# Water and coastal Resources

## Introduction

Water and coastal resources are important components of Mashpee’s landscape and socioeconomic stability. An extensive coastline along its southern and eastern edges as well as inland lakes and rivers provide the Town with a variety of recreational and commercial activities. Meanwhile, aquifers provide residents with potable water. Chapter 8*, Municipal Buildings, Facilities, and Services,* offers more information on the Department of Natural Resources and its role in waterway protection and enforcement*.*

## Existing Conditions

### Shoreline

Mashpee has over five miles of coastline along Nantucket Sound and Vineyard Sound. The Town’s shoreline is formed by large coastal embayments: Waquoit Bay to the west and Popponesset Bay to the east. Waquoit Bay and Popponesset Bay include several small rivers, brooks, and small ponds within close proximity. The majority of Mashpee’s shoreline has been claimed by development, including houses, Town beaches, and summer camps. Information regarding development by the Popponesset Corporation and the New Seabury Resort is detailed in the Land Use Chapter. The Mashpee River Reservation, which empties into Popponesset Bay (The Trustees of Reservations). The Mashpee Water Quality Monitoring Program is comprised of a local partnership between the Mashpee Wampanoag Tribe, Town of Mashpee, and University of Massachusetts – Dartmouth, headed by Dr. Brian Howes. Its purpose is to assess, monitor, and enhance water quality throughout the Waquoit Bay and Popponesset Bay Estuaries. The consortium presented its findings to the Town in July 2021: no high-water quality areas remain within either estuary with an increasing presence of phytoplankton blooms due to nitrogen enrichment (Howes B. L., 2021). Further information on water quality is detailed under the Surface Water section of this chapter.

### Flood Zones

Flood zones are those areas subject to temporary inundation during storm events or seasonal increases in rainfall or snowmelt. Flood zones are defined as areas with a 1% chance of flooding in any given year. These zones play an important role in naturally protecting a community from flood damage. Flood zones are commonly associated with water bodies and are designated and mapped by the Federal Emergency Management Agency (FEMA) by category. Flooding in Mashpee is the result of coastal storms, nor’easters, heavy rains, tropical storms, and hurricanes. Approximately 2,816.43 acres of land in Mashpee is classified by FEMA as a High-Risk Coastal Area (VE), a Regulatory Floodway (AE), or 0.2% annual chance flood areas (X) within the Town (MassGIS, 2017).

Article XI in the Zoning Bylaw regulates the Floodplain District, which includes all Special Flood Hazard Areas (SFHAs) within the town designated as Zone EA or VE on the Barnstable County Flood Insurance Rate Map (FIRM) issued by the Federal Emergency Management Agency (FEMA) for the administration of the National Flood Insurance Program (Town of Mashpee, 2021). These are locations where the NFIP’s floodplain management regulations must be enforced because they are within the land area covered by the floodwaters of the base or 100-year flood (Federal Emergency Management Agency).

Parcels and buildings vulnerable to flooding were identified in the 2017 Hazard Mitigation Plan Draft. The plan identified 19% of the parcels in the A zone and 4.6% of the parcels in the V zone (Cape Cod Commission, 2017). Infrastructure that is vulnerable to the impacts of flooding was also identified in the 2017 Hazard Mitigation Plan. These areas include several culverts, parts of Great Neck Road South and Great Oak Road, Route 28 east of the rotary, and the School Street Bridge (Cape Cod Commission, 2017). Additionally, the Municipal Vulnerability Preparedness (MVP) Planning process identified existing development in vulnerable floodplains, as well as coastal and stormwater flooding of low-lying roads and culverts, including Brook Road crossing Red Brook and Great Oak Road adjacent to Jehu Pond (Woods Hole Group, 2020).

### Surface Water

Surface water is any body of water above ground, including oceans, streams, rivers, lakes, wetlands, reservoirs, and creeks (National Geographic Resource Library, 2021). Surface water plays a vitally important role as it is relied on for many human uses. It is an important source of drinking water and is used for the irrigation of farmland. A watershed is a land area that channels rainfall and snowmelt to these surface water bodies. The health and quality of a watershed are directly linked to the health and quality of its receiving surface water bodies. Mashpee is part of the Cape Cod watershed.

Mashpee is bordered by Waquoit Bay to the west and Popponesset Bay to the east and includes several small rivers, brooks, and small ponds in the area. Waquoit Bay contains open waters, salt, fresh marshes, barrier beaches, dunes, rivers, mixed pine and oak forests, and sandplain grasslands that are important to commercial and recreational shellfish and finfish fisheries (Waquoit Bay National Estuarine Research Reserve). The Town manages four of the largest freshwater ponds on the Cape, including Ashumet Pond, Johns Pond, Mashpee-Wakeby Pond, and the Santuit Pond (Town of Mashpee).

The Mashpee River, which begins at Mashpee/Wakeby Pond and empties into Popponesset Bay, contains poor water quality and some of the highest chlorophyl pigments in Popponesset Bay (Howes, Samimy, & Horvet, 2021). The Waquoit Bay, Santuit Pond, Ashumet Pond, and Popponesset Creek require a total maximum daily load (TMDL) according to the U.S. Clean Water Act. A TMDL is a regulatory term describing a plan for restoring impaired waters that identifies the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards. All water quality impairments are summarized in Table 10-1 below.

| **Table 10-1. Receiving Waters and Impairments, 2018-2020** |
| --- |
| **Water Body** | **Description** | **Impairment** |
| Red Brook | From dam (NATID: MA01037) at Red Brook Road, Falmouth/Mashpee to mouth at inlet Hamblin Pond, Falmouth/Mashpee. | Category 2: Unimpaired for some uses and not assessed for others. |
| Hamblin Pond | From inlet of Red Brook, Falmouth/Mashpee to outlet of Little River, Mashpee and inlet/outlet of Waquoit Bay west of Meadow Neck Road, Falmouth/Mashpee. | Category 4A: Impaired for one or more designated uses but does not require the development of a TMDL: TMDL has been completed. |
| Jehu Pond | Mashpee. | Category 4A: Impaired for one or more designated uses but does not require the development of a TMDL: TMDL has been completed. |
| Great River | From inlet of Abigails Brook, Mashpee to mouth at inlet Waquoit Bay (excluding Jehu Pond), Mashpee. | Category 4A: Impaired for one or more designated uses but does not require the development of a TMDL: TMDL has been completed. |
| Little River | Headwaters outlet Hamblin Pond, Mashpee to mouth at confluence with Great River, Mashpee. | Category 4A: Impaired for one or more designated uses but does not require the development of a TMDL: TMDL has been completed. |
| Waquoit Bay | From mouths of Seapit River, Quashnet River (also known as Moonakis River), Falmouth and Great River, Mashpee to inlet of Vineyard Sound, Falmouth/Mashpee. | Category 4A: Impaired for one or more designated uses but does not require the development of a TMDL: TMDL has been completed. |
| Wakeby Pond | Mashpee/Sandwich. | Category 4A: Impaired for one or more designated uses but does not require the development of a TMDL: TMDL has been completed. |
| Mashpee Pond | Mashpee/Sandwich. | Category 5: Impaired for one or more uses and requiring a restorative “action” plan, such as TMDL or Alternative Restoration Plan (impairment due to pollutant(s) such as nutrients, metals, pesticides, solids, and pathogens). |
| Santuit Pond | Mashpee. | Category 5: Impaired for one or more uses and requiring a restorative “action” plan, such as TMDL or Alternative Restoration Plan (impairment due to pollutant(s) such as nutrients, metals, pesticides, solids, and pathogens). |
| Ashumet Pond | Mashpee/Falmouth. | Category 5: Impaired for one or more uses and requiring a restorative “action” plan, such as TMDL or Alternative Restoration Plan (impairment due to pollutant(s) such as nutrients, metals, pesticides, solids, and pathogens). |
| Peters Pond | Sandwich/Mashpee. | Category 4A: Impaired for one or more designated uses but does not require the development of a TMDL: TMDL has been completed. |
| Popponesset Creek | All waters west of Popponesset Island (from Popponesset Island Road bridge at the north to a line extended from the southeastern most point of the island southerly to Popponesset Beach), Mashpee. | Category 5: Impaired for one or more uses and requiring a restorative “action” plan, such as TMDL or Alternative Restoration Plan (impairment due to pollutant(s) such as nutrients, metals, pesticides, solids, and pathogens). |
| Shoestring Bay | Quinaquisset Avenue, Mashpee/Barnstable to Popponesset Bay (line from Ryefield Point, Barnstable to Punkhorn Point, Mashpee, including Gooseberry Island), Barnstable/Mashpee. | Category 4A: Impaired for one or more designated uses but does not require the development of a TMDL: TMDL has been completed. |
| Mashpee River | Quinaquisset Avenue, Mashpee to mouth at inlet Shoestring Bay (formerly to mouth at Popponesset Bay), Mashpee. | Category 4A: Impaired for one or more designated uses but does not require the development of a TMDL: TMDL has been completed. |
| Popponesset Bay | The waters seaward of an imaginary line connecting Ryefield Point, Barnstable and Punkhorn Point, Mashpee to inlet of Nantucket Sound (including Ockway Bay, Mashpee and Pinquickset Cove, Barnstable) (excludes Popponesset Creek, Mashpee). | Category 4A: Impaired for one or more designated uses but does not require the development of a TMDL: TMDL has been completed. |
| Johns Pond | Mashpee. | Category 4A: Impaired for one or more designated uses but does not require the development of a TMDL: TMDL has been completed. |
| Santuit River | From confluence with fresh water portion south of Old Mill Road, Mashpee to mouth at inlet Shoestring Bay, Mashpee/Barnstable. | Category 4A: Impaired for one or more designated uses but does not require the development of a TMDL: TMDL has been completed. |
| Sagelot Pond | west of Great Oak Road, Mashpee (segment includes tidal channels to Waquoit Bay). | Category 4A: Impaired for one or more designated uses but does not require the development of a TMDL: TMDL has been completed. |

*Source:* U.S. Environmental Protection Agency*, 202*3

### Groundwater

Between 1980 and 2000, Mashpee experienced rapid growth of single-family housing which contributed to many of the land use policies in place today and ongoing challenges for municipal planning. Housing construction stressed natural systems and presented challenges to municipal services, such as water and wastewater.

The Mashpee Clean Water Plan includes plans for wastewater facilities to restore water quality in Mashpee (Town of Mashpee, n.d.). The upper regions of Waquoit Bay and Popponesset Bay estuaries show the greatest level of nutrient-related water quality decline (Howes, Samimy, & Horvet, 2021). Degraded estuarine habitat is primarily restored through nitrogen management. The Town is utilizing shellfish seeding as a remedial action for estuaries approaching their nitrogen targets (Howes, Samimy, & Horvet, 2021).

The MassDEP Public Water Supply lists public water, community surface, groundwater, and public non-community supply sources (MassGIS, 2021). Supply sources, locations of proposed wells, and sources with a defined DEP-approved wellhead protection area (Zone II) are summarized in Table 10-2 below.

| **Table 10-2. Public Water Supply** |
| --- |
| **PWS Identification Number** | **Site Name** | **Type of Public Water Supply** | **Zone II Number** |
| 4172014 | Cape Cod Camp Corporation | Transient Non-Community | 0 |
| 4172039 | Holland Mills Well No. 5 | Proposed Well | 665 |
| 4172039 | Proposed Site #P-1 | Proposed Well | 31 |
| 4172014 | Cape Cod Camp Corporation | Transient Non-Community | 0 |
| 4172039 | Rock Landing Well 3 | Community Groundwater Well | 665 |
| 4172039 | Turner Road Well 2 | Community Groundwater Well | 659 |
| 4172033 | Well 2 | Community Groundwater Well | 0 |
| 4172035 | Well 1 | Community Groundwater Well | 0 |
| 4172039 | Belcher Well 7 | Community Groundwater Well | 632 |
| 4172035 | Well 2 | Community Groundwater Well | 0 |
| 4172033 | Well 1 | Community Groundwater Well | 0 |
| 4172043 | Sea Mist Resort | Transient Non-Community | 0 |
| 4172014 | Cape Cod Camp Corporation | Transient Non-Community | 0 |
| 4172048 | Fit Company For Women | Transient Non-Community | 0 |
| 4172039 | Mashpee Village Well 6 | Community Groundwater Well | 633 |
| 4172001 | Well #2 And Well #3 Manifolded | Community Groundwater Well | 0 |
| 4172043 | Sea Mist Resort | Transient Non-Community | 0 |
| 4172039 | Quaker Run Well 4 | Community Groundwater Well | 655 |
| 4172039 | Site P-11/Tw #1-90 | Proposed Well | 565 |
| 4172039 | Rock Landing Well 2 | Community Groundwater Well | 665 |
| 4172039 | Turner Road Well 5 | Community Groundwater Well | 659 |

*Source: MassGIS, 2020*

Zone I is used to designate the protective radius required around a public water supply well or wellfield. Mashpee has 23 Wellhead Protection Areas designated in Zone I (MassGIS, 2021). DEP Zone II and public water supply (PWS) data are closely linked. Wellhead Protection Areas are important for protecting recharge areas around public water supply groundwater resources (MassGIS, 2021). Mashpee has 12 Wellhead Protection Areas designated in Zone II, which are shown in Map 4-1, *Natural Resources* (MassGIS, 2021). In the absence of an approved Zone II, DEP has adopted the Interim Wellhead Protection Area (IWPA) as the primary, protected recharge area for PWS groundwater sources (MassGIS, 2021). Mashpee has 11 Interim Wellhead Protection Areas Map 4-1, *Natural Resources* (MassGIS, 2021).

### Water and Wastewater Resources and Facilities

The Mashpee Water District provides clean and safe drinking water to 10,149 accounts, as of December 31, 2021. The Mashpee Water District was formed in 1987 and from 1987 to 1990 established an agreement to authorize the District to receive water from the Town of Falmouth to supply water to areas of Mashpee that were contaminated by Otis Air Force Base. In 1990 the District established a new source of water with the Quaker Run Road well installation. In 1991, the District purchased the Highwood Water Company, increasing their customer base from 500 to 3,000, also bringing along three water supply wells. The District continued to expand through 2005, adding two water tanks (Back Road in 1993 and Meeting House Road in 2003), two new wells (Turner Road Well in 1999, Mashpee Village Well in 2002, and Belcher Road Well in 2005). The Sewer Commission is staffed by the Wastewater superintendent leading the wastewater department. Table 8-5 provides illustrates the growth of the Mashpee Water District’s consumers from 1987 to 2004. An addition of 1,000 new consumers is projected and in the planning stages.

| **Table 10-3. Mashpee Water District Consumer Counts** |
| --- |
| **Year** | **Number of Consumers** |
| 1987-1991 | 0 to 3,000 |
| 1994 | 4,000 |
| 1996 | 5,000 |
| 1999 | 6,000 |
| 2001 | 7,000 |
| 2004 | 8,000 |

Source: Mashpee Water District, 2005

### Challenges & Opportunities

A variety of human activities pose a threat to the Town’s natural resources. This section presents the most notable threats to the water resources in Mashpee.

Unmanaged Stormwater Runoff

Stormwater is rainwater or melted snow that runs off streets, roofs, pavement, and other impervious surfaces as well as lawns, woodlands, and other more pervious areas as they become saturated. As the water flows over these surfaces, it can collect pollutants and sediment that can contaminate water bodies. Stormwater is addressed by federal, state, and local regulations. The United States Environmental Protection Agency (USEPA) has determined that municipal separate storm sewer systems (MS4s), a drainage system in an urbanized area, are a major pathway for the introduction of pollutants to waterways and are a leading cause of the impairment of ambient water quality, for both fresh and coastal waters (United States Environmental Protection Agency). Through the National Pollutant Discharge Elimination System (NPDES) under Section 319 of the Clean Water Act, the U.S. EPA regulates stormwater from MS4s. The Massachusetts Department of Environmental Protection (MassDEP) is delegated by USEPA to administer the program in Massachusetts. In 2016, EPA issued a final NPDES general permit for discharges of stormwater from small MS4s in Massachusetts (the MA MS4 Permit) (United States Environmental Protection Agency).

Mashpee is currently subject to MS4 jurisdiction in Massachusetts. Under this law, MassDEP requires subject communities to develop stormwater management program plans (SWMPPs) to address six minimum control measures. The six minimum control measures required in the SWMPP are addressed in Mashpee’s Stormwater Management Program (Tighe&Bond, 2019):

* Public Education and Outreach
* Public Participation
* Illicit Discharge Detection and Elimination
* Management of Construction Site Runoff
* Management of Post Construction Site Runoff
* Good Housekeeping in Municipal Operations

Mashpee has established a Stormwater Management Task Force to develop and implement a Townwide Stormwater Management Plan (SWMP) to fully comply with the new National Pollution Discharge Elimination System (NPDES) permit and to continue to mitigate the impacts of stormwater runoff with the Town (Town of Mashpee).

Nutrient Control

Nutrient-related water quality decline is a serious threat to coastal waters and freshwater ponds in southeastern Massachusetts. The Massachusetts Estuaries Project (MEP) technical report indicated that the Waquoit Bay and the Popponesset Bay system are in impaired water quality as they exceed their critical threshold for nitrogen (Cape Cod Commission, 2017). The Comprehensive Watershed Nitrogen Management Plan is the culmination of multiple documents examining the needs and coordinating efforts of the Massachusetts Estuaries Project (MEP) (Town of Mashpee, 2019). The Mashpee Sewer Commission is exploring the expansion of Phase 2 of the Town's Comprehensive Watershed Nitrogen Management Plan to include lakes and ponds (Jung, 2021).

Nitrogen is detrimental to the water quality of Mashpee’s ponds, streams, and bay area. Excess nitrogen can also cause algae blooms, which lower oxygen levels and lead to long-term damage to the ecosystem (Town of Mashpee, 2021). The Nitrogen Control section in the Town Bylaw aims to conserve valuable waterways and other resources that increase property values, protect the unique environment vital to the local economy, and reduce the financial burden on taxpayers and property owners by regulating the outdoor application of nitrogen and phosphorous on turf (Town of Mashpee, 2019). The regulation of fertilizer applications will reduce the overall amount of excess nitrogen and phosphorous entering resource areas as defined in the Mashpee Wetlands Protection Bylaw (Town of Mashpee, 2019). The Town also seeds shellfish as a remedial action for estuaries approaching their nitrogen targets (Howes B. L., 2021).

Phosphorus introduction into Mashpee’s freshwater systems can lead to algal growth and subsequent eutrophication. Eutrophication can result in anoxia, or lack of oxygen, from water bodies, threatening biodiversity. Phosphorus enrichment was found to be causing eutrophication in three of Mashpee’s four largest ponds (Ashumet, Santuit, Mashpee Wakeby). Harmful algae blooms (HABs) can result in adverse health effects in humans and animals. Mashpee Wakeby Pond and Santuit Pond have been closed to the public for extended periods of time due to the presence of HABs. Long-term closures are expected to increase with climate change and nutrient pollution (Mashpee Department of Natural Resources and Fuss & O'Neill, 2022).

Groundwater Contamination

Joint Base Cape Cod, which includes Otis Air National Guard Base and Camp Edwards, has been an Environmental Protection Agency (EPA) Superfund site since the late 1980s. Per- and polyfluoroalkyl substances (PFAS) were detected in nearby groundwater, threatening the Sagamore Lens aquifer (EPA). The EPA continues to conduct groundwater plume extraction and treatment will be provided until PFAS levels reach EPA standards, with an expected completion date of 2060 for some measures (Massachusetts National Guard, 2019).

### Opportunities

Mashpee has many tools at its disposal to improve water quality, stormwater management, and protect native aquatic species. The Town is currently in the process of developing and adopting a state approved harbor management plan, which will take approximately two years as of January 2023. The Harbor Management Plan and Mashpee Clean Water Plan offer guidance for implementing actions that address Mashpee’s groundwater contamination and invasive species management. Irrigation policies and the wetland protection bylaw are examples of what future policy-based actions should mimic.

### Current Measures

Shellfish aquaculture is a core component of Mashpee’s modern “blue” economy. Mashpee and regional partners have introduced programs and projects that primarily address nitrogen loading, including the MVP Action Grant Nitrogen Loading on Santuit Pond, Mashpee/Wakeby Pond Study, SNEP Program, Harbor Management Plan, Ashumet Pond Clean Up, and updated Town bylaws associated with clean water.

## Goals & Policies

*Goals*

1. Maintain and restore the quality of Mashpee’s groundwater to ensure an adequate supply of safe, high quality drinking water.
2. Protect Mashpee’s groundwater supply, wetlands, and surface water from contamination and restore/remediate impacted and polluted water bodies.
3. Prevent harmful algal blooms in Mashpee waters to maximize recreational opportunities and preserve safe drinking water for all residents.
4. Maintain and expand wastewater treatment and disposal facilities.
5. Expand wastewater management from the baseline set by the state to enhanced I/A waste water treatment systems and require the removal and replacement of all outdated systems such as cesspools.
6. Remove all threats from pollutants emerging from Joint Base Cape Cod into Mashpee’s groundwater and open water bodies.

*Policies*

1. Continue to support the shellfish propagation program to enhance local fisheries, restore vital habitat, and remove excessive nitrogen in both Waquoit and Popponesset Bay.
2. Protect the seashore from erosion.
3. Preserve fish and hunting rights of way on shore.
4. Promote shellfish seeding programs.