



The Problem

The Massachusetts Estuaries Project (MEP) technical report (available at www.oceanscience.net/estuaries/) indicates that the Lewis Bay system exceeds its critical threshold for nitrogen, resulting in impaired water quality. The MEP Technical Report indicates that the cause of eutrophication to the system is excess nitrogen from the contributing watershed.

- **MEP TECHNICAL REPORT STATUS:** Final
- **TMDL STATUS:** Draft TMDL
- **TOTAL WASTEWATER FLOW:** 1.1 billion gal per year
- **TREATED WW FLOW:** 657 MGY (million gal per year)
- **SEPTIC FLOW:** 475 MGY
- **UNATTENUATED TOTAL NITROGEN LOAD (MEP):** 60,950 Kg/Y (kilograms per year)
- **ATTENUATED TOTAL NITROGEN LOAD (MEP):** 52,369 Kg/Y
- **SOURCES OF CONTROLLABLE NITROGEN (MEP):**
 - 63% Septic Systems
 - 6% Lawn Fertilizer
 - 9% Stormwater from Impervious Surfaces
 - 22% Wastewater Treatment Facilities

CONTRIBUTING TOWNS

- BARNSTABLE
- YARMOUTH

THE MEP RESTORATION SCENARIO:

- **WATERSHED TOTAL NITROGEN REDUCTION TARGET:** 27%
- **WATERSHED SEPTIC REDUCTION TARGET:** 39%
(The scenario represents the aggregated sub-embayment percent removal targets from the MEP technical report)

LEWIS BAY ESTUARY

- **EMBAYMENT AREA:** 1,737 acres
- **EMBAYMENT VOLUME:** 452 million cubic feet
- **2012 INTEGRATED LIST STATUS:**
 - Snows Creek: Category 4a for fecal coliform
 - Lewis Bay: Category 4a, 5 for fecal coliform and estuarine bioassessments
 - Mill Creek: Category 5 for fecal coliform and nitrogen
 - Category 4a - TMDL is completed; Category 5 - Waters requiring a TMDL
 - www.mass.gov/eea/docs/dep/water/resources/07v5/12list2.pdf

The Lewis Bay estuary and embayment system shoreline is located in the Towns of Barnstable and Yarmouth. It is comprised of several primary segments that include Hyannis Inner Harbor, Mill Creek, Snows Creek and Stewarts Creek. Lewis Bay is guarded by Great Island which contains Uncle Roberts Cove and Pine Island Creek. The Bay supports a variety of recreational uses including boating, swimming, shell fishing and fin fishing.

LEWIS BAY WATERSHED

- **ACRES:** 15,605
- **PARCELS:** 9,531
- **% DEVELOPED RESIDENTIAL PARCELS:** 77%
- **PARCEL DENSITY:** 1.64 acres per parcel
- **WASTEWATER TREATMENT FACILITIES:** 5
 - Hyannis Water Pollution Control Facility (Barnstable)
 - Mill Pond Villages (Yarmouth)
 - Mayflower Place (Yarmouth)
 - The Cove Resort (Yarmouth)
 - Buck Island Condominium (Yarmouth)

Freshwater Sources

PONDS

- **IDENTIFIED SURFACE WATERS:** 71
- **NUMBER OF NAMED FRESHWATER PONDS:** 7
- **PONDS WITH PRELIMINARY TROPHIC CHARACTERIZATION:** 6
(Listed In Appendix 4C, Ponds With Water Quality Data)
- **2012 INTEGRATED LIST STATUS:** None listed
- **DISCUSSION:** The Towns of Barnstable and Yarmouth and its watershed associations have been participants in the Pond and Lake Stewardship (PALS) program that has helped establish baseline pond water quality.

Twelve ponds have water quality data, but only six ponds have enough data that allows a preliminary trophic characterization. The towns of Barnstable and Yarmouth benefited from a Cape Cod Commission ponds assessment funded through Barnstable County, and the Town of Barnstable completed a Pond Action Report as part of its 2012 Draft CWMP.

STREAMS

- **SIGNIFICANT FRESHWATER STREAM OUTLETS:** 6
Halls Creek:
 - Average Flow: 1,185 cubic meters per day (m³/d)
 - Average Nitrate Concentrations: 0.85 milligrams per liter (mg/L)

LOCAL PROGRESS

BARNSTABLE

The Town of Barnstable submitted a Draft Comprehensive Waste Management Plan (CWMP) in 2012, which characterized the wastewater needs of the Lewis Bay watershed in terms of required nitrogen reduction according to the MEP technical report and Total Maximum Daily Load (TMDL). In 1979 the Town completed a sewer extension to hook-up the Barnstable Village area and additional areas in Hyannis. At that time the Water Pollution Control Facility (WPCF) was upgraded to a secondary treatment plant with a 4.2 MGD capacity, but due to site constraints was limited to 1.8 MGD capacity. During the subsequent 1990-2007 Wastewater Facility Plan (WWFP), the plant was upgraded to tertiary treatment for nitrogen removal. The 2007 WWFP allowed the Town to

increase treatment capacity to 4.2 MGD, with a contingent disposal site. The WWFP identified and assessed a potential future wastewater disposal site in the Barnstable Harbor watershed adjacent to Route 132. The site was approved for permitting through the Joint Massachusetts Environmental Policy Act (MEPA)/Cape Cod Commission Development of Regional Impact (DRI) review.

YARMOUTH

The Yarmouth CWMP was voted down by Town Meeting in 2011. The CWMP proposed phased sewerage throughout much of the southern portions of town. At the time, the MEP technical report for the Bass River watershed had not been published, so the plan emphasized nitrogen reduction needs in the Parkers River and Lewis Bay watersheds. Yarmouth's share of the Lewis Bay watershed nitrogen load was proposed to be collected and discharged at a

newly constructed facility in the Parkers River watershed. The ability of the Parkers River watershed to receive transported load from out of its watershed is predicated on a new culvert opening at route 28 to increase its tidal flushing. Even with the tidal flushing increase the proposed plan would have used nearly all of Parkers River assimilative capacity.

Since the town meeting vote that rejected CWMP funding, the town has received funding to reconstruct the culvert beneath route 28 in order to improve tidal flushing in the Parkers River.

The Needs Assessment identified other wastewater needs to address Title 5 compliance and economic development needs, particularly south of Route 28.

Local efforts in these towns are described in Chapter 6.

LEWIS BAY

Stewarts Creek:

- Average Flow: 31,966 m3/d
- Average Nitrate Concentrations: 1.17 mg/L

Snow's Creek:

- Average Flow: 5,298 m3/d
- Average Nitrate Concentrations: 1.14 mg/L

Hospital Bog:

- Average Flow: 1,318 m3/d
- Average Nitrate Concentrations: 0.65 mg/L

Mill Pond:

- Average Flow: 15,655 m3/d
- Average Nitrate Concentrations: 0.61 mg/L

Chase Brook:

- Average Flow: 3,255 m3/d
- Average Nitrate Concentrations: 0.45 mg/L

- **DISCUSSION:** Characterization of fresh water streams like these is a regular part of the MEP technical reports. Several of these surface water concentrations are significantly 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

DRINKING WATER SOURCES

■ WATER DISTRICTS: 2

- Hyannis Water Division
- Yarmouth Water Department

■ GRAVEL PACKED WELLS: 22

- 12 have nitrate concentrations between 0 and 0.5 mg/L
- 4 have nitrate concentrations between 0.5 and 1 mg/L
- 3 have nitrate concentrations between 2.5 and 5 mg/L
- 3 have no nitrate concentration data

■ SMALL VOLUME WELLS: 0

- **DISCUSSION:** Each of the Towns has 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. The wells with high nitrate concentrations are coincident with high density

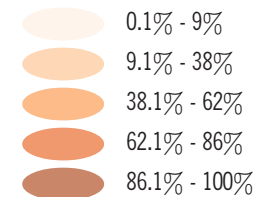
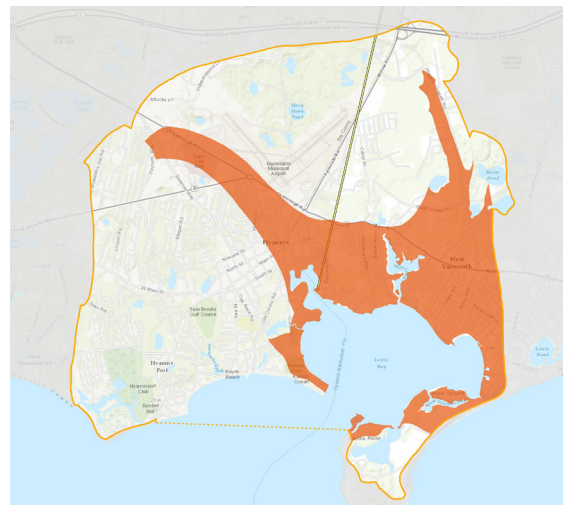
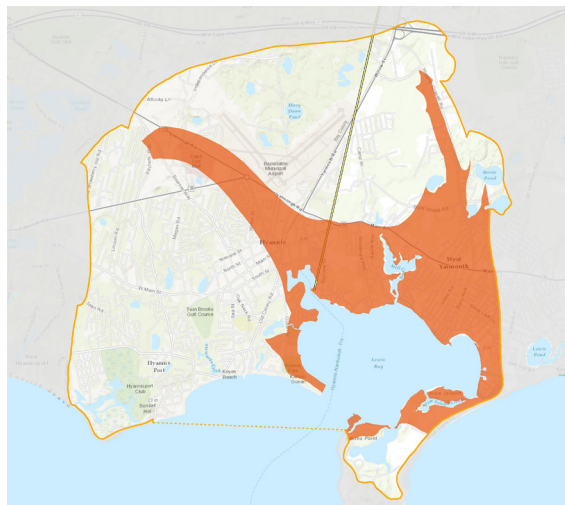
WATERSHEDS: MID CAPE

development and indicative of septic and wastewater impacts to groundwater 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 27% and 39% for total watershed and septic nitrogen loads, respectively. More specifically, the targeted amount of nitrogen reduction required by subwatershed ranges from 68% to 80% removal as indicated in Figure 4-1 LB Subwatersheds with Total Nitrogen Removal Targets and Figure 4-2 LB Subwatersheds with Septic Nitrogen Removal Targets.

The nitrogen load from the watershed exceeds the threshold for Lewis Bay, resulting in impaired water quality. The upper



Subwatersheds with Total Nitrogen Removal Targets

Figure 4-1 LB

Subwatersheds with Septic Nitrogen Removal Targets

Figure 4-2 LB

headwaters of Lewis Bay are particularly impaired. 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.

ECOLOGICAL CHARACTERISTICS AND WATER QUALITY

- **OVERALL ECOLOGIC CONDITION:** Healthy to Significantly Impaired
- **OUTER LEWIS BAY:** Significantly Impaired
- **INNER LEWIS BAY:** Significantly Impaired
- **UNCLE ROBERTS COVE:** Significantly Impaired
- **HYANNIS INNER HARBOR:** Moderately Impaired
- **MILL CREEK:** Moderately Impaired
- **HALLS CREEK:** Healthy
- **SENTINEL STATIONS:**
 - Total Nitrogen Concentration Threshold: 0.378 mg/L
 - Total Nitrogen Concentration Existing: 0.407 mg/L
(As reported at the MEP sentinel water-quality monitoring stations)