



The Problem

The Massachusetts Estuaries Project (MEP) technical report (available at www.oceanscience.net/estuaries/) indicates that the Three Bays system exceeds its critical threshold for nitrogen, resulting in impaired water quality. A Total Maximum Daily Load (TMDL) for nitrogen has been developed and approved.

- MEP Technical Report Status: Final
- TMDL Status: Final TMDL
- Total Wastewater Flow: 528 MGY (million gal per year)
 - Treated WW Flow: 8 MGY
 - Septic Flow: 520 MGY
- **UNATTENUATED TOTAL NITROGEN LOAD (MEP):**
74,567 Kg/Y (kilograms per year)
- **ATTENUATED TOTAL NITROGEN LOAD (MEP):**
54,657 Kg/Y
- **SOURCES OF CONTROLLABLE NITROGEN (MEP):**
 - 85% Septic Systems
 - 10% Lawn Fertilizer
 - 5% Stormwater From Impervious Surfaces

CONTRIBUTING TOWNS

- BARNSTABLE
- MASHPEE
- SANDWICH

THE MEP RESTORATION SCENARIO

- **WATERSHED TOTAL NITROGEN REDUCTION TARGET:** 46%
- **WATERSHED SEPTIC REDUCTION TARGET:** 60%
(The scenario represents the aggregated sub-embayment percent removal targets from the MEP technical report)

THREE BAYS ESTUARY

- **EMBAYMENT AREA:** 1,251 acres
- **EMBAYMENT VOLUME:** 429 million cubic feet
- **2012 INTEGRATED LIST STATUS:** Category 4a for nitrogen and fecal coliform
 - Category 4a: TMDL is completed
 - www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

THREE BAYS WATERSHED

- **ACRES:** 12,458
- **PARCELS:** 7,670
- **% DEVELOPED RESIDENTIAL PARCELS:** 85%
- **PARCEL DENSITY:** 1.6 acres per parcel (approx.)
- **WASTEWATER TREATMENT FACILITIES:** 2
 - Cotuit Landing
 - Marstons Mills Elementary School and adjacent Affordable Housing site

The Three Bays estuary and embayment system is located in the Town of Barnstable. It is comprised of three primary segments that include West Bay, North Bay and Cotuit Bay. Sub-systems include Prince Cove that flows into North Bay, the Narrows that flows between North Bay and Cotuit Bay and Eel Pond that flows into East Bay. The embayment is guarded by Sampson's Island (Dead Neck) which defines the inner Seapuit River causeway between Cotuit Bay and East Bay. Three Bays supports a variety of recreational uses including boating, swimming, shell fishing and fin fishing

Freshwater Sources

PONDS

- **IDENTIFIED SURFACE WATERS:** 54
- **NUMBER OF NAMED FRESHWATER PONDS:** 21
- **PONDS WITH PRELIMINARY TROPHIC CHARACTERIZATION:** 19
(Listed In Appendix 4C, Ponds With Water Quality Data)
- **2012 INTEGRATED LIST STATUS:** 6 listed
 - Hamblin Pond
 - Lovells Pond
 - Middle Pond
 - Mystic Lake
 - Lawrence Pond
 - Shubael Pond
- **DISCUSSION:** The Town of Barnstable and its watershed associations have been participants in the Pond and Lake Stewardship (PALS) program that has helped establish baseline pond water quality. The Town of Barnstable benefited from a Cape Cod Commission

pond assessment funded through Barnstable County, and completed a Pond Action Report as part of its 2012 draft Comprehensive Wastewater Management Plan (CWMP). In addition, the Town has worked with watershed associations to implement alum treatments for Hamblin and Mystic Ponds and Lovells Pond treatment is scheduled. The Town regularly treats several ponds with Sonar, an herbicide to combat invasive weeds.

reports. These concentrations are higher than areas of the aquifer with less than 0.05 mg/L background concentrations that are evident in public supply wells located in pristine areas. This provides further evidence of the impact of non-point source nitrogen pollution from residential areas on the aquifer and receiving coastal waters.

STREAMS

- **SIGNIFICANT FRESHWATER STREAM OUTLETS:** 2
 - Marstons Mills River:
 - Average Flow: 16,000 cubic meters per day (m³/d)
 - Average Nitrate Concentrations: 0.48 milligrams per liter (mg/L)
 - Little River:
 - Average Flow: 3,500 m³/d
 - Average Nitrate Concentrations: 0.86 mg/L
- **DISCUSSION:** Characterization of fresh water streams like these is a regular part of the MEP technical

DRINKING WATER SOURCES

- **WATER DISTRICTS:** 3
 - Sandwich Water District
 - Centerville-Osterville-Marstons Mills (COMM) Water District
 - Cotuit Water District
- **GRAVEL PACKED WELLS:** 26
 - 6 have nitrate concentrations between 0 and 0.5 mg/L
 - 7 have nitrate concentrations between 0.5 and 1 mg/L
 - 7 have nitrate concentrations between 1 and 2.5 mg/L
 - 2 have nitrate concentrations between 2.5 and 5 mg/L
 - 4 have no nitrate concentration data

LOCAL PROGRESS

BARNSTABLE

The Town of Barnstable submitted a draft Comprehensive Wastewater Management Plan (CWMP) in 2012, which characterized the wastewater needs of the Three Bays watershed in terms of required nitrogen reduction according to the MEP technical report and TMDL. The earlier 2007 CWMP and its predecessor, the 1993 Needs Assessment, identified other wastewater needs according to Title 5 conditions.

MASHPEE

Mashpee comprises less than 1% of the attenuated wastewater nitrogen sources to the Three Bays watershed because it has a small percentage of the land area and the majority of the area is now preserved as open space. Prior to its purchase by a combination of the MA Department of Conservation and Recreation (DCR), land trust, and town funds, it was the site of the proposed Cape Cod Golf Club course development project.

SANDWICH

Sandwich comprises 7% of the attenuated wastewater nitrogen load to the Three Bays watershed. Although it contains approximately 25% of the land area, much of the land is protected open space as Water District land and recreational space by Camp Lyndon. Sixty three percent of the Sandwich nitrogen load is attenuated by the intervening ponds and streams in the upper watershed.

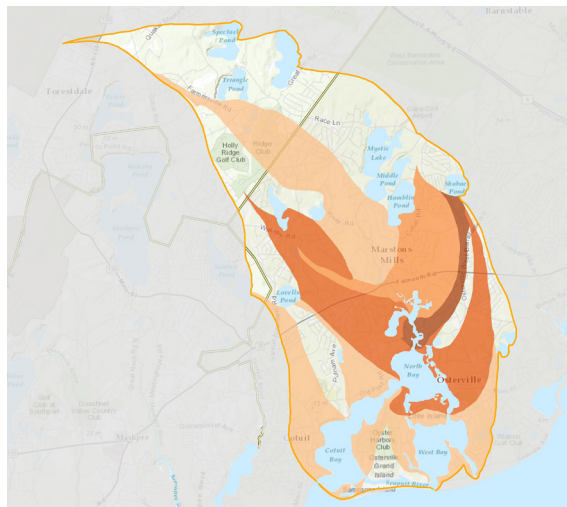
Local efforts in these towns are described in Chapter 6.

THREE BAYS

- **SMALL VOLUME WELLS:** 9
- **DISCUSSION:** Each of the water districts and land trusts have acquired significant portions of land in their Zone IIs for water quality protection which, together with adopted land use controls recommended from the 1978 §208 Plan, has resulted in excellent water quality.

Degree of Impairment and Areas of Need

For the purposes of the §208 Plan Update areas of need are primarily defined by the amount of nitrogen reduction required as defined by the TMDL and/or MEP technical report. The aggregated watershed removal rates are 40% and 60% for total nitrogen and septic nitrogen, respectively. More specifically, the targeted amount of nitrogen reduction required by subwatershed ranges from 20 to 80% removal, as indicated in Figure 4-1 TB Subwatersheds with Total Nitrogen Removal Targets and Figure 4-2 TB Subwatersheds with Septic Nitrogen Targets

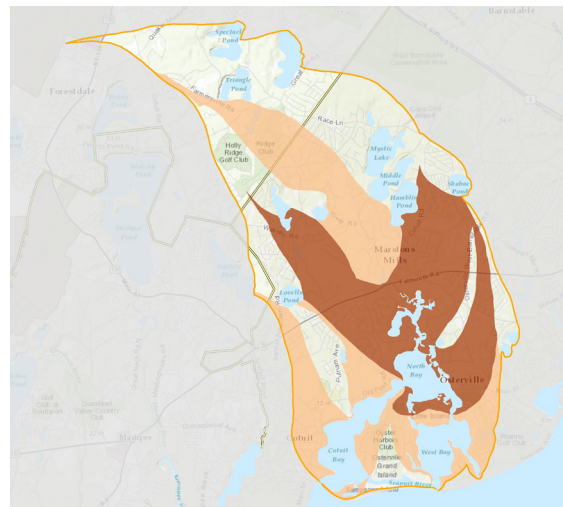


Removal Targets.

The nitrogen load from the watershed exceeds the TMDL for Three Bays, resulting in impaired waters quality. The ecological health of a water body is determined from water quality, extent of eelgrass, assortment of benthic fauna, and dissolved oxygen and ranges from 1-severe degradation, 2-significantly impaired, 3-moderately impaired, 4- healthy habitat conditions. The upper head waters of Three Bays are particularly impaired and the upper Prince Cove segment experiences occasional severe eutrophic conditions affecting recreational activities.

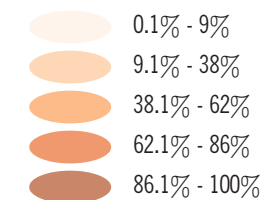
ECOLOGICAL CHARACTERISTICS AND WATER QUALITY

- **OVERALL ECOLOGIC CONDITION:** Moderately Impaired to Severely Degraded
- **PRINCES COVE:** Significantly Impaired to Severely Degraded



WATERSHEDS: MID CAPE

- **WARRENS COVE:** Severely Degraded
- **UPPER NORTH BAY:** Significantly Impaired to Severely Degraded
- **LOWER NORTH BAY:** Moderately to Significantly Impaired
- **COTUIT BAY:** Moderately Impaired
- **WEST BAY:** Moderately Impaired
- **EEL POND:** Moderately to Significantly Impaired
- **SENTINEL STATIONS:**
 - Total Nitrogen Concentration Threshold: 0.38 mg/L
 - Total Nitrogen Concentration Existing: 0.05 mg/L (As reported at the MEP sentinel water-quality monitoring stations)



Subwatersheds with Total Nitrogen Removal Targets

Figure 4-1 TB

Subwatersheds with Septic Nitrogen Removal Targets

Figure 4-2 TB