



Pleasant Bay Group

Baseline Conditions & Needs Assessment

What is the 208 Plan?

Clean Water Act Section 208



The Commission was directed to update the 1978 Plan

The Commonwealth provided \$3 million to fund the project

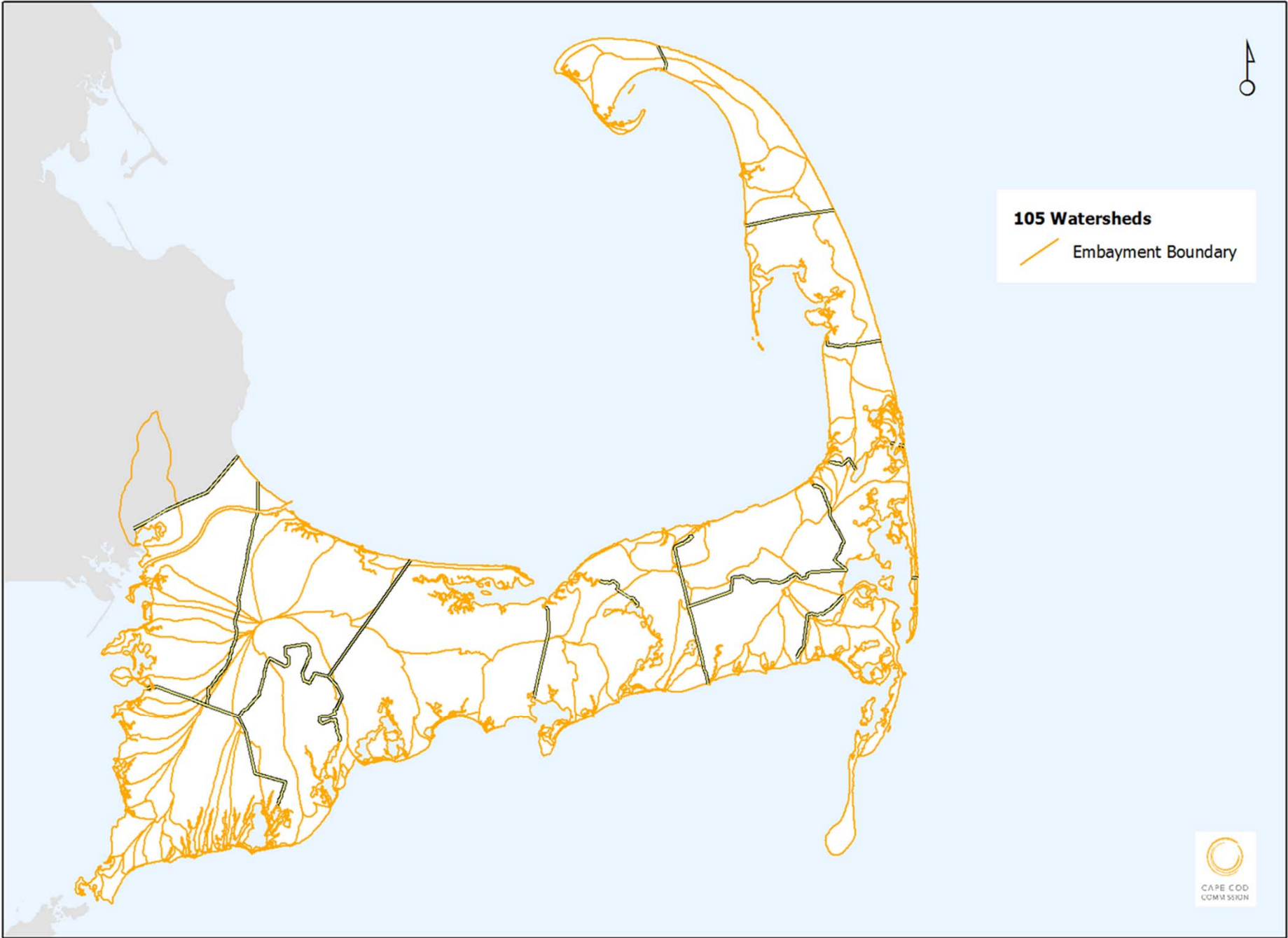
Focus on 21st Century Problems



Nitrogen:
Saline Waters

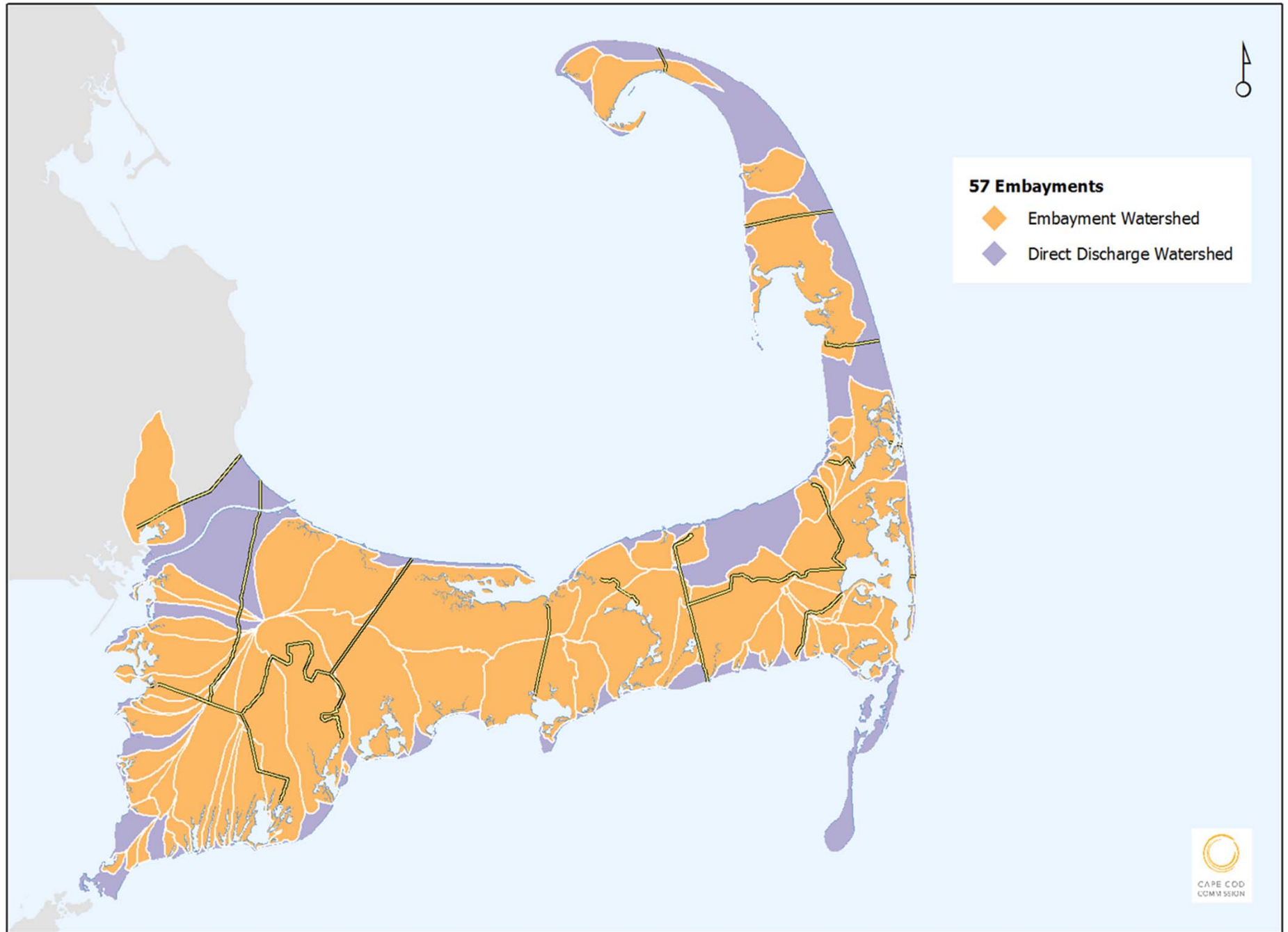
Phosphorus:
Fresh Waters

Growth &
Title 5
Limitations



105 Watersheds
— Embayment Boundary

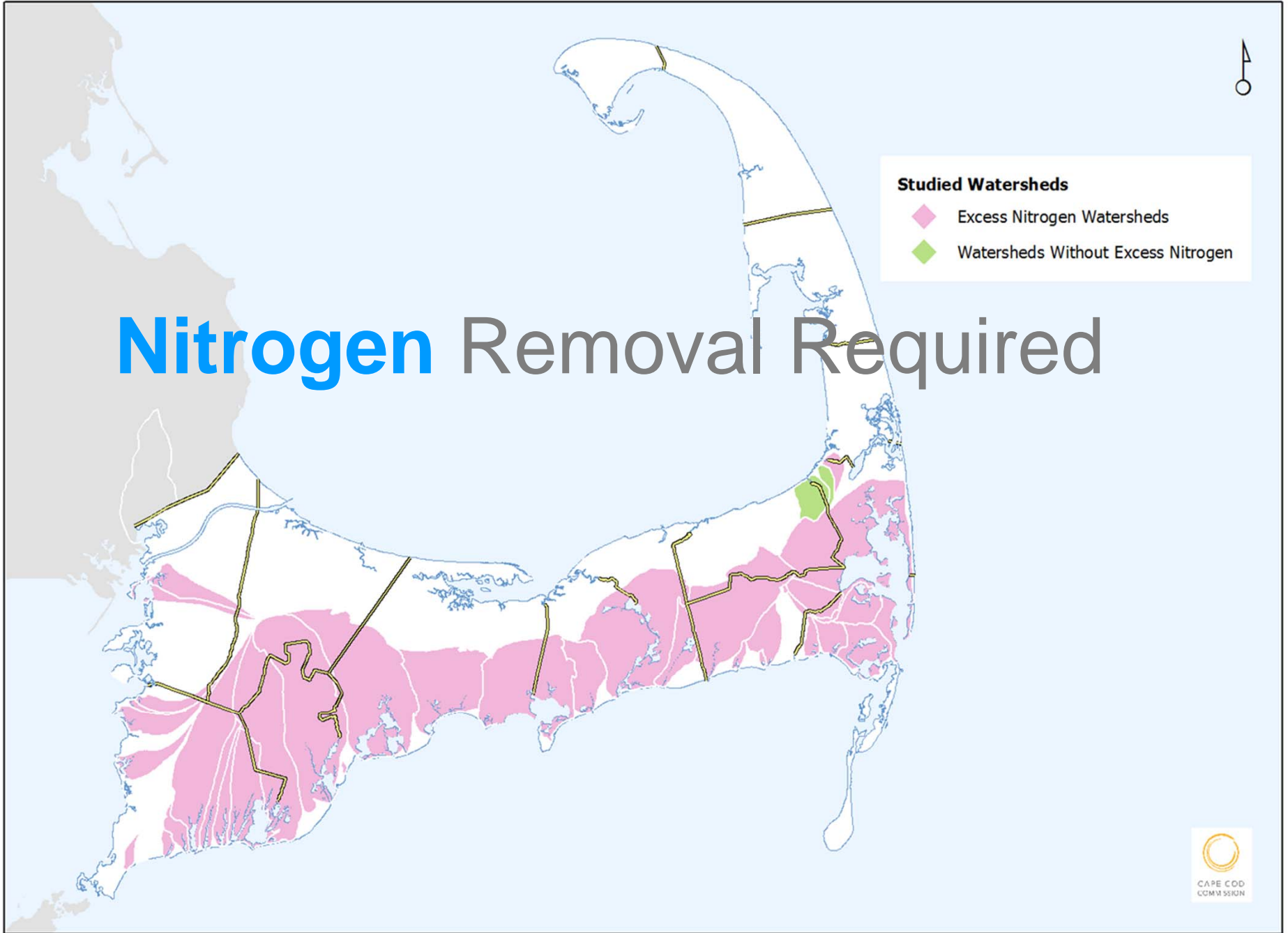


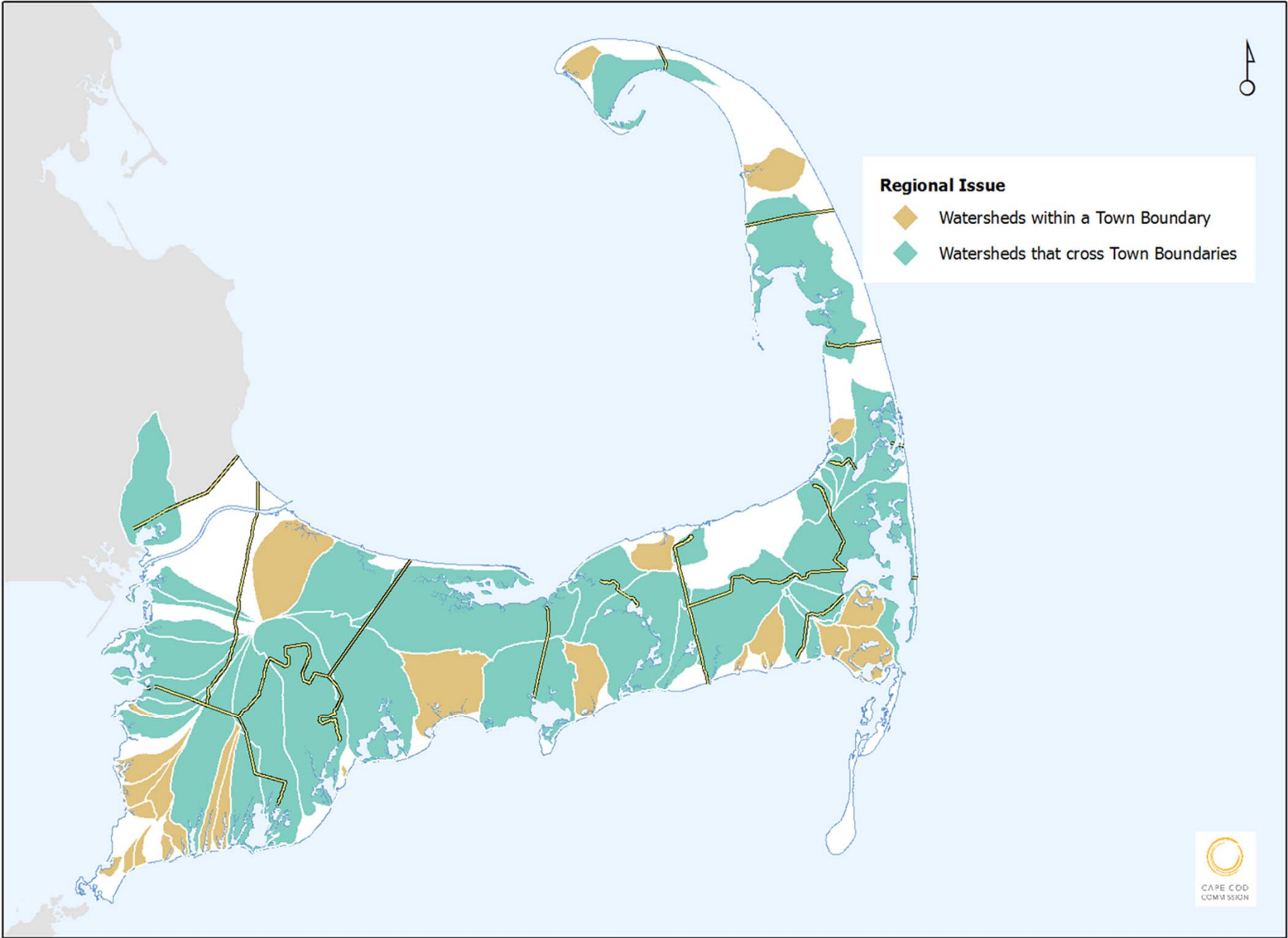


Nitrogen Removal Required

Studied Watersheds

- ◆ Excess Nitrogen Watersheds
- ◆ Watersheds Without Excess Nitrogen



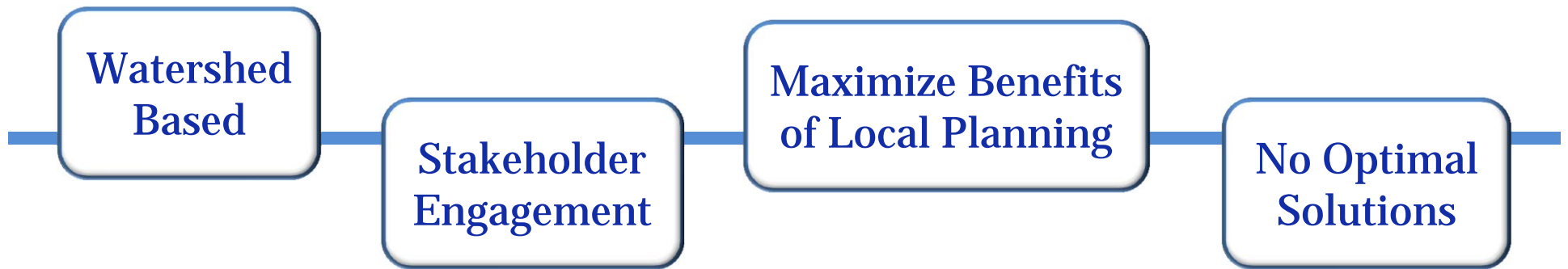


Regional Issue

- ◆ Watersheds within a Town Boundary
- ◆ Watersheds that cross Town Boundaries



Approach to the 208 Plan Update

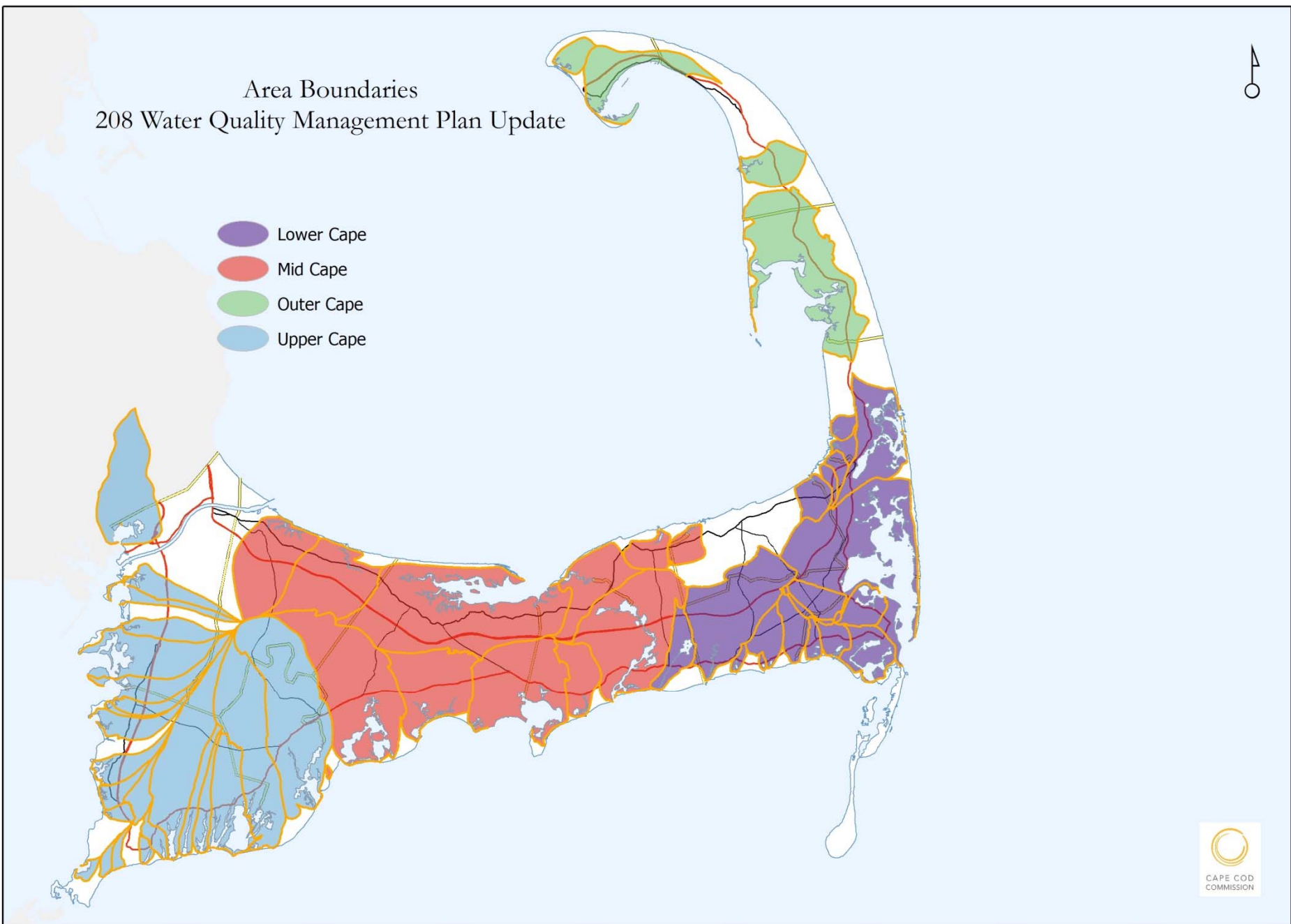


Goal:

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

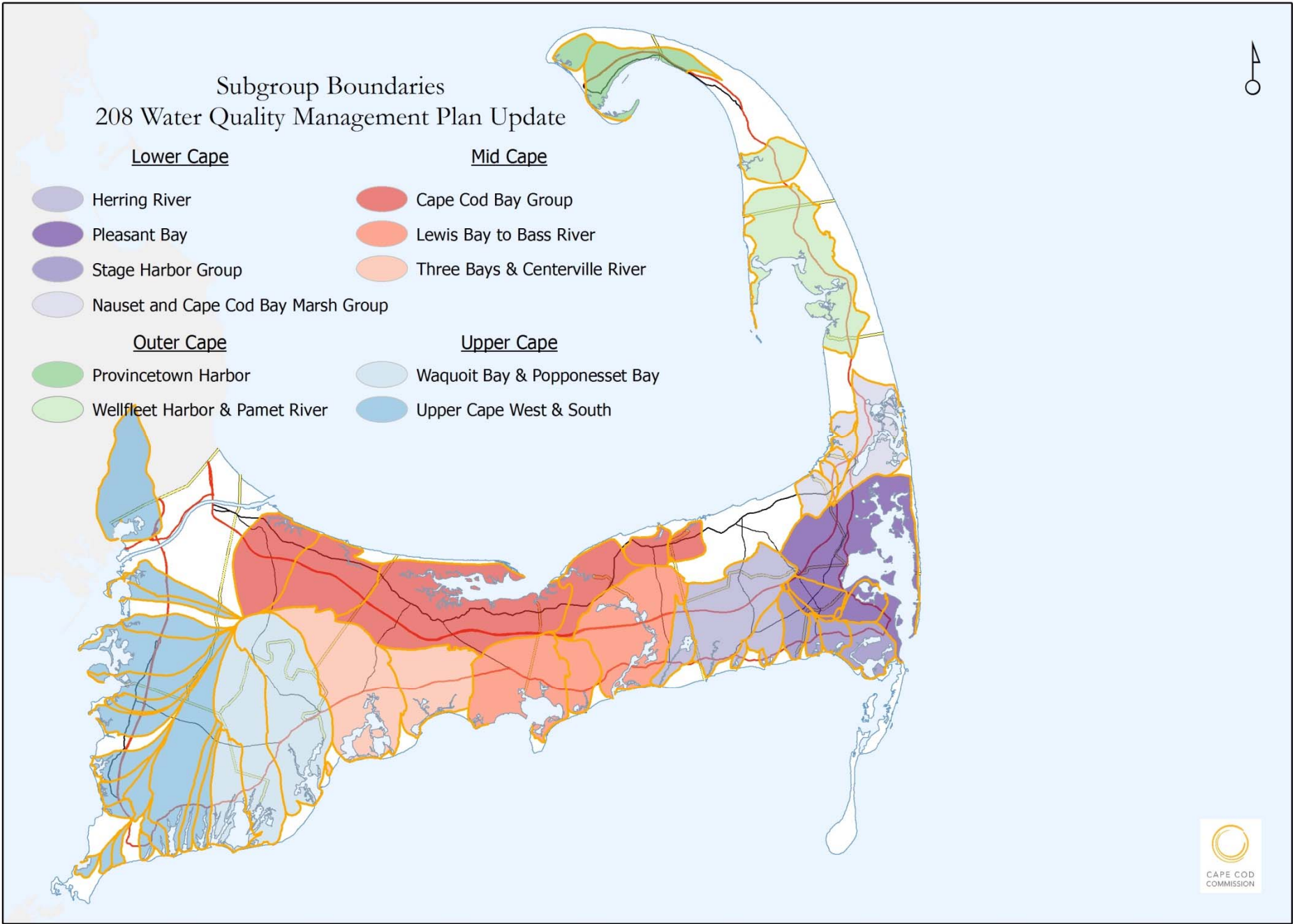
- Cape Cod Bay Group
- Lewis Bay to Bass River
- Three Bays & Centerville River

Outer Cape

- Provincetown Harbor
- Wellfleet Harbor & Pamet River

Upper Cape

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



What is the stakeholder process?

Public Meetings

Watershed Working Groups



July

August

September

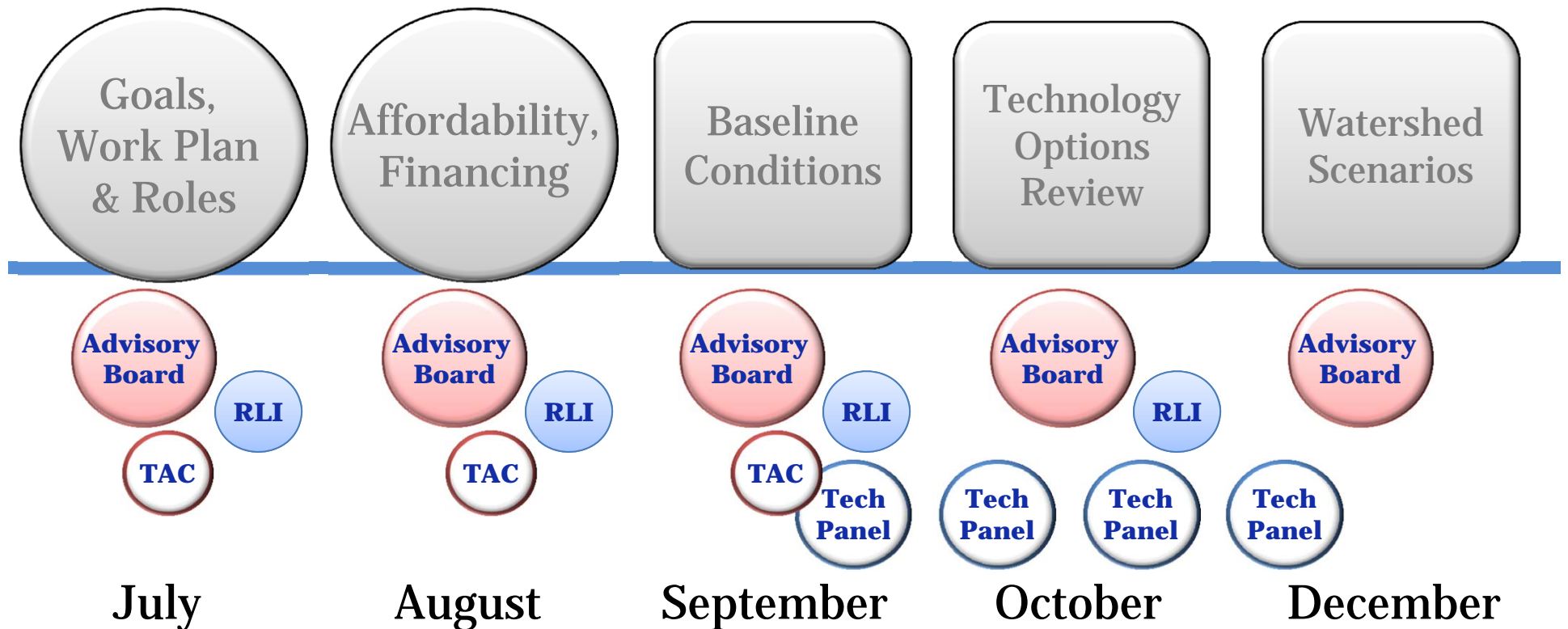
October

December

208 Planning Process

Public Meetings

Watershed Working Groups



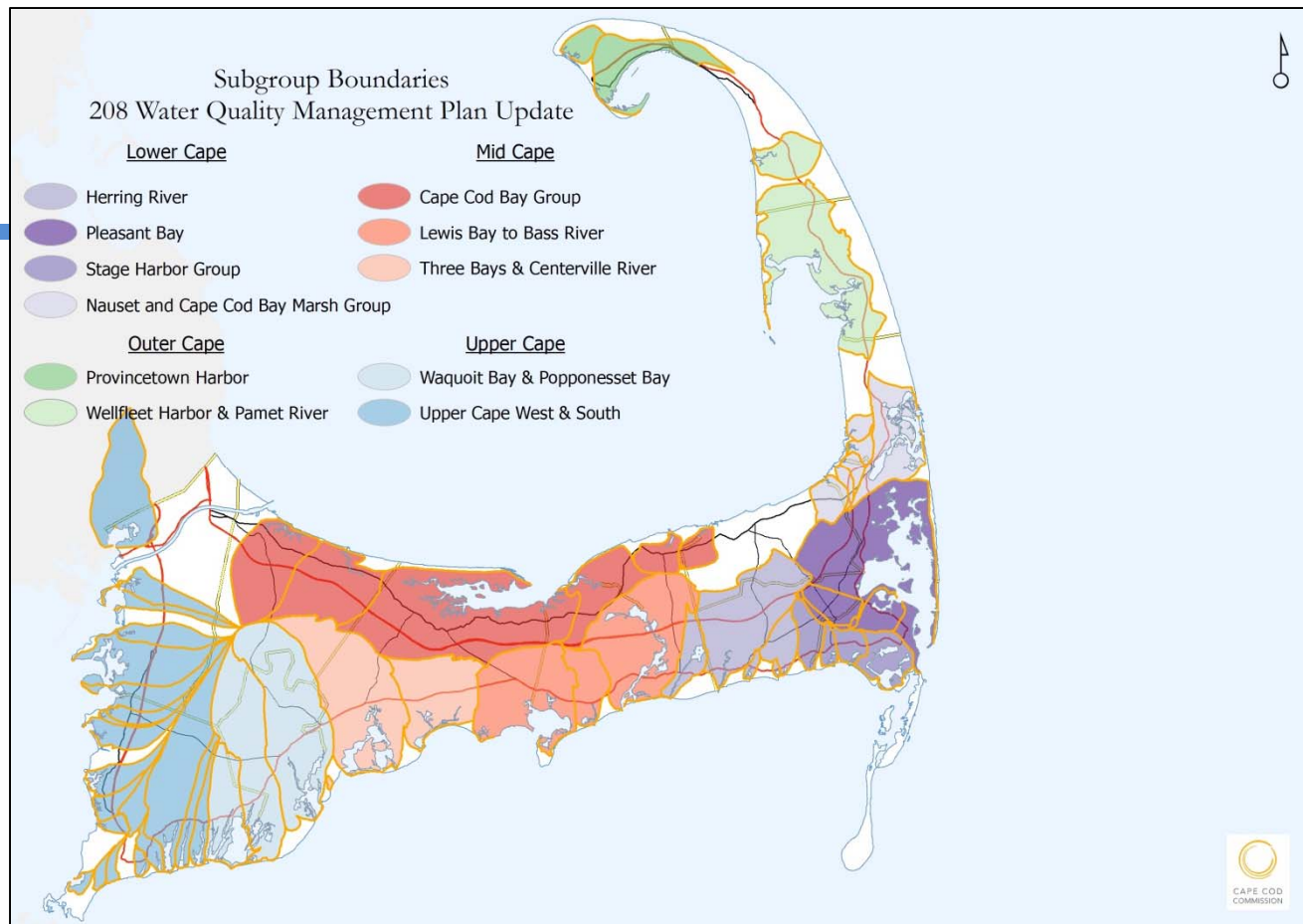
RLI Regulatory, Legal & Institutional Work Group

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**

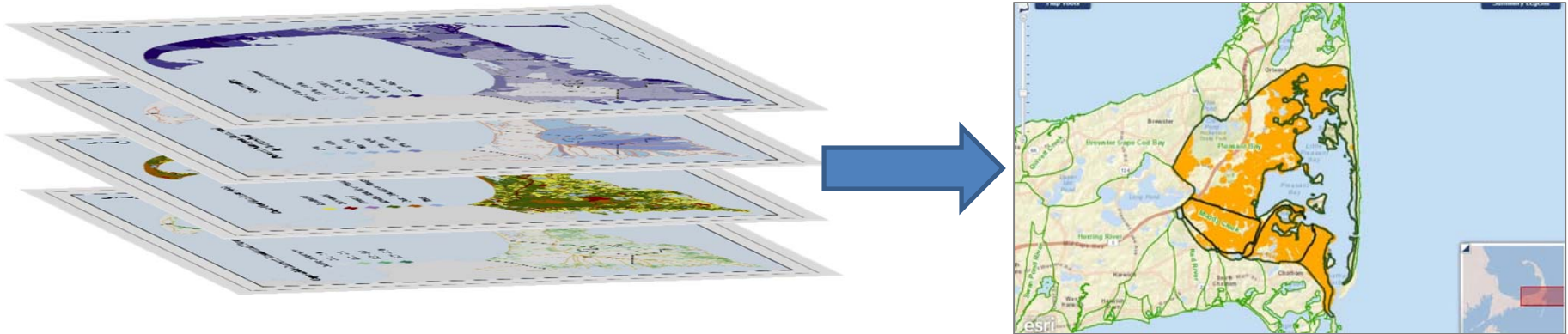
11 Working
Group Meetings:
Sept 18-27

**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:

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

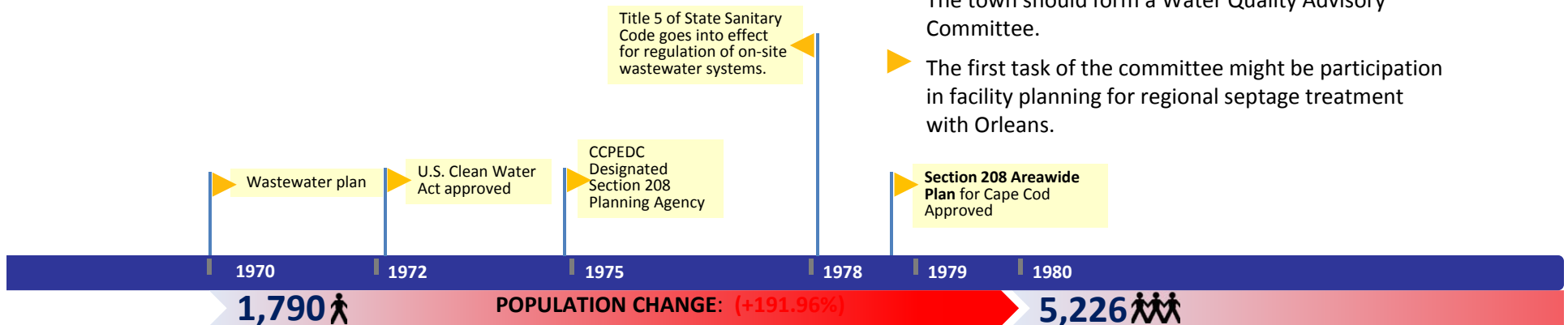


**Bassing Harbor/Ryders Cove
Muddy Creek
Pleasant Bay**

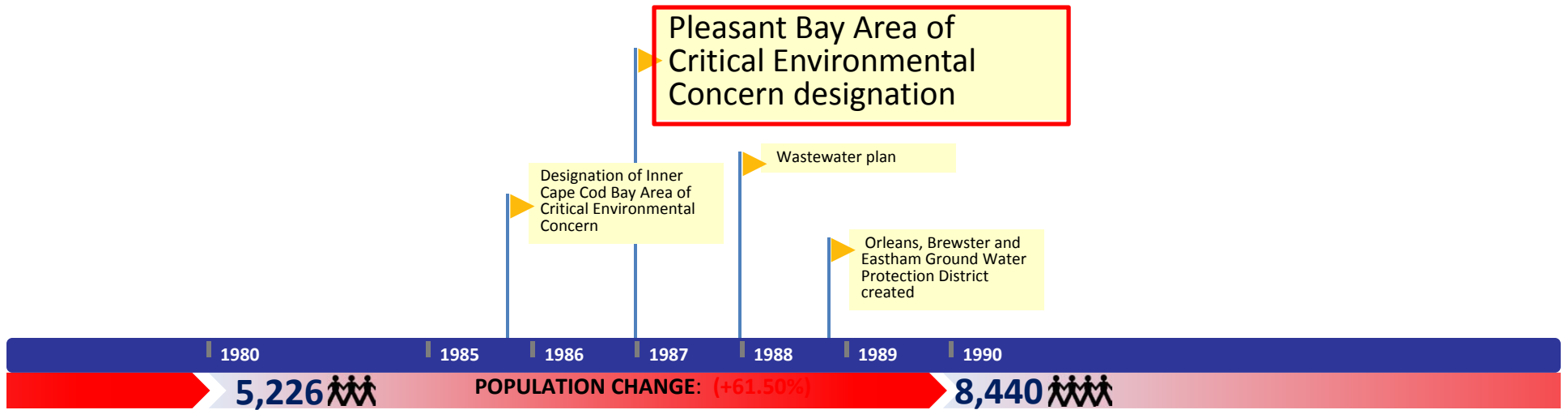
Brewster

From 1978 Section 208 Plan

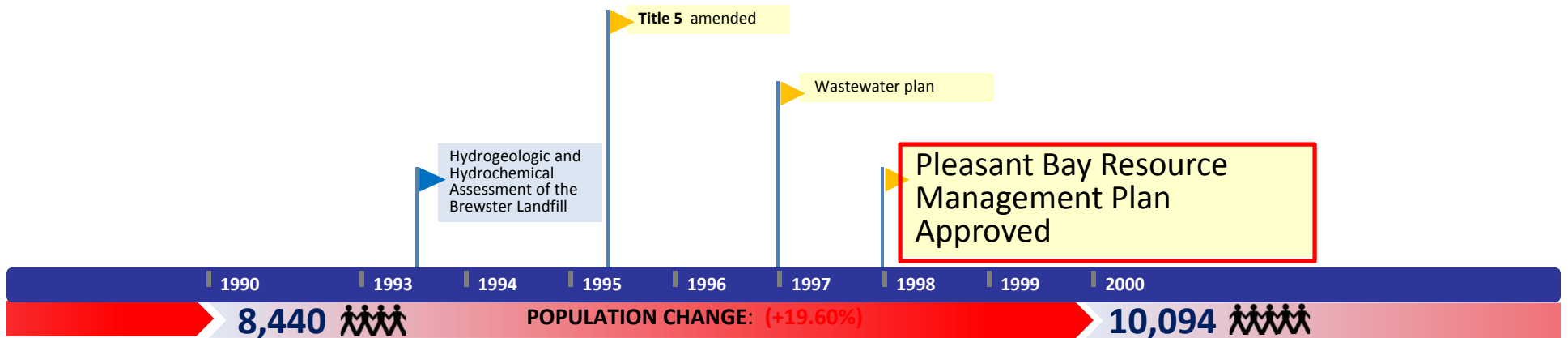
- ▶ Present and future town well sites should be protected from the non-point sources resulting from New development by creating Watershed Protection Districts.
- ▶ The town should cooperate in regional water supply planning to determine future water supply needs of neighboring towns and whether it can 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.



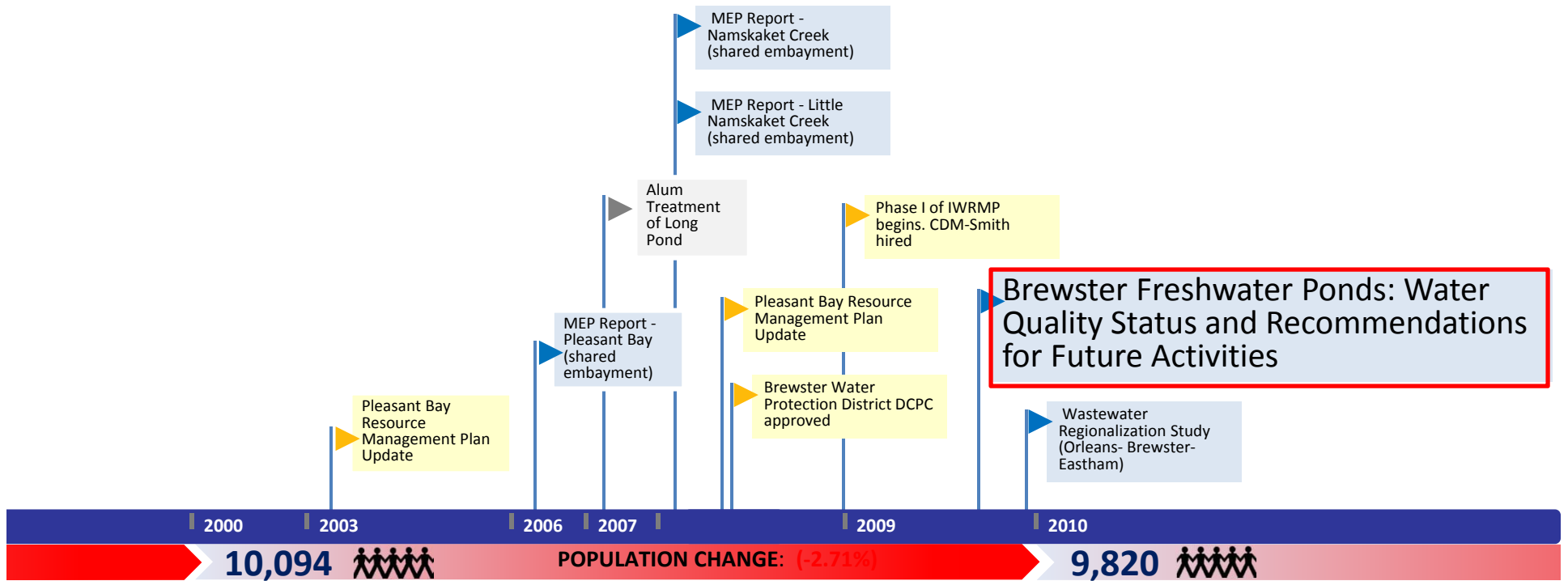
Brewster: 1970-2013



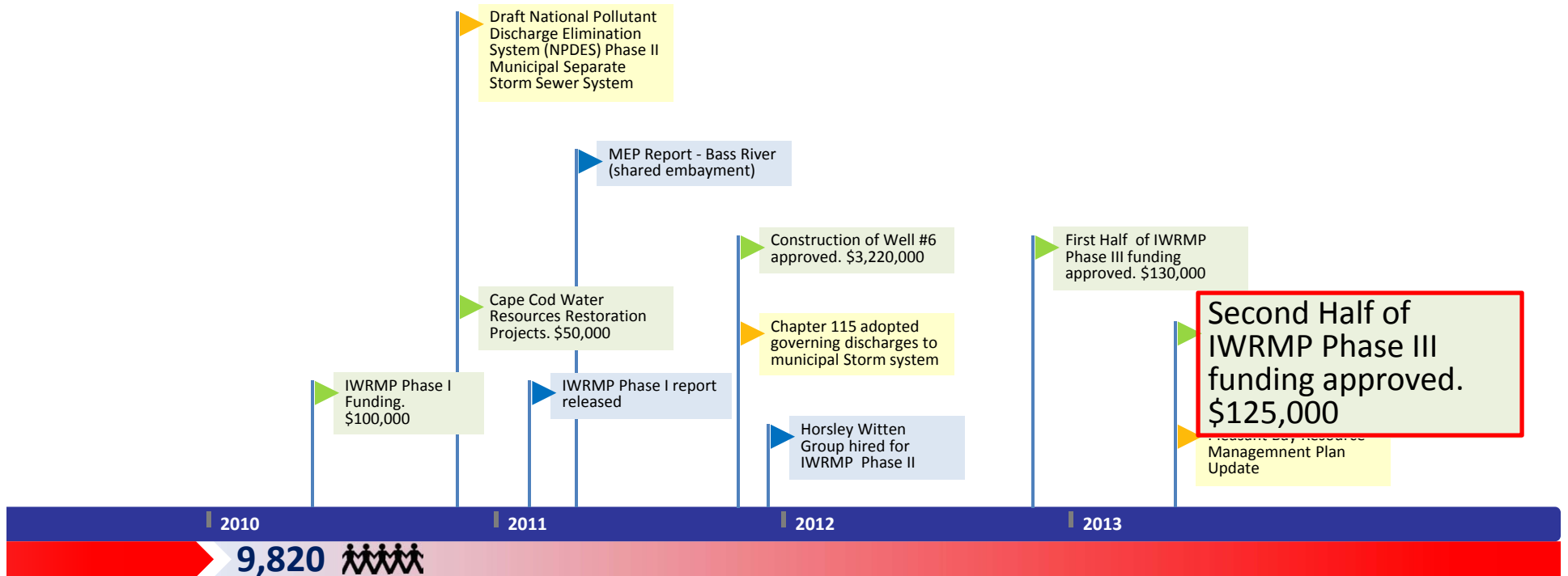
Brewster: 1970-2013



Brewster: 1970-2013



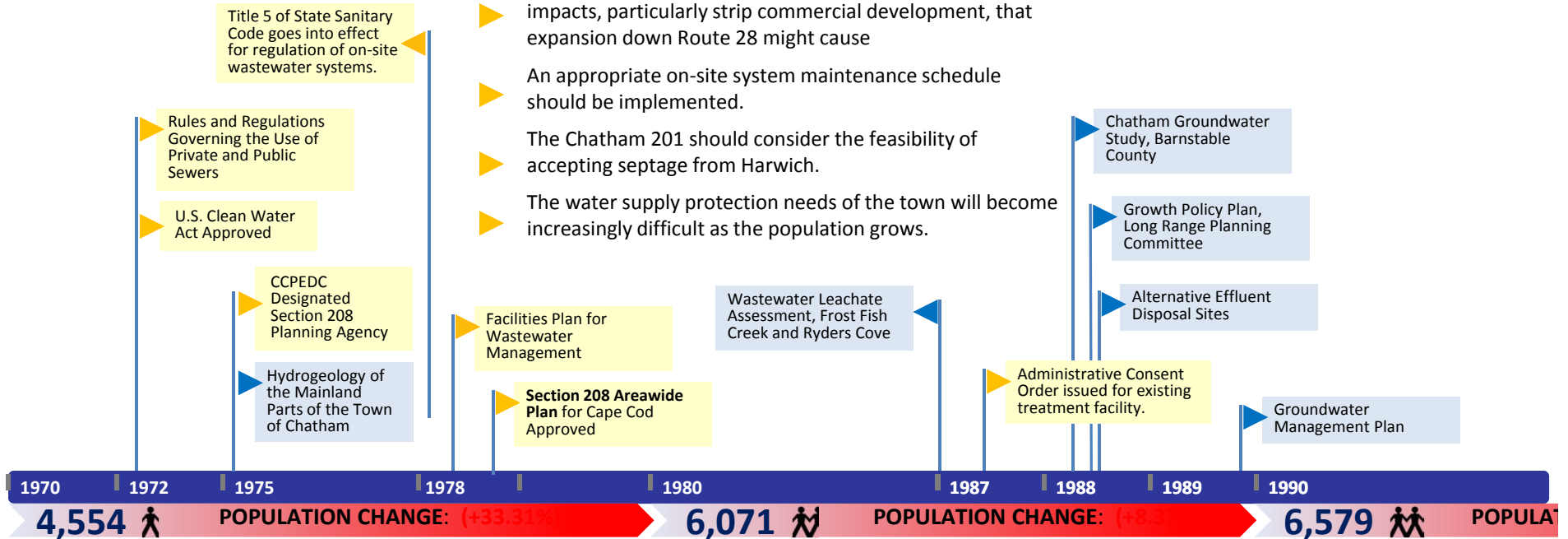
Brewster: 1970-2013



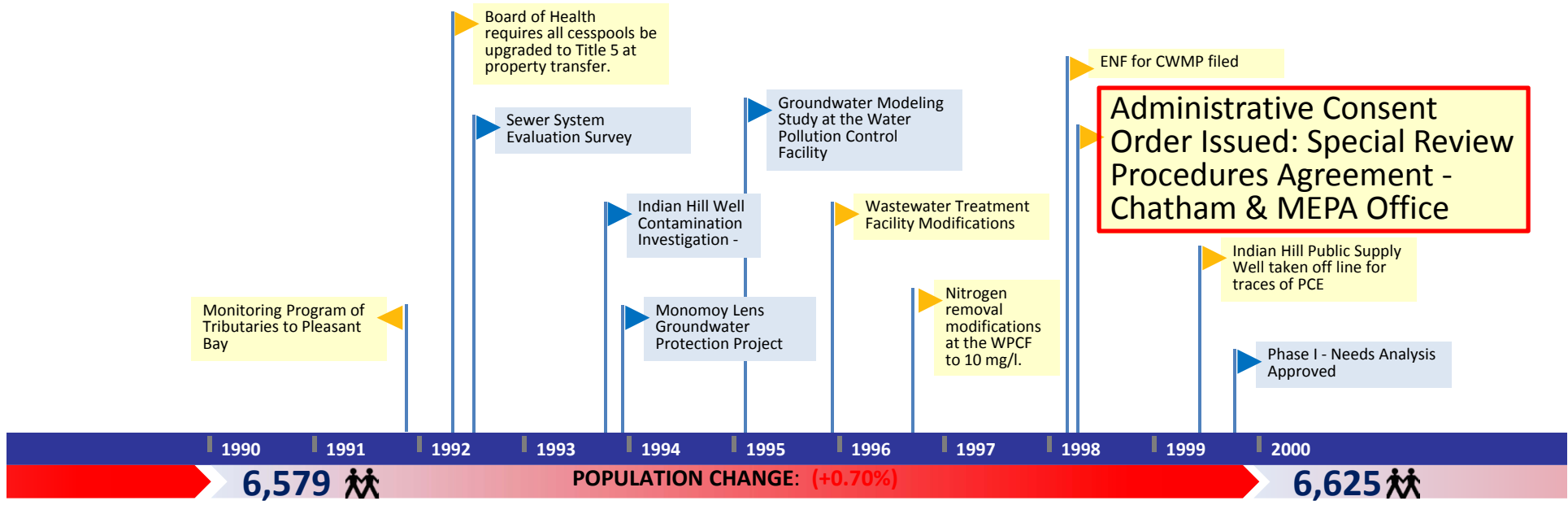
Chatham

From 1978 Section 208 Plan

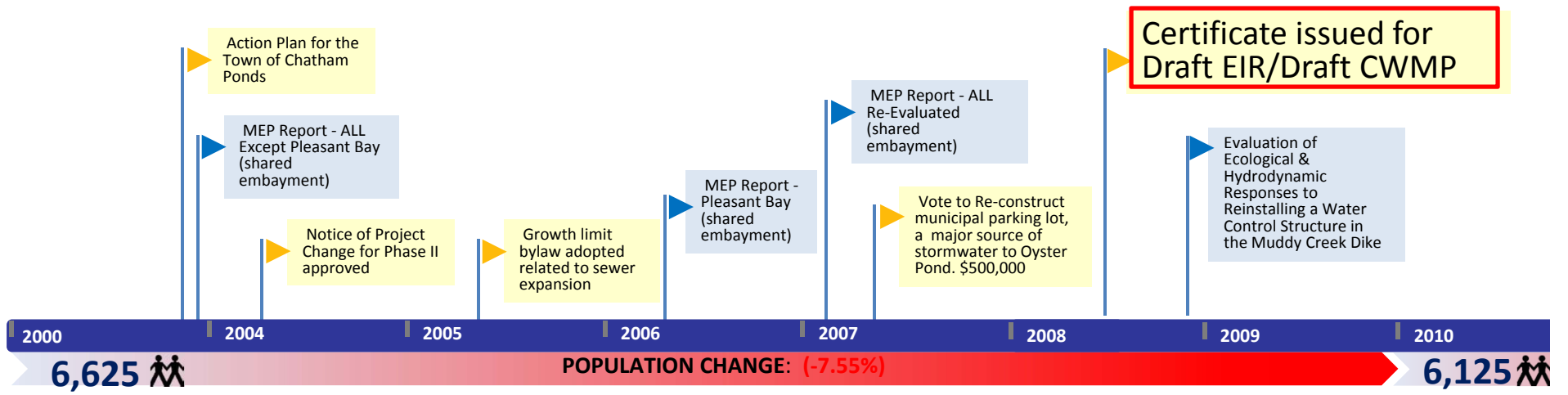
- ▶ A study is needed to examine the present capacity of the town's sewage treatment plant and the possible need to expand the present collection system.
- ▶ The 201 facility plan should be town-wide in scope and should fully evaluate all problem areas in the town including coastal water problems.
- ▶ The town should fully examine all problem areas considered for expansion in terms of present EPA criteria for determining sewer needs. Since most of the costs for such expansion are not eligible for 201 funding, the town is likely to find the cost of extensive expansion is very high.
- ▶ The 201 study should also address the secondary growth impacts, particularly strip commercial development, that expansion down Route 28 might cause
- ▶ An appropriate on-site system maintenance schedule should be implemented.
- ▶ The Chatham 201 should consider the feasibility of accepting septage from Harwich.
- ▶ The water supply protection needs of the town will become increasingly difficult as the population grows.



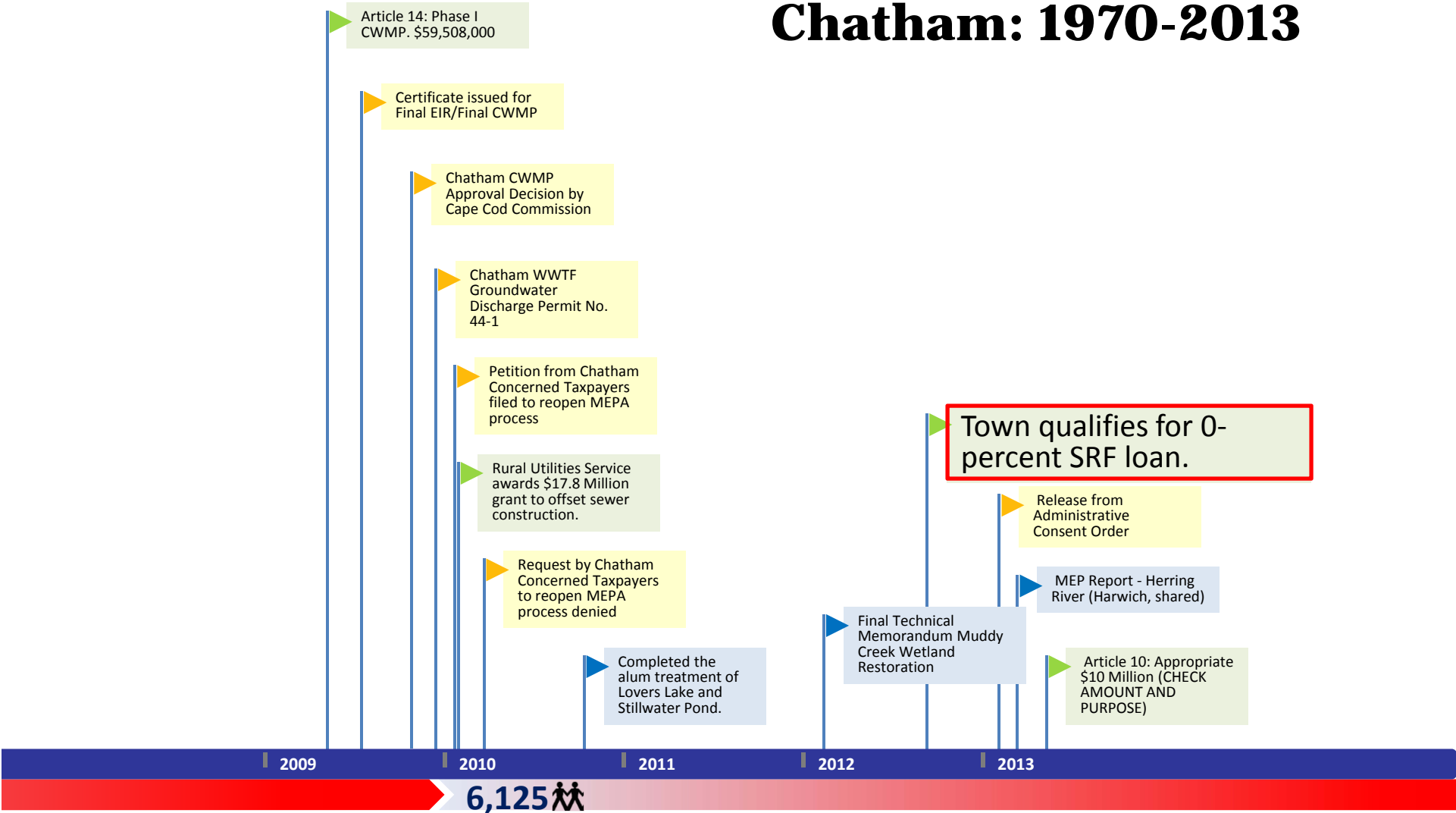
Chatham: 1970-2013



Chatham: 1970-2013



Chatham: 1970-2013

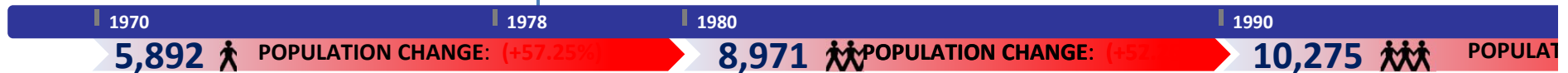


Harwich

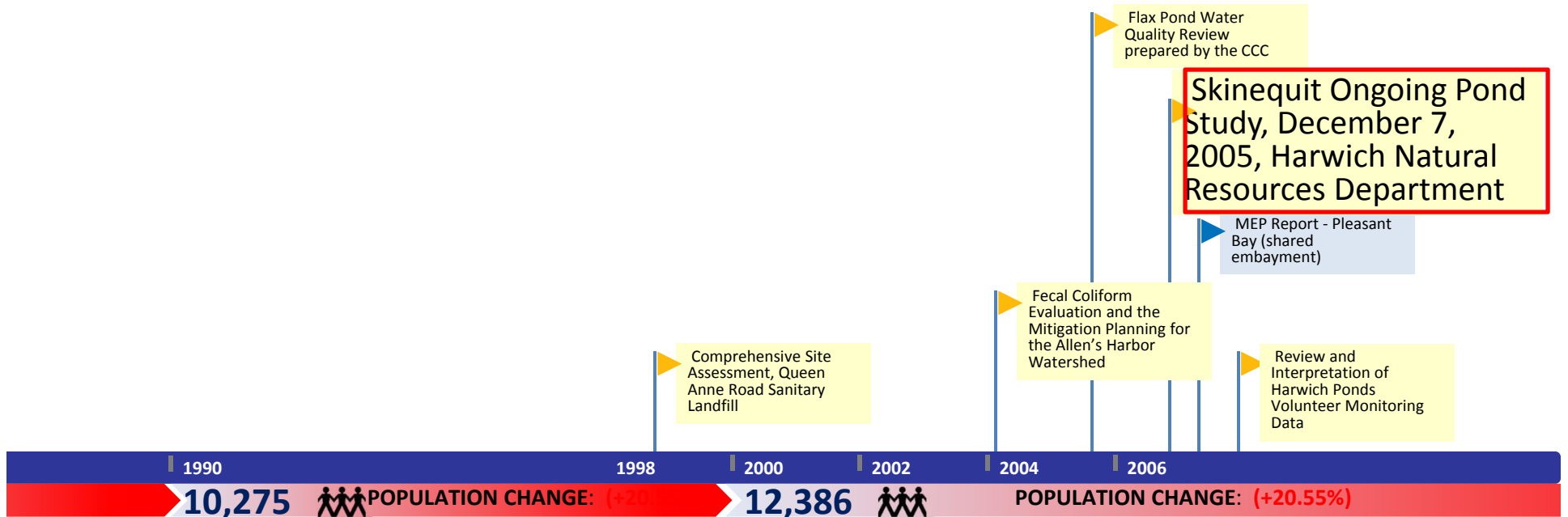
From 1978 Section 208 Plan

- ▶ That the town recognize that the Category 2 problem areas on the south side of town need special attention.
- ▶ It is also suggested that the town consider establishing "Seasonal Residential Districts" in this area to control the conversion of seasonal dwellings to year-round occupancy.
- ▶ The 208 plan does not indicate a sewer need in Harwich. This means that the town will not be eligible for a major central collection system for twenty years.
- ▶ New wastewater management problems created by the town's failure to take recommended actions for on-site system management will not be eligible for future 201 construction funds.
- ▶ While Harwich presently has a state approved interim lagoon, the town should not view this system as a long-term solution to its septage treatment problems.
- ▶ There has been considerable concern raised over the possible development of a large subdivision and golf course upgradient of the town's wellfield.
- ▶ The town should also consider purchasing additional areas to protect the town wells.

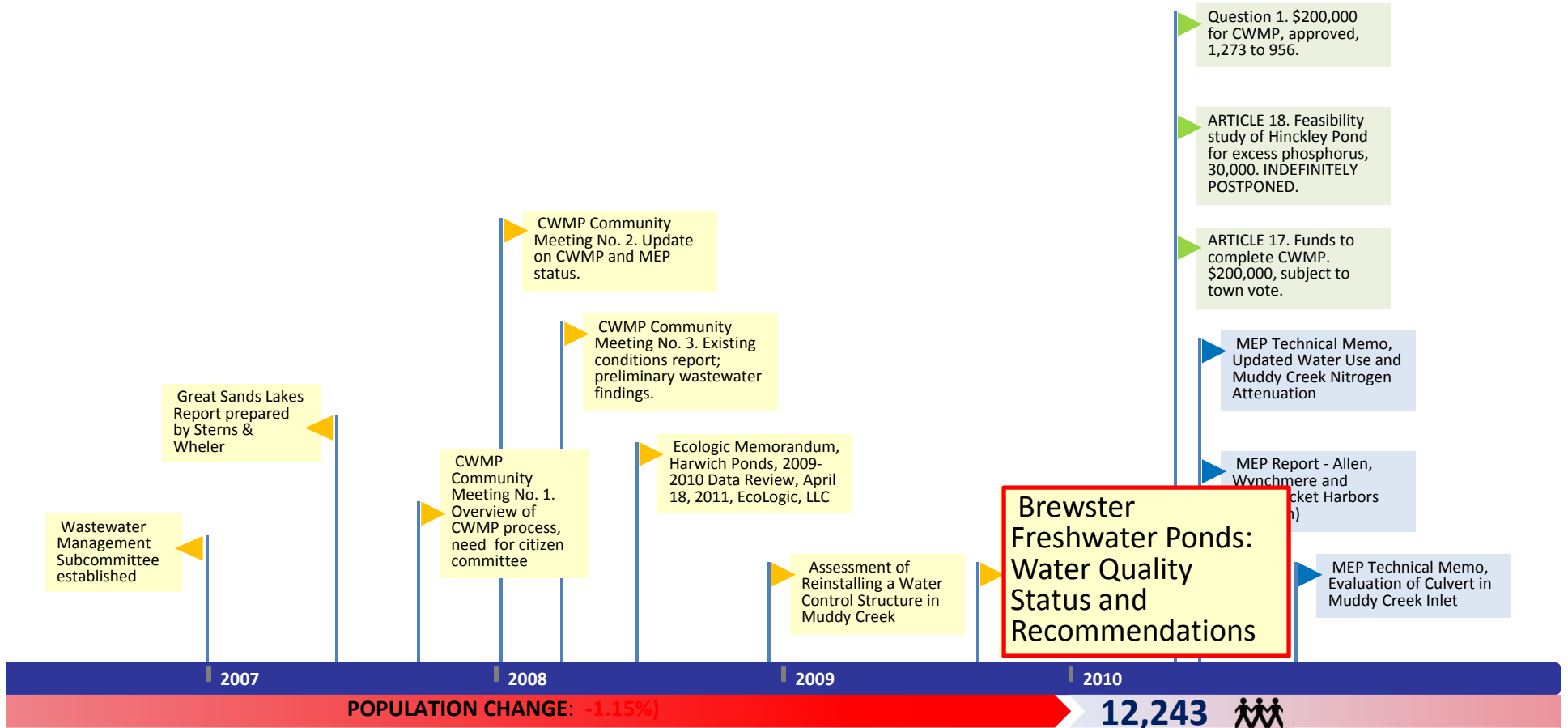
▶ Section 208 Areawide Plan for Cape Cod Approved



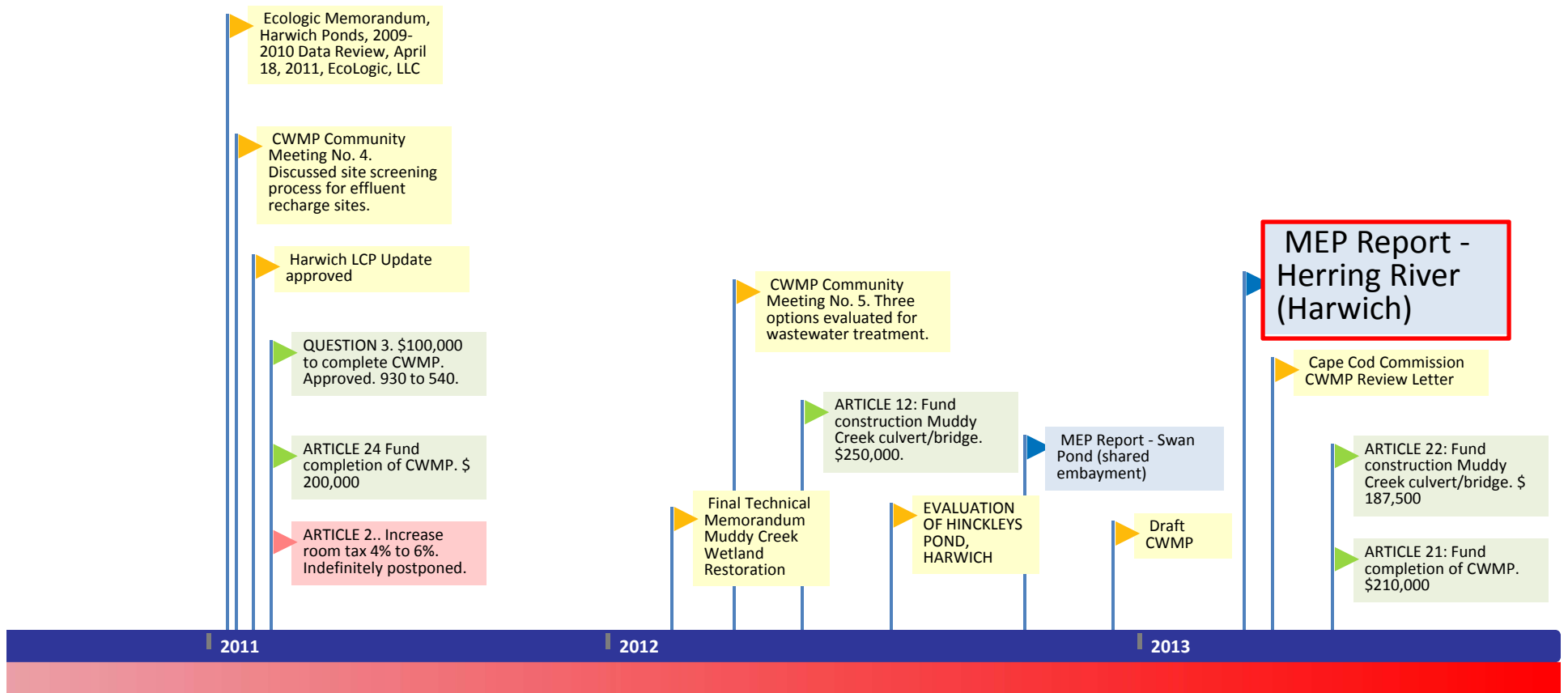
Harwich: 1970-2013



Harwich: 1970-2013



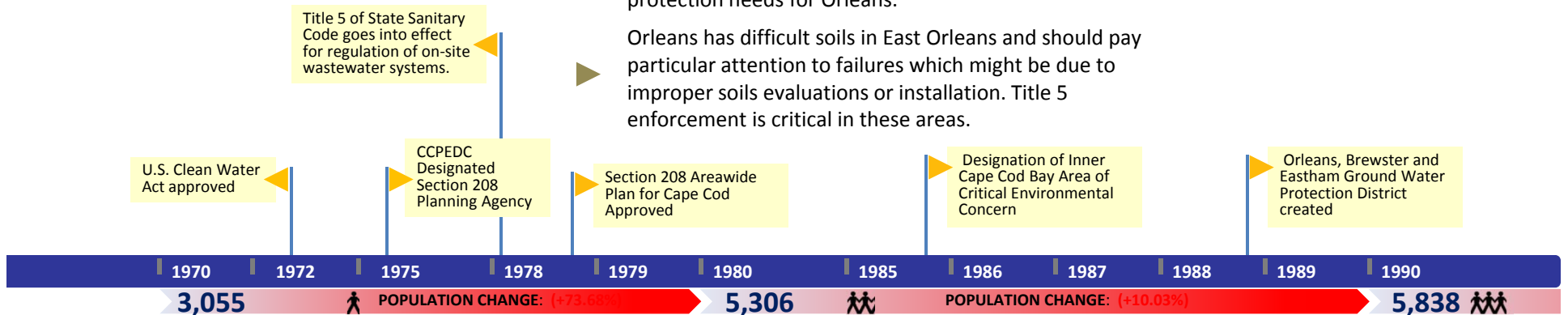
Harwich: 1970-2013



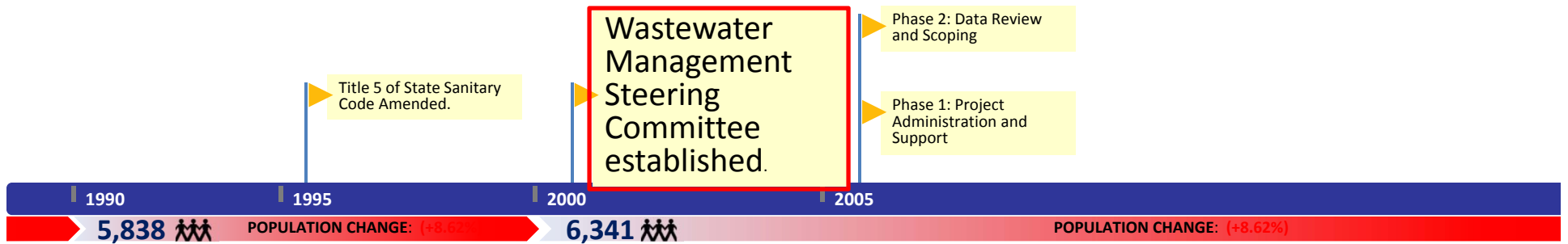
Orleans

From 1978 Section 208 Plan

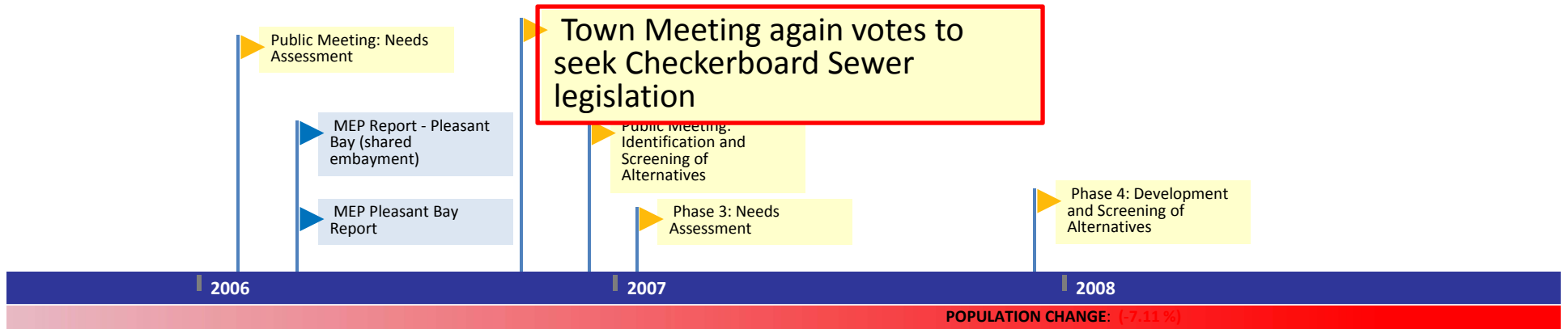
- ▶ The major problems in Orleans at present are septage management, failing systems in the town center, and protection of water quality in the municipal wells.
- ▶ Orleans is one of the first towns on the Cape to take positive action to abate the serious problems posed by septage disposal.
- ▶ A scope 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.



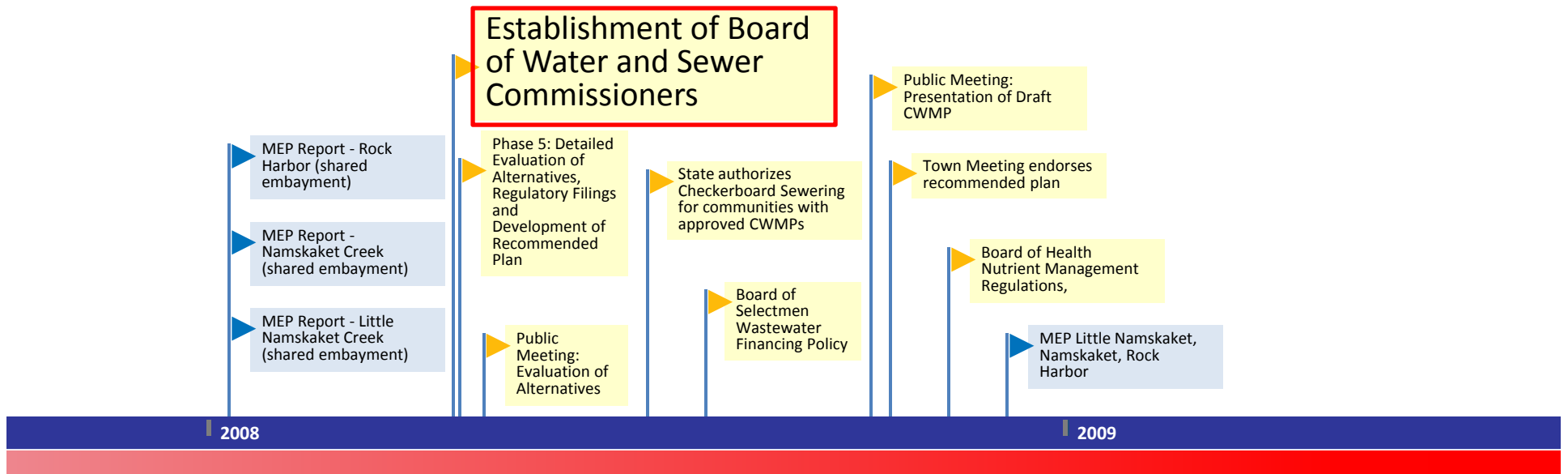
Orleans: 1970-2013



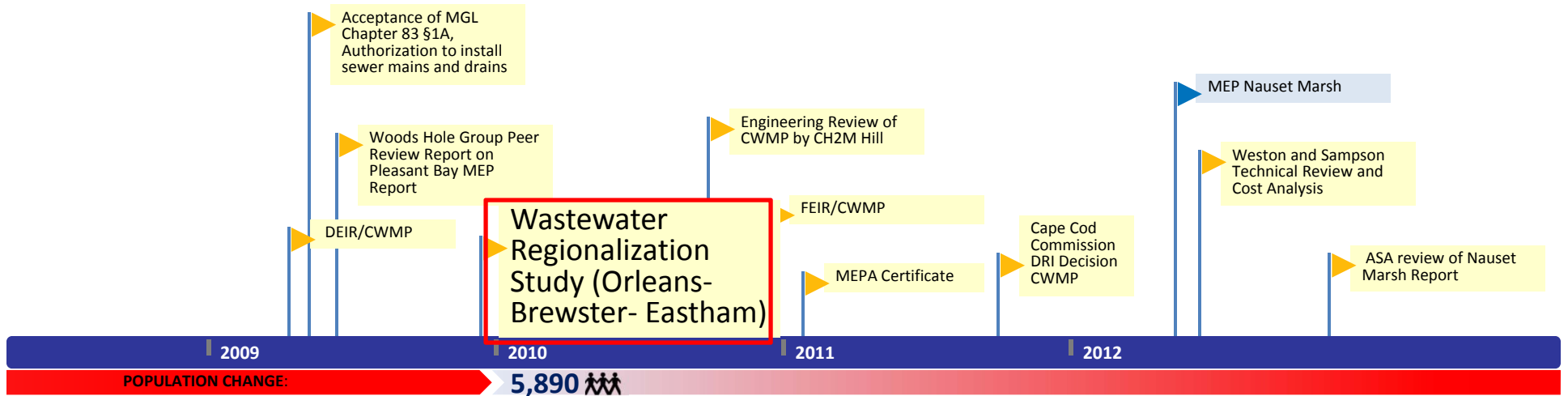
Orleans: 1970-2013



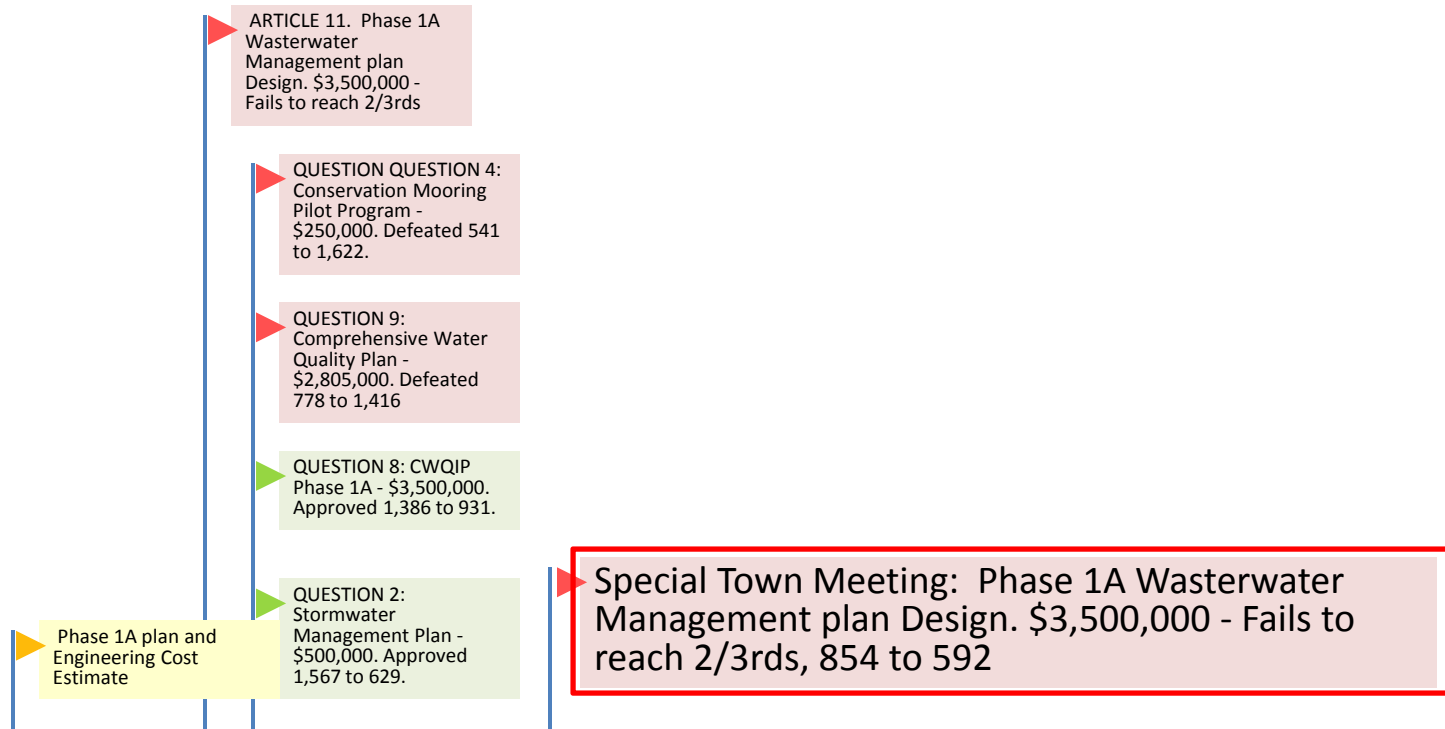
Orleans: 1970-2013



Orleans: 1970-2013



Orleans: 1970-2013



Did we miss anything?

Your Watersheds



Bassing Harbor/Ryders Cove
Muddy Creek
Pleasant Bay



23.6 square miles



4 Towns




Cape Cod National Seashore




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

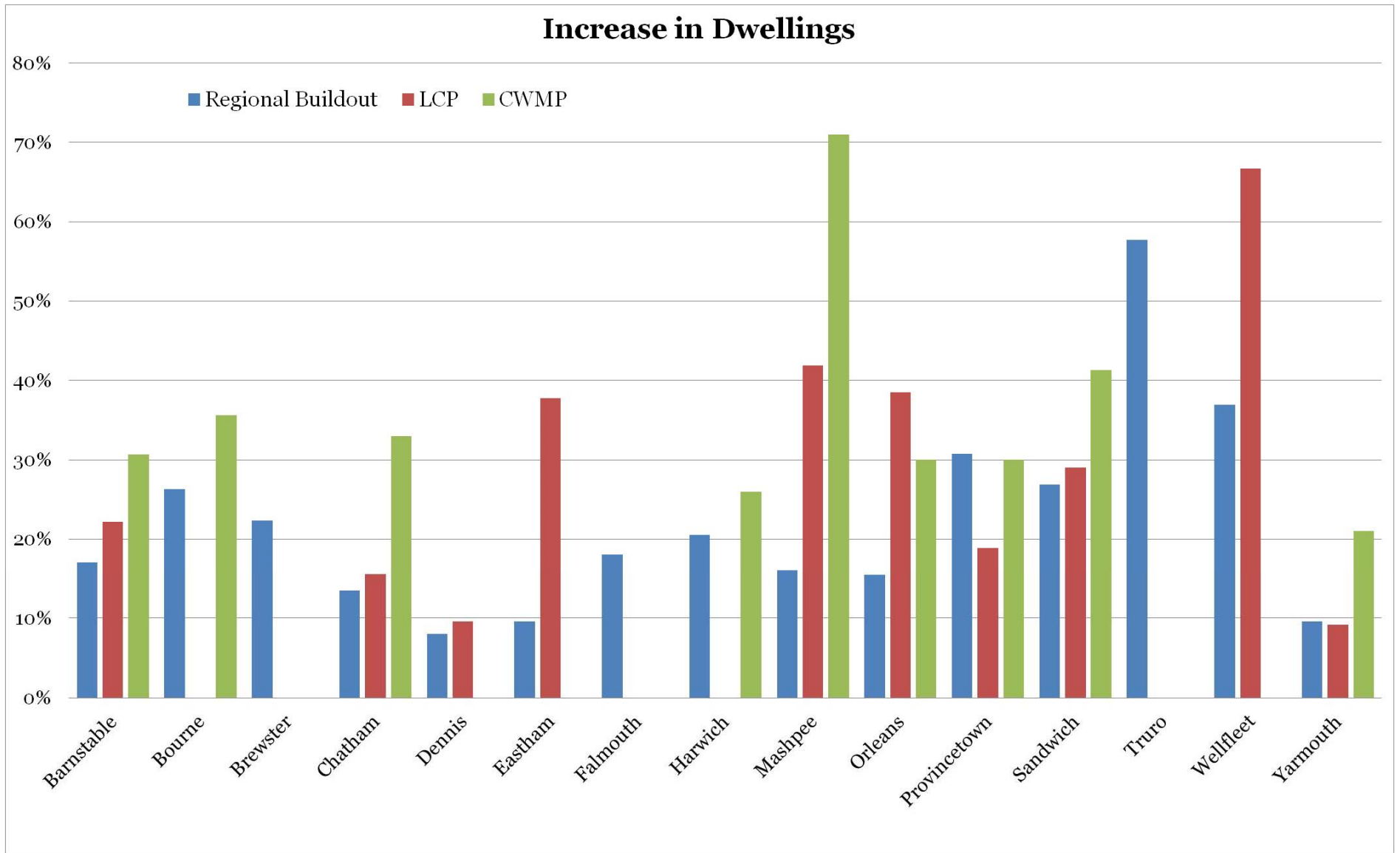
 Open - Disturbed or Managed

 Water

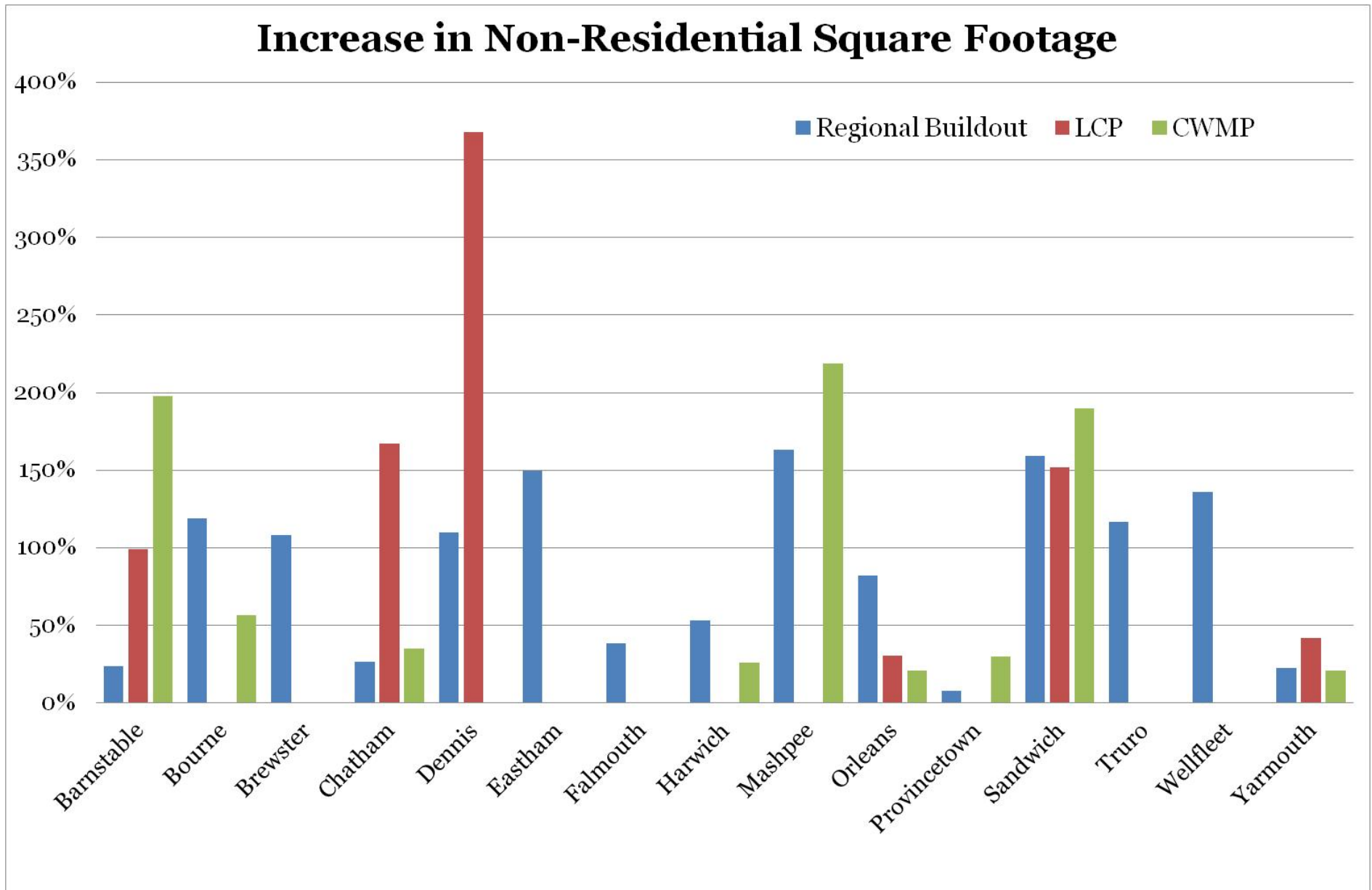
Density

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

Buildout



Buildout

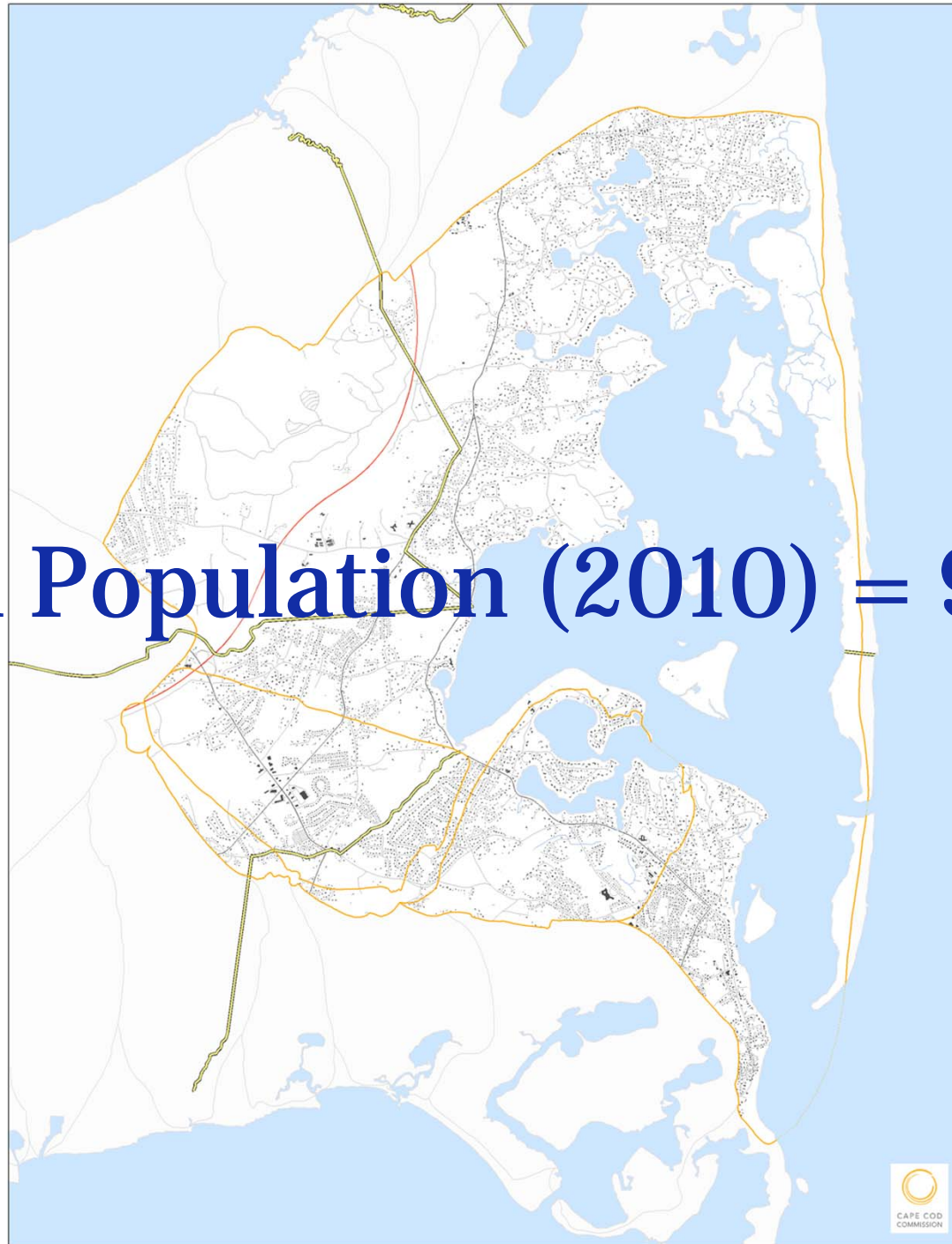


The People



Bassing Harbor/Ryders Cove
Muddy Creek
Pleasant Bay

Total Population (2010) = 9,099



Population (2010)

4.2 % of the Total Cape Cod Population

7,000
6,000
5,000
4,000
3,000
2,000
1,000
-

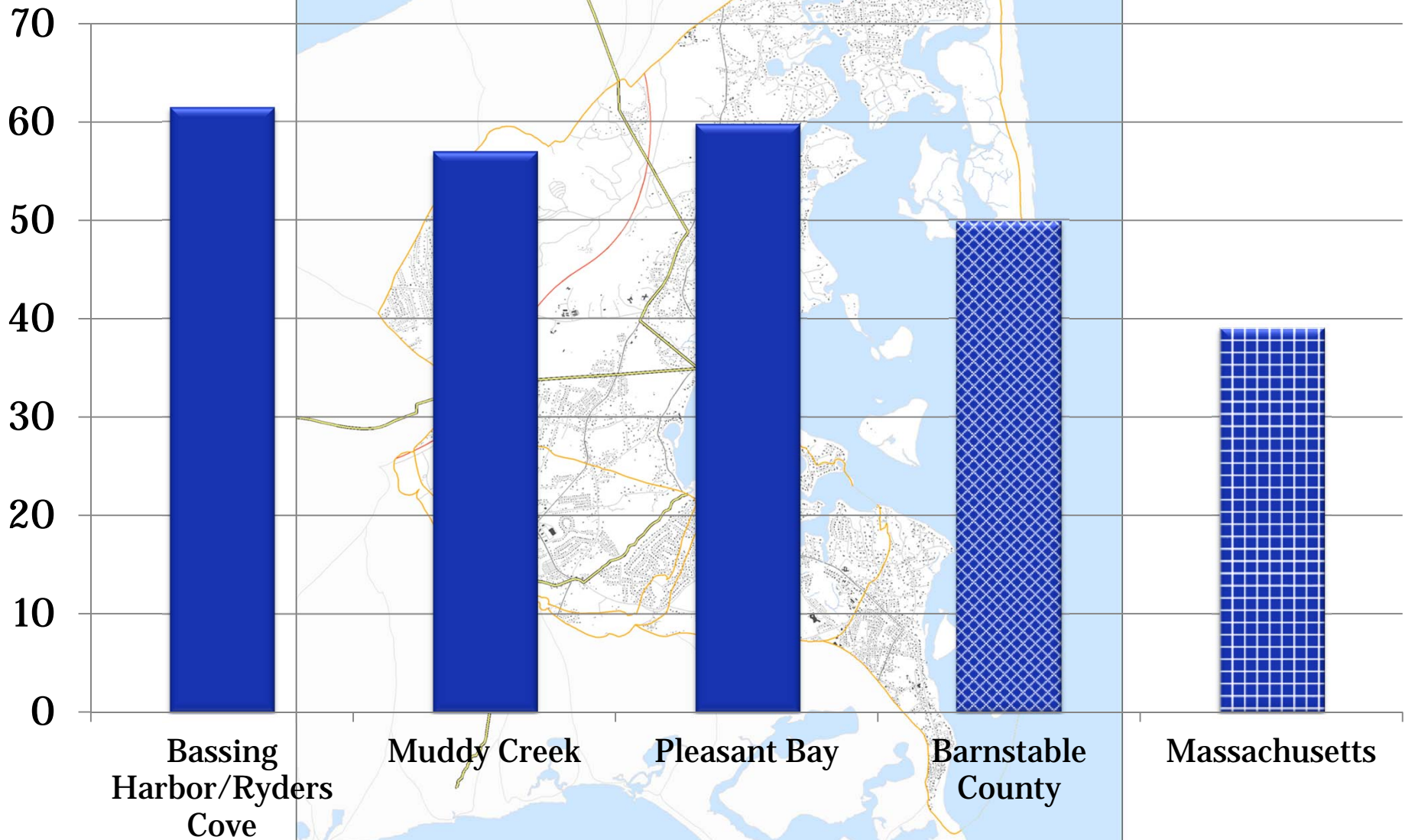
Bassing Harbor/Ryders
Cove

Muddy Creek

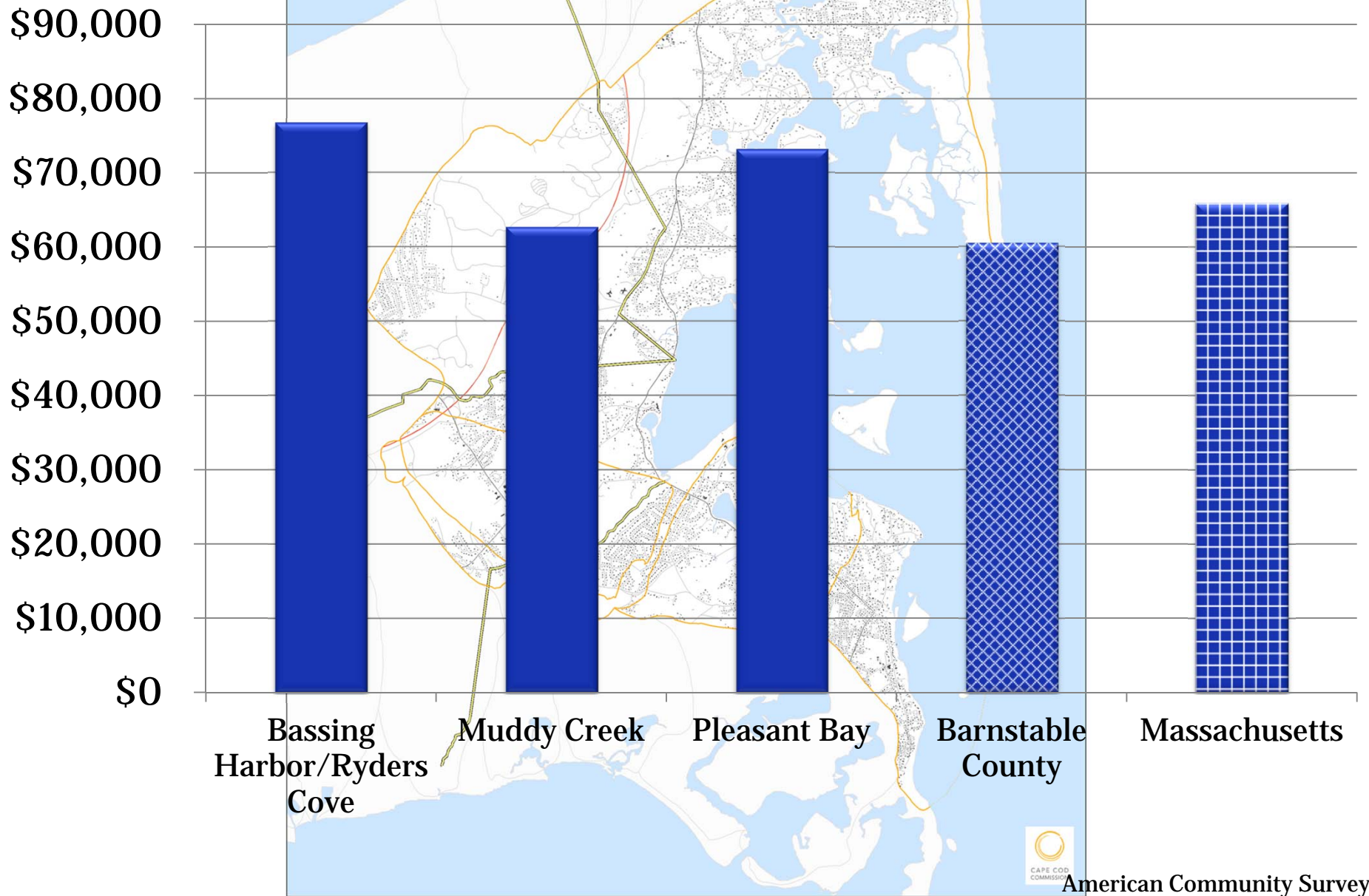
Pleasant Bay



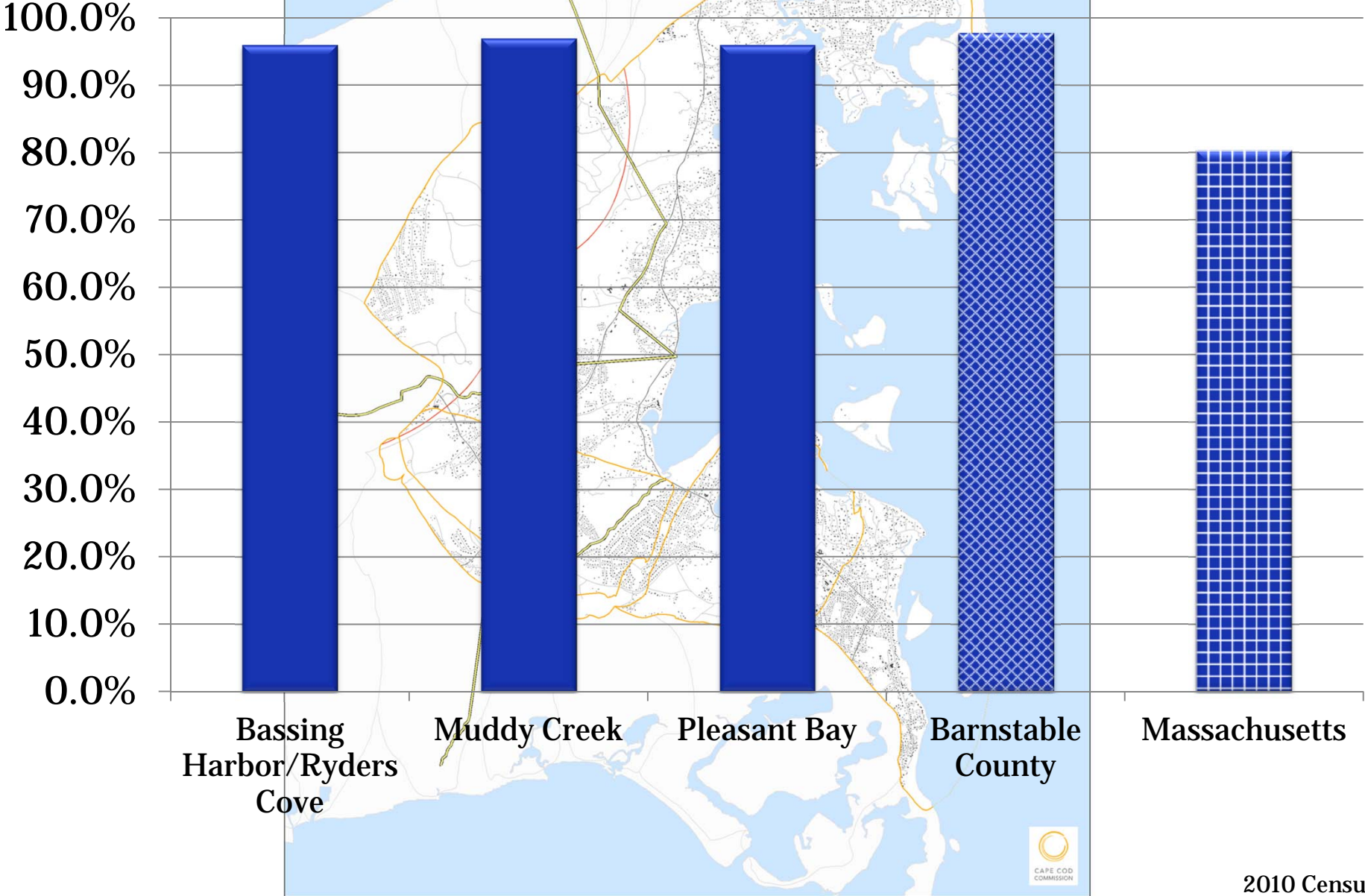
Median Age (2010)



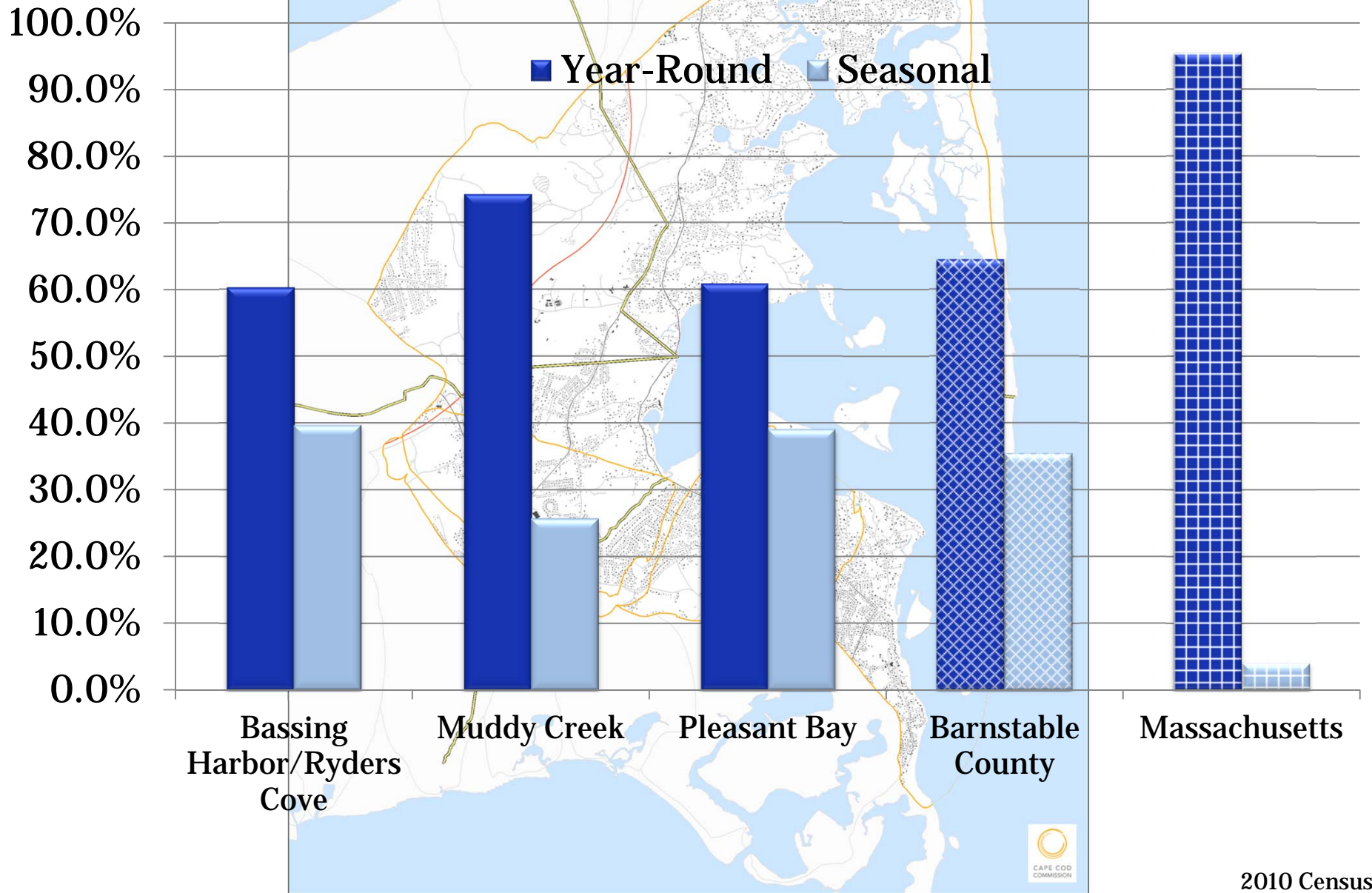
Average Median Income (2010)



Race - % White (2010)



Seasonal vs. Year Round Housing (2010)



Average Assessed Home Value (2010)

\$1,000,000

Total Assessed Value of
Residential Homes=
\$4,790,151,300

\$0

Bassing
Harbor/Ryders
Cove

Muddy Creek

Pleasant Bay

Barnstable
County

Massachusetts



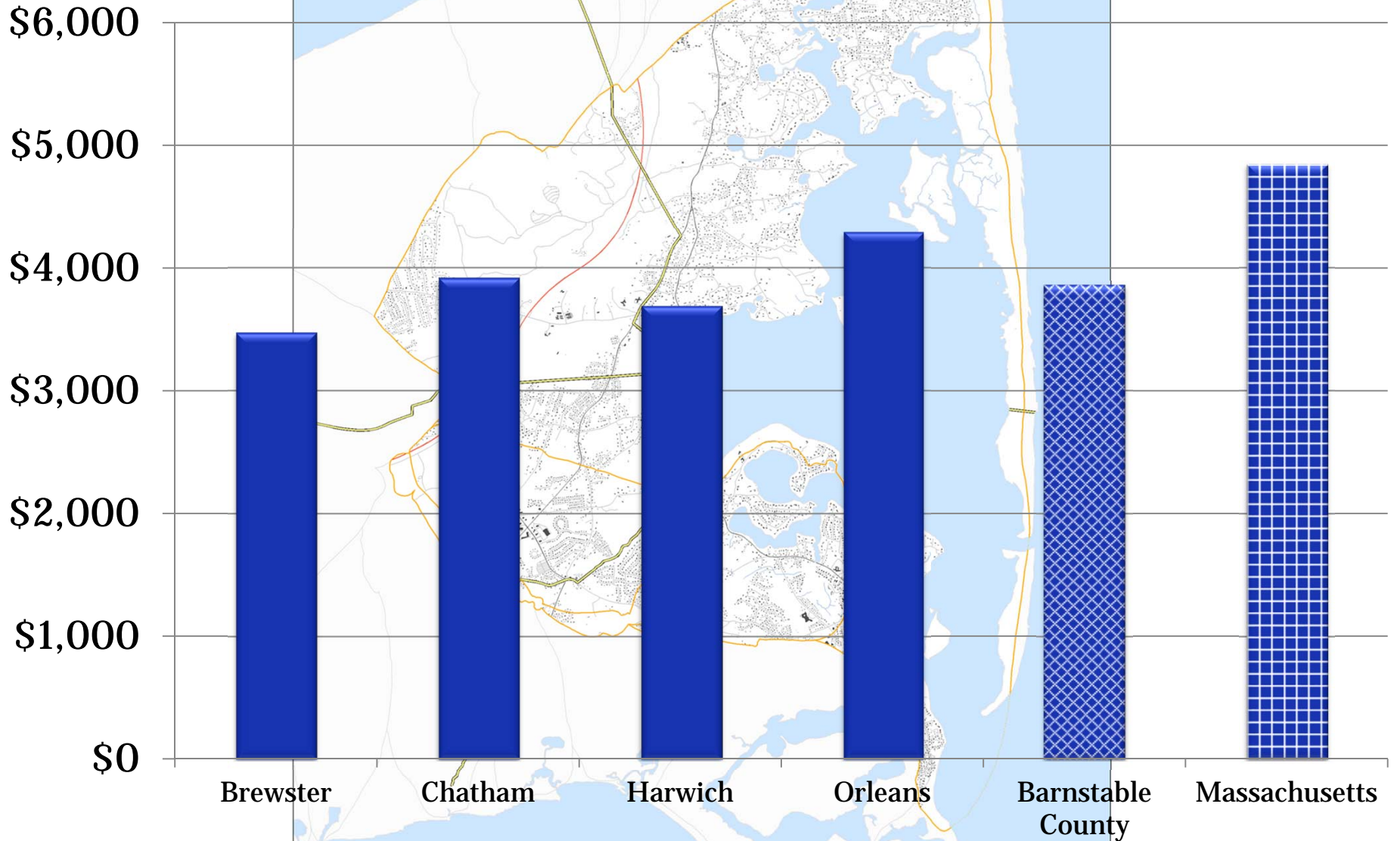
Your Government & Taxes



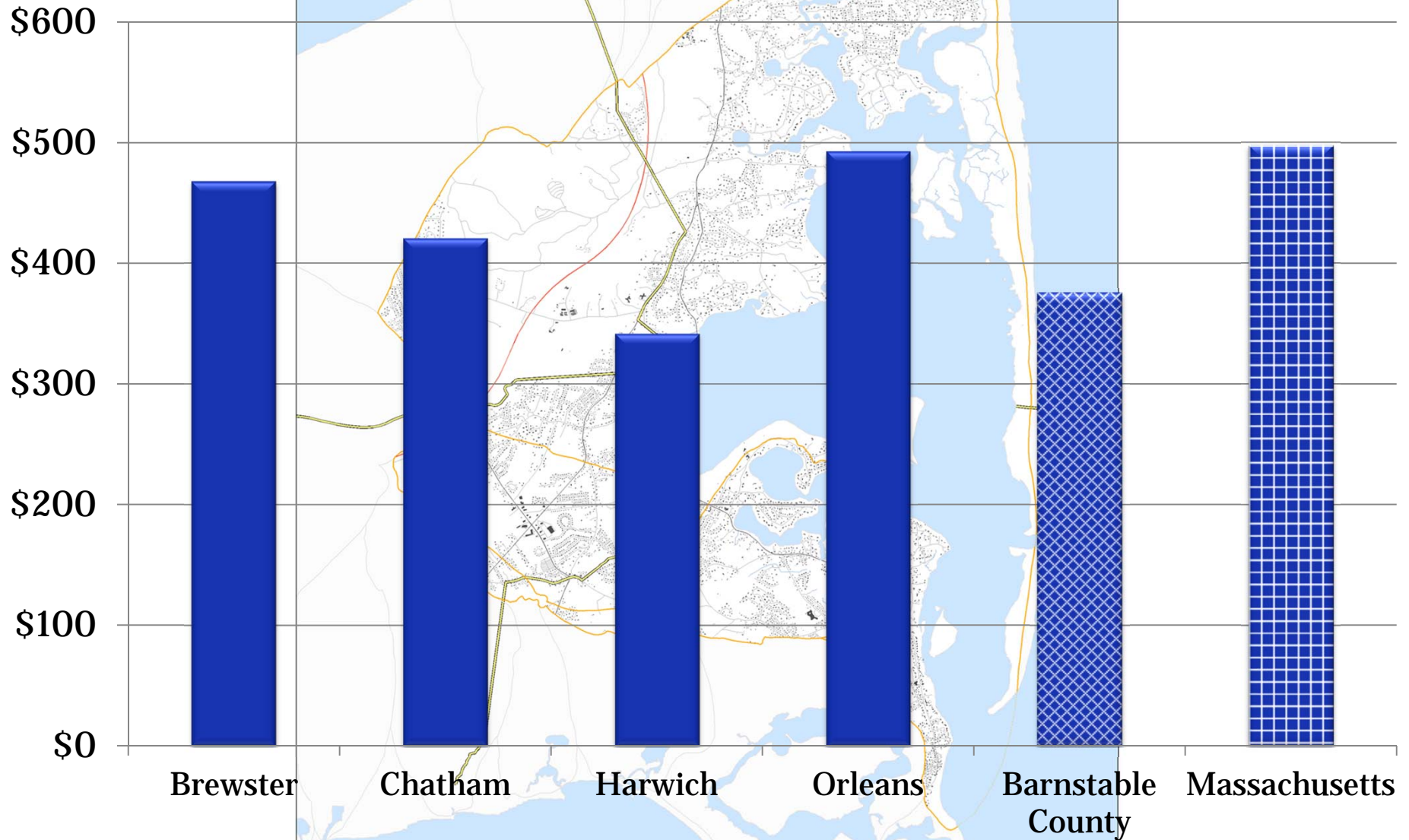
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**Bassing Harbor/Ryders Cove
Muddy Creek
Pleasant Bay**

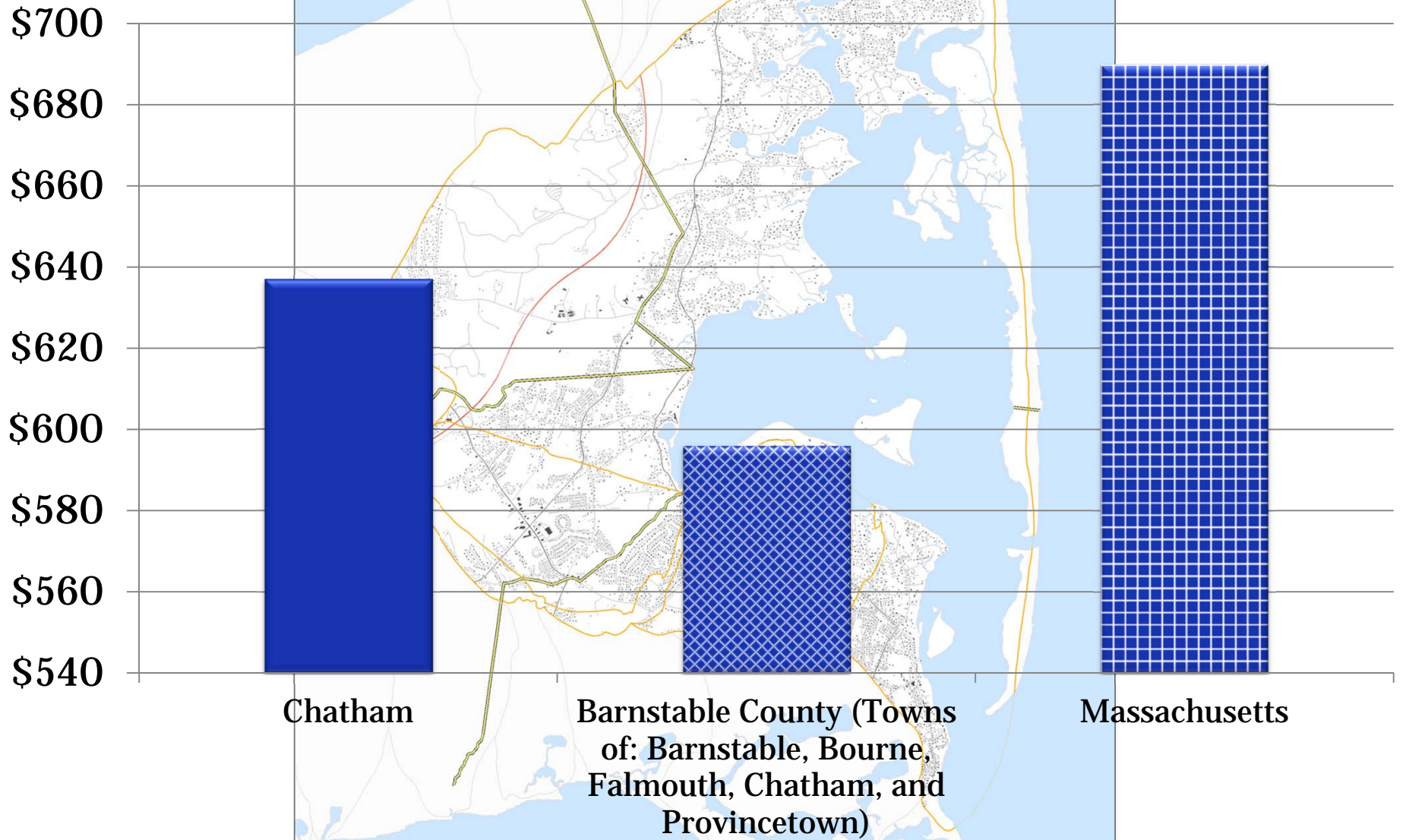
Average Single Family Property Tax Bill (2013)



Average Annual Water Bill (2012)



Average Annual Sewer Bill (2012)



The Problem



**Bassing Harbor/Ryders Cove
Muddy Creek
Pleasant Bay**



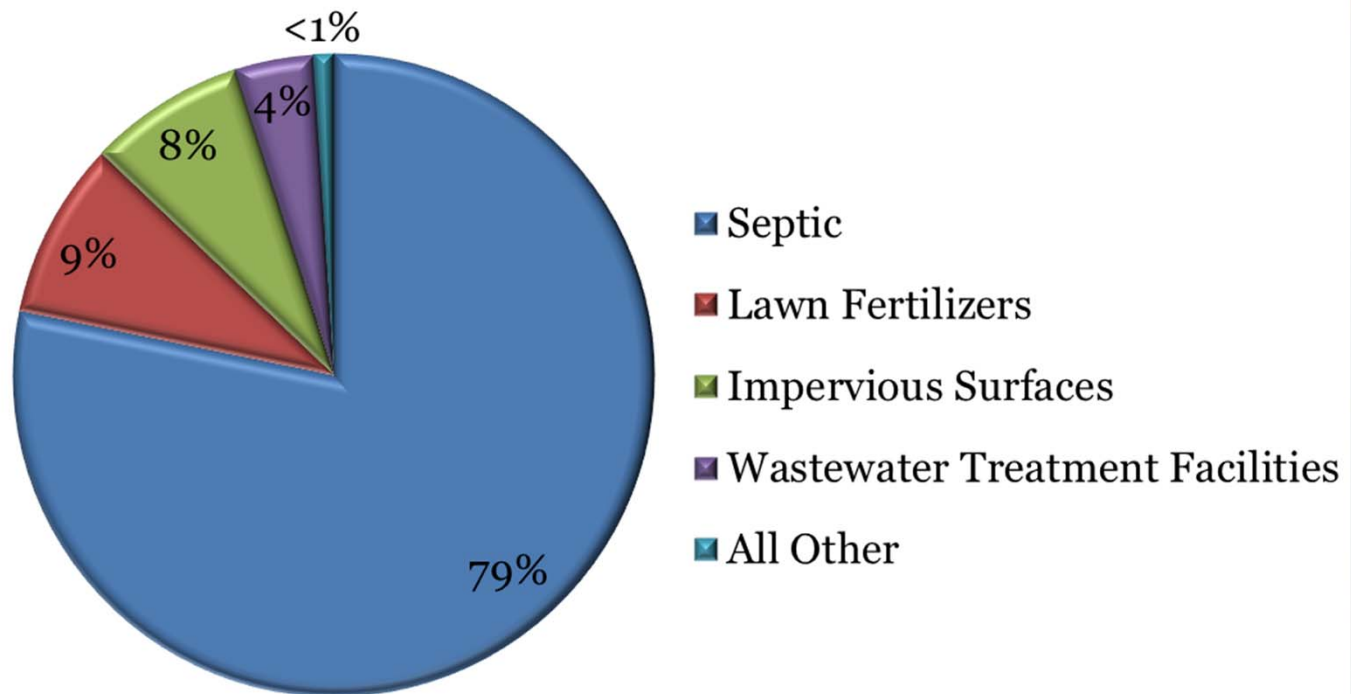
Photo credit: National Park Service

An aerial photograph of a coastal region. On the left, a sandy beach curves along the edge of a blue body of water. The land is covered in dense green vegetation, with some roads and buildings visible. The sky is a clear, light blue.

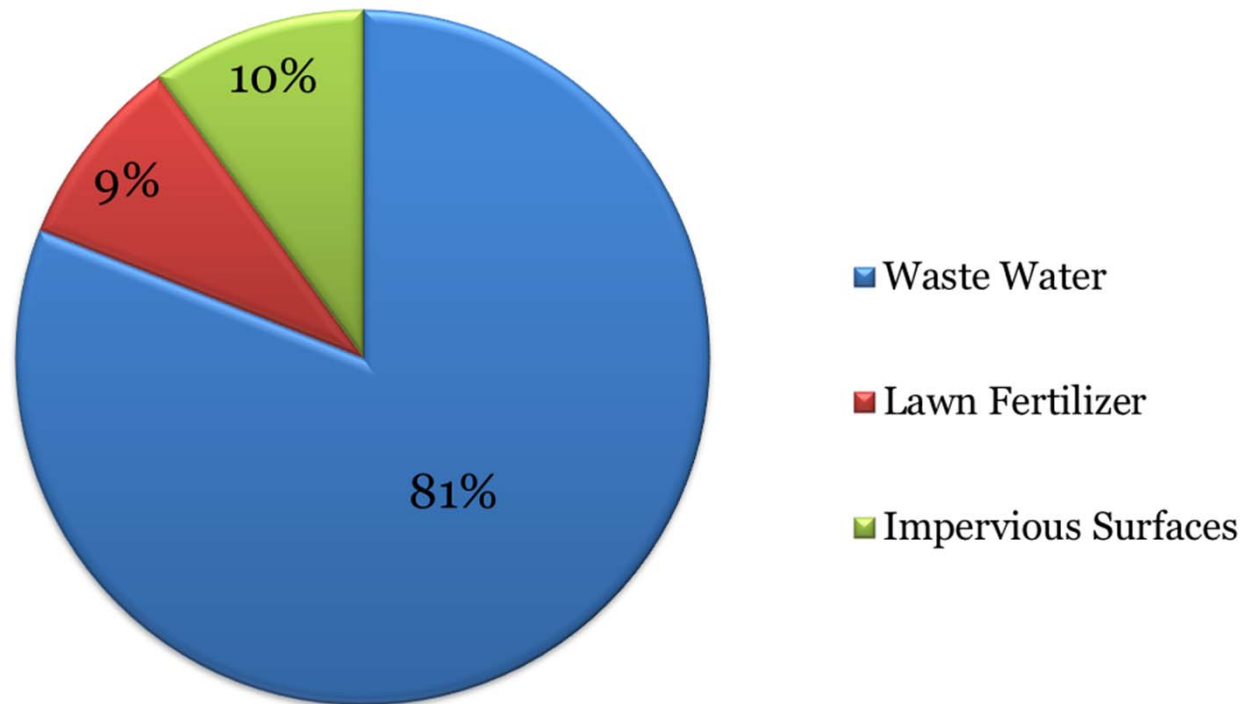
Massachusetts Estuaries Project

- 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

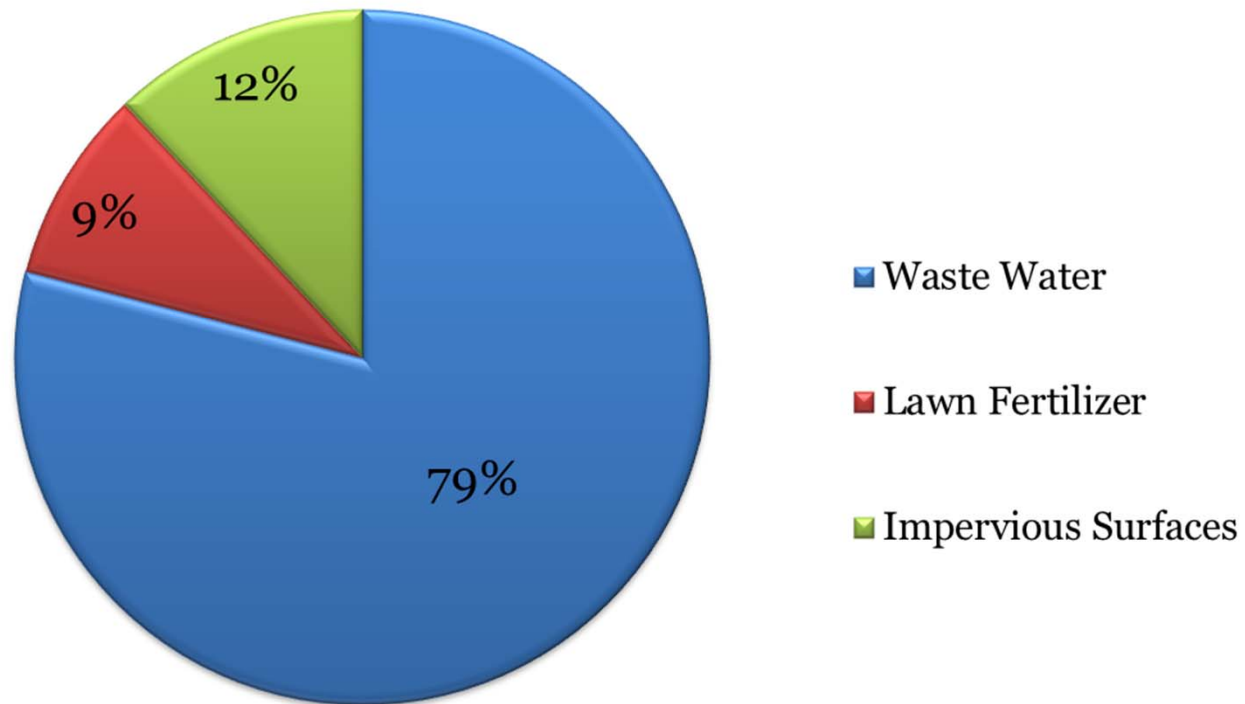


Bassing Harbor/Ryders Cove



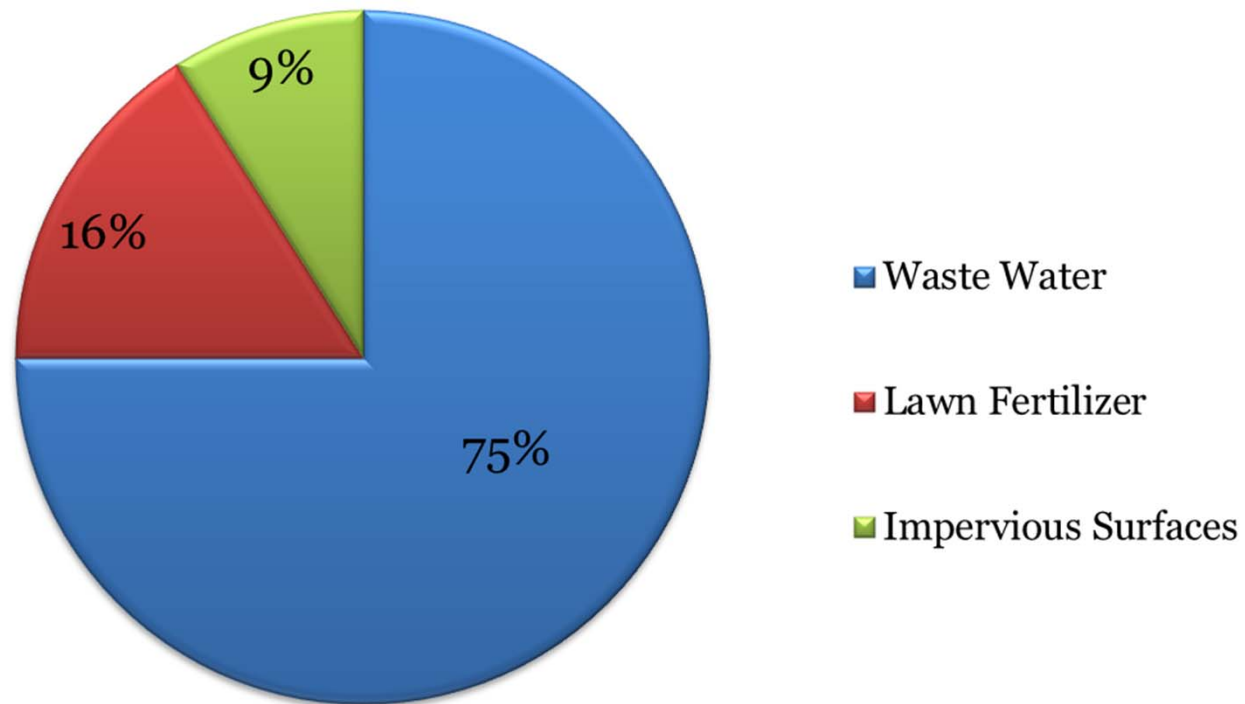
Massachusetts Estuaries Project, Dec 2003

Muddy Creek



Massachusetts Estuaries Project, Dec 2003


Pleasant Bay



Massachusetts Estuaries Project, May 2006


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 in Public Supply Wells


-  0 - 0.5 mg/l
-  0.5 - 1 mg/l
-  1 - 2.5 mg/l
-  2.5 - 5 mg/l


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

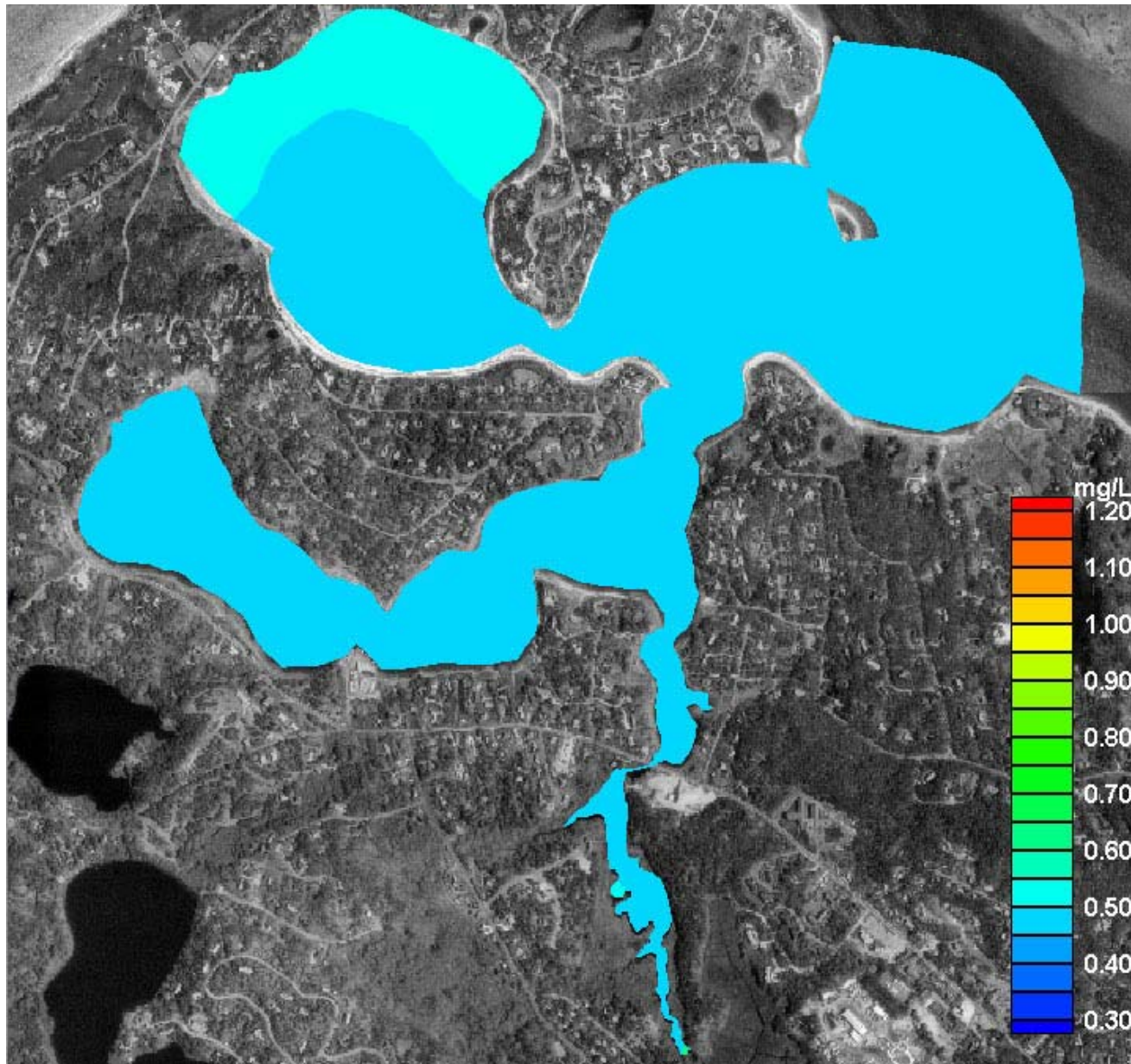
 0.1 % - 9%

 9.1 % - 38 %

 38.1 % - 62 %

 62.1 % - 86 %

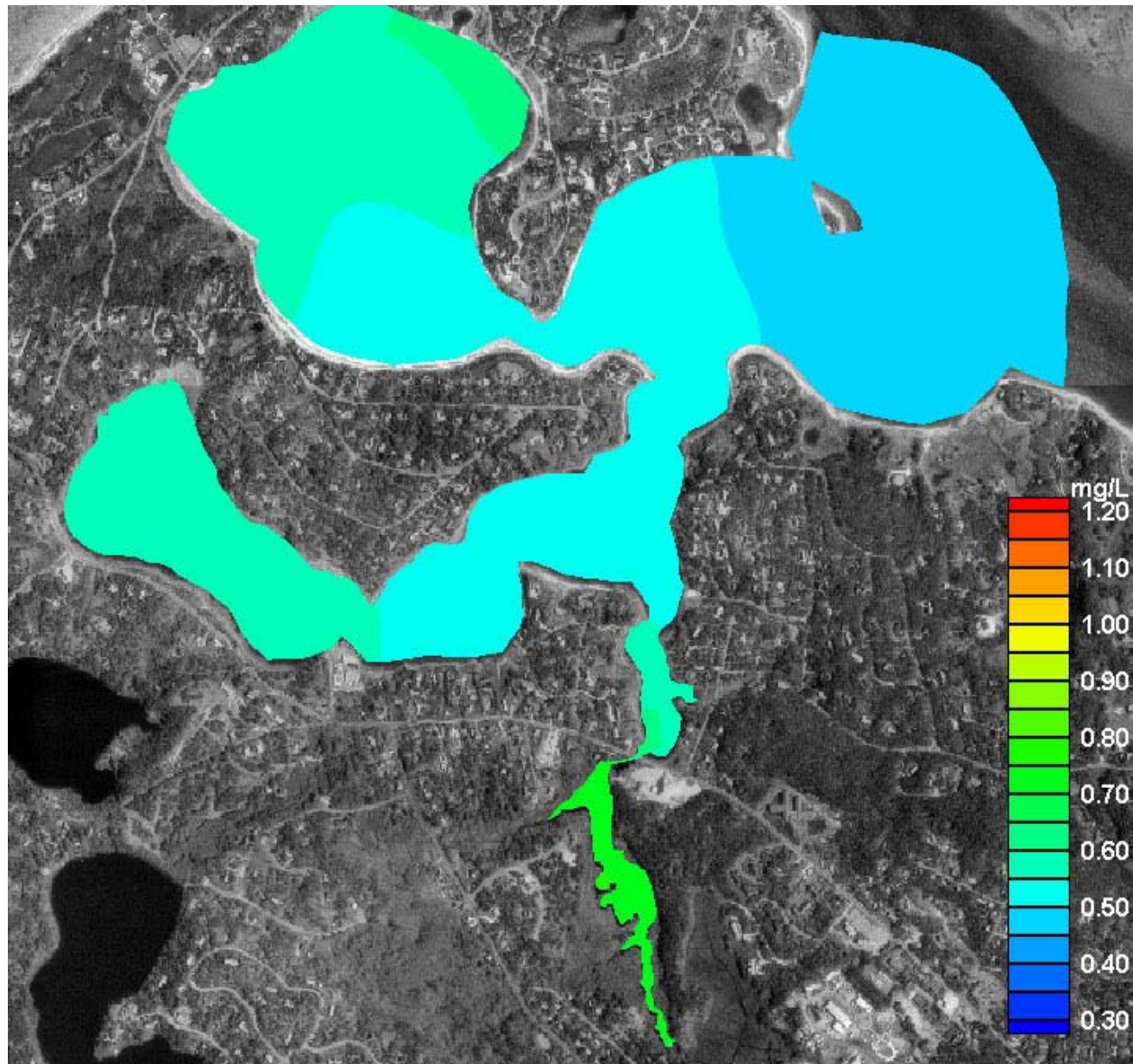
 86.1 % - 100%



Contour Plot of **modeled total nitrogen concentrations (mg/L)** in the Bassing Harbor system, for no anthropogenic loading conditions, and present background N concentration at the entrance to Pleasant Bay (0.48 mg/L).

(Source: MEP 2003)

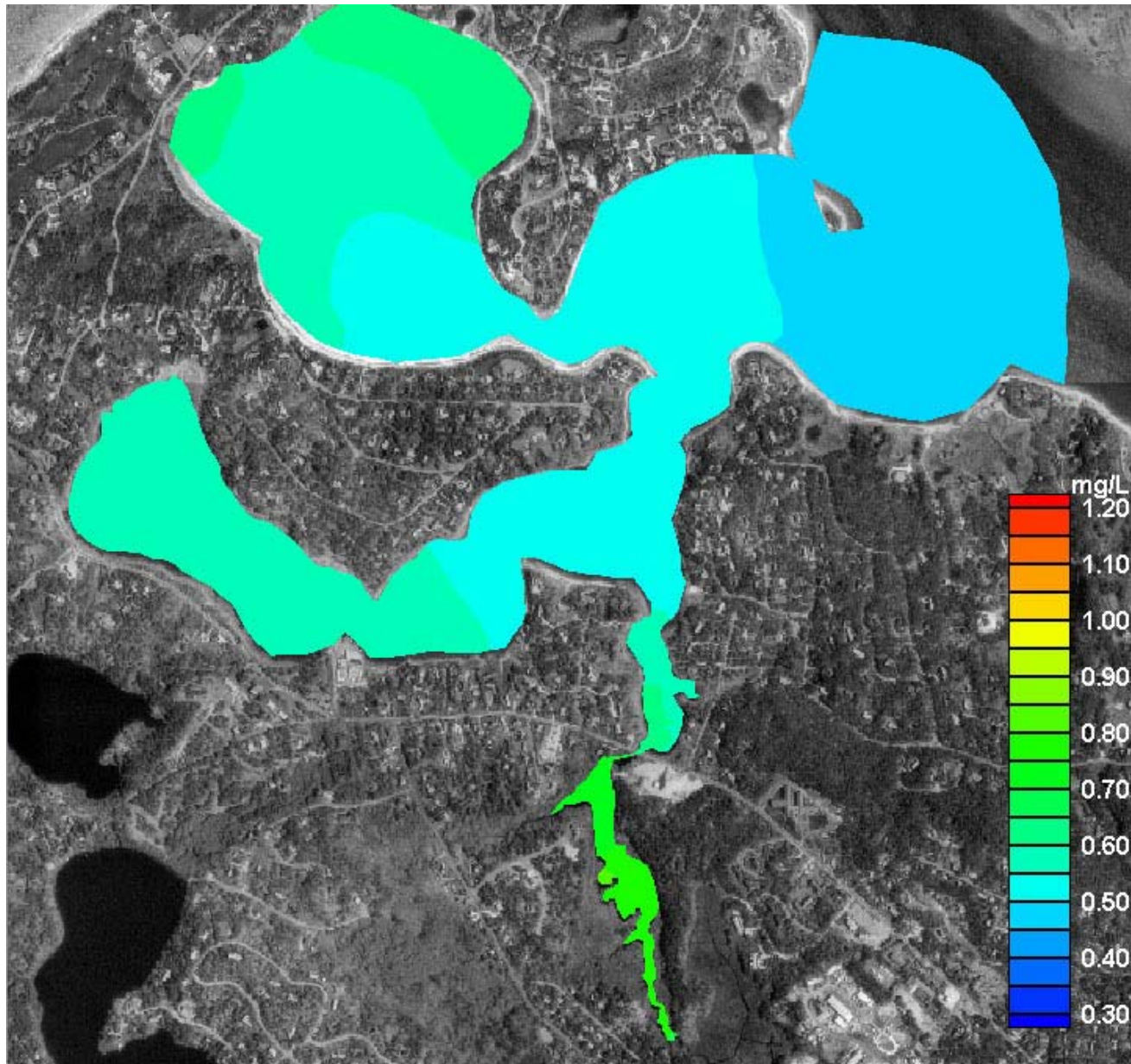
Pre-Colonial Conditions: Bassing Harbor/Ryders Cove



Contour Plot of **modeled total nitrogen concentrations (mg/L)** in the Bassing Harbor system, for present loading conditions, and present background N concentration at the entrance to Pleasant Bay (0.48 mg/L).

(Source: MEP 2003)

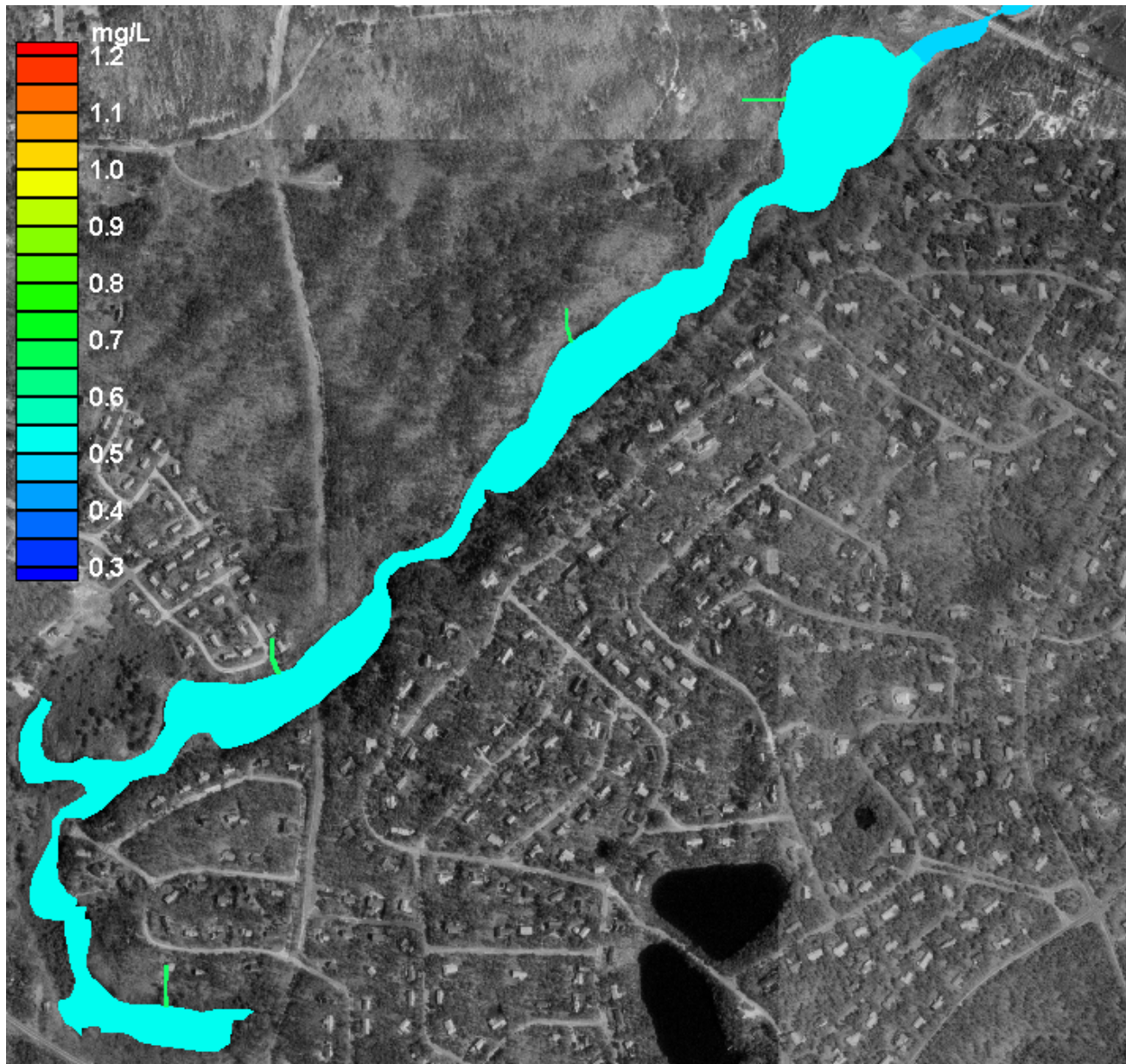
Present Conditions: Bassing Harbor/Ryders Cove



Contour Plot of **modeled total nitrogen concentrations (mg/L)** in the Bassing Harbor system, for projected build out loading conditions, and present background N concentration at the entrance to Pleasant Bay (0.48 mg/L).

(Source: MEP 2003)

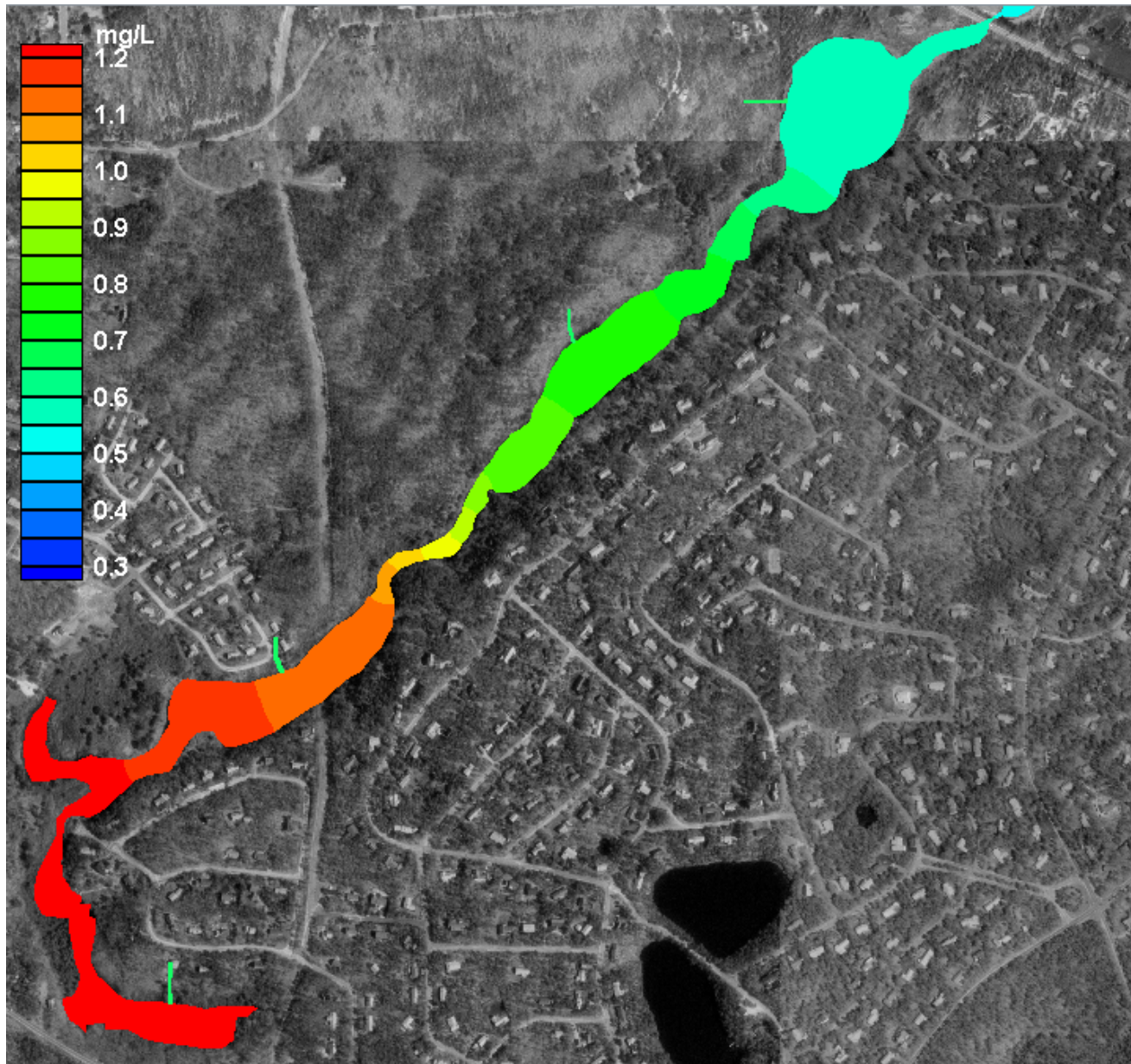
Buildout Conditions: Bassing Harbor/Ryders Cove



Contour plot of **modeled total nitrogen concentrations** in Muddy Creek, for no anthropogenic loading conditions, and present total nitrogen concentration in Pleasant Bay (0.50 mg/L).

(Source: MEP 2003)

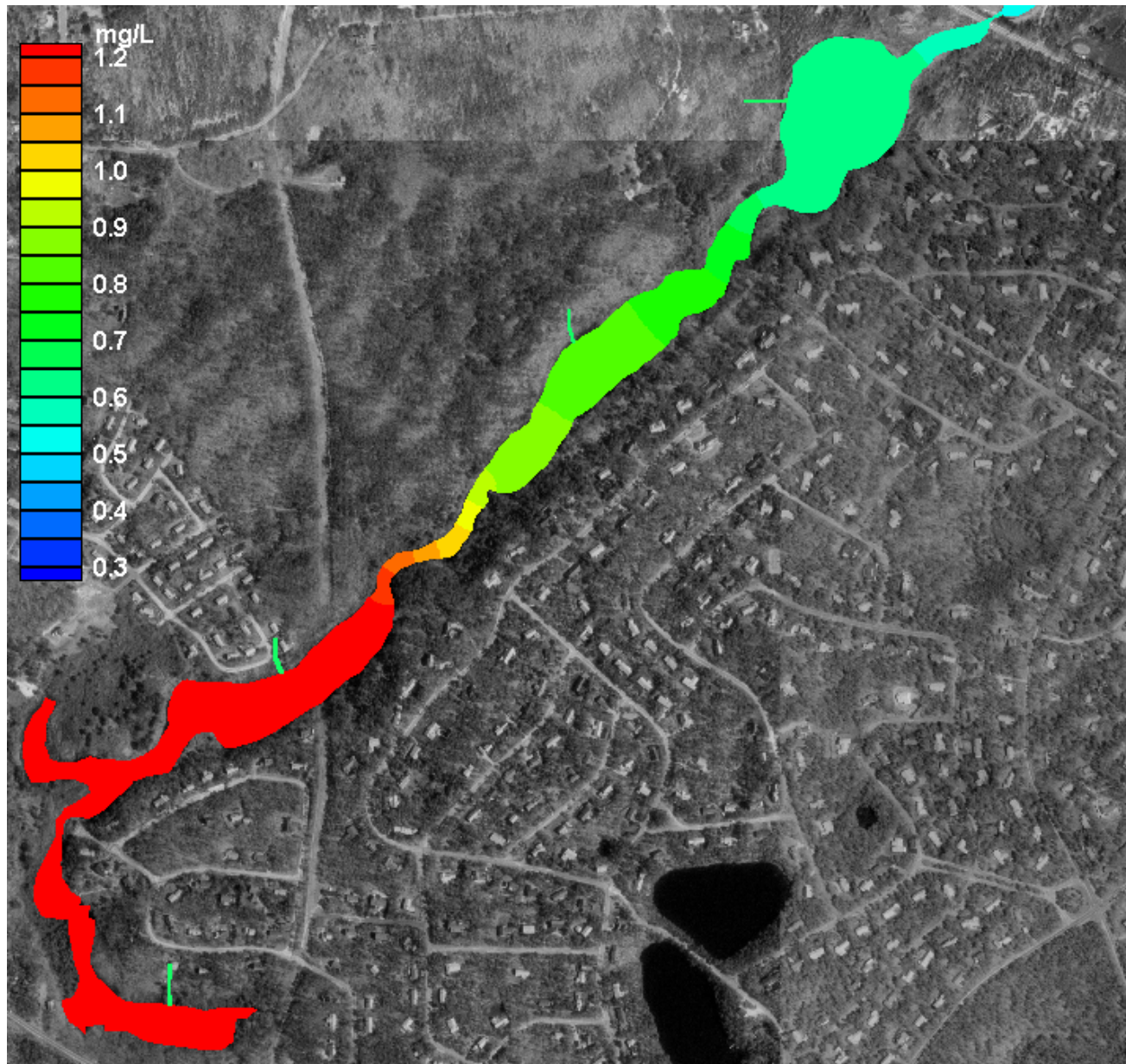
Pre-Colonial Conditions: Muddy Creek



Contour plot of **modeled total nitrogen concentrations** in Muddy Creek, for present loading conditions, and present total nitrogen concentration in Pleasant Bay (0.50 mg/L).

(Source: MEP 2003)

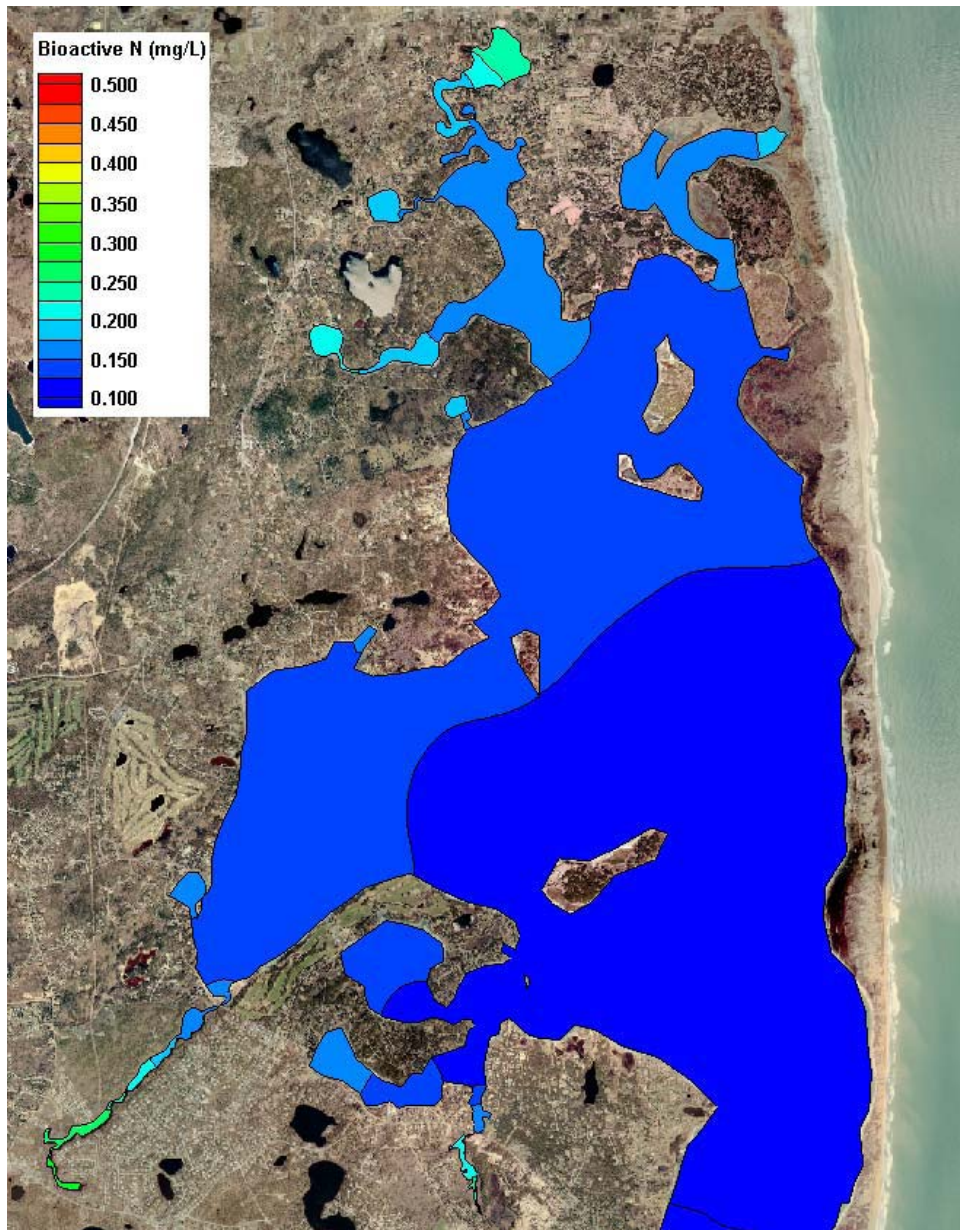
Present Conditions: Muddy Creek



Contour plot of **modeled total nitrogen concentrations** in Muddy Creek, for projected build out loading conditions, and present total nitrogen concentration in Pleasant Bay (0.50 mg/L).

(Source: MEP 2003)

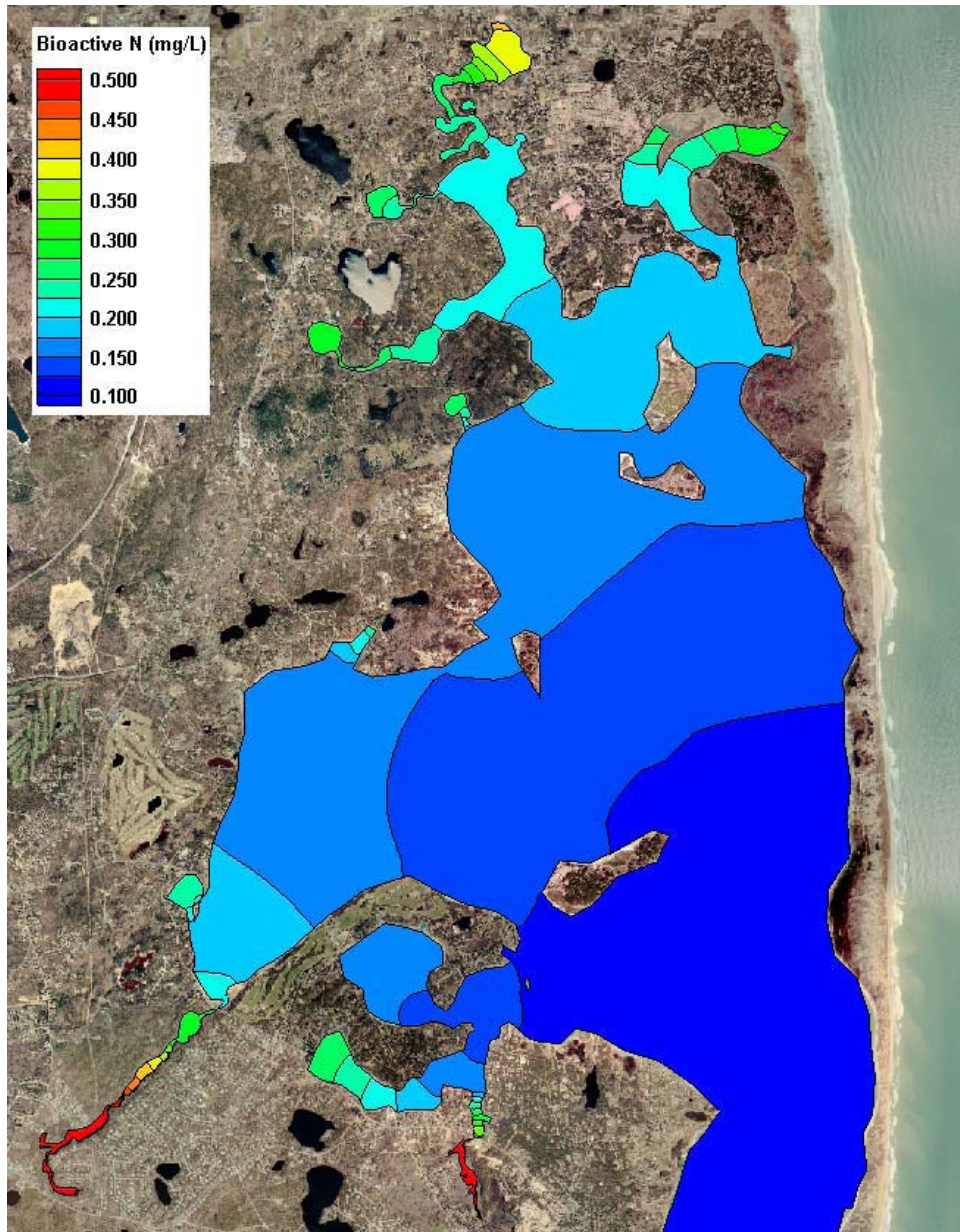
Buildout Conditions: Muddy Creek



Contour plot of **modeled total nitrogen concentrations (mg/L)** in Pleasant Bay, for no anthropogenic loading conditions.

(Source: MEP 2003)

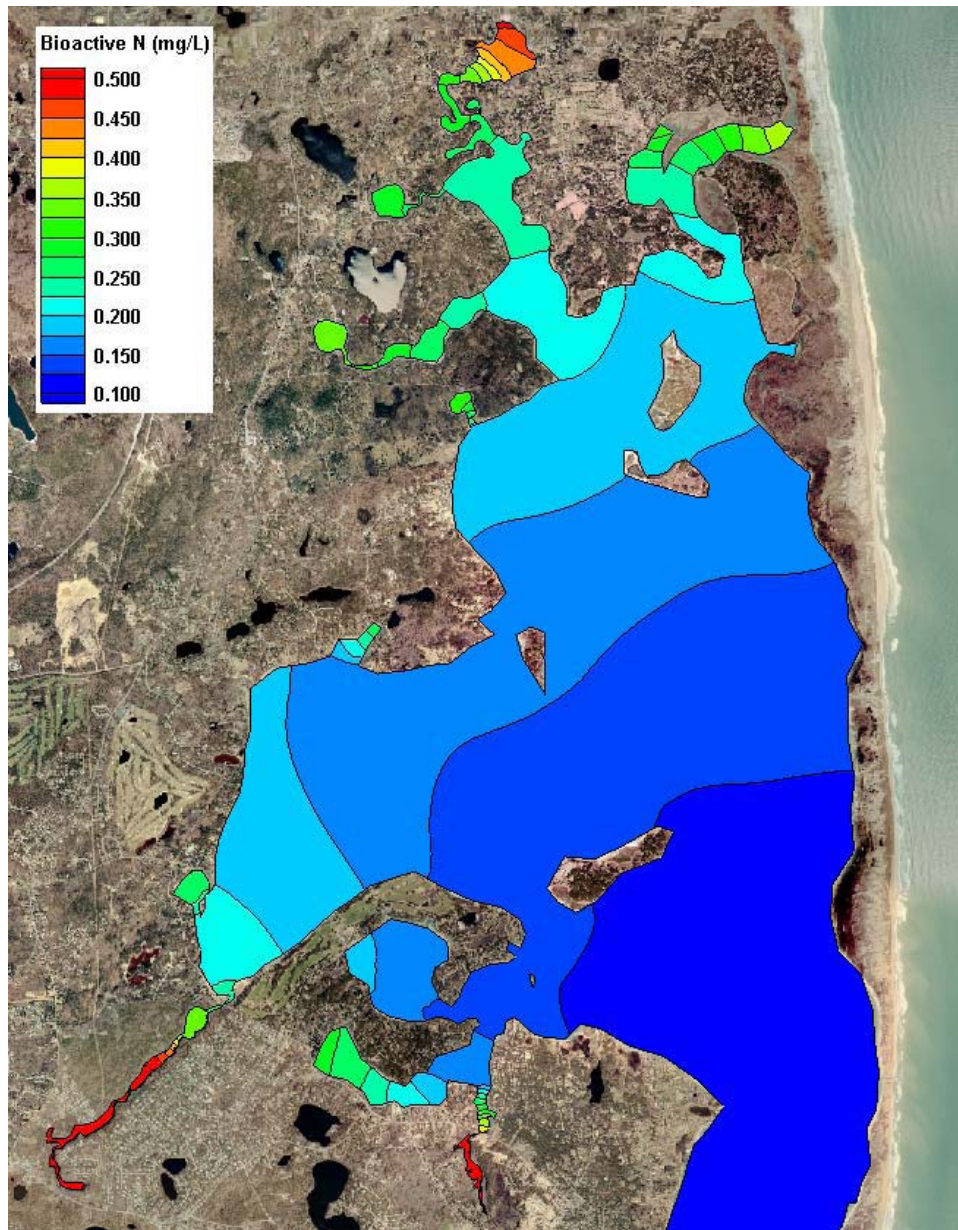
Pre-Colonial Conditions: Pleasant Bay



Contour plot of **average bioactive (DIN+PON) nitrogen concentrations** from results of the present conditions loading scenario, for the Pleasant Bay system.

(Source: MEP 2003)

Present Conditions: Pleasant Bay




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

(Source: MEP 2003)

Buildout Conditions: Pleasant Bay


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



**Bassing Harbor/Ryders Cove
Muddy Creek
Pleasant Bay**


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

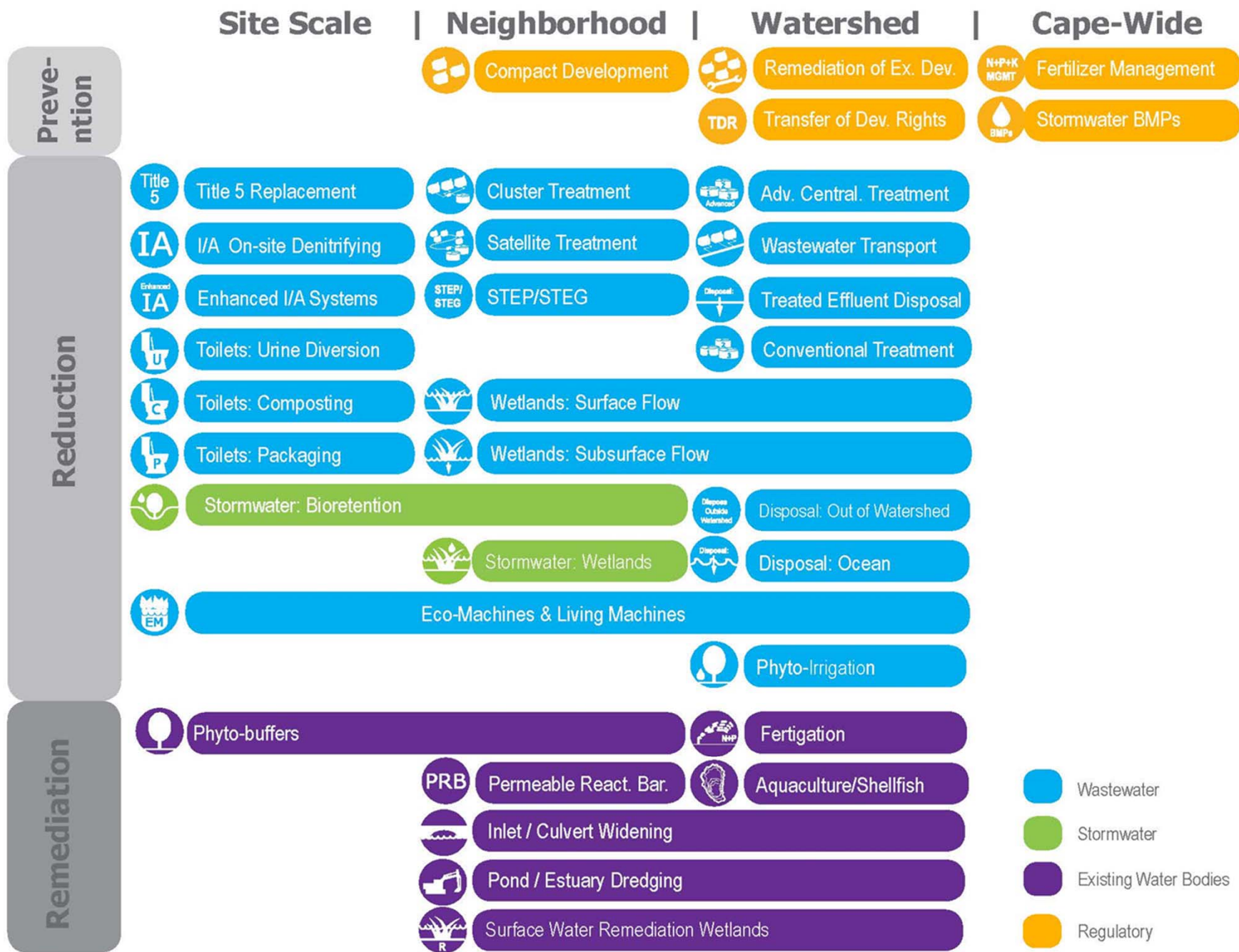
 2031 - 2040

 2041 - 2050



Framework for Addressing Solutions Moving Forward

**Bassing Harbor/Ryders Cove
Muddy Creek
Pleasant Bay**



- 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 Pleasant Bay Group will be available on the Cape Cod Commission website:

<http://watersheds.capecodcommission.org/index.php/watersheds/lower-cape/pleasant-bay-town-cove-nauset-marsh>

**Bassing Harbor/Ryders Cove
Muddy Creek
Pleasant Bay**