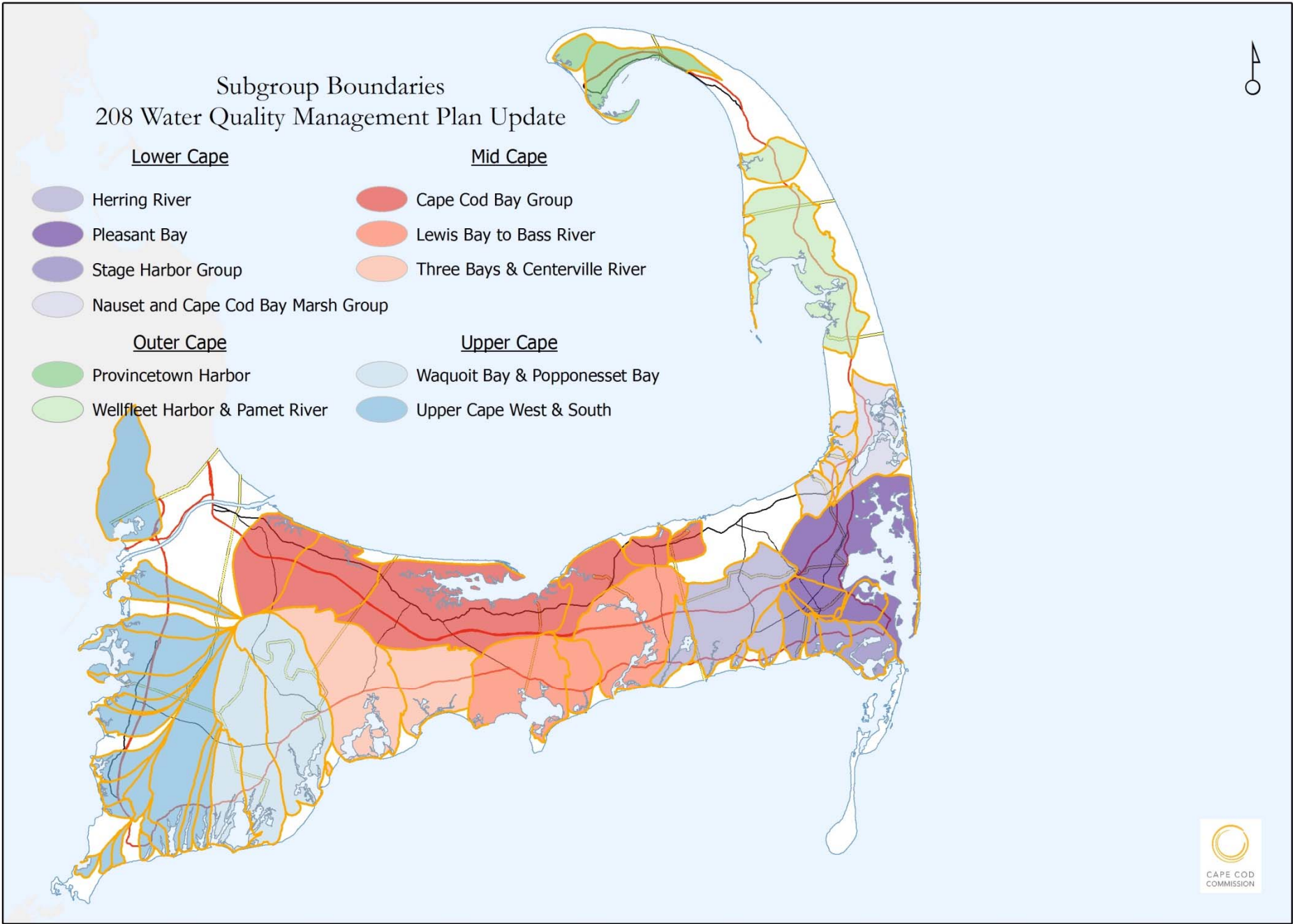
- Cape Cod Bay Group
- Lewis Bay to Bass River
- Three Bays & Centerville River

## Outer Cape

- Provincetown Harbor
- Wellfleet Harbor & Pamet River

## Upper Cape

- Waquoit Bay & Popponesset Bay
- Upper Cape West & South



**What is the stakeholder process?**

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## Public Meetings

## Watershed Working Groups



July

August

September

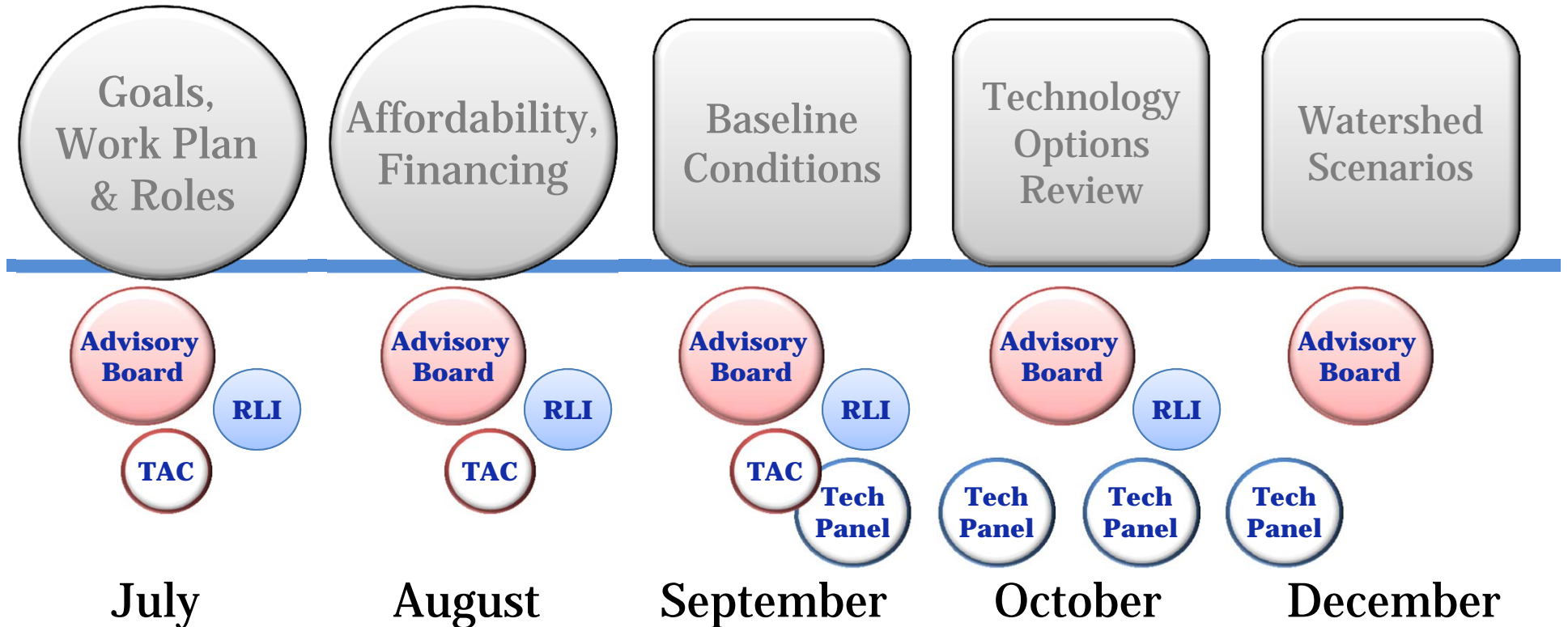
October

December

**208 Planning Process**

## Public Meetings

## Watershed Working Groups



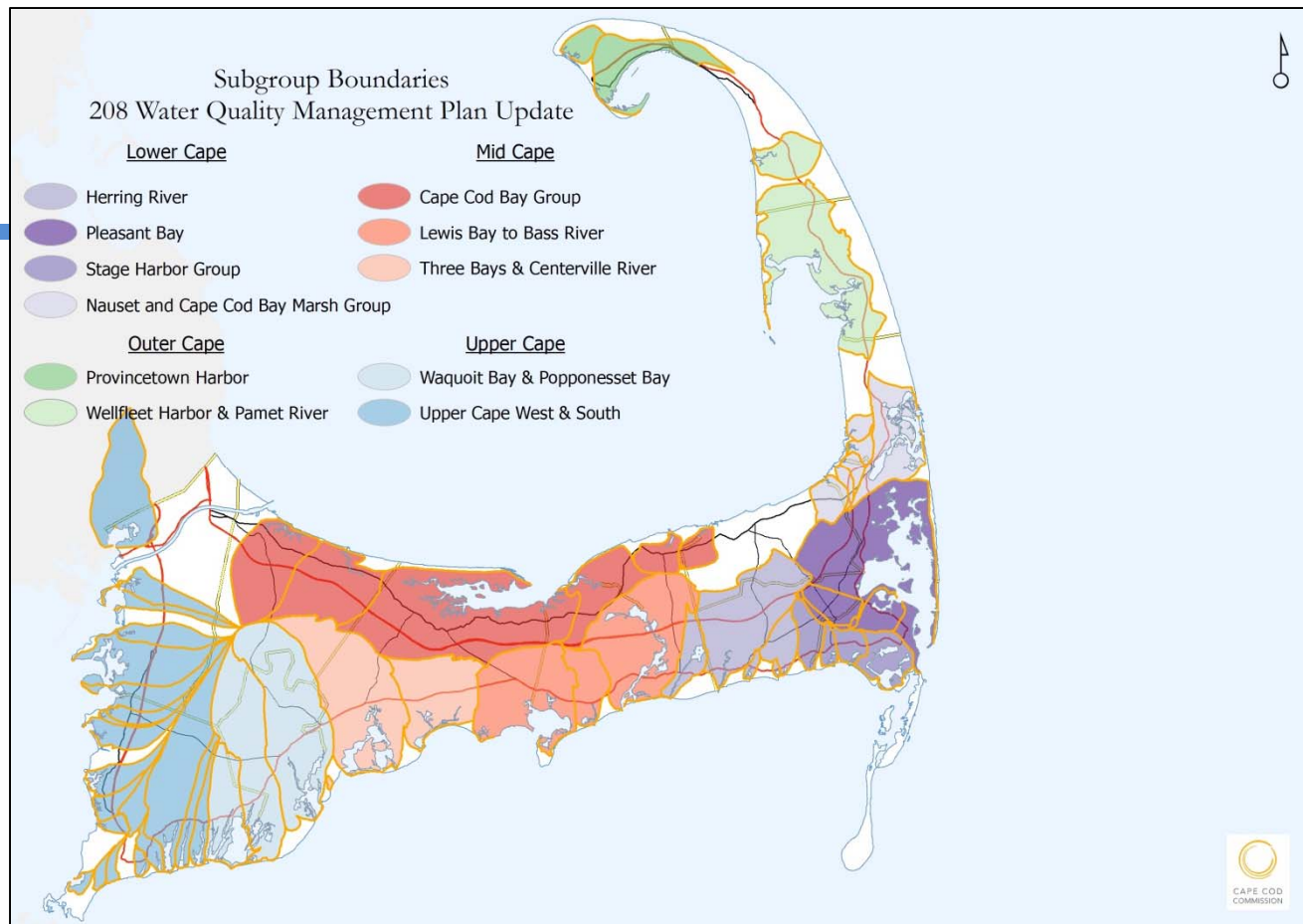
**RLI** Regulatory, Legal & Institutional Work Group

**TAC** Technical Advisory Committee of Cape Cod Water Protection Collaborative

# 208 Planning Process

# Baseline Conditions

11 Working  
Group Meetings:  
Sept 18-27



## 208 Planning Process

**Baseline Conditions**

11 Working Group Meetings:  
Sept 18-27

**Technology Options Review**

11 Working Group Meetings:  
Oct 21-Nov 5



- Wastewater
- Stormwater
- Existing Water Bodies
- Regulatory

# 208 Planning Process

Baseline  
Conditions

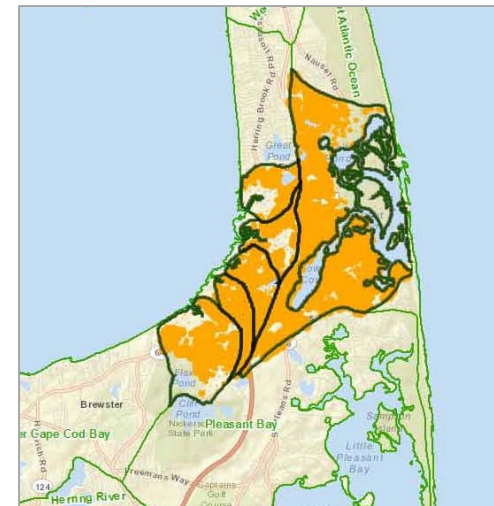
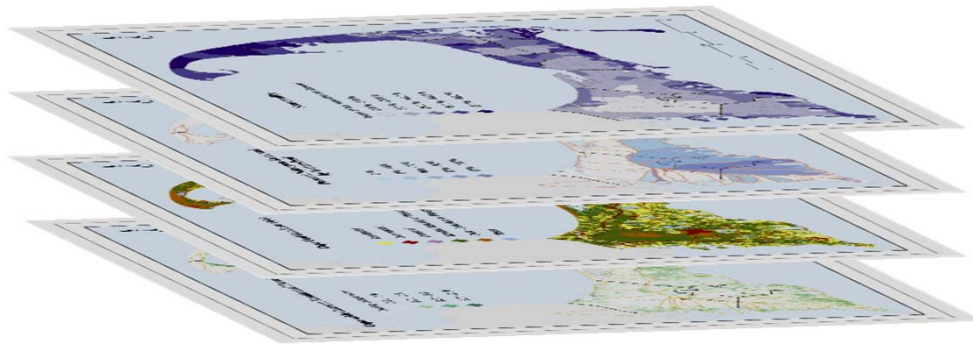
11 Working  
Group Meetings:  
Sept 18-27

Technology  
Options  
Review

11 Working  
Group Meetings:  
Oct 21-Nov 5

Watershed  
Scenarios

11 Working  
Group Meetings:  
Dec 2-11



**208 Planning Process**

**Baseline  
Conditions**

**11 Working  
Group Meetings:  
Sept 18-27**

## **Goal of Today's Meeting:**

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To review and develop shared understanding of the characteristics of these watersheds, the work done to date, existing data and information available, and how to apply all of this to planning for water quality improvements for these watersheds moving forward.

**208 Planning Process**

# Local Progress to Date



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Boat Meadow River  
Herring River  
Little Namskaket Creek  
Namskaket Creek  
Rock Harbor  
Town Cove/Nauset Marsh

# Brewster

## From 1978 Section 208 Plan

▶ Present and future town well sites should be protected from the non-point sources resulting from New development by creating Watershed Protection Districts.

▶ The town should cooperate in regional water supply planning to determine future water supply needs of neighboring towns and whether it can assist.

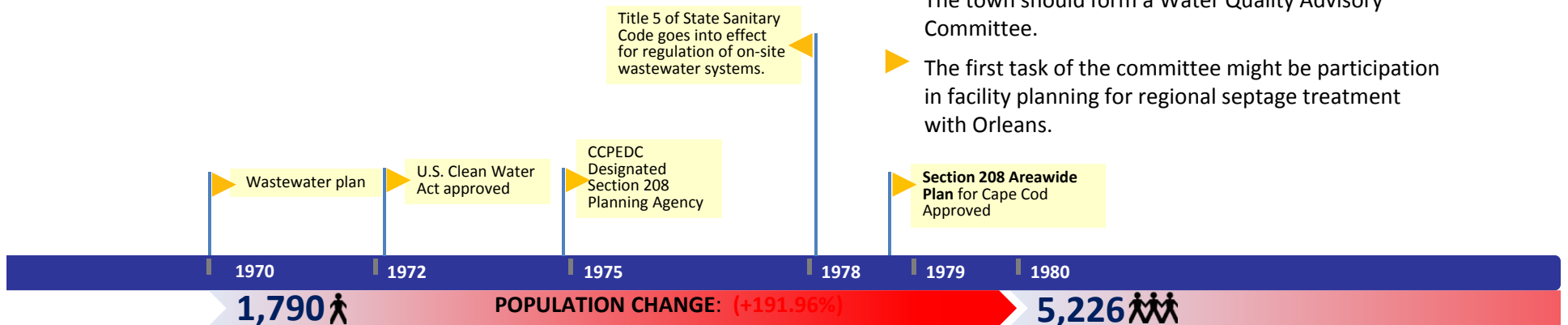
▶ WASTEWATER: It is expected that no new problem areas will develop and that present problem areas will be controlled during the planning period.

▶ The Orleans 201 facility plan will soon be underway and the cooperation of Brewster in the planning of a septage facility in Orleans that can meet Brewster's septage treatment needs is highly recommended.

▶ It is recommended that Brewster consider cooperating in a regional landfill monitoring program.

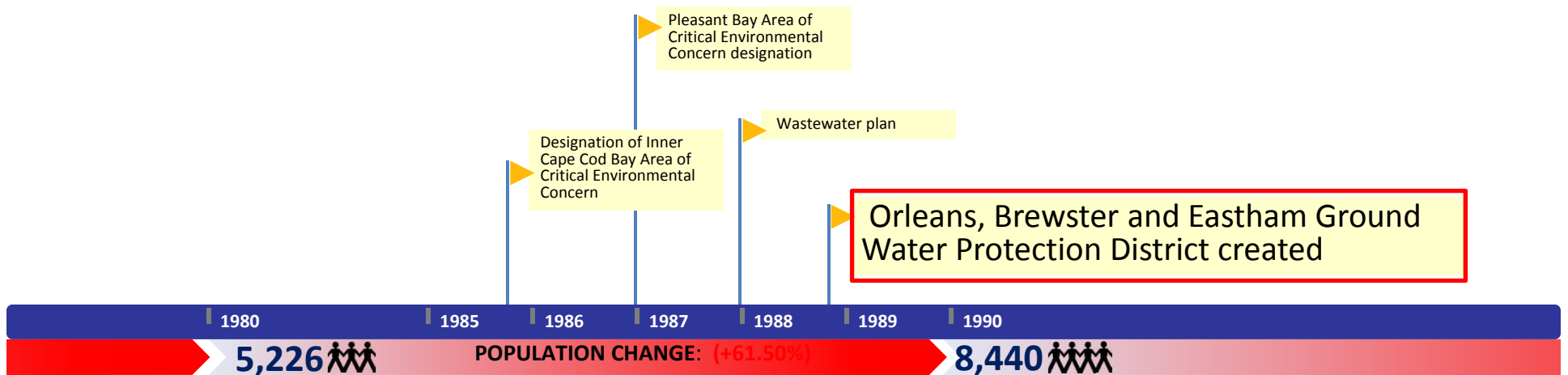
▶ The town should form a Water Quality Advisory Committee.

▶ The first task of the committee might be participation in facility planning for regional septage treatment with Orleans.

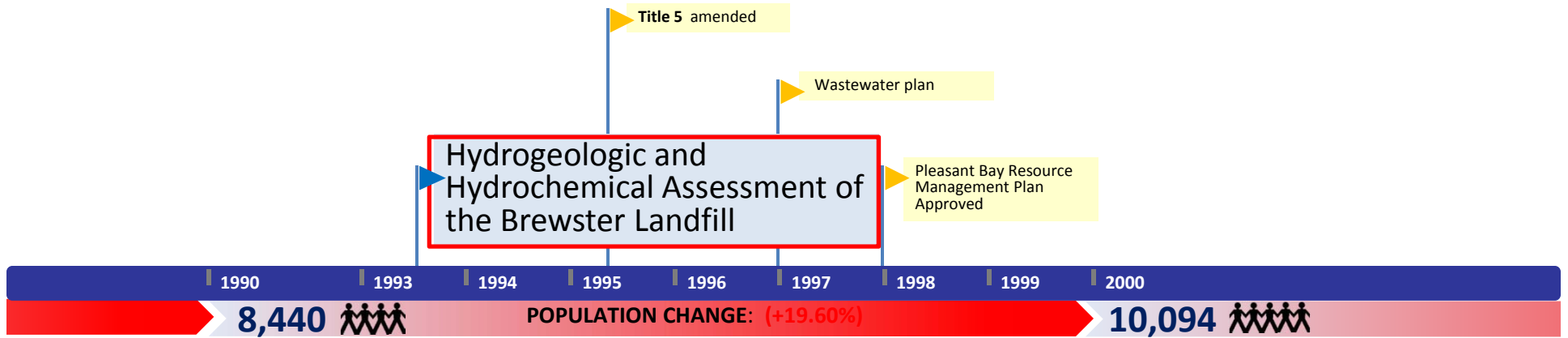




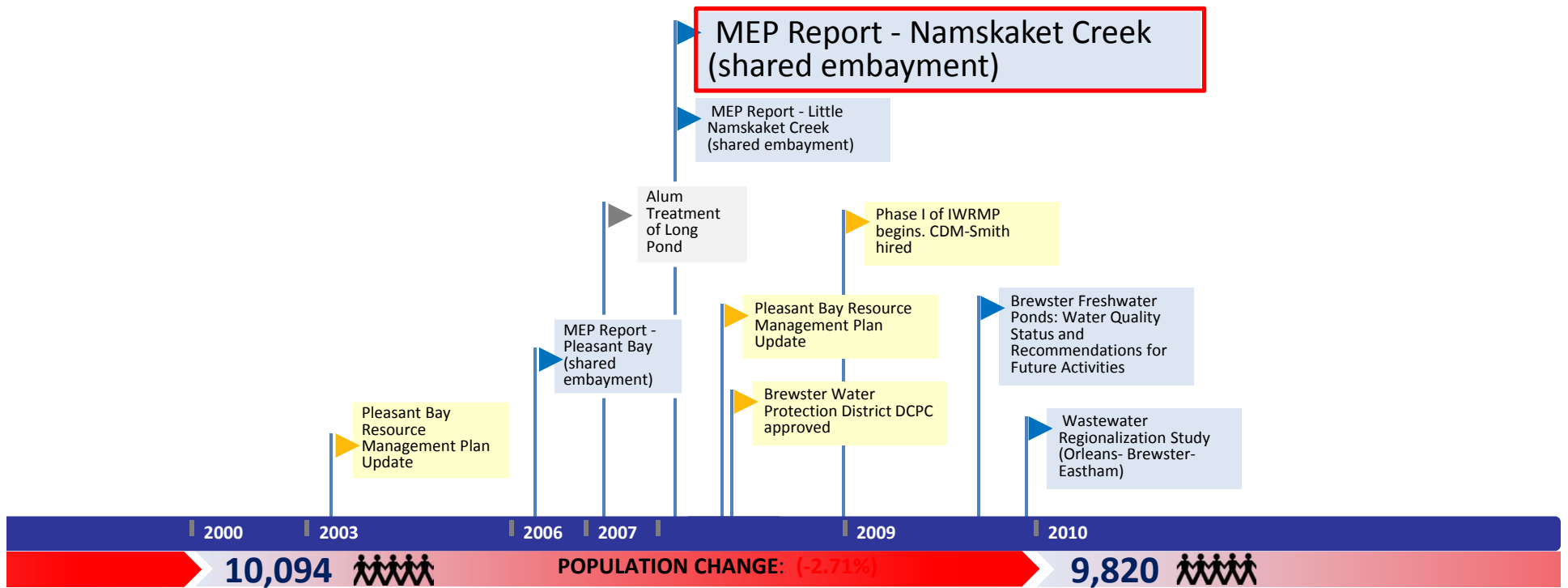
# Brewster: 1970-2013



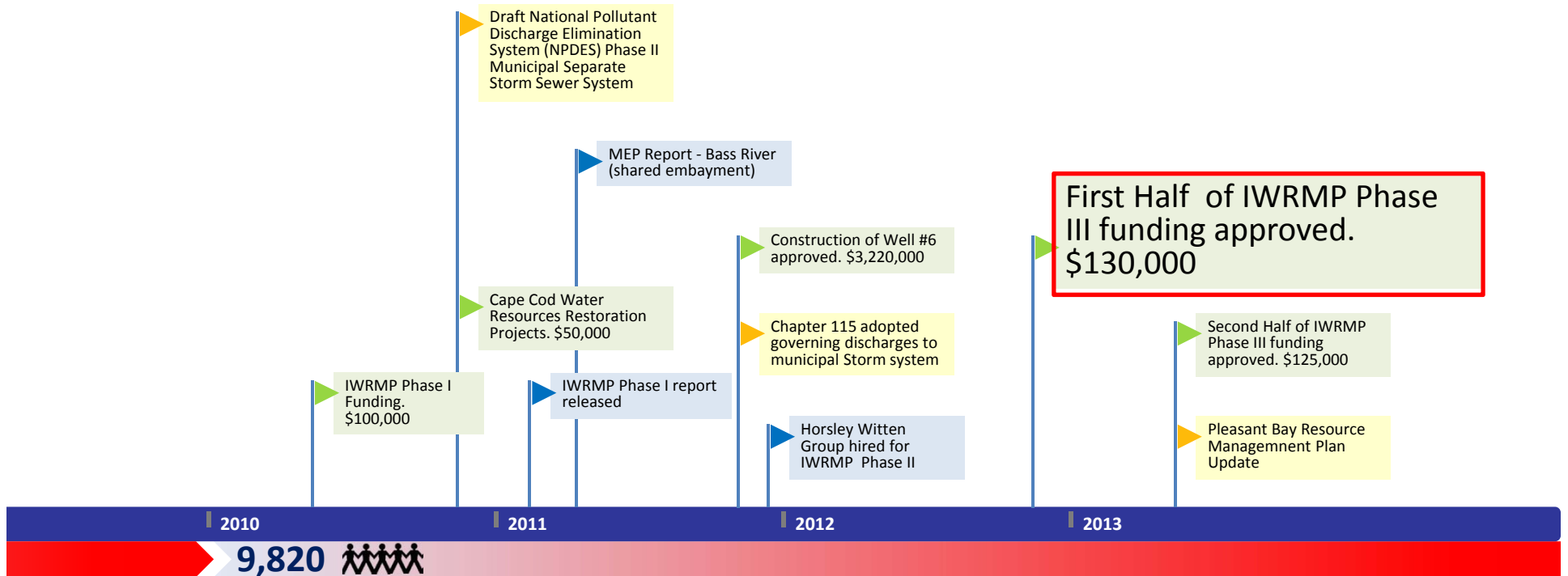
# Brewster: 1970-2013



# Brewster: 1970-2013



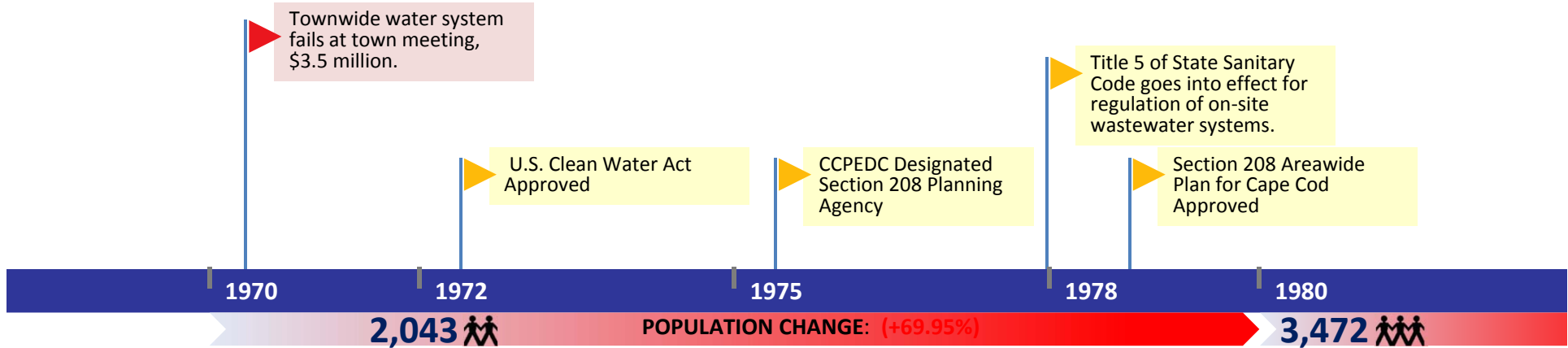
# Brewster: 1970-2013



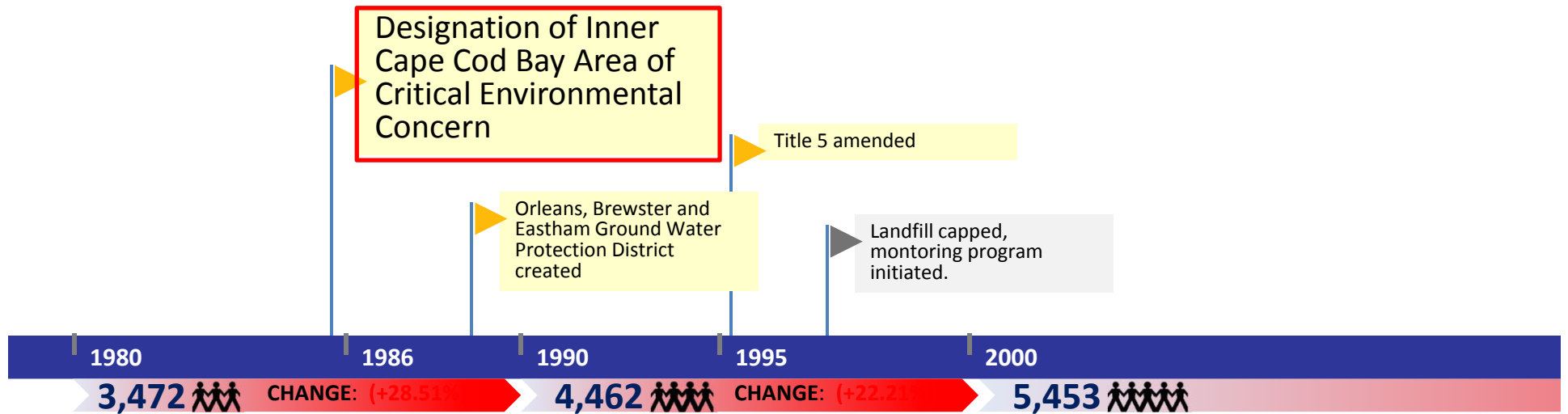
# Eastham

## From 1978 Section 208 Plan

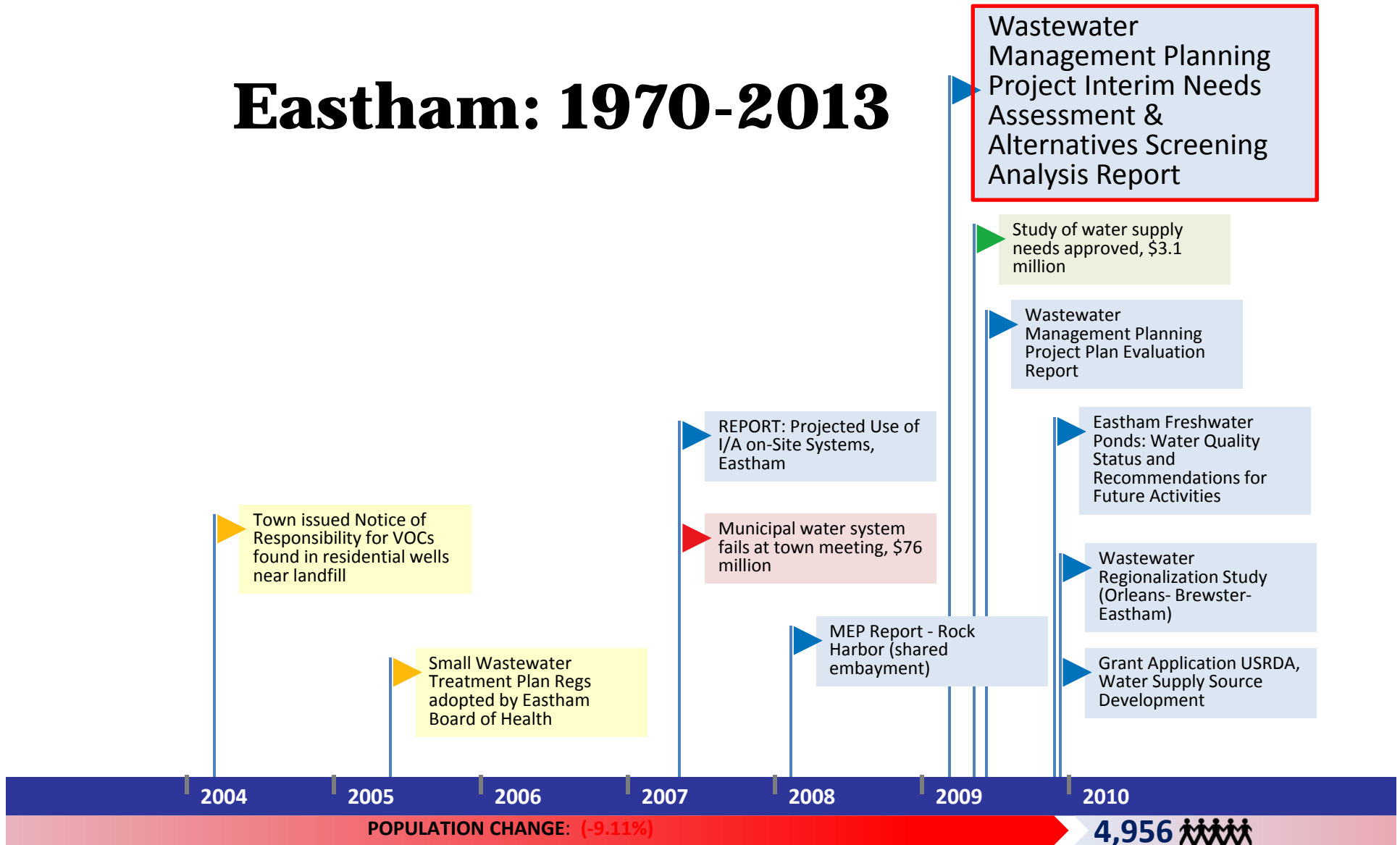
- ▶ Eastham should give priority to improving Title 5 enforcement and controlling conversion of seasonal dwellings.
- ▶ The town should work with CCPEDC to implement a Seasonal Residential District for the western shore of Eastham.
- ▶ Water supply is also of concern in Eastham. The high density areas and the town's present 20,000 square foot minimum lot size are not considered to provide adequate protection of private wells.
- ▶ It is suggested that the town begin to implement its water supply plan in the near future to serve densely populated areas, and areas around the town landfill.
- ▶ The town should install water table wells around the existing landfill to determine the probable direction of groundwater flow from the site.
- ▶ Further studies in cooperation with USGS may be necessary to locate the plume, since public water is not available and development is encroaching on the landfill area.
- ▶ The town should join regional waste disposal planning efforts in the hopes that a regional solution will be available before the existing site is exhausted.
- ▶ Eastham should join with Orleans in construction of a regional septage facility.



# Eastham: 1970-2013

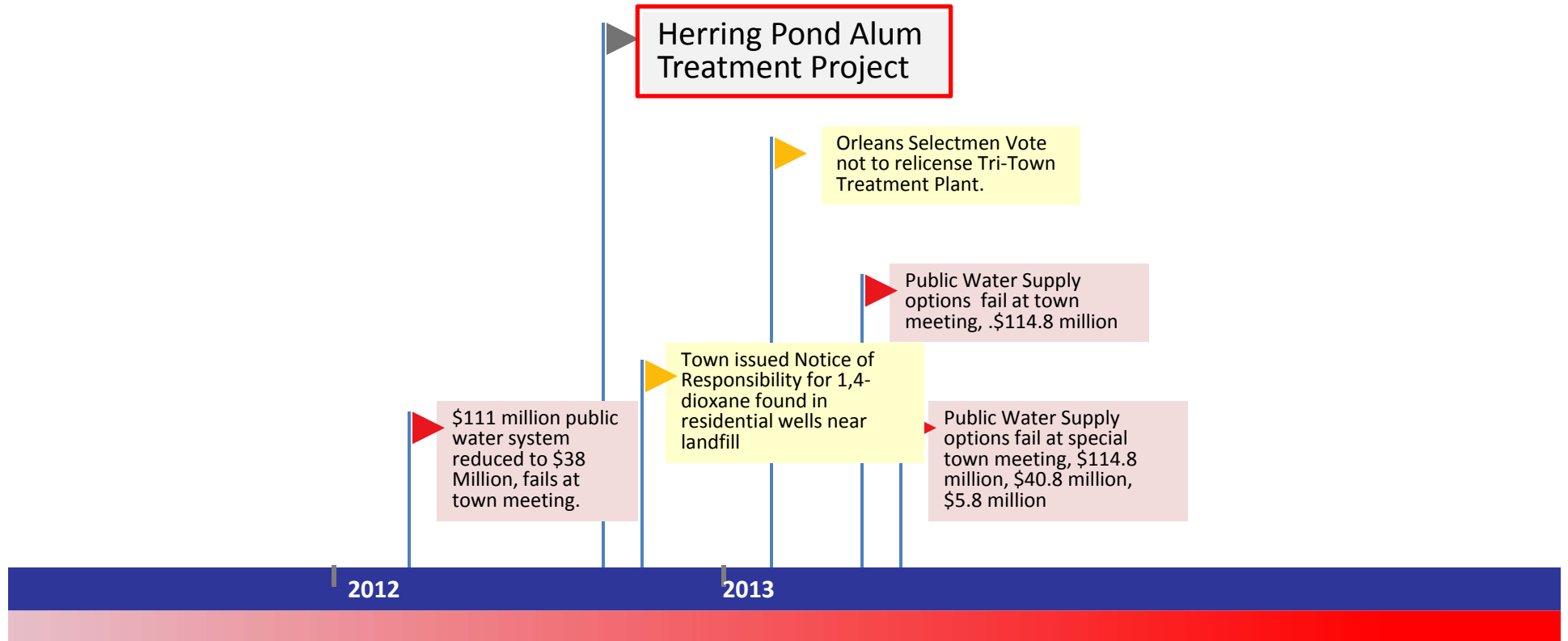


# Eastham: 1970-2013



POPULATION: 4,956  
(-9.11%)

# Eastham: 1970-2013

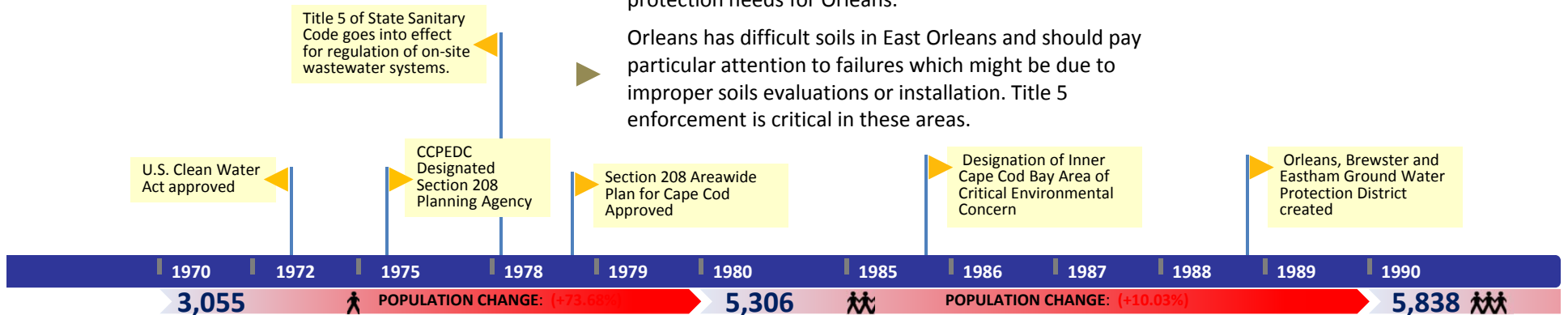




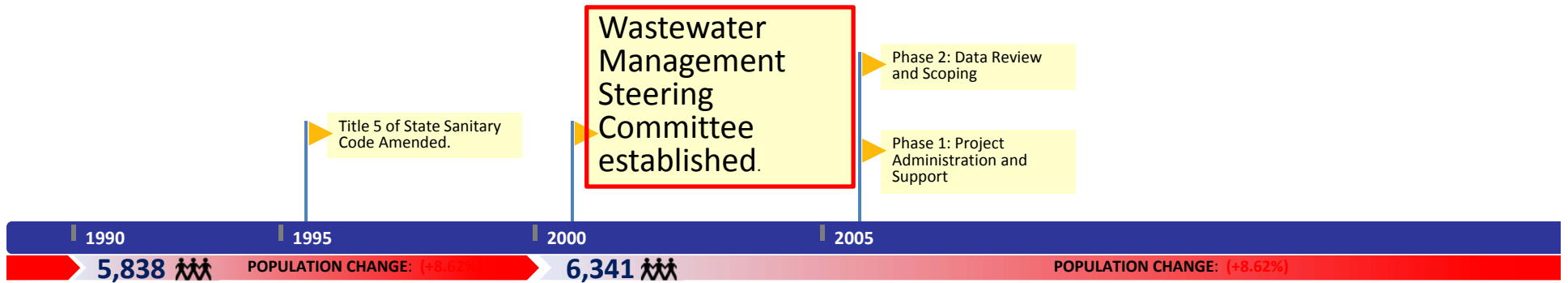
# Orleans

## From 1978 Section 208 Plan

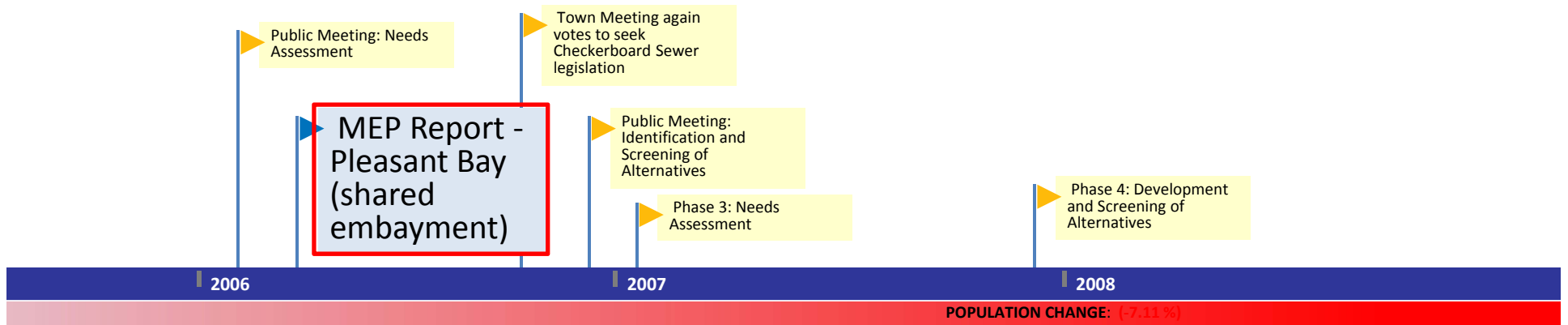
- ▶ The major problems in Orleans at present are septage management, failing systems in the town center, and protection of water quality in the municipal wells.
- ▶ Orleans is one of the first towns on the Cape to take positive action to abate the serious problems posed by septage disposal.
- ▶ A scope of work that would adequately address the problems in downtown Orleans, which may need to be sewered with a small neighborhood system was developed.
- ▶ The scope of work considered regionalized septage treatment with Eastham and Brewster.
- ▶ The actual landfill plume location has not been determined. This is critical if the site is to be used as a septage disposal site in the future.
- ▶ A coordinated land use analysis coordinated with Brewster is necessary to determine watershed protection needs for Orleans.
- ▶ Orleans has difficult soils in East Orleans and should pay particular attention to failures which might be due to improper soils evaluations or installation. Title 5 enforcement is critical in these areas.



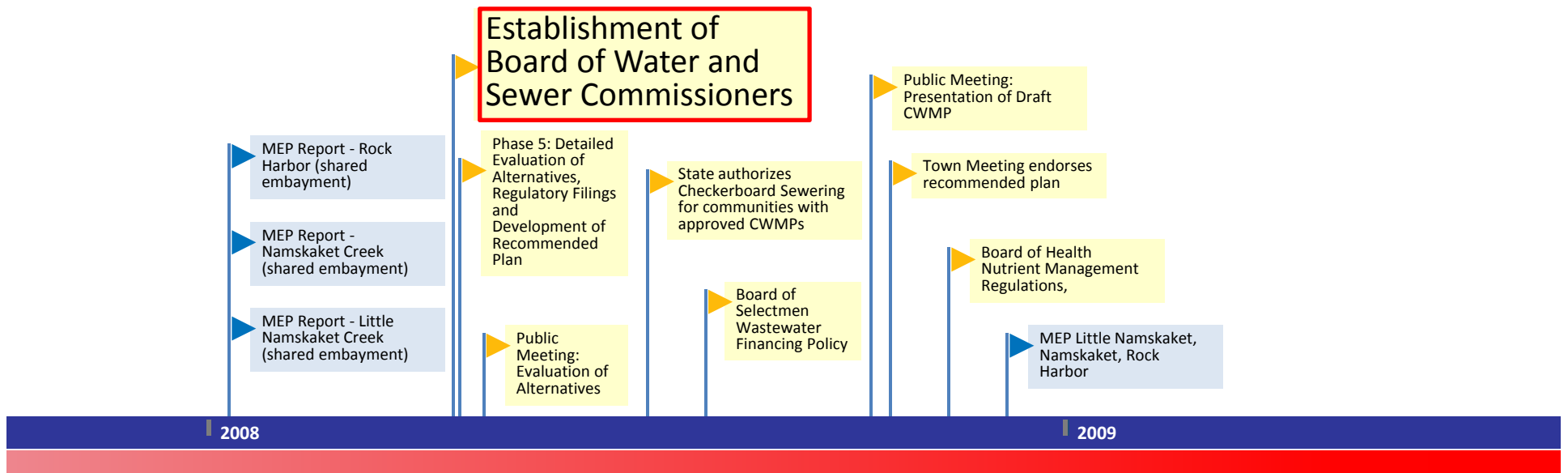
# Orleans: 1970-2013



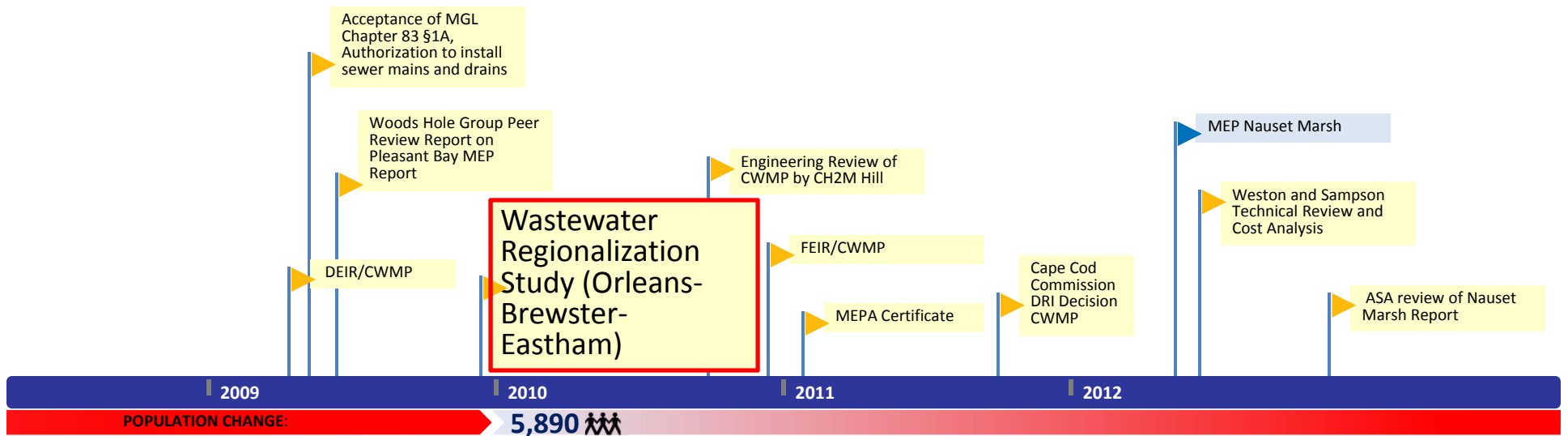
# Orleans: 1970-2013



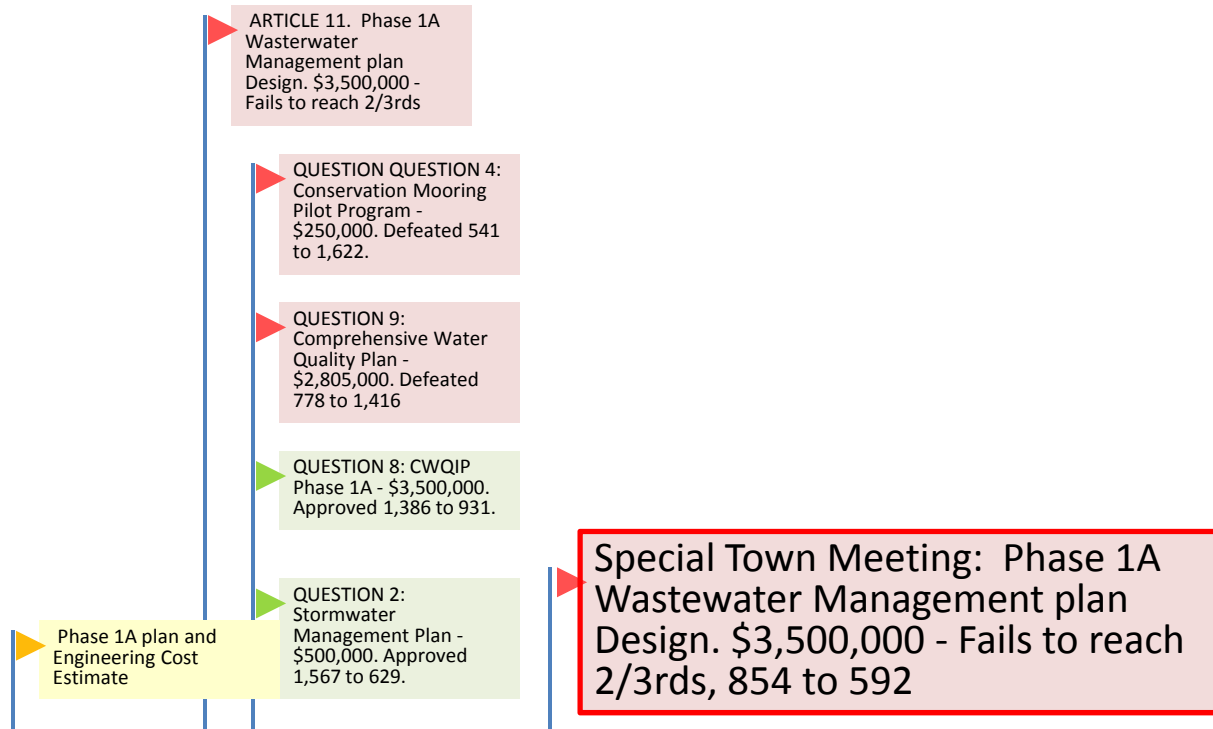
# Orleans: 1970-2013



# Orleans: 1970-2013



# Orleans: 1970-2013



**Did we miss anything?**

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# Your Watersheds

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- Boat Meadow River
- Herring River
- Little Namskaket Creek
- Namskaket Creek
- Rock Harbor
- Town Cove/Nauset Marsh





**13.6 square miles**




# 3 Towns




# Natural Features


## Base Map

 Town Lines


 Rivers


## Embayment Boundary

 On Land


 On Sea


## Major Roads

 US Highway


 State Highway


 Roads


 Structures

 Ponds


## Natural Areas


 Natural Heritage & Endangered Species Program (NHESP) Certified Vernal Pools

 Water Table Contours

 Cranberry Bogs


 Wetlands

 Sea, Lake, & Overland Surges from Hurricanes (SLOSH) Update 2013

 Preliminary FEMA Flood Insurance Rate Map (FIRM) Zones 2013


# Managed Surfaces


## Base Map

 Town Lines


 Rivers


## Embayment Boundary

 On Land


 On Sea

## Major Roads

 US Highway


 State Highway


 Roads


 Structures


 Ponds

## Managed Surfaces

 Approximate Managed Ground Surfaces

 Approximate Residential Managed Lawns


 Approximate Managed Golf Courses

 Approximate Municipal Managed Natural Surfaces




# Regulatory


## Base Map

 Town Lines


 Rivers


## Embayment Boundary

 On Land


 On Sea

## Major Roads

 US Highway


 State Highway


 Roads


 Structures

 Ponds


## Regulatory

 Areas of Critical Environmental Concern

 DEP Approved Wellhead Protection Areas (Zone IIs)

 Growth Incentive Zone


## OpenSpace: Level of Protection


 In Perpetuity

 Limited

 None


## Landuse Vision Map


 Economic Center

 Industrial and Service Trade Area

 Village


 Resource Protection Area

 Other

 Undesignated


# Land Use Change


## Base Map

 Town Lines


 Rivers


## Embayment Boundary


 On Land


 On Sea

## Major Roads

 US Highway


 State Highway


 Roads


 Structures


 Ponds


## LandUse Change

 Residential

 Commercial

 Industrial

 Wooded, Natural, or Wetlands

 Open - Disturbed or Managed

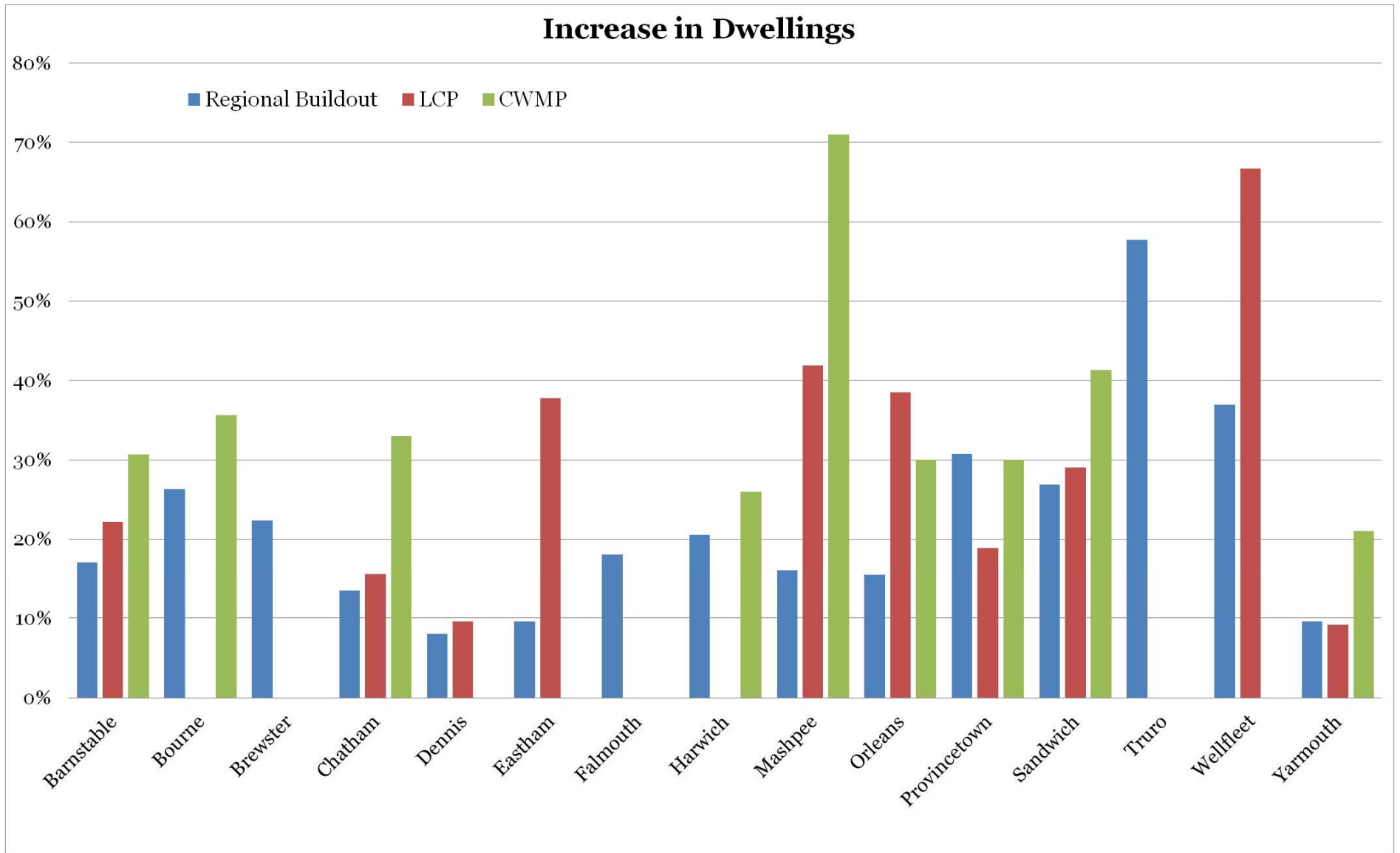
 Water

# Density

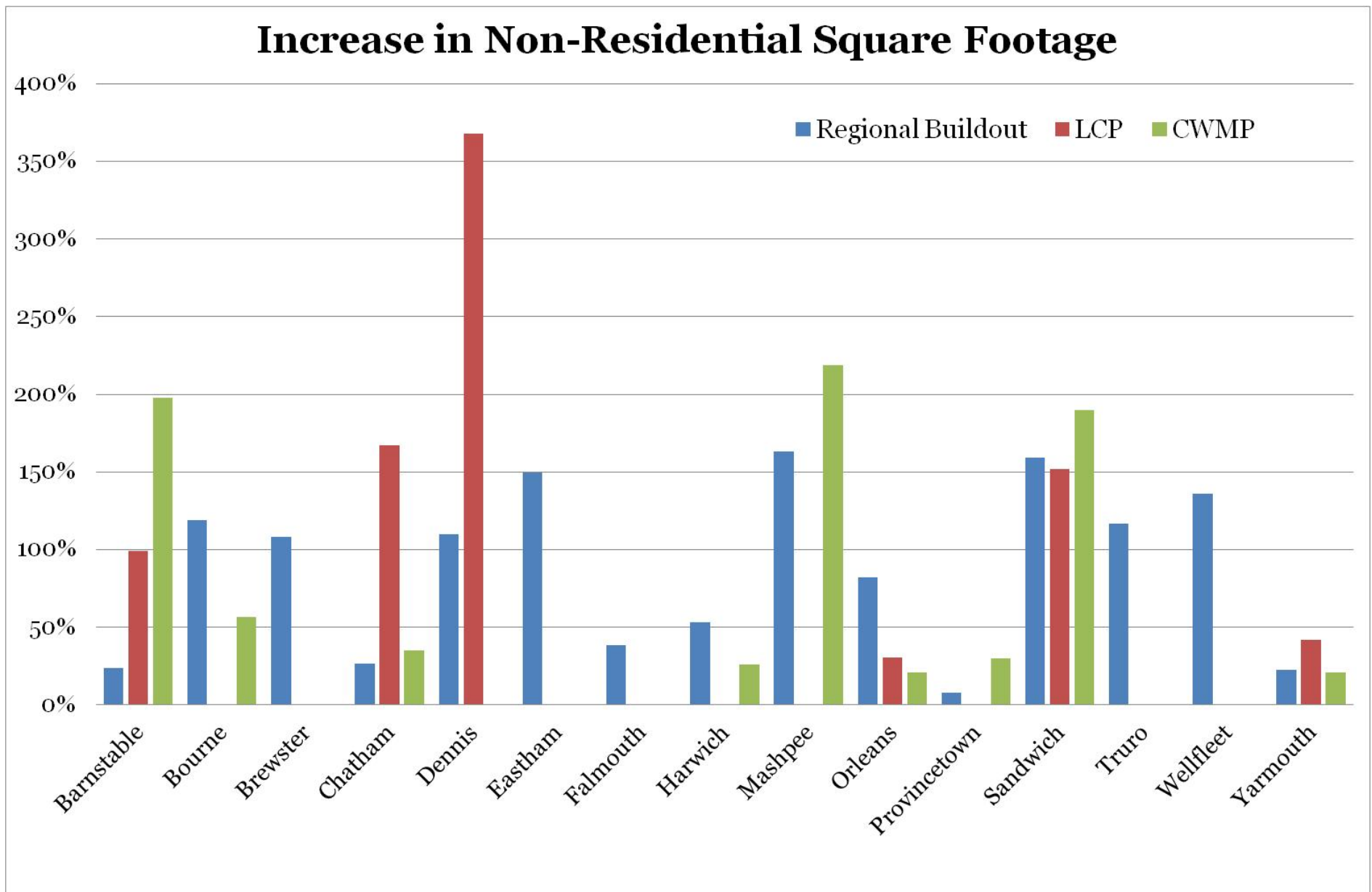
**Cape Wide Cost Estimate:  
30% growth will increase  
capital costs by 40%**



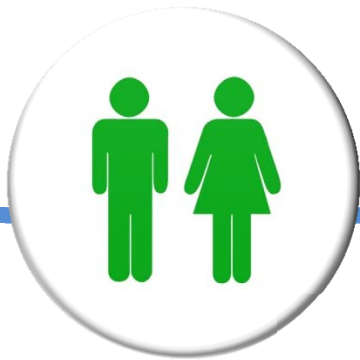
# Buildout



# Buildout



# **The People**



**Boat Meadow River**

**Herring River**

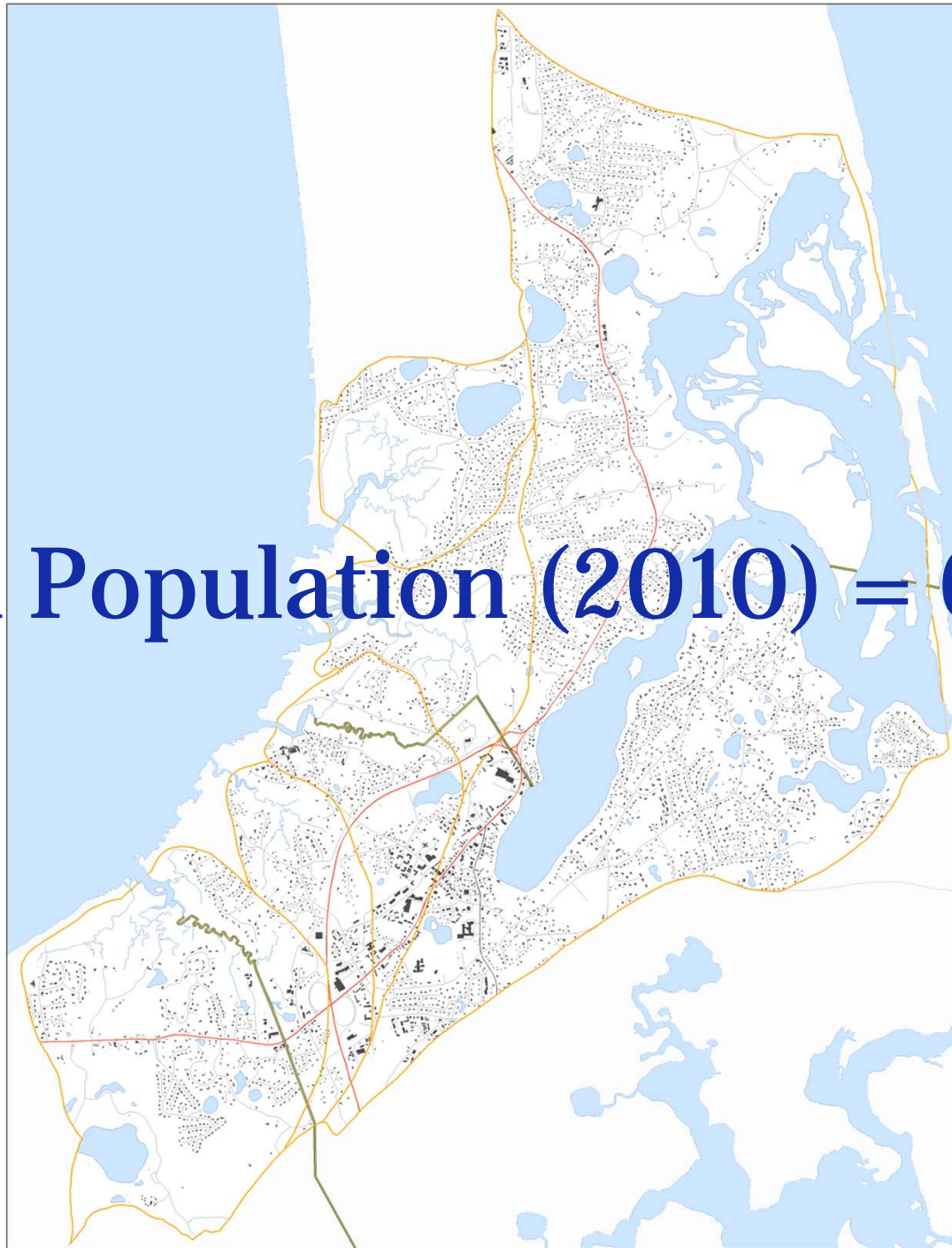
**Little Namskaket Creek**

**Namskaket Creek**

**Rock Harbor**

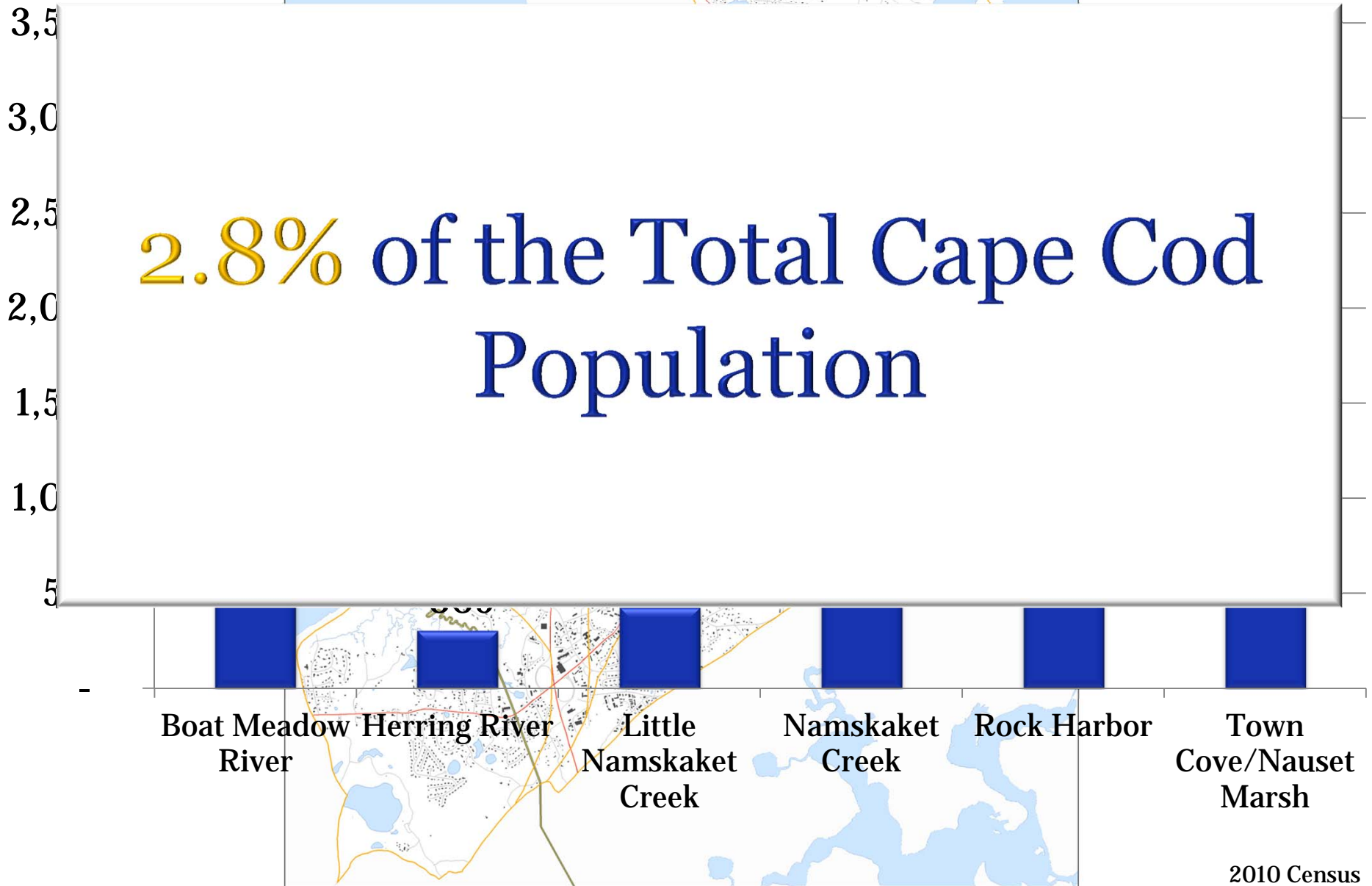
**Town Cove/Nauset Marsh**

**Total Population (2010) = 6,220**

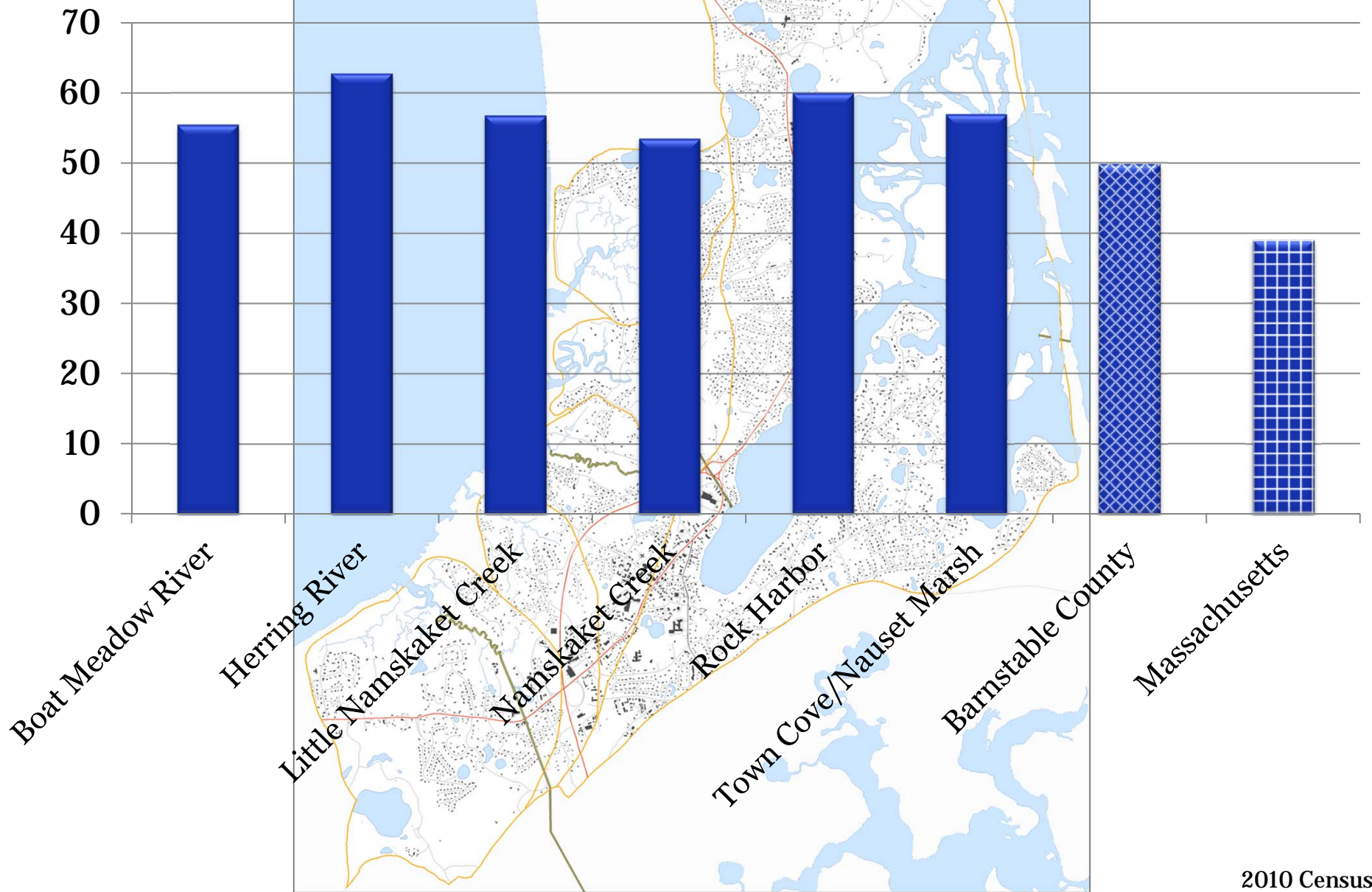


## Population (2010)

2.8% of the Total Cape Cod Population

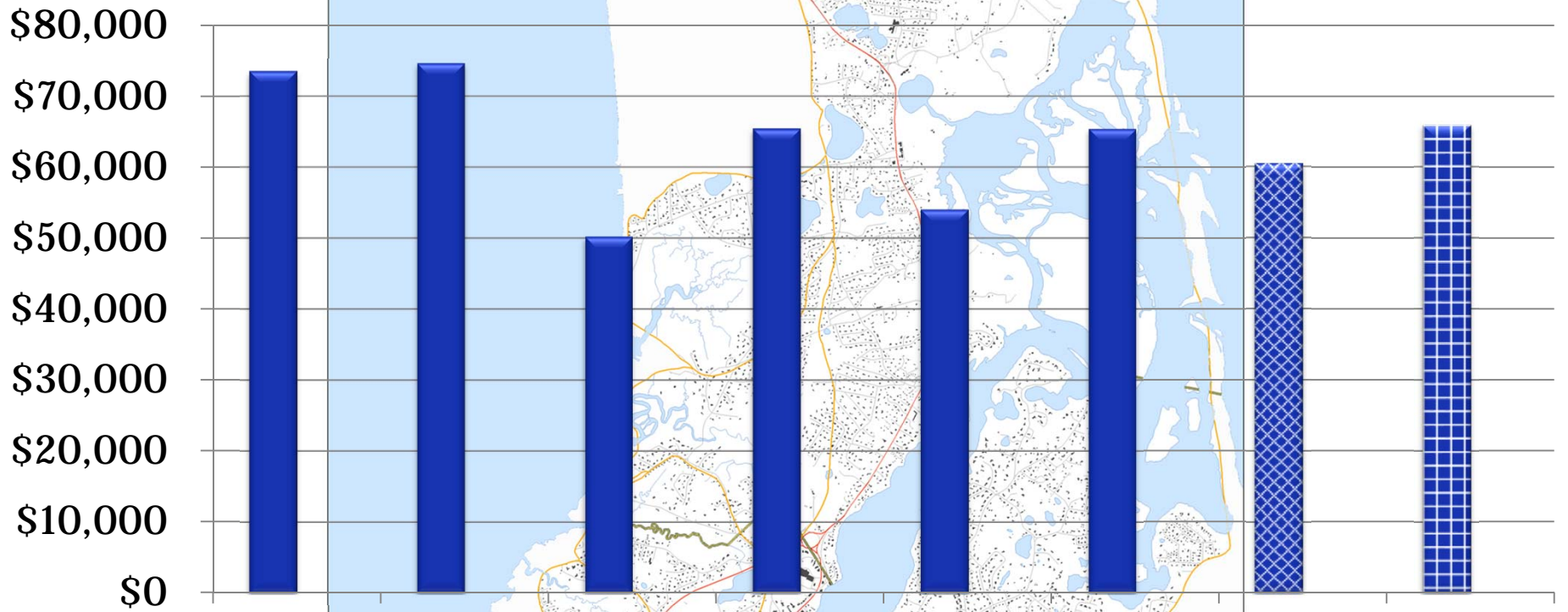


# Median Age (2010)





# Median Income (2010)



Boat Meadow River

Herring River

Little Namskaket Creek

Namskaket Creek

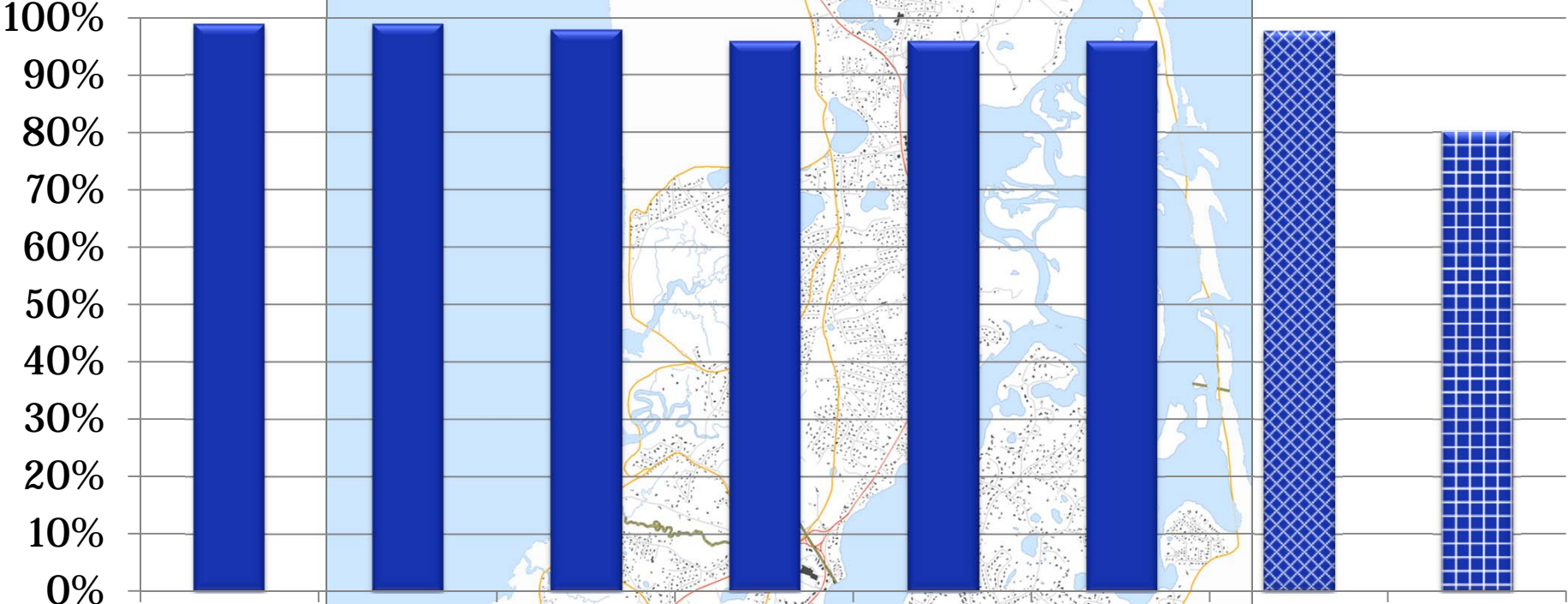
Rock Harbor

Town Cove/Nauset Marsh

Barnstable County

Massachusetts

# Race - % White (2010)



Boat Meadow River

Herring River

Little Namskaket Creek

Namskaket Creek

Rock Harbor

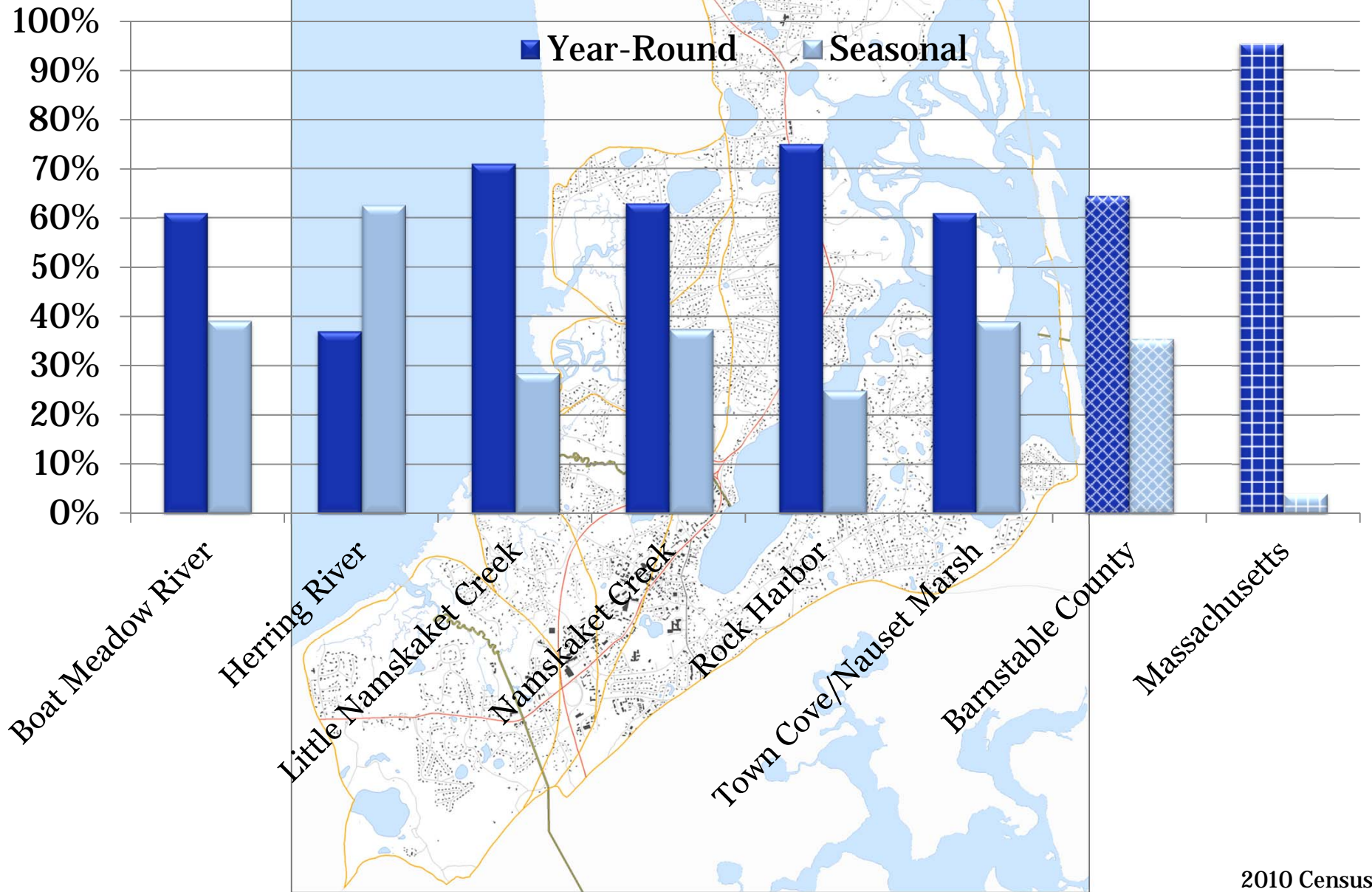
Town Cove/Nauset Marsh

Barnstable County

Massachusetts



# Seasonal vs. Year Round Housing (2010)



# Average Assessed Home Value (2010)

\$700,000  
\$600,000  
\$500,000  
\$400,000  
\$300,000  
\$200,000  
\$100,000

Total Assessed Value of Residential Homes=  
**\$2,513,942,530**

Boat Meado

Herrin

Little Namskake

Namskake

Rock

Town Cove/Nauset

Barnstable

Massac

# **Your Government & Taxes**



**Boat Meadow River**

**Herring River**

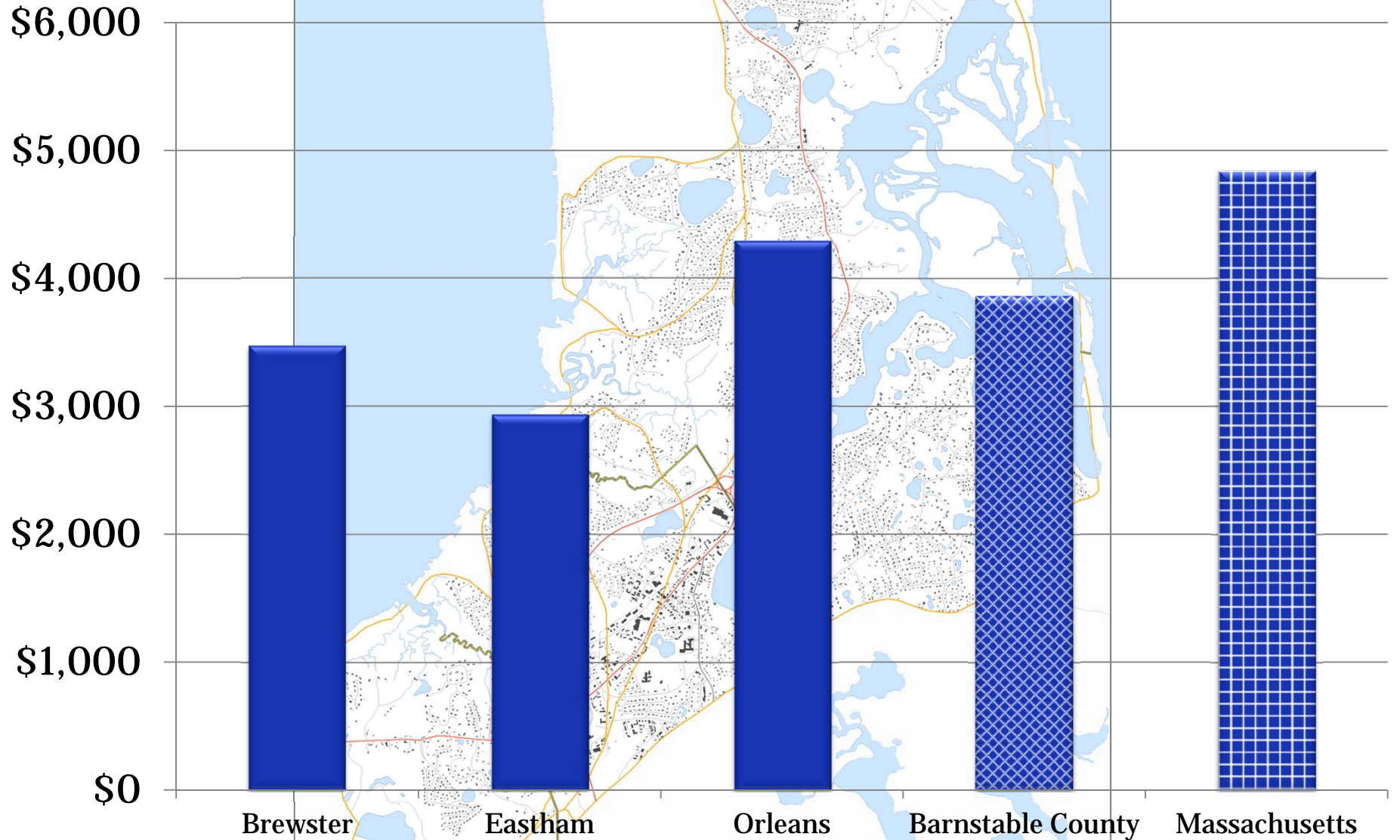
**Little Namskaket Creek**

**Namskaket Creek**

**Rock Harbor**

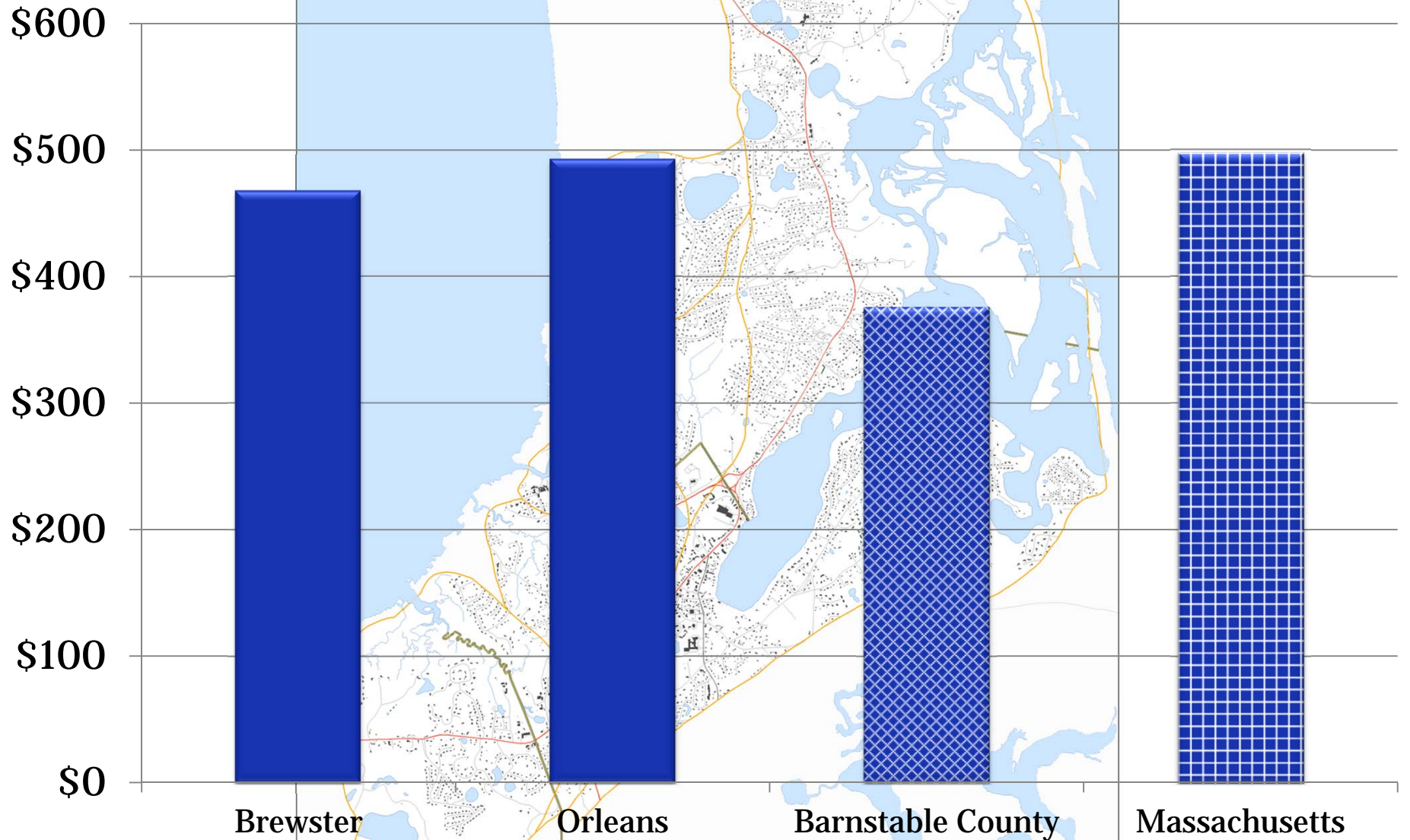
**Town Cove/Nauset Marsh**

# Average Single Family Property Tax Bill (2013)

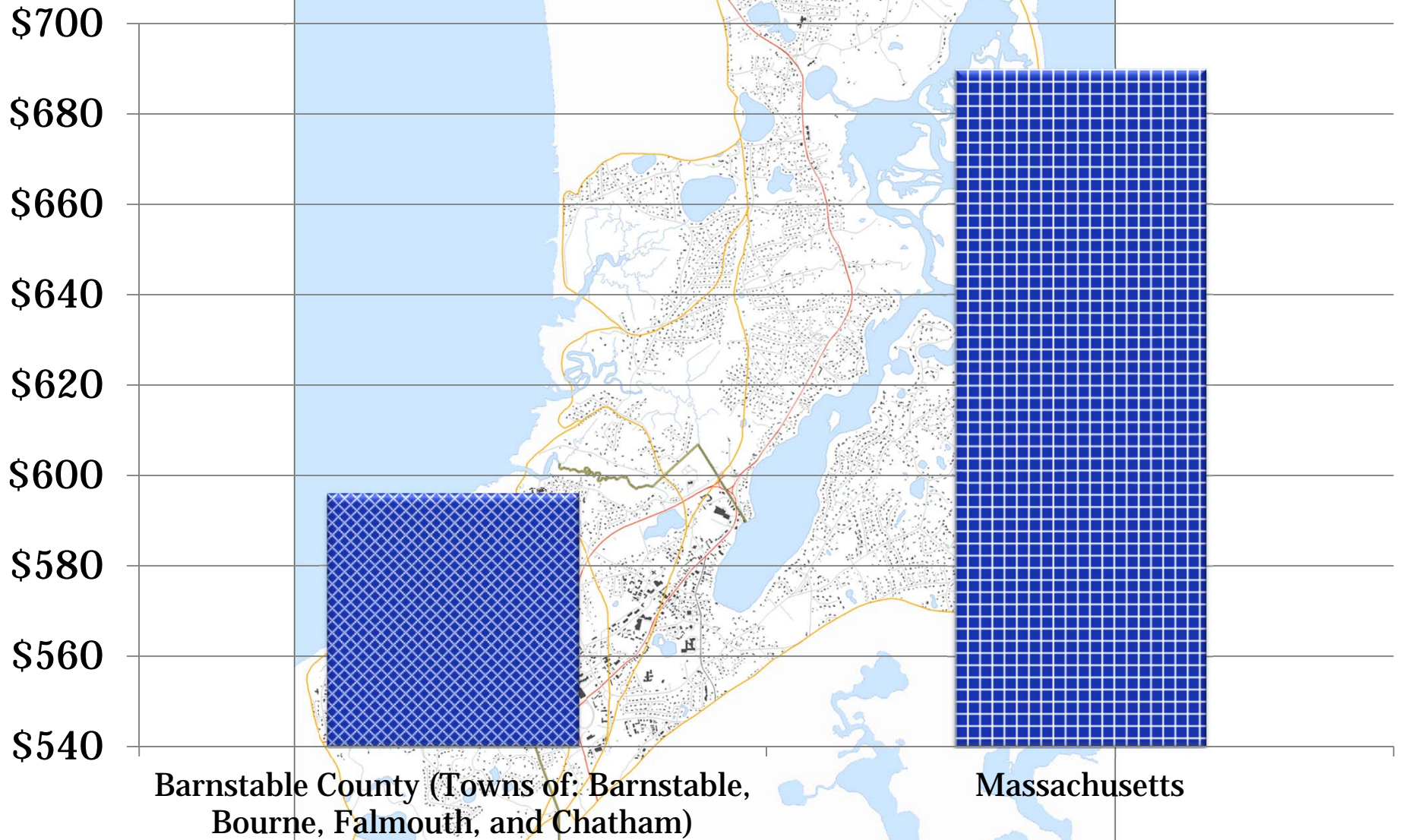




# Average Annual Water Bill (2012)



# Average Annual Sewer Bill (2012)



# The Problem

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Boat Meadow River  
Herring River  
Little Namskaket Creek  
Namskaket Creek  
Rock Harbor  
Town Cove/Nauset Marsh





Photo credit: Commonwealth of Massachusetts

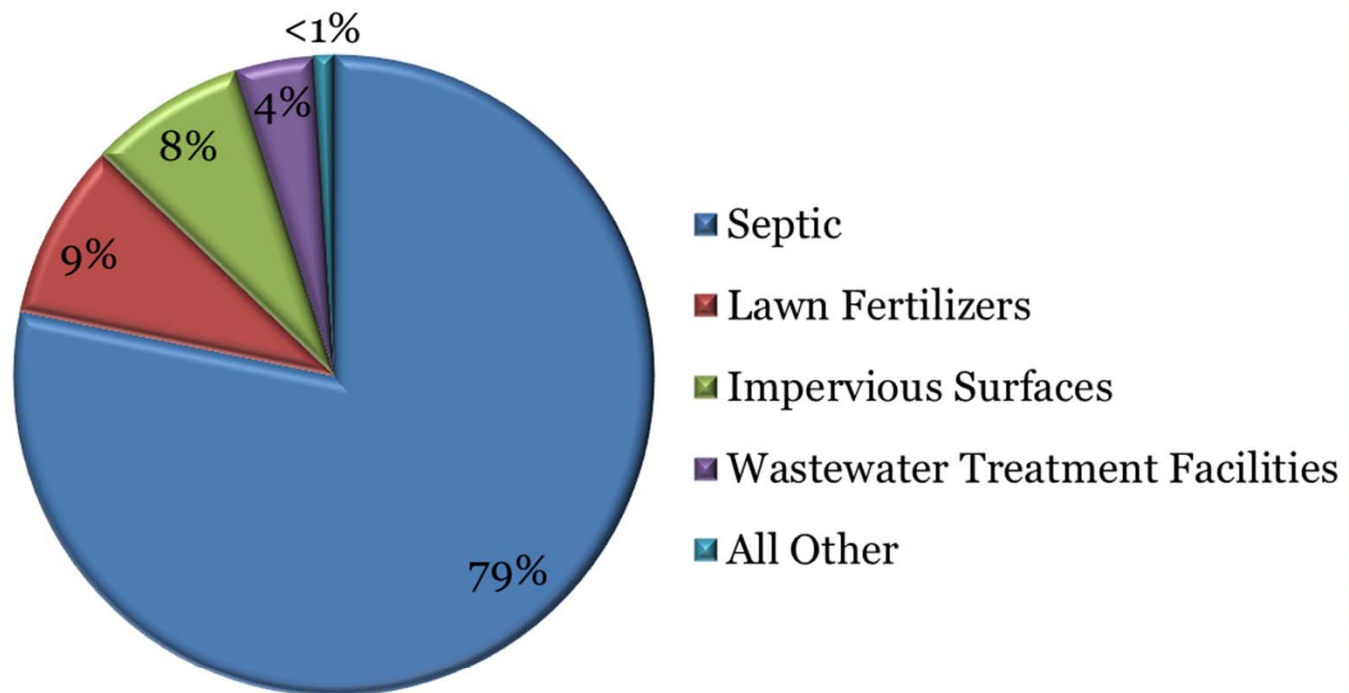




## Massachusetts Estuaries Project

- Opportunity for towns to obtain independent analysis of nitrogen loading and its impact on water quality
- Provides water quality, nutrient loading, and hydrodynamic information
- Water quality monitoring – minimum of 3 years of data for each embayment
- Watershed model links water quality data to nitrogen loads

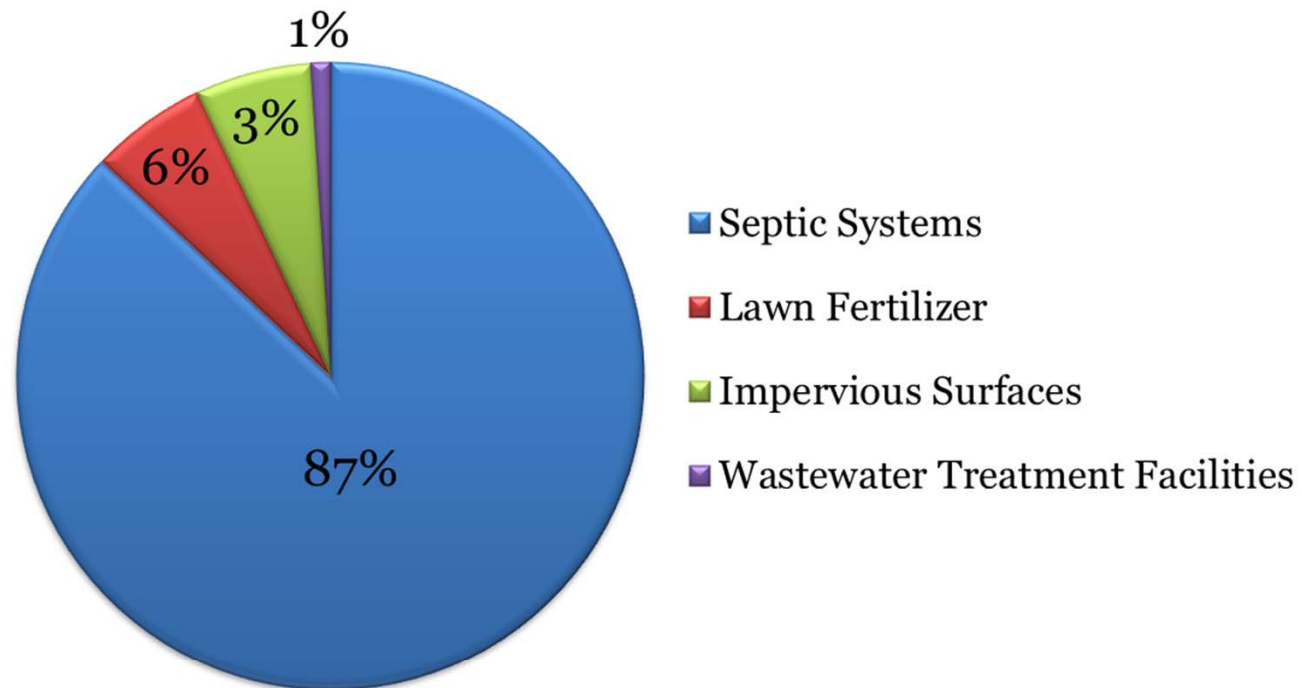
## Cape-Wide Controllable Nitrogen Loads



Note: Data averaged from existing Massachusetts Estuaries Project Reports

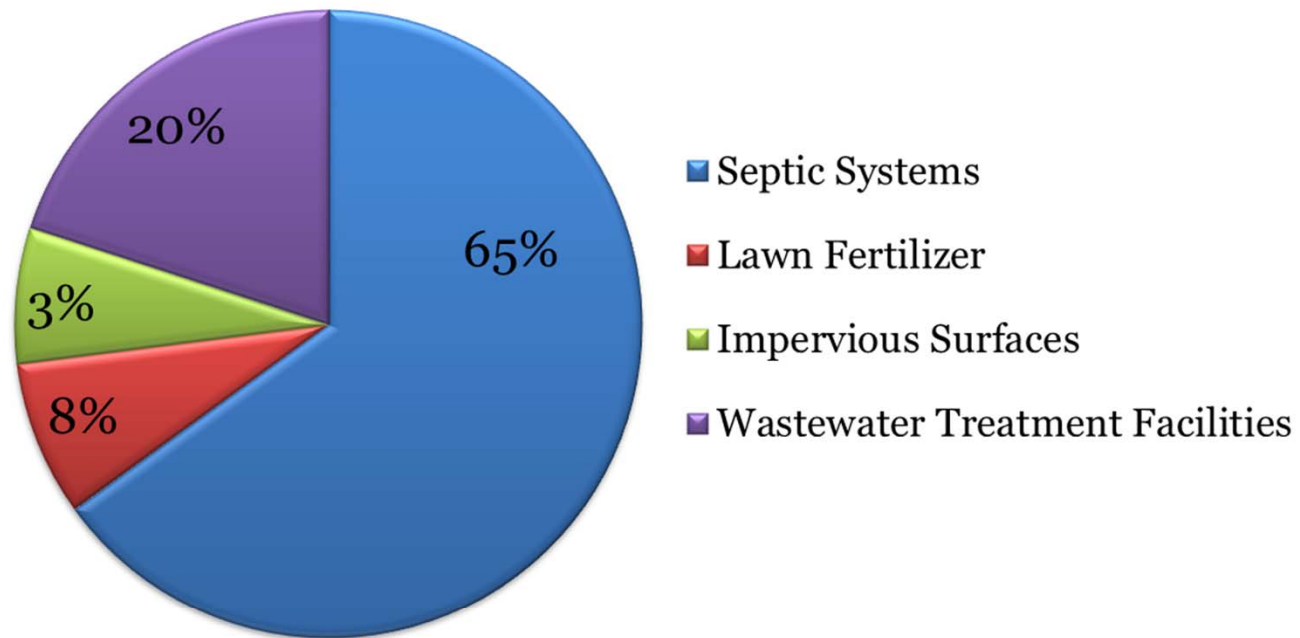


## Little Namskaket Creek Controllable Nitrogen Loads



Massachusetts Estuaries Project, 2008

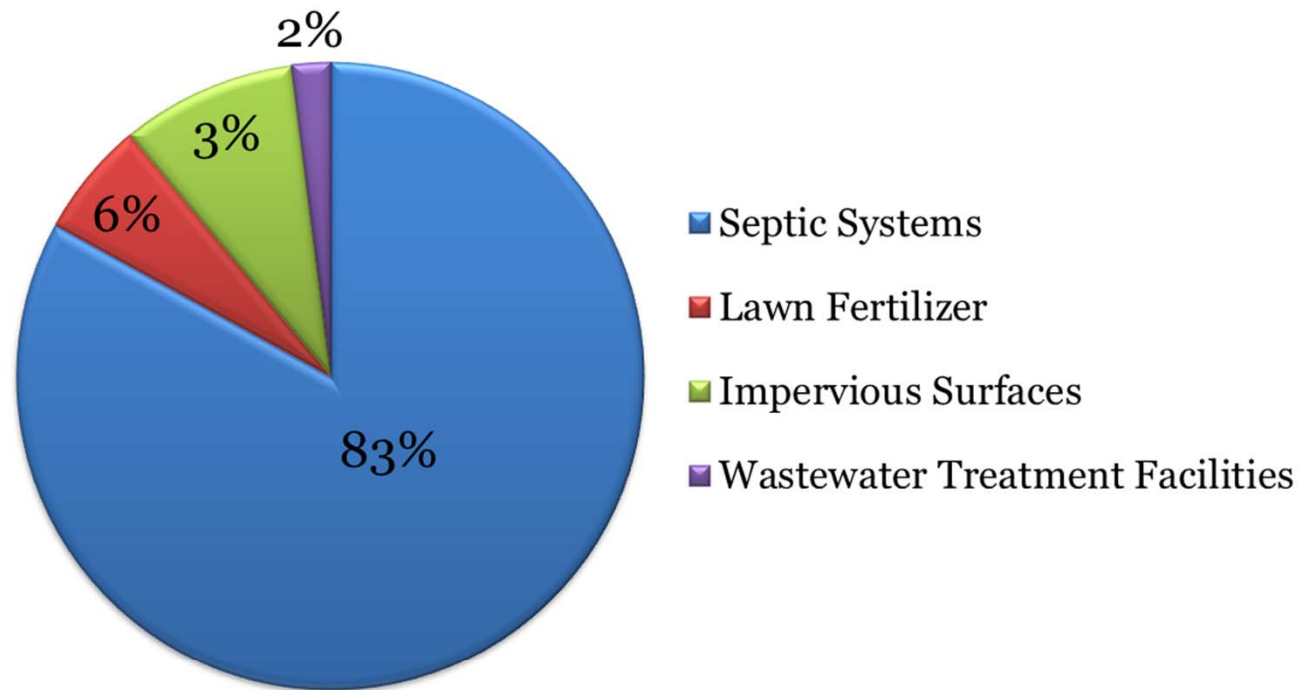
## Namskaket Creek Controllable Nitrogen Loads



Massachusetts Estuaries Project, 2008

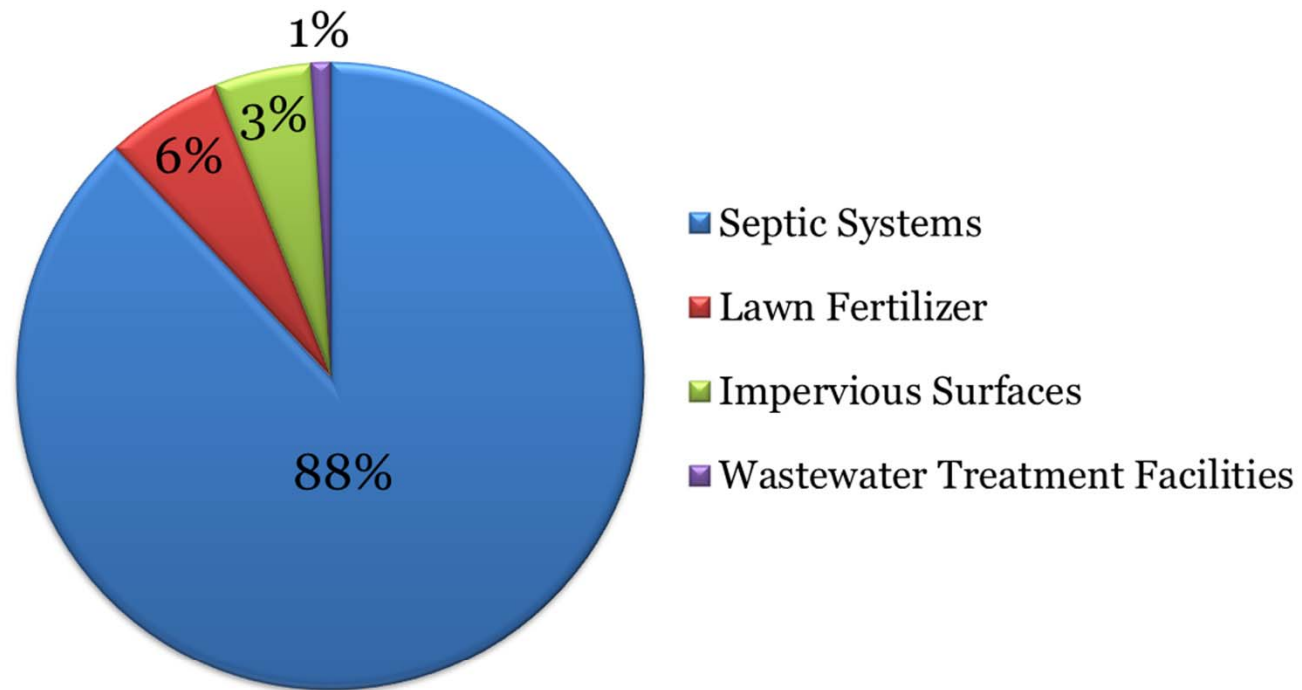


## Nauset Marsh Controllable Nitrogen Loads



Massachusetts Estuaries Project, 2012

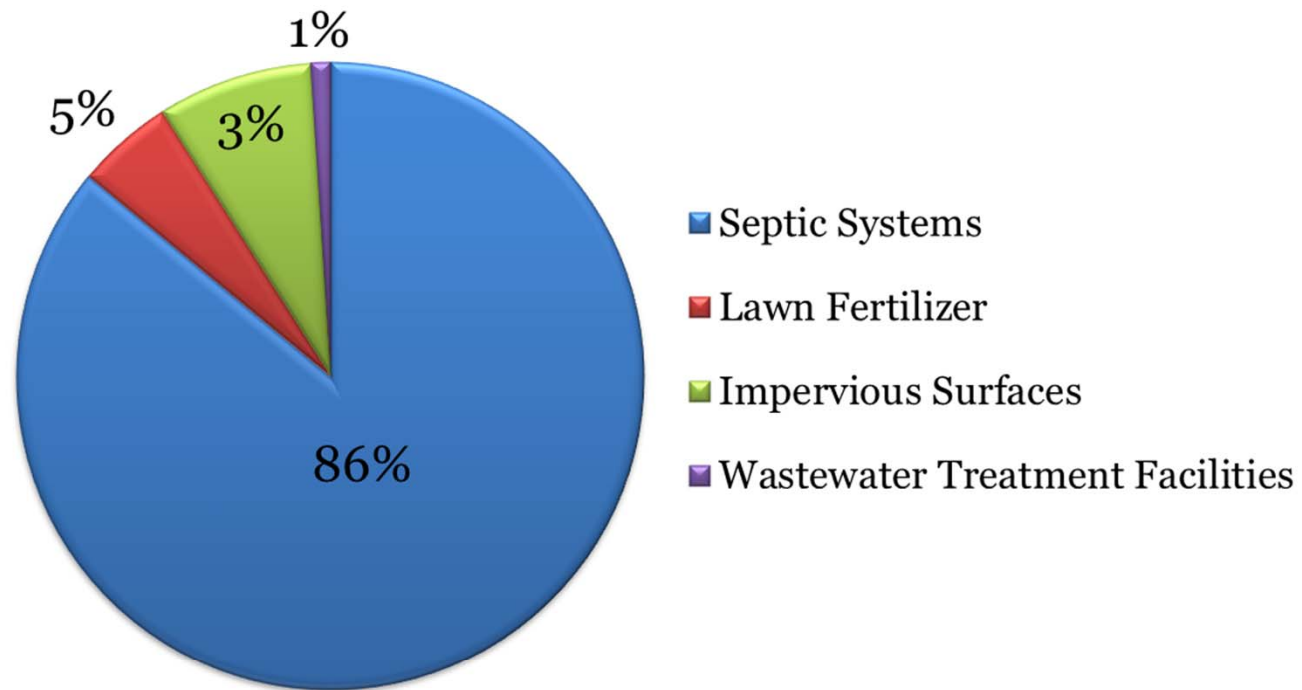
## Rock Harbor Controllable Nitrogen Loads



Massachusetts Estuaries Project, 2008




## Town Cove Controllable Nitrogen Loads



Massachusetts Estuaries Project, 2012


# Nitrogen Problem


## Base Map

 Town Lines


 Rivers


## Embayment Boundary


 On Land


 On Sea

## Major Roads

 US Highway

 State Highway






 Roads

 Structures

 Ponds

## Nitrogen

### Ecological Indicators

-  Healthy
-  Healthy/Moderately Impacted
-  Healthy/Significantly Impacted
-  Moderately Impacted
-  Moderately Impacted/Significantly Impacted
-  Significantly Impacted
-  Significantly Impacted/Significantly Degraded
-  Significantly Degraded


### Yearly Nitrate Concentration Averages


-  0 - 0.5 mg/l
  -  0.5 - 1 mg/l
  -  1 - 2.5 mg/l
  -  2.5 - 5 mg/l
- in Public Supply Wells**


### Embayments with Removal Target


Total NLoad Percent Removal

0 %

 1 - 52 %


 53 - 72 %


 73 - 86 %


 87 - 100 %


### Subwatersheds with Removal Target


Total NLoad Percent Removal

 0.1 % - 9%

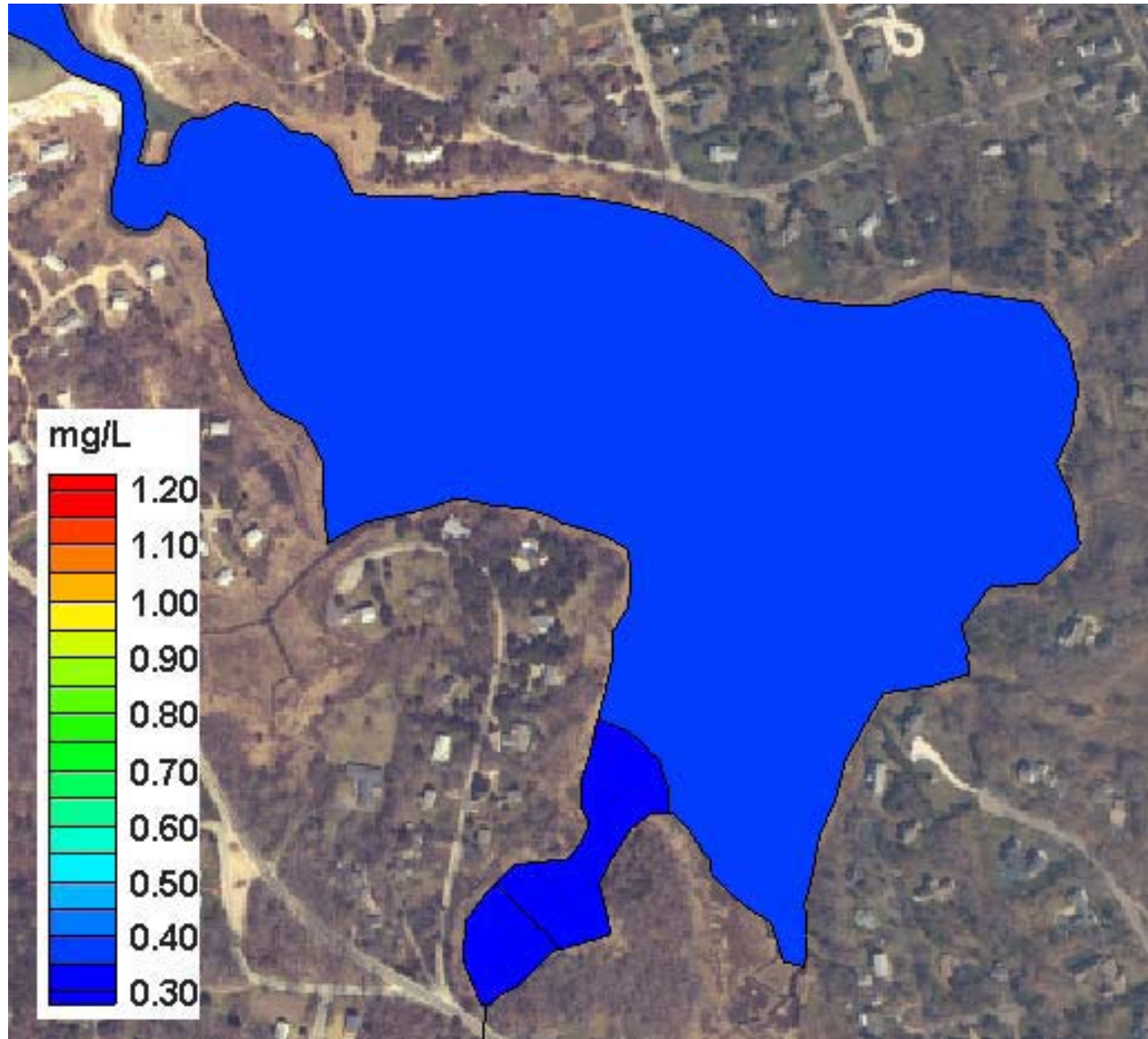
 9.1 % - 38 %

 38.1 % - 62 %

 62.1 % - 86 %

 86.1 % - 100%

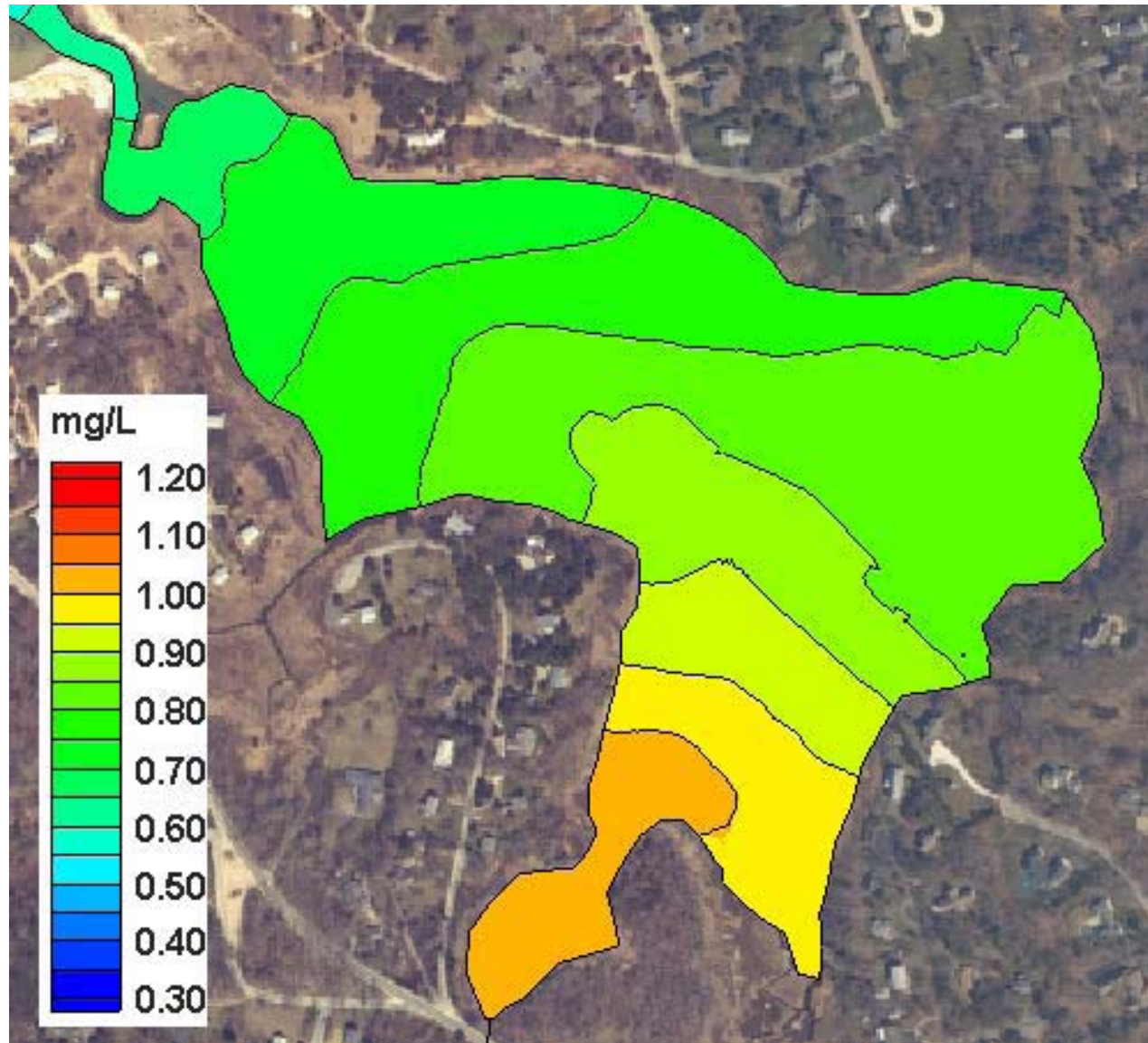




Contour Plot of **modeled total nitrogen concentrations (mg/L)** in Little Namskaket Creek for no anthropogenic loading conditions.

(Source: MEP 2008)

Pre-Colonial Conditions: Little Namskaket Creek

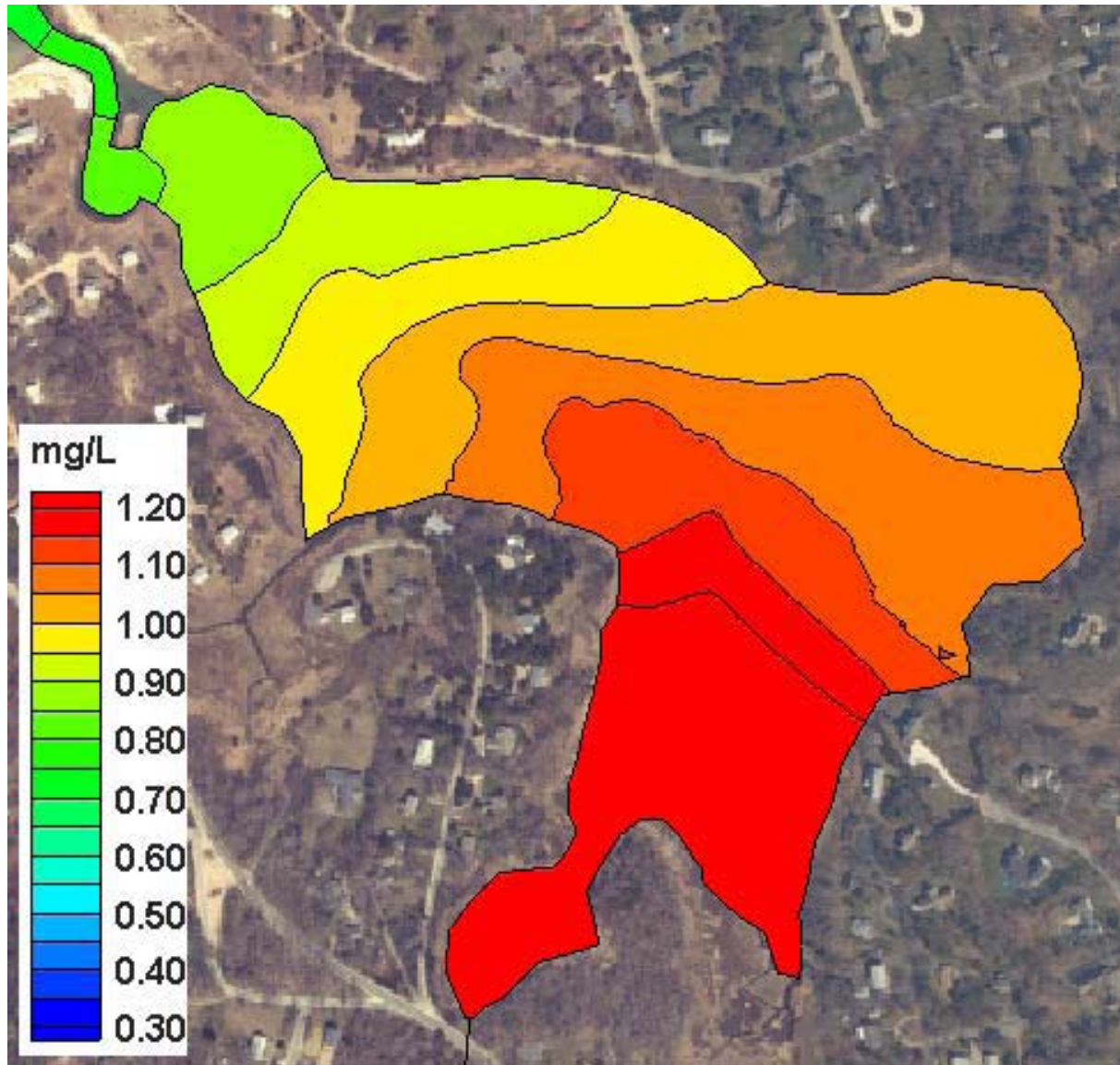


Contour Plot of **average total nitrogen concentrations** from the results of the present conditions loading scenario for the Little Namskaket Creek system.

(Source: MEP 2008)

**Present Conditions: Little Namskaket Creek**

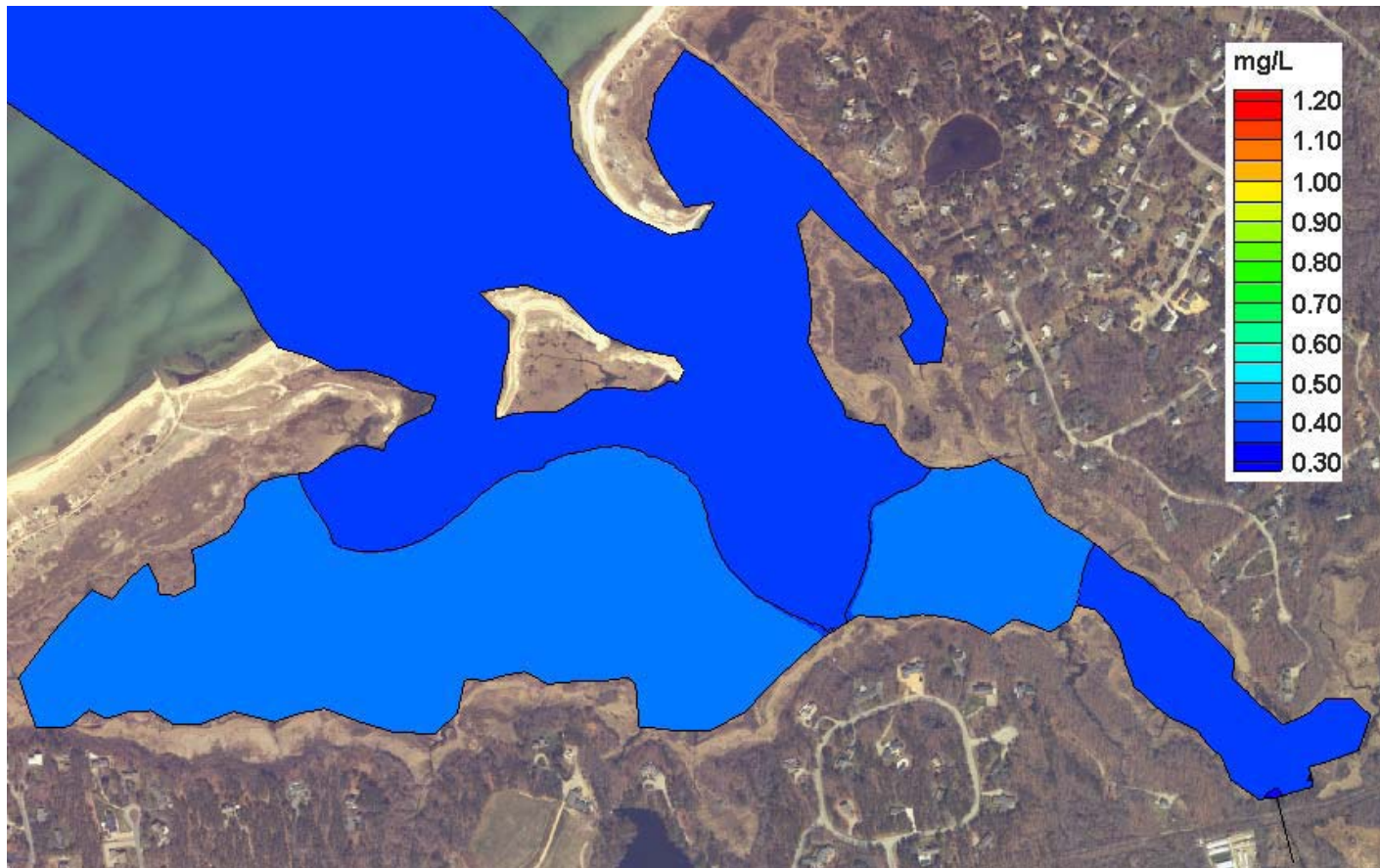




Contour Plot of **modeled total nitrogen concentrations (mg/L)** in the Little Namskaket Creek system, for projected build-out loading conditions.

(Source: MEP 2008)

**Present Conditions: Little Namskaket Creek**

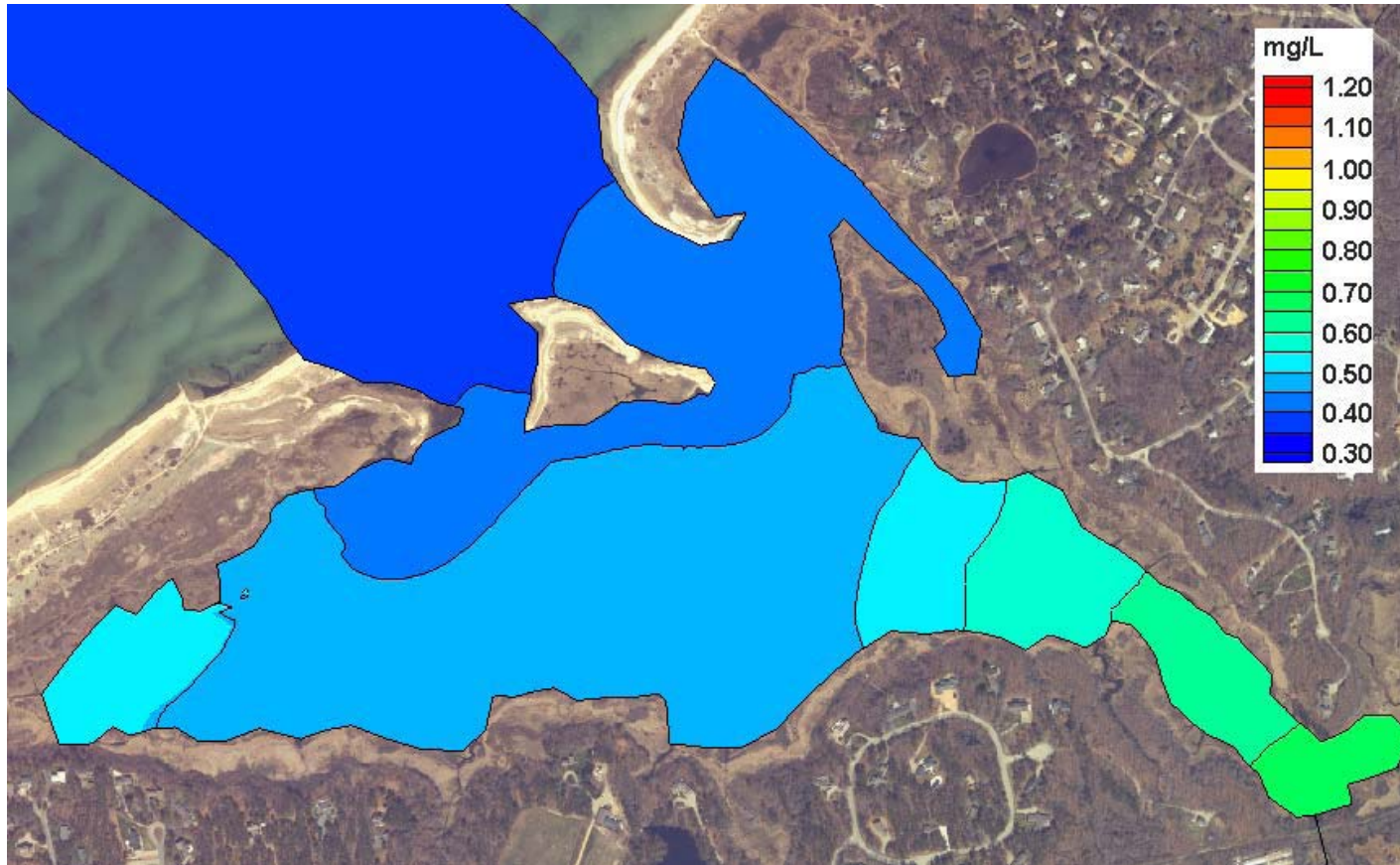


Contour Plot of **modeled total nitrogen concentrations (mg/L)** in Namskaket Creek for no anthropogenic loading conditions.

(Source: MEP 2008)

**Pre-Colonial Conditions: Namskaket Creek**

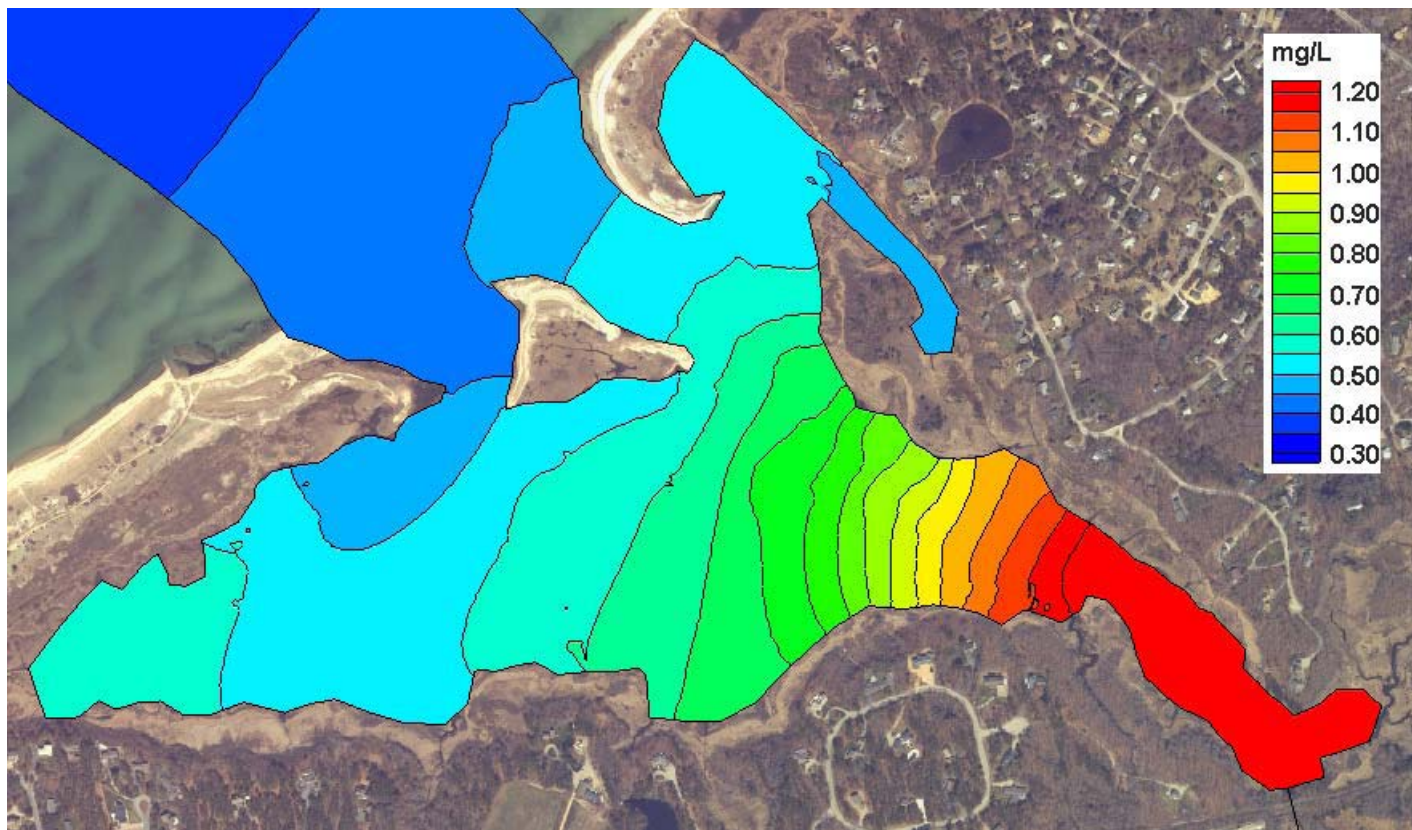




Contour Plot of **average total nitrogen concentrations** from the results of the present conditions loading scenario for the Namskaket Creek system.

(Source: MEP 2008)

**Present Conditions: Namskaket Creek**

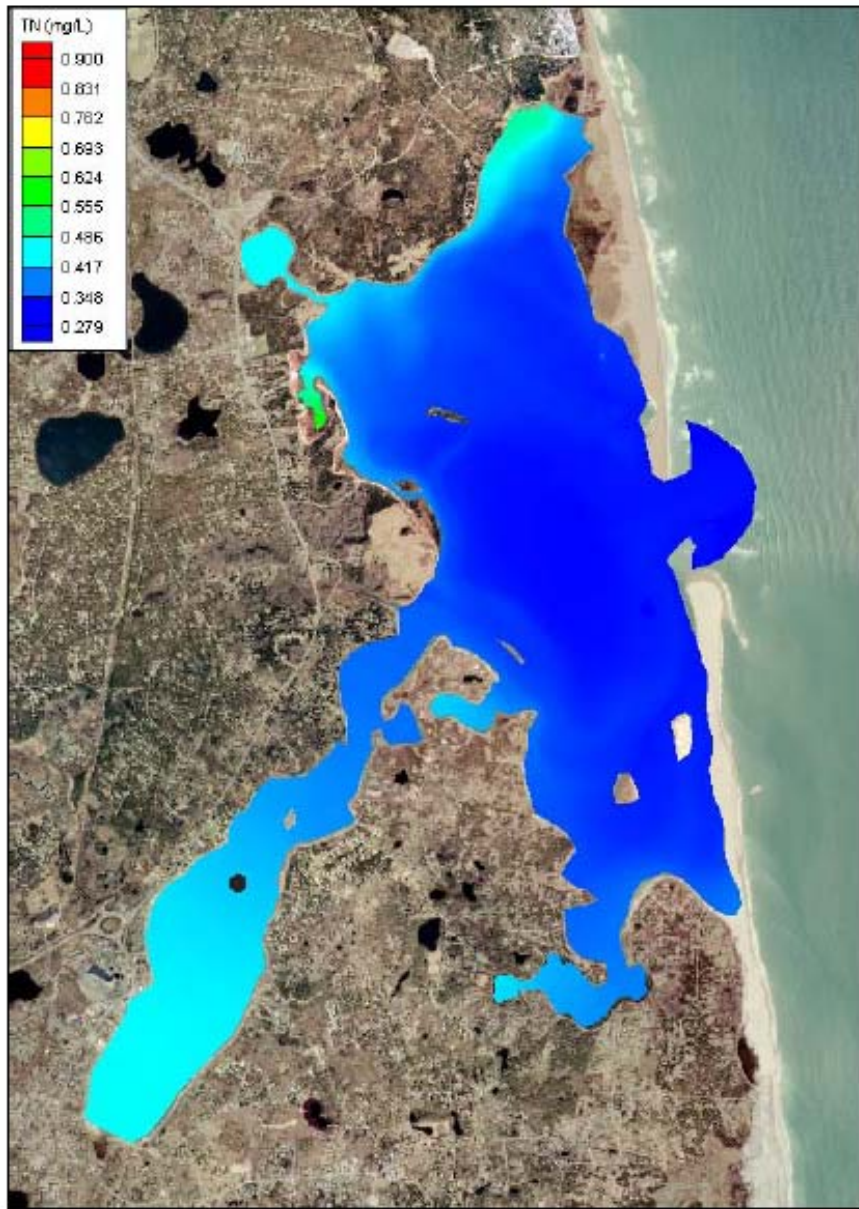


Contour Plot of **modeled total nitrogen concentrations (mg/L)** in the Namskaket Creek system, for projected build-out loading conditions.

(Source: MEP 2008)

**Build-out Conditions: Namskaket Creek**

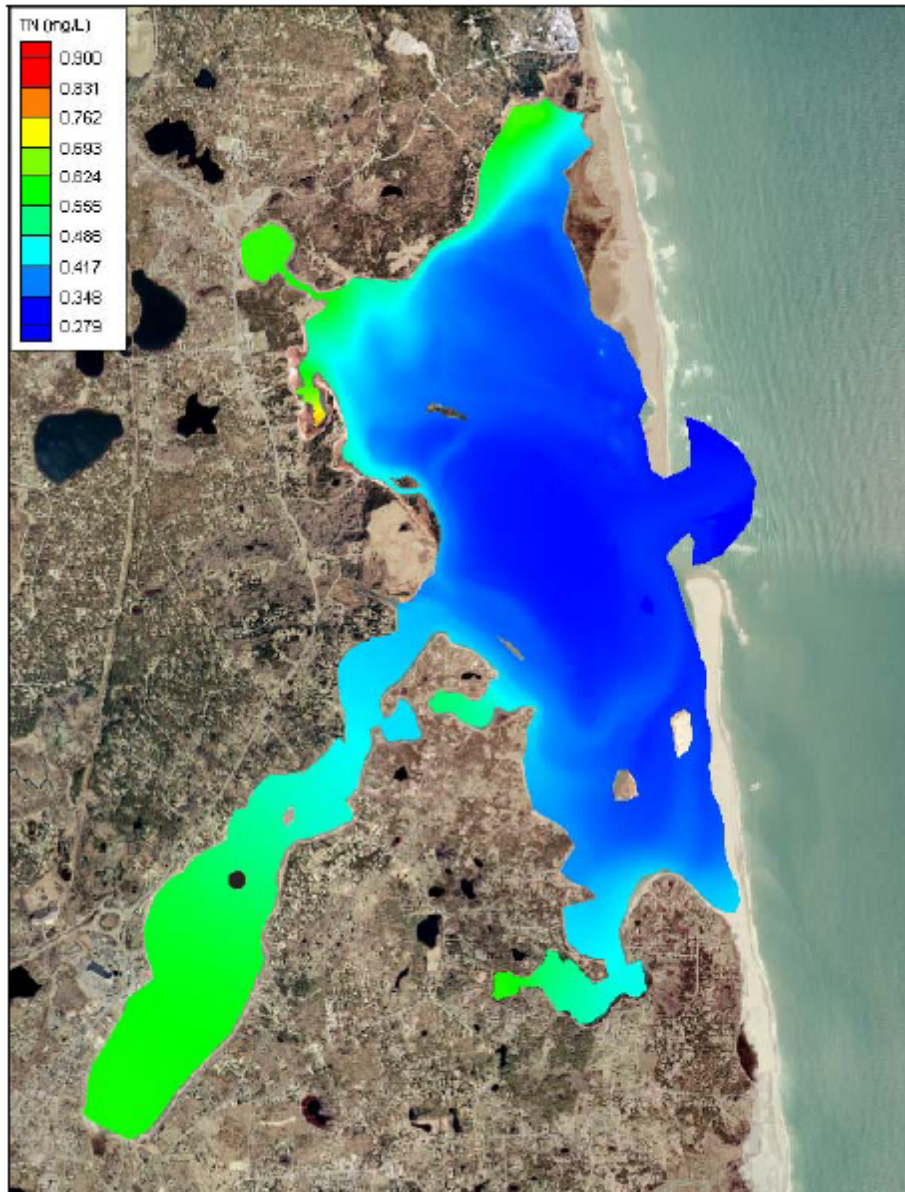




Contour plots of **modeled total nitrogen concentrations (mg/L)** in the Nauset Harbor estuary system under no anthropogenic loading conditions. The approximate location of the sentinel threshold station for the Nauset Harbor estuary system is shown by the black symbol (WMO-27 in Town Cove).

(Source: MEP 2012)

**Pre-Colonial Conditions: Nauset Marsh/Town Cove**

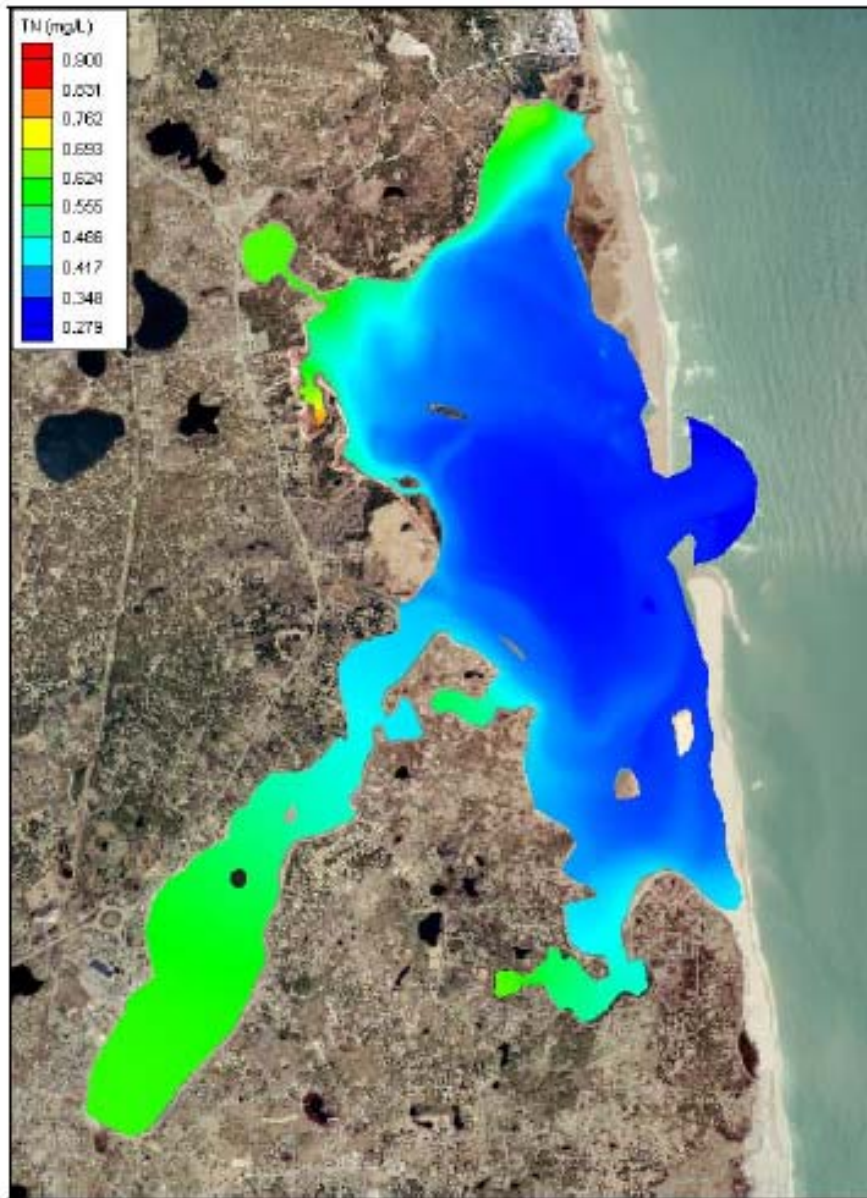


Contour plots of **average total nitrogen concentrations** from the results of the present conditions loading scenario for the Nauset Harbor estuary system. The approximate location of the sentinel threshold station for the Nauset Harbor estuary system is shown by the black symbol (WMO-27 in Town Cove).

(Source: MEP 2012)

**Present Conditions: Nauset Marsh/Town Cove**

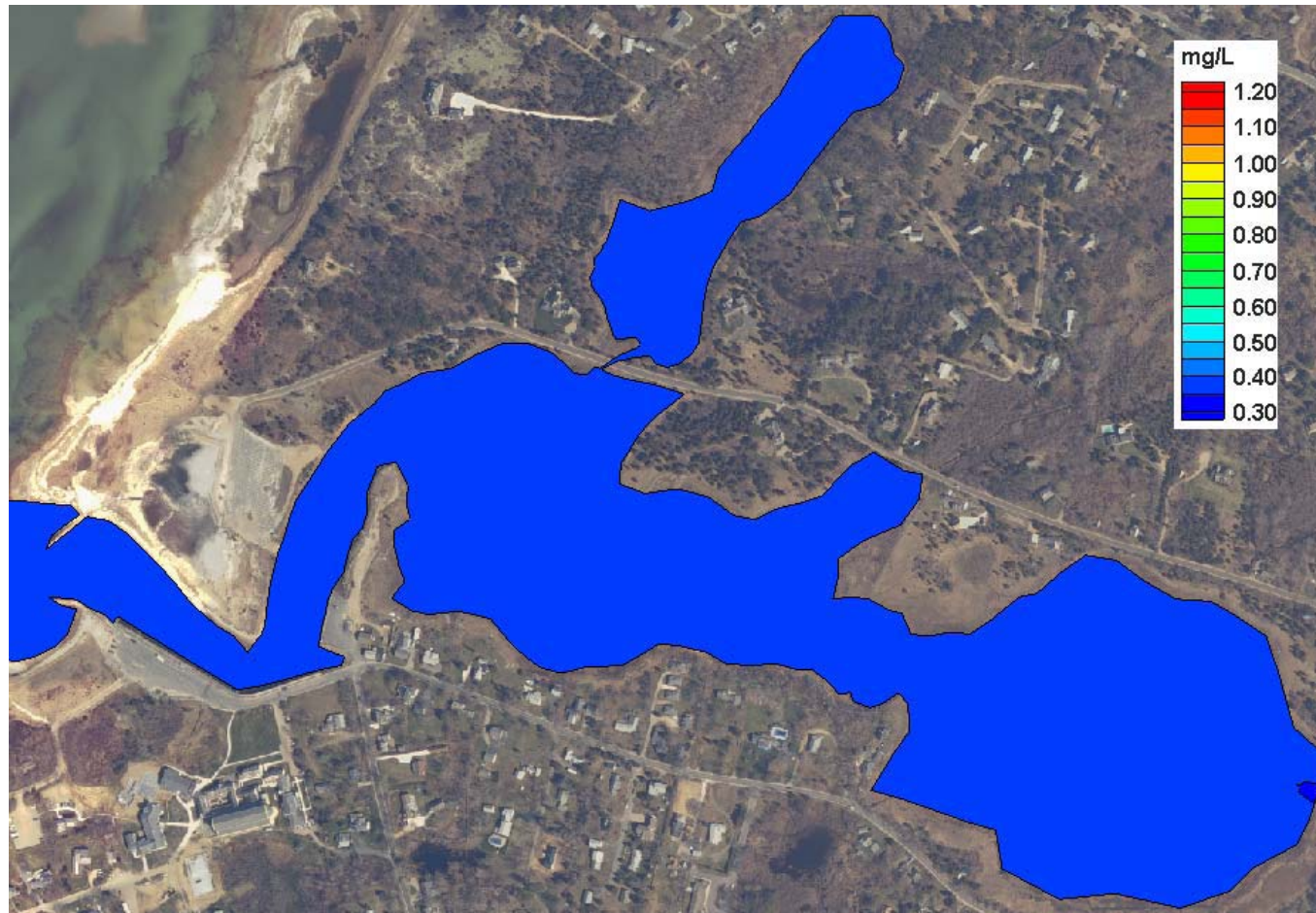




Contour plots of **modeled total nitrogen concentrations (mg/L)** in the Nauset Harbor estuary system under projected build-out loading conditions. The approximate location of the sentinel threshold station for the Nauset Harbor estuary system is shown by the black symbol (WMO-27 in Town Cove).

(Source: MEP 2012)

**Build-out Conditions: Nauset Marsh/Town Cove**

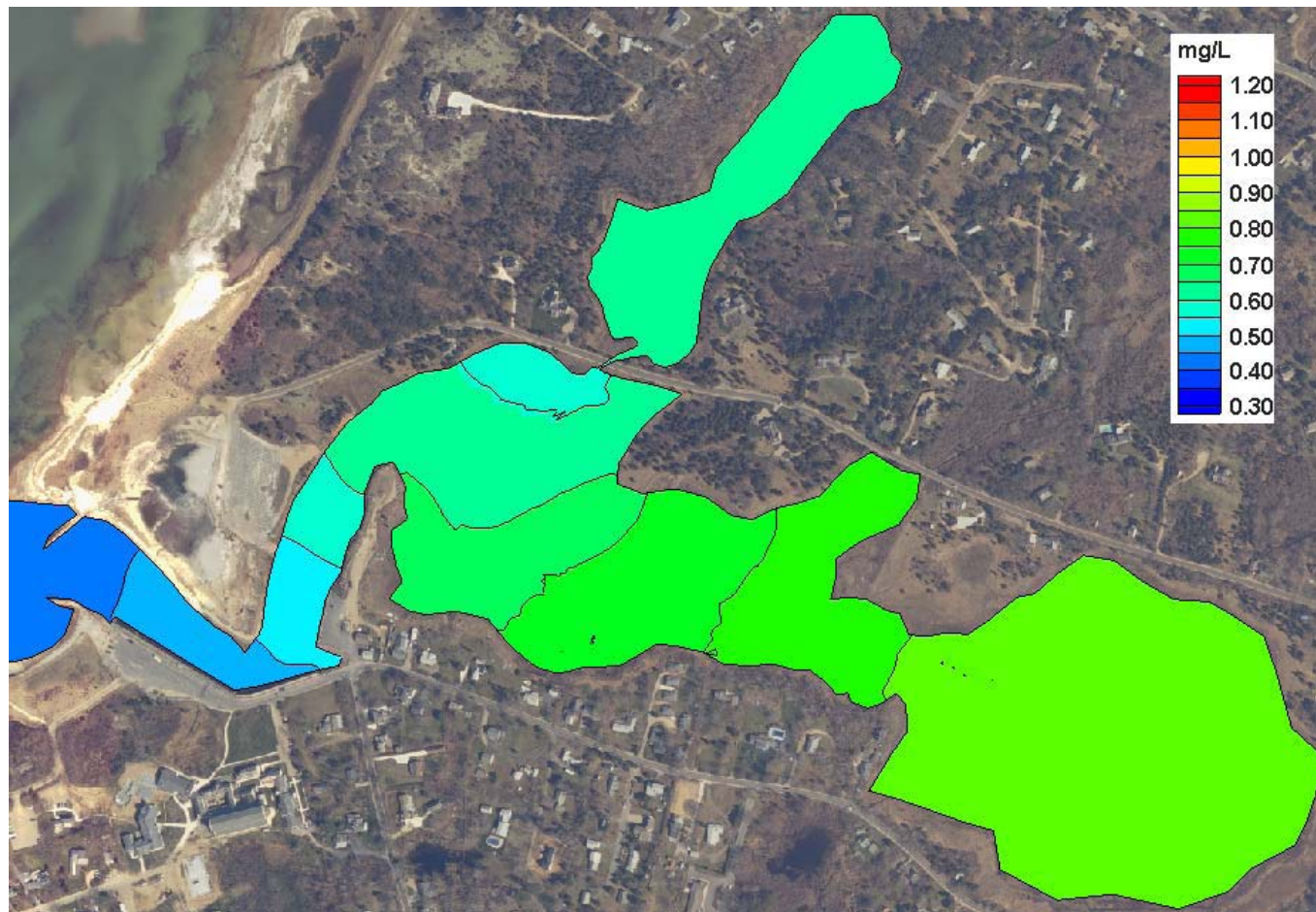


Contour Plot of **modeled total nitrogen concentrations (mg/L)** in Rock Harbor for no anthropogenic loading conditions.

(Source: MEP 2008)

## Pre-Colonial Conditions: Rock Harbor

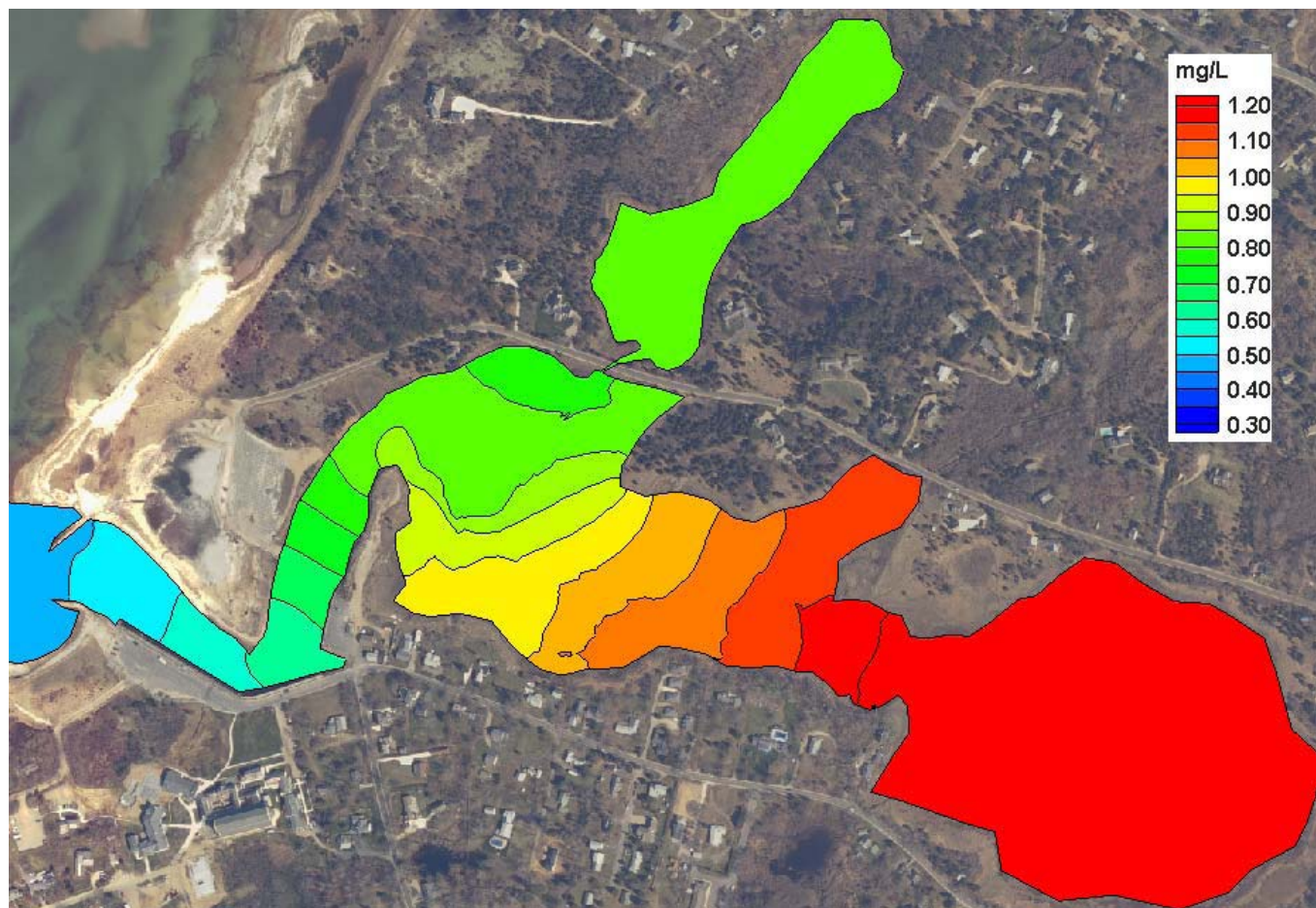




Contour Plot of **average total nitrogen concentrations** from the results of the present conditions loading scenario for Rock Harbor.

(Source: MEP 2008)

Present Conditions: Rock Harbor



Contour Plot of **modeled total nitrogen concentrations (mg/L)** in the Namskaket Creek system, for projected build-out loading conditions.


(Source: MEP 2008)

**Build-out Conditions: Rock Harbor**




# Nitrogen Problem


## Base Map

 Town Lines


 Rivers


## Embayment Boundary


 On Land


 On Sea

## Major Roads

 US Highway

 State Highway









 Roads

 Structures

 Ponds

## Nitrogen

### Ecological Indicators






-  Healthy
-  Healthy/Moderately Impacted
-  Healthy/Significantly Impacted
-  Moderately Impacted
-  Moderately Impacted/Significantly Impacted
-  Significantly Impacted
-  Significantly Impacted/Significantly Degraded
-  Significantly Degraded

### Yearly Nitrate Concentration Averages

-  0 - 0.5 mg/l
  -  0.5 - 1 mg/l
  -  1 - 2.5 mg/l
  -  2.5 - 5 mg/l
- in Public Supply Wells**





### Embayments with Removal Target

Total NLoad Percent Removal

-  0 %
-  1 - 52 %
-  53 - 72 %
-  73 - 86 %
-  87 - 100 %

### Subwatersheds with Removal Target

Total NLoad Percent Removal

-  0.1 % - 9%
-  9.1 % - 38 %
-  38.1 % - 62 %
-  62.1 % - 86 %
-  86.1 % - 100%


# Eelgrass Extent


## Base Map

 Town Lines


 Rivers


## Embayment Boundary


 On Land


 On Sea

## Major Roads

 US Highway


 State Highway

 Roads

 Structures

 Ponds


## Eelgrass

 Eelgrass Extent




# Phosphorus Problem


## Base Map

 Town Lines


 Rivers


## Embayment Boundary

 On Land


 On Sea

## Major Roads

 US Highway

 State Highway

 Roads

 Structures


 Ponds


## Phosphorus


### Priority Ponds

Trophic Status

 Eutrophic *Most Impacted*


 Mesotrophic

 Oligotrophic *Least Impacted*

 Not Interpreted


# Title 5 Compliance Issues


## Base Map

 Town Lines


 Rivers


## Embayment Boundary


 On Land


 On Sea

## Major Roads

 US Highway


 State Highway


 Roads

 Structures


 Ponds


## Existing Conditions

 Approx. Locations of Loans Issued for Title 5 Repair

 Potential Title 5 Compliance Issues

 Wastewater Treatment Facility

 Groundwater Discharge Points

 Sewered Parcels

# Existing & Proposed Solutions



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Boat Meadow River  
Herring River  
Little Namskaket Creek  
Namskaket Creek  
Rock Harbor  
Town Cove/Nauset Marsh


# Existing Infrastructure


## Base Map

 Town Lines


 Rivers


## Embayment Boundary

 On Land


 On Sea

## Major Roads

 US Highway


 State Highway


 Roads


 Structures


 Ponds


## Existing Conditions

 Approx. Locations of Loans Issued for Title 5 Repair

 Potential Title 5 Compliance Issues


 Wastewater Treatment Facility

 Groundwater Discharge Points


 Sewered Parcels

## Enhanced Attenuation Sites

 Pipe


 Stormwater


## Public Supply Wells

 Public Water Supply Well

 Small Volume Wells, Non-Transient

 Proposed Public Water Supply Well

 Surface Water Supply

 Small Volume Wells, Transient


# Proposed Infrastructure


## Base Map

 Town Lines


 Rivers


## Embayment Boundary


 On Land


 On Sea

## Major Roads

 US Highway

 State Highway

 Roads


 Structures

 Ponds

## Proposed Conditions


### Natural Attenuation Sites


 Bridge

 Culvert


 Inlet

 Pipe


 Sewer Alternatives


 Stormwater


### CWMP Sewershed Phasing


 No Date Set


Phase Date

 2001 - 2010

 2011 - 2020

 2021 - 2030

 2031 - 2040

 2041 - 2050



# Framework for Addressing Solutions Moving Forward

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Boat Meadow River

Herring River

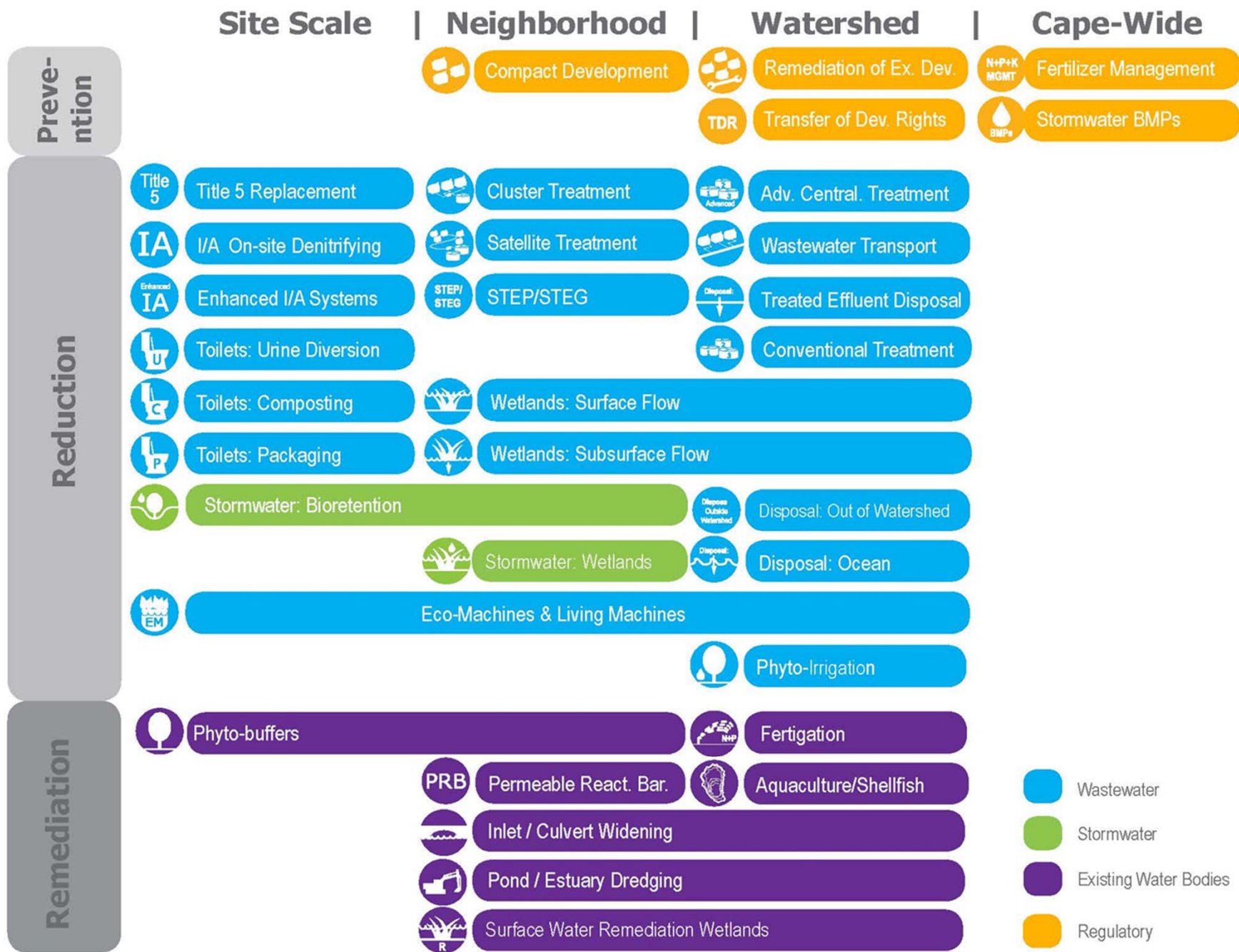
Little Namskaket Creek

Namskaket Creek

Rock Harbor

Town Cove/Nauset Marsh





- Wastewater
- Stormwater
- Existing Water Bodies
- Regulatory

# Alternatives: Screening Method

1  
2  
3  
4  
5  
6  
7



Wastewater



Existing Water Bodies



Regulatory

## Targets/ Goals

**Present Load:** X kg/day **—** **Target:** Y kg/day **=** **Reduction Required:** N kg/day

## Composite Target Areas

- A. High Nitrogen Reduction Areas
- B. Pond Recharge Areas
- C. Title 5 Problem Areas

## Low Barrier to Implementation

- A. Fertilizer Management
- B. Stormwater Mitigation



## Watershed/Embayment Options

- A. Permeable Reactive Barriers
- B. Inlet/Culvert Openings
- C. Constructed Wetlands
- D. Dredging



## Alternative On-Site Options

- A. Eco-toilets (UD & Compost)
- B. I/A Technologies
- C. Enhanced I/A Technologies
- D. Shared Systems



## Priority Collection/High-Density Areas

- A. Greater Than 1 Dwelling Unit/acre
- B. Village Centers
- C. Economic Centers
- D. Growth Incentive Zones



## Supplemental Sewering



**All materials and resources for the Nauset and Cape  
Cod Bay Marsh Group will be available on the Cape  
Cod Commission website:**

<http://watersheds.capecodcommission.org/index.php/watersheds/lower-cape/boat-meadow-herring-river>

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Boat Meadow River  
Herring River  
Little Namskaket Creek  
Namskaket Creek  
Rock Harbor  
Town Cove/Nauset Marsh