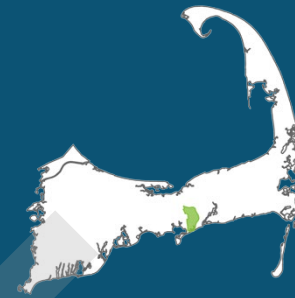


# Parkers River

YARMOUTH

HIGH



Parkers River is an estuary with shoreline located entirely within the Town of Yarmouth. Parkers River estuary extends inland approximately 2 miles to Swan Pond. Tidal flushing of the upper reach of the Parkers River and Swan Pond is impeded by a culvert beneath Route 28. A small tributary emerges from Long Pond that drains to Swan Pond. Parkers River supports a variety of recreational uses including boating, swimming, shell fishing and fin fishing; however, the upper portion experiences exceptional eutrophic conditions.

## The Problem

The Massachusetts Estuaries Project (MEP) technical report (available at [www.oceanscience.net/estuaries](http://www.oceanscience.net/estuaries)) indicates that the Parkers River system exceeds its critical threshold for nitrogen, resulting in impaired water quality. A Total Maximum Daily Load (TMDL) for nitrogen has not yet been established.

- **MEP TECHNICAL REPORT STATUS:** Final
- **TMDL STATUS:** Pending, hearings held summer 2016

Town submitted watershed reports included watershed characteristics that slightly differ from the regional database, both values are reported below.

- **TOTAL WASTEWATER FLOW:**
  - Regional Database Total Wastewater Flow: 209 MGY (million gal per year)
  - Town Reported Total Wastewater Flow: 209 MGY
- Treated Wastewater Flow:**
  - Regional Database Treated Wastewater Flow: 0 MGY
  - Town Reported Treated Wastewater Flow: 28 MGY
- Septic Flow:**
  - Regional Database Septic Flow: 209 MGY
  - Town Reported Septic Flow: 209 MGY
- **UNATTENUATED TOTAL NITROGEN LOAD (MEP):** 28,402 Kg/Y (kilograms per year)

- **ATTENUATED TOTAL NITROGEN LOAD (MEP):** 25,221 Kg/Y  
(Natural attenuation removes a considerable amount of nitrogen as groundwater flows through freshwater ponds and discharges to streams.)
- **SOURCES OF CONTROLLABLE NITROGEN (MEP):**
  - 85% Septic Systems
  - 7% Lawn Fertilizer
  - 7% Stormwater From Impervious Surfaces
  - 1% Wastewater Treatment Facilities

## CONTRIBUTING TOWN

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.

- **YARMOUTH:** 100%
- **BARNSTABLE:** <1%\*

\*Under existing conditions, the load contributed by Barnstable is so small that reductions are not necessary at this time; however, growth management measures should be taken to ensure that the contribution does not increase. Contributions will be reevaluated at least every five years, based on updated data.

THE MEP RESTORATION SCENARIO

- **WATERSHED TOTAL NITROGEN REDUCTION TARGET:** 80%
- **WATERSHED SEPTIC REDUCTION TARGET:** 96% with existing culvert opening and 67% with increased culvert opening.

The 67% septic reduction target listed above reflects an alternative MEP scenario that was run to assess the beneficial effect of increased tidal flow from a proposed widening of the culvert under Route 28. This document assumes that the culvert widening project, that is now funded, is constructed.

PARKERS RIVER ESTUARY

- **EMBAYMENT AREA:** 74 acres
- **EMBAYMENT VOLUME:** 29 million cubic feet
- **2014 INTEGRATED LIST STATUS:** Category 4a for fecal coliform
  - Category 4a: TMDL is completed
  - [www.mass.gov/eea/docs/dep/water/resources/07v5/14list2.pdf](http://www.mass.gov/eea/docs/dep/water/resources/07v5/14list2.pdf)

PARKERS RIVER WATERSHED

Town submitted watershed reports included watershed characteristics that slightly differ from the regional database, both values are reported below.

- **ACRES:**
  - Regional Database Acres: 2,729
  - Town Reported Acres: 3,108
- **PARCELS:**
  - Regional Database Parcels: 3,318
  - Town Reported Parcels: 4,416

- **% DEVELOPED RESIDENTIAL PARCELS:**
  - Regional Database: 92%
  - Town Reported: 85% (approx.)
- **PARCEL DENSITY:**
  - Regional Database Parcel Density: 0.82 acres per parcel (approx.)
  - Town Reported Parcel Density: 0.70 acres per parcel (approx.)
- **WASTEWATER TREATMENT FACILITIES:** 1
  - Town of Yarmouth Septage Treatment Facility (discharges to fields at a town disposal site south of Buck Island Road)

- Plashes Brook:
  - Average Flow: 3,107 m3/d
  - Average Nitrate Concentrations: 0.41 mg/L
- Grays Brooks:
  - Average flow and average nitrate concentrations were not evaluated

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.

Freshwater Sources

PONDS

- **IDENTIFIED SURFACE WATERS:** 14
- **NUMBER OF NAMED FRESHWATER PONDS:** 4
- **PONDS WITH PRELIMINARY TROPHIC CHARACTERIZATION:** 0
- **2014 INTEGRATED LIST STATUS:** None listed

Yarmouth has 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
  - Forest Road:
    - Average Flow: 823 cubic meters per day (m3/d)
    - Average Nitrate Concentrations: 0.46 milligrams per liter (mg/L)

DRINKING WATER SOURCES

- **WATER DISTRICTS:** 1
  - Yarmouth Water Department
- **GRAVEL PACKED WELLS:** 5
  - 1 has nitrate concentrations between 0.5 and 1 mg/L
  - 2 have nitrate concentrations between 1 and 2.5 mg/L
  - 1 has nitrate concentrations between 2.5 and 5 mg/L
  - 1 has no nitrate concentration data
- **SMALL VOLUME WELLS:** 0
- **DISCUSSION:** The town water department and land trusts have acquired significant portions of land within wellhead protection areas for water quality protection, which together with adopted land use controls recommended from the 1978 Section 208 water quality plan, has resulted in excellent drinking water quality.

Degree of Impairment and Areas of Need

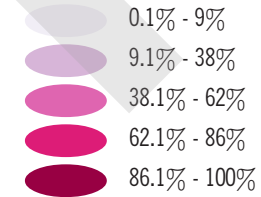
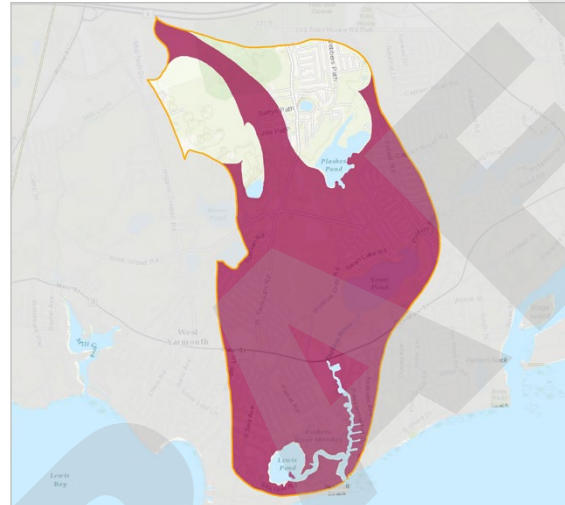
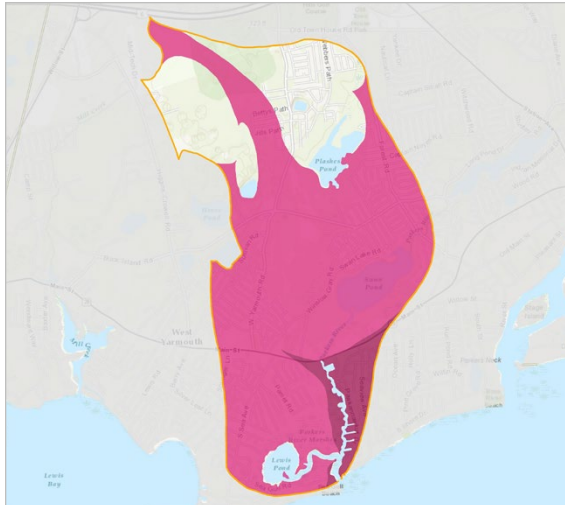
For the purposes of the Section 208 Plan Update, areas of need are primarily defined by the amount of nitrogen reduction

required as defined by the TMDL and/or MEP technical report. These reductions are identified above as 80% of the total nitrogen load and 67% of the septic nitrogen load (with culvert widening), and more specifically as the targeted amount of nitrogen reduction required by subembayment (see figures,

Subwatersheds with Total Nitrogen Removal Targets and Subwatersheds with Septic Removal Targets).

The load from the Parkers River watershed exceeds the nitrogen threshold, resulting in impaired water quality. Head

water subembayments of Parkers River, such as Seine Pond are particularly impaired. Lower reaches of the system have been deemed by the MEP to be severely degraded due to the absence of eelgrass where it historically occurred. The ecological health of a water body is determined from water

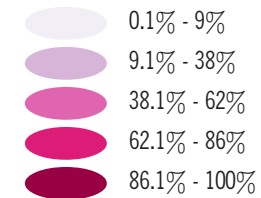
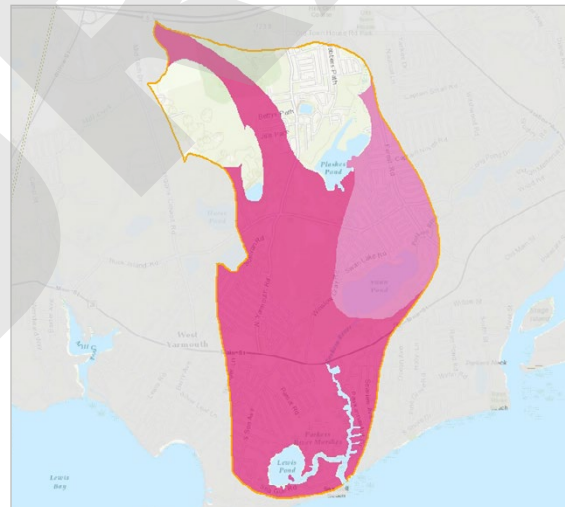
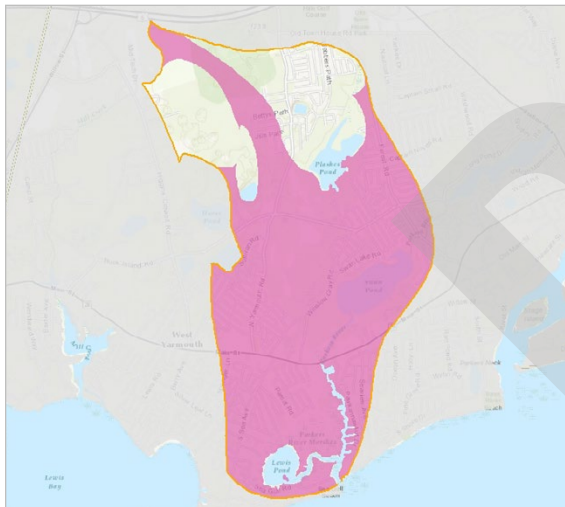


**Subwatersheds with Total Watershed Removal Targets**

(Left) Benthic and atmospheric loads directly on embayments are not included.

**Subwatersheds with Septic Nitrogen Removal Targets**

(Right)



**Subwatersheds with Total Watershed Removal Targets - Optimized Culvert Threshold**

(Left) Benthic and atmospheric loads directly on embayments are not included.

**Subwatersheds with Septic Nitrogen Removal Targets - Optimized Culvert Threshold**

(Right)

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
- **UPPER REACH**
  - Mill Pond: Significantly Impaired
  - Follins Pond: Significantly Impaired
  - Dinah Pond: Moderately to Significantly Impaired
  - Kelleys Bay: Significantly Impaired
- **MID REACH**
  - Mid River: Significantly Impaired
  - Grand Cove: Significantly Impaired
- **LOWER REACH**
  - Lower River: Significantly Impaired
  - Weir Creek Basin: Healthy to Moderately Impaired
- **SENTINEL STATION:**
  - Total Nitrogen Concentration Threshold: 0.42 mg/L
  - Total Nitrogen Concentration Existing: 0.64 mg/L  
(As reported at the MEP sentinel water-quality monitoring station)

DRAFT

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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.

In Parkers River, the Town of Yarmouth has done additional and more detailed planning. Included in the last section of this report is a description of their efforts, along with details of plans developed to date.

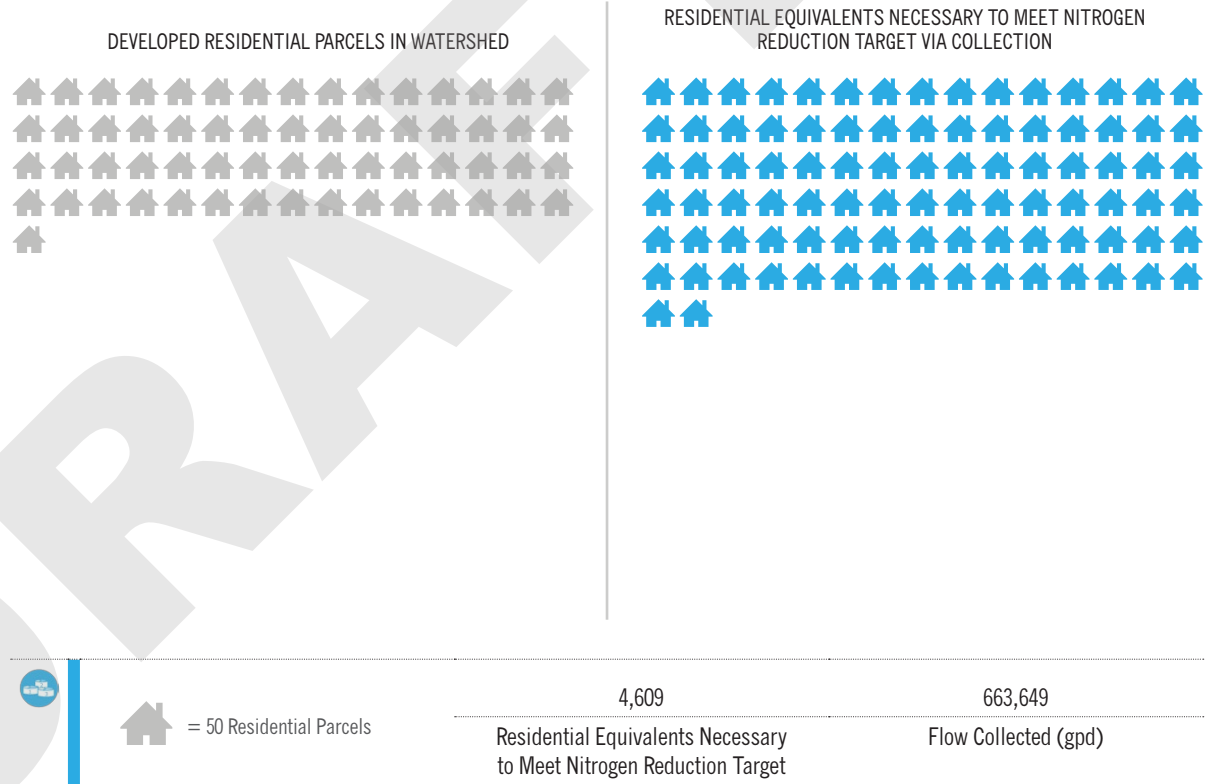
PARKERS RIVER NITROGEN SOURCES	TOTAL NITROGEN LOAD (kg-N/yr)
Wastewater	19,337
Fertilizer	2,308
Stormwater	2,271
Other	481
<b>TOTAL</b>	<b>24,396</b>
Total Watershed Load (including atmospheric)	24,396
Total Watershed Threshold	4,913
<b>TOTAL LOAD TO BE REMOVED</b>	<b>19,483</b>

# Collection & Non-Collection Scenarios

## Non-Collection

-  25 % Nitrogen Reduction - Fertilizer Management
-  25 % Nitrogen Reduction - Stormwater Mitigation
-  7500 Linear Feet - Permeable Reactive Barrier (PRB)
-  15 Acres - Aquaculture/Oyster Beds
-  7,625 Square Feet - Floating Constructed Wetlands
-  39 Units - Ecotoilets (UD & Compost)

## Collection



SCENARIO ASSUMPTIONS: Assumes treatment to 5 parts per million (ppm) nitrogen. Assumes disposal occurs inside the watershed. In this watershed, reduction targets may not be met with disposal 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 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 that will increase tidal flushing. Even with the tidal flushing increase the proposed plan would have used nearly all of the Parkers Rivers capacity to assimilate nitrogen. 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 sewerage locations. The phasing of these sewerage 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, with the exception of the route 28 culvert opening project. Since the town meeting vote to deny funding for phase 1, the town received funding to reconstruct the culvert beneath Route 28 in order to improve tidal flushing in the Parkers River. In May 2016, the Town voted to appropriate \$1.6 Million in funding to supplement \$3.4 Million in Hurricane Sandy grant funding.

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. To achieve a 25% nitrogen reduction from stormwater in the Lewis Bay watershed, 50% of the total roads in the watershed are assumed to require stormwater best management practices (BMPs). Yarmouth plans to achieve 25% nitrogen reduction in fertilizers by implementing a town-wide fertilizer education program.

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



## Town of Yarmouth Watershed Scenario Details

NAME OF TECHNOLOGY	CREDITS		REDUCTION TECHNOLOGIES			REMEDATION AND RESTORATION TECHNOLOGIES			REMOVAL
	% Nitrogen Reduction	Load Reduction (kg-N/yr)	# Properties / Units	Average Daily Flow Collected* (gpd)	Load Reduction (kg-N/yr)	# Units Proposed	Unit Metric	Load Reduction (kg-N/yr)	Total Scenario Load Reduction (kg-N/yr)
Scenario									Not reported
Fertilizer Management	25%	Not reported**							
Stormwater Mitigation	25%	Not reported**							
Centralized Sewer			3,100	710,787	Not reported**				

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.

NOTES:

\* Average daily flow collected includes buildout and estimated inflow and infiltration.





















\*\* Scenario details recieved from the town did not include load reduction.

# Scenario Maps

## Parkers River Watershed Scenario YARMOUTH

Representative locations of conceptually proposed infrastructure

### Legend

-  Aquaculture
-  Constructed Wetland
-  Eco-Toilets
-  Fertigation
-  Fertilizer Management
-  Floating Constructed Wetlands
-  IA Toilet
-  Inlet Widening
-  Permeable Reactive Barrier
-  PhytoRemediation
-  PhytoBuffer
-  Coastal Restoration
-  Stormwater
-  Stormwater - Bio Retention
-  Stormwater Management
-  Widening
-  Town Lines
-  Embayment Watersheds
-  Proposed Sewershed
-  Sewered Areas

