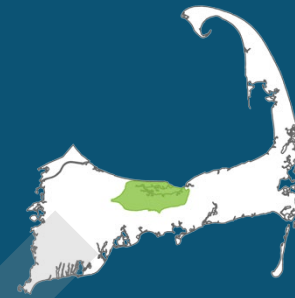


Barnstable Harbor

BARNSTABLE, YARMOUTH & SANDWICH

LOW



The Barnstable Harbor estuary and embayment system is an estuary with its shoreline primarily located in the Town of Barnstable with a portion in Yarmouthport. Barnstable Harbor is a large embayment that receives tidal flow from Cape Cod Bay, with a 9-foot fluctuation, and extends nearly 5 miles towards the extensive Barnstable marsh. The bay supports a variety of recreational uses including boating, swimming, shell fishing and fin fishing.

The Problem

For the purposes of the Section 208 Plan Update, areas of wastewater need are primarily defined by the amount of nitrogen reduction required as defined by the Total Maximum Daily Load (TMDL) or Massachusetts Estuaries Project (MEP) technical report. An MEP report has not yet been completed for the Barnstable Harbor watershed. Due to its large tidal flow it is not expected to be severely overloaded with respect to nitrogen except for some of the upper reaches.

- **MEP TECHNICAL REPORT STATUS:** Data Collection Phase
- **TMDL STATUS:** In Progress
- **TOTAL WASTEWATER FLOW:** 291 MGY (million gal per year)
- **UNATTENUATED SEPTIC NITROGEN LOAD:** 28,973 Kg/Y (kilograms per year)
- **ATTENUATED NITROGEN LOAD:** Not assessed

CONTRIBUTING TOWNS

Percent contributions listed below are the aggregate sub-embayment contributions identified in Appendix 8C of the Cape Cod Section 208 Plan Update (contributions are based on attenuated load where available). See Appendix 8C for detailed town allocations by sub-embayment.

- **BARNSTABLE:** 82%
- **YARMOUTH:** 14%
- **SANDWICH:** 4%

BARNSTABLE HARBOR ESTUARY

- **EMBAYMENT AREA:** 2,793 acres
- **EMBAYMENT VOLUME:** Unknown
- **2014 INTEGRATED LIST STATUS:** Category 5 for fecal coliform
 - Category 5: Waters requiring a TMDL
 - www.mass.gov/eea/docs/dep/water/resources/07v5/14list2.pdf

BARNSTABLE HARBOR WATERSHED

- **ACRES:** 17,043
- **PARCELS:** 5,542
- **% DEVELOPED RESIDENTIAL PARCELS:** 70%
- **PARCEL DENSITY:** 3 acres per parcel
- **WASTEWATER TREATMENT FACILITIES:** 0
 - Approximately 18% of the watershed wastewater is collected and treated at Barnstable's Water Pollution Control Facility in Hyannis (located in the Lewis Bay watershed).

Freshwater Sources

PONDS

- IDENTIFIED SURFACE WATERS: 63
- NUMBER OF NAMED FRESHWATER PONDS: 18
- PONDS WITH PRELIMINARY TROPHIC CHARACTERIZATION: 8
- 2014 INTEGRATED LIST STATUS FOR NUTRIENTS:
None listed

Barnstable and Yarmouth have participated in the Pond and Lake Stewardship (PALS) program that has helped establish baseline water quality. Trophic characterizations are based on most recent Commission staff assessment.

STREAMS

- SIGNIFICANT FRESHWATER STREAM OUTLETS: 3
 - Scorton Creek, Sandwich
 - Average Flow: Not Assessed
 - Average Nitrate Concentrations: Not Assessed
 - Bridge Creek, Barnstable
 - Average Flow: Not Assessed
 - Average Nitrate Concentrations: Not Assessed
 - Brickyard Creek, Barnstable
 - Average Flow: Not Assessed
 - Average Nitrate Concentrations: Not Assessed

Nitrate concentrations higher than 0.05 mg/L background concentrations, evident in public supply wells located in pristine areas, provide evidence of the impact of non-point source pollution on the aquifer and receiving coastal water bodies.

DRINKING WATER SOURCES

- WATER DISTRICTS: 4
 - Barnstable Fire District
 - Centerville Osterville Marstons Mills Fire District
 - Hyannis Water Division
 - Yarmouth Water Division
- GRAVEL PACKED WELLS: 3
 - 1 has nitrate concentrations between 0.5 and 1 mg/L
 - 1 has nitrate concentrations between 1 and 2.5 mg/L
 - 1 has no nitrate concentration data
- SMALL VOLUME WELLS: 5
 - West Barnstable and East Sandwich are served exclusively by private wells.

Degree of Impairment

Since there is no evidence of water quality impairment at this time, wastewater needs are determined based upon other factors, such as Title5 compliance.

Barnstable Harbor is listed as a Category 5 impaired water body for fecal coliform on the 2014 Integrated List of Impaired Waters.

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Collection & Non-Collection Scenarios

Regional Data

In 2010, the Commission sought to collect regionally consistent data for the purposes of watershed scenario development. Both parcel data and water use data was identified and collected for the entire region. While the scientific basis for planning is the thresholds identified in the MEP technical reports, each report uses data from different years, and in some cases the MEP data used is 10 or more years old. In addition, there are watersheds on Cape Cod without the benefit of an MEP report; therefore, similar data was not available for planning purposes.

The updated regional data set was used to estimate wastewater, stormwater and fertilizer loads, using the same methodologies as the MEP. This approach allows for a reevaluation of existing development, which may have changed in the last 10 years. Parcel data included in the regional database is from 2010-2012 and water use data is from 2008-2011, depending on the water district. This approach allows for regionally consistent watershed scenario development.

Watershed Scenarios

The watershed scenarios that follow outline possibilities for the watershed. A series of non-traditional technologies that might be applicable are included, as well as the amount of flow and approximate number of residential parcels that would



need to be collected if a traditional collection system and treatment facility was implemented. Some assumptions were made in determining the approximate flows and parcels for collection, including a treatment factor of 5 parts per million (ppm), disposal occurring inside the watershed, and no natural attenuation, therefore prioritizing parcels with a direct impact on the water body. Site specific determinations of collection areas may result in the need to collect more or less parcels to meet the nutrient reduction target. The scenarios presented are meant to act as a starting point for discussions regarding effective and cost efficient solutions.

BARNSTABLE HARBOR NITROGEN SOURCES	TOTAL NITROGEN LOAD (kg-N/yr)
Wastewater	28,973
Fertilizer	4,605
Stormwater	9,086
Other	3,443
TOTAL	46,107
Total Watershed Load (including atmospheric)	46,107
Total Watershed Threshold*	34,580
TOTAL LOAD TO BE REMOVED	11,527

*Assumes 25% reduction is needed, as no MEP report has been completed for this watershed.

Collection & Non-Collection Scenarios

Non-Collection

-  25 % Nitrogen Reduction - Fertilizer Management
-  25 % Nitrogen Reduction - Stormwater Mitigation
-  2 Acres - Constructed Wetlands (Collection System)
-  5,600 Linear Feet - Permeable Reactive Barrier (PRB)
-  150 Acres - Fertigation - Turf
-  15 Acres - Aquaculture/Oyster Beds
-  198 Units - Ecotoilets (UD & Compost)
-  304 Units - I & A Systems
-  169 Units - Enhanced I & A Systems

Collection



 = 50 Residential Parcels

2,523
Residential Equivalents Necessary
to Meet Nitrogen Reduction Target

363,315
Flow Collected (gpd)

SCENARIO ASSUMPTIONS: Assumes treatment to 5 parts per million (ppm) nitrogen. Assumes disposal occurs inside the watershed. Assumes no natural attenuation; therefore, prioritizing parcels with a direct impact on the water body.

Town of Yarmouth Local Progress

In 2010, the Town of Yarmouth submitted its Comprehensive Wastewater Management Plan (CWMP) as a Draft Environmental Impact Report (DEIR). The draft CWMP targeted areas that would require wastewater collection to restore water quality in the Lewis Bay and Parkers River watersheds and deal with the Title 5 constraints on economic redevelopment in the area of Route 28. The town's plan included approximately 125 miles of sewer lines and the collection of 2.75 million gallons per day (MGD) of wastewater to be treated at a single facility in the Parkers River watershed. The project would ultimately serve 9,580 properties by 2035. Phase 1 of the plan would begin with the treatment facility and main trunk line sewer to serve Route 28 and portions of the Parkers River and Lewis Bay watershed.

The plan relies on gravity, pressure, and vacuum sewers. The MEP nitrogen reduction goals were the primary factor in choosing sewer locations. The phasing of these sewer areas also takes the town's economic goals into consideration.

The town submitted its Final Environmental Impact Report (FEIR) and received Massachusetts Environmental Policy Act (MEPA) approval in July 2011, but did not complete the Cape Cod Commission Development of Regional Impact (DRI) process before going to September 2011 Town Meeting to seek Phase 1 design and construction funds. Phases 1 through 5 were scheduled to be implemented over a 25-year period. The estimated cost of the total plan was \$275 million. The first phase had an estimated cost of \$55 million. Town Meeting did

not approve the expenditure. The town withdrew the CWMP from the DRI review process.

Wastewater planning in the community had effectively come to a stop prior to the development of the 208 Plan Update.

In January 2016 town staff met with the Board of Selectmen to discuss a new financing plan for implementation of a program that would meet water quality standards in all of their watersheds.

The recommended plan includes a combination of traditional sewerage methods with centralized treatment facilities as well as non-traditional nitrogen management options including a permeable reactive barrier (PRB) at the Buck Island Road effluent recharge site. The Town of Yarmouth is proposing a phased wastewater program that includes a collection system, a conveyance system and a centralized treatment facility, each constructed over several years. In addition to the proposed sewerage, the recommended plan involves public outreach to promote nitrogen reduction and to prevent sewer system inflow, zoning modifications for growth management and establishment of the activity centers, development of sewer ordinances, and continued maintenance of Title 5 and I/A systems in the northern and western areas of the town that will not be served by the proposed wastewater collection system. The town also plans to implement stormwater and fertilizer improvement programs. As suggested in the 208 Plan Update, up to a 25% nitrogen reduction credit can be obtained by

towns that implement stormwater and fertilizer management programs to reduce nitrogen contributions to each watershed.

During the spring 2016 town meeting, the town approved \$200,000 for additional CWMP planning.

In April 2016, Yarmouth submitted a request for assistance to continue CWMP development and town staff met with the Commission to discuss the request in early May. In FY17 the Commission will work with Yarmouth to move forward toward implementation.

In June 2016, Yarmouth received \$35,000 from the Commission for the Towns of Dennis, Harwich and Yarmouth for a regional treatment facility cost study. Funding was part of \$142,149 in local grants made by the Commission in support of 208 Plan implementation.

Town of Sandwich Local Progress

The Town of Sandwich has an established water quality committee to oversee water quality and wastewater planning efforts. In October 2015 town staff and their consultant (Wright-Pierce) met with Cape Cod Commission staff to discuss watershed planning, decision support tools, and scenario development for Sandwich watersheds. In the same month the town was approached by Mashpee regarding approaches for Popponesset Bay, and a potential watershed permit, and has agreed to participate with Mashpee and Barnstable in this shared effort. It is expected that Barnstable, Mashpee, and Sandwich will collaborate on the first watershed permit in the region in close coordination with the Cape Cod Commission and the Massachusetts Department of Environmental Protection.

Previously the committee developed a scope of work for a Comprehensive Wastewater Management Plan (CWMP) and submitted the scope under the Sagamore Lens Natural Resource Damages Assessment, related to past groundwater contamination at the Textron facility at Joint Base Cape Cod (JBCC). The town received an award of \$400,000 to conduct its water/wastewater plan and completed a comprehensive needs assessment, as well as an interim wastewater solutions plan to accommodate economic development in the South Sandwich Village Center.

The town spent several years working with a private developer on a development project that included a public-private wastewater component for the construction of a facility that

would accommodate the private project, in addition to some public wastewater needs. That project will not be completed, but the town is again seeking a private partner to create new economic growth and to potentially participate in infrastructure development.

The town has participated in discussions at JBCC about the potential use of its existing wastewater infrastructure as a regional option for the Upper Cape towns.

In February 2016 the Town of Sandwich requested a meeting with Commission staff to discuss watershed scenarios and potential modifications to watersheds in which Sandwich has jurisdiction. The town provided collection footprints and assumptions for a single treatment facility to serve all three watersheds (Popponesset Bay, Three Bays, and Waquoit Bay), consistent with the Sandwich CWMP, and identified locations for non-traditional approaches, in addition to credits for stormwater and fertilizer reduction. The Town proposes a 25% fertilizer management credit and a 6.25% stormwater management credit. While the proposed interventions, alone, do not meet the nitrogen allocations identified in Appendix 8C of the 208 Plan Update, the town has expressed a preference to rely on nutrient trading or cost sharing to reduce the load allocated to the downgradient towns in the shared watersheds of Popponesset Bay, Three Bays and Waquoit Bay, where nitrogen reductions can be more cost effectively attained.

Town of Barnstable Local Progress

The Cape Cod Commission and the Town of Barnstable met and discussed the use of WatershedMVP to evaluate targeted watershed approaches for each of the watersheds in which they have jurisdiction. In 2015, the town reformulated its Citizen's Advisory Committee (CAC) for wastewater planning to better address local needs. In addition to local participation, the newly formed committee (the Water Resources Advisory Committee or WRAC) includes state and regional representatives. Town staff provided modifications to Commission-developed watershed scenarios and presented those scenarios to their WRAC for review and discussion.

The Town of Barnstable operates the Hyannis Water Pollution Control Facility (WPCF), located off Bearses Way in Hyannis, which is the primary wastewater treatment facility serving approximately 2,900 properties in Hyannis and Barnstable village. The treatment facility has been upgraded and permitted to treat additional flows up to a total of 4.2 million gallons per day (MGD), upon meeting requirements of an adaptive management plan approved by the Commission in 2007. Property along Route 132 was acquired by the town in 2002 to potentially accommodate future disposal needs. The site is approved under a 2006 Massachusetts Environmental Policy Act (MEPA) certificate to discharge up to 0.5 MGD. The site is not presently in use. However, a force main and sewer has been extended to the site from the WPCF.

The WPCF treats an average daily flow of 1.46 MGD and a maximum monthly average flow of 1.94 MGD. Treatment

performance has averaged 5 milligrams per liter (mg/L) total nitrogen in the treated effluent and the facility has a discharge limit of 5 mg/L under the 2007 Development of Regional Impact (DRI) decision and a limit of 10 mg/L under a Groundwater Discharge Permit (GWDP). The facility is also equipped with sludge thickening, storage and dewatering facilities sized for the current process conditions.

The Town of Barnstable also operates two smaller facilities – the Marstons Mills Wastewater Treatment Facility (WWTF) and the Red Lily Pond Cluster System. The Marstons Mills WWTF is limited to a discharge flow of 42,900 gallons per day (GPD) and is intended to service the Barnstable United Elementary School and the Village at Marstons Mills affordable housing development. The Red Lily Pond Cluster System currently serves 17 homes. According to the comprehensive wastewater management plan (CWMP) approved in 2007, no performance sampling of the system occurs and the system is assumed to produce comparable effluent to any conventional single family septic system.

In addition to municipally-owned facilities, there are two privately-owned treatment facilities treating wastewater from the Cotuit Landing shopping plaza and the Cape Regency nursing and rehabilitation facility. These facilities provide high levels of wastewater treatment. The treatment facility at Cotuit Landing was designed with additional treatment capacity beyond the expected needs of the shopping plaza for potential treatment of flows from neighboring properties.

Barnstable is working on a town-wide nutrient management plan that will provide the basis of its CWMP. The plan will address nitrogen and other needs in watersheds draining to Three Bays, Centerville River, and Lewis Bay. A nitrogen total maximum daily load (TMDL) for Barnstable Harbor has not been approved by US EPA. The MEPA certificate scope for the Final Environmental Impact Report (FEIR) includes engagement in a targeted watershed approach, consistent with the 208 Plan Update.

In the fall of 2014, Barnstable adopted local nitrogen-oriented fertilizer management regulations consistent with the Cape-wide Fertilizer Management District of Critical Planning Concern (DCPC).

In 2015, the Town submitted a Statement of Interest to the US EPA for a hydrogeologic site characterization as an initial step toward piloting a permeable reactive barrier in the town. One of three sites proposed by the Town was selected for characterization. The work was completed in 2016. The draft report is presently being reviewed by the Town.

In June 2016, Barnstable received \$28,850 from the Commission to fund upgrades to three stormwater treatment BMPs. Funding was part of \$142,149 in local grants made available to communities by the Commission in support of 208 Plan implementation.