

**Final Massachusetts Statewide
Total Maximum Daily Load for
Pathogen-Impaired Waterbodies**

Appendix N: Taunton River Basin

Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
Rebecca L. Tepper, Secretary
Massachusetts Department of Environmental Protection
Bonnie Heiple, Commissioner
Bureau of Water Resources
Kathleen M. Baskin, Assistant Commissioner

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Prepared by:
TMDL Section, Watershed Planning Program
Division of Watershed Management, Bureau of Water Resources
Massachusetts Department of Environmental Protection

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Massachusetts Department of Environmental Protection

The mission of the Massachusetts Department of Environmental Protection (MassDEP) is to protect and enhance the Commonwealth's natural resources – air, water, and land – to provide for the health, safety, and welfare of all people, and to ensure a clean and safe environment for future generations. In carrying out this mission MassDEP commits to address and advance environmental justice and equity for all people of the Commonwealth; provide meaningful, inclusive opportunities for people to participate in agency decisions that affect their lives; and ensure a diverse workforce that reflects the communities we serve.

Watershed Planning Program

The mission of the Watershed Planning Program (WPP) in the Massachusetts Department of Environmental Protection is to protect, enhance, and restore the quality and value of the waters of the Commonwealth. Guided by the federal Clean Water Act, WPP implements this mission statewide through five Sections that each have a different technical focus: (1) Surface Water Quality Standards; (2) Surface Water Quality Monitoring; (3) Data Management and Water Quality Assessment; (4) Total Maximum Daily Load; and (5) Nonpoint Source Management. Together with other MassDEP programs and state environmental agencies, WPP shares in the duty and responsibility to secure the environmental, recreational, and public health benefits of clean water for all people of the Commonwealth.

Acknowledgements

FB Environmental Associates, under contractual agreements with MassDEP, previously prepared two separate documents for the Watershed Planning Program: (1) *Massachusetts TMDL for Pathogen-Impaired Inland Fresh Water Rivers* and (2) *Massachusetts Statewide TMDL for Pathogen-Impaired Coastal Waterbodies*. MassDEP combined these two documents into a single statewide approach encompassing both inland fresh water and coastal impairments to prepare the *Final Massachusetts Statewide Total Maximum Daily Load for Pathogen-Impaired Waterbodies*.

Disclaimer

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Contact Information

Watershed Planning Program
Division of Watershed Management, Bureau of Water Resources
Massachusetts Department of Environmental Protection
8 New Bond Street, Worcester, MA 01606
Website: <https://www.mass.gov/guides/watershed-planning-program>
Email address: dep.wpp@mass.gov

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1. Introduction

This appendix to the Massachusetts Statewide Total Maximum Daily Load (TMDL) for Pathogen-Impaired Waterbodies provides additional information to support the determination of the TMDL for the pathogen-impaired segment in the Taunton watershed (Figure 1-1). The core document and appendix together complete the TMDL for this pathogen-impaired segment.

This appendix includes a description of the watershed and maps to identify the segments of focus for the TMDLs; the impaired uses, and the water classification and qualifiers as designated by the Massachusetts Surface Water Quality Standards (SWQS, 314 CMR 4.00); the water quality standards applicable to the impaired uses; the data supporting the pathogen impairment determination; and a description of the sources of pathogen loading with supporting maps.

This appendix also includes a summary of the allocation of the current indicator bacteria load into two categories: point sources (waste load allocation, WLA) and nonpoint sources (load allocation, LA), based on an analysis of watershed percent impervious cover. This appendix identifies the percent reduction in indicator bacteria pollutant load from current conditions required to meet the TMDL, based on the highest levels of indicator bacteria recorded in the monitoring data, if applicable. The TMDL for the Taunton River segment was calculated with the flow-based equation. Refer to Tables 1-1 and 1-2.

Finally, for the impaired segment, this appendix presents existing local management efforts to reduce pathogen pollutant loading. General recommended next steps for implementation of this TMDL are provided in the Taunton River Watershed Overview section.



Figure 1-1. Conceptual diagram of water flow through the Taunton River watershed for the pathogen-impaired segment. Connections between waterbodies are shown with black arrows. Not to scale. Impaired segments are shown with the assessment unit.

Table 1-1. *E. Coli* Total Maximum Daily Loads (TMDLs), the percent reductions needed to meet the TMDL target (126 CFU/100ml) based on the Massachusetts Surface Water Quality Standards (SWQS), and the flow-based TMDL allocations for pathogen-impaired **freshwater** assessment units in the Taunton River Basin

Waterbody & Assessment Unit	Class (Qualifier)	TMDL Type	SWQS-Based TMDL target (CFU/100ml)	Maximum Geomean (CFU/100ml)	Geomean Percent Reduction	TMDL Allocation	Flow (cfs)					
							1	10	100	1,000	10,000	100,000
							Flow-Based Target TMDL (CFU/day*10^9)					
Taunton River	B (WW)	R	126	283 (30 day)	55%	WLA (11%)	0.3	3.4	33.6	335.7	3,357.0	33,570.1
MA62-01						LA (89%)	2.7	27.5	274.7	2,747.0	27,469.8	274,697.9

Table 1-2. *Enterococci* Total Maximum Daily Loads, the percent reductions needed to meet the TMDL target (35 CFU/100ml) based on the Massachusetts Surface Water Quality Standards (SWQS), and the flow-based TMDL allocations for pathogen-impaired **freshwater** assessment units in the Taunton River Basin

Waterbody & Assessment Unit	Class (Qualifier)	TMDL Type	SWQS-Based TMDL target (CFU/100ml)	Maximum Geomean (CFU/100ml)	Geomean Percent Reduction	TMDL Allocation	Flow (cfs)					
							1	10	100	1,000	10,000	100,000
							Flow-Based Target TMDL (CFU/day*10^9)					
Taunton River	B (WW)	P	35	NA	-	WLA (11%)	0.1	0.9	9.3	93.3	932.5	9,325.0
MA62-01						LA (89%)	0.8	7.6	76.3	763.0	7,630.5	76,305.0

Class defined in the Massachusetts Surface Water Quality Standards (SWQS) at 314 CMR 4.02.

Qualifiers that identify segments with special characteristics are defined at 314 CMR 4.06(1)(d).

WW = Warm Water; waters that meet the warm water fisheries (WWF) definition at 314 CMR 4.02 and are subject to WWF dissolved oxygen and temperature criteria

Pathogen bacteria units are presented in colony-forming units or CFU per 100 milliliter or ml.

TMDL Type identifies the restorative or protective action approach:

R = Restorative TMDL addressing a pathogen impairment identified in the 2018/2020 Integrated List of Waters

R* = Restorative TMDL addressing a historic impairment of former indicator bacteria for which no current applicable criteria are available See Section 2.3 of the core document for summary of water quality criteria and designated uses.

P = Protective TMDL addressing all applicable uses, regardless of impairment status, for the associated pathogen (refer to the Massachusetts SWQS: 314 CMR 4.00)

Target TMDL or Total Maximum Daily Load is presented as both SWQS-Based and Flow-Based.

SWQS-Based TMDL Target is the target concentration applicable to the TMDL pollutant indicator bacteria based on the Surface Water Quality Standards (314 CMR 4.00).

Flow-Based Target TMDL is the target concentration (CFU/100mL) multiplied by the standard flow volume (cubic feet per second or cfs). See Section 4.2.2 in core document for full equation and conversion factors.

Maximum Geomean is the highest calculated 30- or 90- day rolling geometric mean for TMDL pollutant indicator bacteria associated with the segment.

Geomean Percent Reduction is the percent reduction from the highest calculated 30- or 90- day rolling geomean needed to achieve the target concentration. Percent reductions are for planning purposes only.

2. Taunton River Watershed Overview

The Taunton River Watershed covers an area of approximately 529 square miles (mi²) in southeastern Massachusetts (Figure 2-1). It includes the mainstem of the Taunton River, which generally flows southwest from its headwaters at the confluence of the Town and Matfield rivers in Bridgewater, MA to its mouth at Mount Hope Bay at the Fall River and Somerset, MA municipal border. Major tributaries to the Taunton River include the Assonet, Cotley, Forge, Mill, Nemasket, Segreganset, Threemile, and Winnetuxet rivers. Due to its relatively flat geography, the Taunton River watershed contains extensive wetland areas that help to moderate flow by buffering the effects of extreme precipitation (Rojko, Tamul, and Kennedy, 2005). This wet terrain enables the Taunton River watershed to host some of the most productive cranberry bogs in the country. Overall, there are 94 mi² of wetlands and 12,883 acres of lakes in the watershed (Rojko, Tamul, and Kennedy, 2005).

There are two designated Areas of Critical Environmental Concern (ACEC) in the Taunton River watershed: the Hockomock Swamp ACEC and the Canoe River Aquifer ACEC. The Hockomock Swamp ACEC was officially designated on February 10, 1990, and encompasses roughly 16,950 acres in southeastern Massachusetts. This wetland area is home to 13 rare and endangered species and is hydrologically connected to underlying medium- and high-yield aquifers. The Canoe River Aquifer ACEC was officially designated on May 18, 1991 and encompassed roughly 17,200 acres within four towns in southeastern Massachusetts. This aquifer is home to 10 municipal wells and numerous private wells that provide high-quality drinking water to over 66,000 people. The area contains more than a hundred rivers and streams that flow through a diverse landscape consisting of wetland areas, open fields, forests, and farmland (Rojko, Tamul, and Kennedy, 2005).

The Taunton River watershed overlaps a portion of 43 municipalities in Massachusetts. Of these municipalities, Berkley, Bridgewater, East Bridgewater, Easton, Norton, Raynham, Taunton, and West Bridgewater are completely contained within the watershed. The majority of Abington, Avon, Brockton, Dighton, Foxborough, Freetown, Halifax, Hanson, Lakeville, Mansfield, Middleborough, Plympton, Somerset, Stoughton, and Whitman are also contained within the watershed. See Figure 2-1 for a map showing impaired segments and watershed municipalities.

All municipalities in the watershed operate and maintain municipal separate storm sewer systems (MS4s) in urban areas except for the towns of Rochester and Plympton, which have EPA-approved waivers. The networks of drains and pipes in MS4 systems convey polluted runoff from streets and developed areas to waterbodies. In addition, these networks are sometimes subject to direct wastewater inflows through illegal cross-connections, leaks from sewer pipes or septic systems, dumping, or other unauthorized wastewater sources, and together these sources are termed illicit discharges.

EPA and MassDEP jointly issued the General Permits for Stormwater Discharges from MS4s, which became effective on July 1, 2018, with modifications effective on January 6, 2021 (USEPA, 2020). Communities that discharge to pathogen-impaired waterbodies with approved TMDLs are required to implement enhanced best management practices (BMPs) for public education and designate the catchments as Problem Catchments or High Priority under the Illicit Discharge Detection and Elimination (IDDE) Program, in addition to the MS4 requirement to reduce pollutants to the Maximum Extent Practicable (USEPA, 2020).

The geographic range of three Regional Planning Agencies (RPAs) includes the Taunton River watershed. RPAs are public organizations advising municipalities, private business groups, and state and federal governments on a range of matters. Their research, coordination and technical assistance are especially valuable in addressing watershed-level issues such as pathogen pollutants and stormwater that cross town boundaries. These Taunton River RPAs include:

- Metropolitan Area Planning Council (MAPC, 2021)
- Old Colony Planning Council (OCPC, 2022)
- Southeast Regional Planning & Economic Development District (SRPEDD, 2022)

The following RPA initiatives and tools utilized in the South Coastal watershed are especially noteworthy:

- The MAPC utilizes the Integrated Water Management (IWM) approach to coordinate planning across the wastewater, drinking water, and stormwater sectors.

- The MAPC has developed two tools that assist MS4 regulated communities in fulfilling the requirements of the permit. These tools are:
 - Stormwater Utility/Funding Starting Kit (MAPC, 2014)
 - GIS toolkit to calculate MS4 outfall catchments, which is a requirement under the MS4 General Permit, created by MAPC and the Neponset River Watershed Association (MAPC, 2018).
- The OCPC administers a Community Septic Management Program that assists homeowners in addressing septic system failures.
- SRPEDD assists in developing watershed management plans for waterbodies in the region (SRPEDD, 2022)
- SRPEDD is involved in watershed enhancement through a grant from the Southeast New England Coastal Watershed Restoration Program (SNEP).

Beyond these activities, the Massachusetts Statewide Municipal Stormwater Coalition (MSMSC), composed of about 10 stormwater groups around the state, further coordinates with and assists municipalities on pathogen pollutant concerns through their “Think Blue” campaign (Think Blue Massachusetts, 2019).

Additional watershed-scale initiatives are carried out by several organizations, including:

- **EPA Southern New England Program (SNEP)** whose mission is to “foster collaboration among regional partners across southeast New England’s coastal watersheds to protect and restore water quality, ecological health, and diverse habitats by sharing knowledge and resources, promoting innovative approaches, and leveraging economic and environmental investments to meet the needs of current and future generations”. SNEP is currently assisting in the Canoe River Aquifer Pilot Project which aims to “enhance the protection of the Canoe River Aquifer using Nature Based Solutions or NBS” (SNEP, 2022)
- **Taunton River Watershed Alliance (TRWA)** is “an Alliance of concerned residents, businesses and organizations united to restore and properly manage the water and natural resources within the Watershed” (TRWA, 2022)
- **The Nature Conservancy (TNC)** has been involved in numerous restoration projects in the Taunton River watershed, including most notably a dam removal project on the Mill River (TNC, 2022)
- **Trout Unlimited (TU)** operates a chapter in the geographic area of the Taunton watershed in Massachusetts, including the Southeastern Mass (SEMASS). Their mission is to conserve, protect and restore our country’s cold water fisheries and their watersheds; some of their activities include river cleanups, scientific assessments (e.g., trout habitat, culvert connectivity) and restoration projects (TU, 2022).
- **U.S. Environmental Protection Agency (USEPA)** is assisting in the development of a tool through the Healthy Watersheds Project that will “help inform how Taunton communities decide on priority actions that would increase their overall resiliency and reduce their vulnerability to the converging impacts of climate change and development” (USEPA, 2022a). USEPA is also developing a watershed optimization management tool that will be applied to the Taunton River watershed. Among other things, this tool quantifies the water quality impacts of converting permeable land cover to impervious cover and implementing stormwater management strategies (USEPA, 2022b).

The following actions by identified stakeholders will help reduce pathogen loads to the impaired segments. The list represents a starting point and is not intended to be comprehensive. For a more detailed discussion of pollutant reduction actions, see Section 5, “Implementation” of the Pathogen TMDL core document.

- **Municipalities:** Continue to implement the MS4 permit, which includes specific requirements for waterbodies with an approved Bacteria/Pathogen TMDL, such as prioritization and reporting, enhanced BMPs, IDDE, and education (USEPA, 2020).
- **Regional Planning Agencies (RPAs) and municipalities:** Continue and expand collaboration on MS4 and stormwater issues. Cooperatively develop tools and share knowledge to reduce costs, increase innovation, and generate consistent and effective stream restoration efforts at the watershed scale.
- **USDA NRCS and landowners:** Develop comprehensive nutrient management plans for agriculture, reaching farmers through local connections.

- **Parks departments, schools, private landowners, and others** who maintain large, mowed fields with direct connections to surface water should consider maintaining a vegetated buffer along the shoreline. Buffers slow and filter stormwater runoff, provide a visual screen that can discourage large aggregations of waterfowl, and offer many other water quality benefits at low cost.

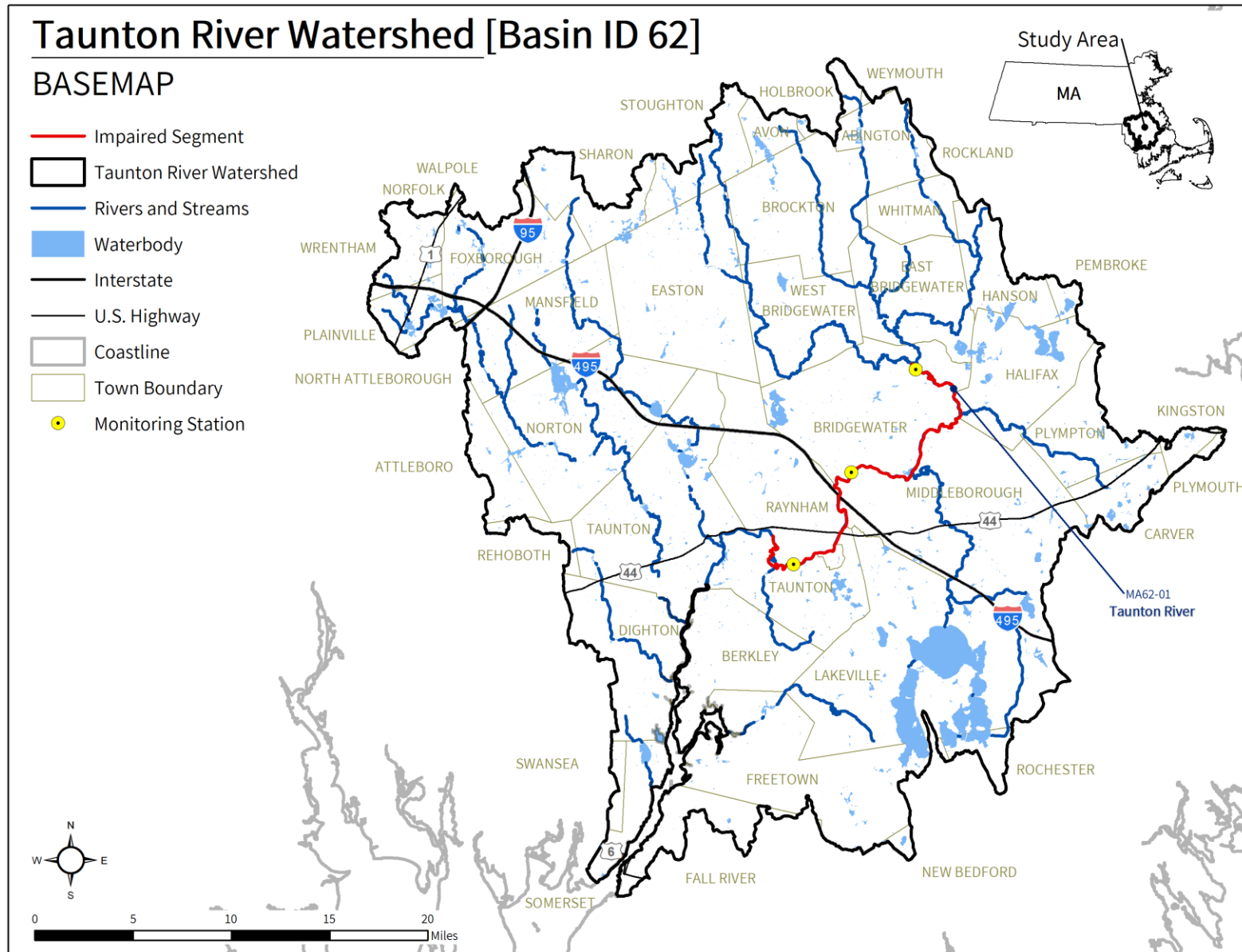


Figure 2-1: Map of pathogen-impaired segments in this appendix, water quality monitoring stations, municipal borders, waterbodies, and major roads in the Taunton River watershed.

3.MA62-01 Taunton River

3.1 Waterbody Overview

Taunton River segment MA62-01 is 19.5 miles long and begins at the confluence of the Town and Matfield rivers in Bridgewater, MA. The segment flows generally southwest, ending at the MA-24 bridge at the Taunton and Raynham, MA municipal border.

Tributaries to the Taunton River segment MA62-01 include Bassett Brook, Cotley River, Furnace Brook, Nemasket River, Otis Pratt Brook, Poquoy Brook, Purchase Brook, Sawmill Brook, Snows Brook, Spring Brook, Winnetuxet River, and several unnamed streams. Lakes and ponds in the watershed include Ames Long Pond, Ames Pond, Assawompset Pond, Big Bearhold Pond, Brockton Reservoir, Burrage Pond, Clear Pond, Cleveland Pond, Cooper Pond, Cushing Pond, Dry Pond, East Monponsett Pond, Elders Pond, Great Quittacas Pond, Hobart Pond, Island Grove Pond, Lake Nippenicket, Lake Rico, Langwater Pond, Little Quittacas Pond, Long Pond, Middle Pond, Morse Pond, Muddy Pond, Pocksha Pond, Robbins Pond, Shovelshop Pond, Stetson Pond, Tispaquin Pond, Thirty Acre Pond, Upper Porter Pond, Waldo Lake, West Monponsett Pond, Woods Pond, and several unnamed waterbodies. The segment flows through a combination of agricultural, wetland, and other natural or forested areas.

Key landmarks in the watershed include the town centers of Avon, Bridgewater, Brockton, East Bridgewater, Easton, Halifax, Lakeville, Middleborough, Monponsett, Plympton, West Bridgewater, and Whitman; Bridgewater State University, Massasoit Community College, and Stonehill College; Ames Nowell, Borderland, and Massasoit state parks. From upstream to downstream, segment MA62-01 is crossed by Plymouth Street/MA-104 (Bridgewater), Cherry Street (Bridgewater/Halifax), Summer Street (Bridgewater/Middleborough), Titicut Street (Bridgewater/Middleborough), Bedford Street/MA-18 (Bridgewater/Middleborough), Green Street/Plymouth Street (Bridgewater/Middleborough), Vernon Street (Bridgewater/Middleborough), I-495 (Middleborough/Raynham), U.S. Route 44 (Raynham/Taunton), Church Street (Raynham), South Street East/Old Colony Avenue

Reduction from Highest Calculated Geomean: NA

Watershed Area (Acres): 193,642

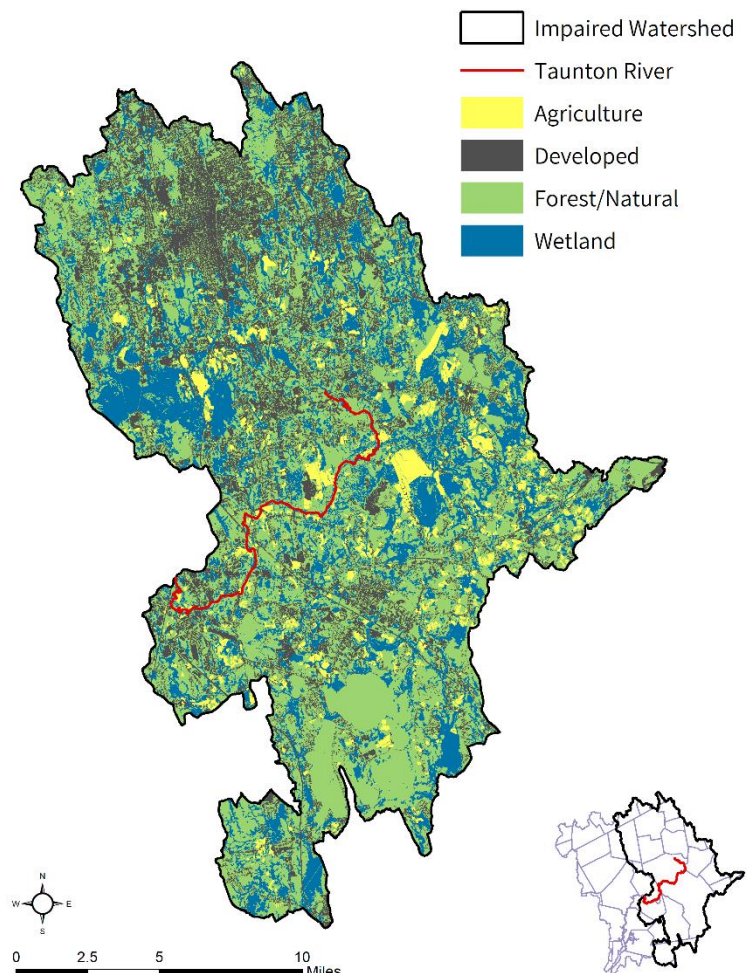
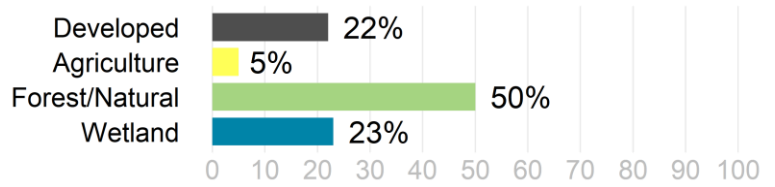
Segment Length (Miles): 19.5

Impairment(s): *E. coli* (Primary Contact Recreation)

Class (Qualifier): B (Warm Water)

Impervious Area (Acres, %): 21,087 (11%)

DCIA Area (Acres, %): 12,144 (6%)



(Raynham/Taunton), and Fall River Expressway/MA-24 (Raynham/Taunton).

Taunton River (MA62-01) drains a total area of 303 square miles (mi²), of which 33.0 mi² (11%) are impervious and 19.0 mi² (6%) are directly connected impervious area (DCIA). The watershed is partially served by public sewer systems in Abington, Avon, Bridgewater, Brockton, Easton, Holbrook, Middleborough, New Bedford, Raynham, Rockland, Stoughton, Taunton, Weymouth, and Whitman¹; and 56% of the total land area is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (USEPA, 2020). There are seven additional NPDES permits on file governing point source discharges of pollutants to surface waters. Of these, five are NPDES permits for a wastewater treatment facility, three of which are within the immediate drainage area to the impaired segment, Table 3-1). Outside the immediate drainage area, the Bridgewater Wastewater Treatment Facility (NPDES ID MA0100641) drains to Sawmill Brook (MA62-36, unassessed) and the Brockton Advanced Water Reclamation Facility (NPDES ID MA0101010) drains to Trout Brook (MA62-06, pathogen-impaired). There are 20 MassDEP discharge-to-groundwater permits for on-site wastewater discharges within the watershed, seven of which are within the immediate drainage area to the impaired segment, Table 3-2. There are no combined sewer overflows (CSOs) within the watershed. There are 26 landfills and four unpermitted land disposal dumping grounds within the segment watershed. See Figure 3-1.

The Taunton River segment MA62-01 watershed is located in a moderately-developed part of Massachusetts. Half of the watershed consists of forest and natural areas (50%) and a little under a quarter consists of wetland areas (23%). There is a moderate amount of agriculture in the watershed (5%) that generally consists of cranberry bogs in the southern and eastern portions of the watershed and pasture/hay and cultivated fields in the central and northern portions of the watershed. Development accounts for 22% of total land use, most prominently in the upper watershed around the Town of Brockton and in the lower watershed in the Town of Middleborough.

In the Taunton River (MA62-01) watershed, under the Natural Heritage and Endangered Species Program, there are 31,528 acres (16%) of Priority Habitats of Rare Species and 1,942 acres (1%) of Priority Natural Vegetation Communities. There are 11,106 acres (6%) under Public Water Supply protection, 12,045 acres (6%) within the Hockomock Swamp Area of Critical Environmental Concern, and 38,006 acres (20%) of Outstanding Resource Waters. Overall, there are 29,222 acres (15%) of land protected in perpetuity², part of 34,406 acres (18%) of Protected and Recreational Open Space³. See Figure 3-1.

Table 3-1. National Pollutant Discharge Elimination System (NPDES) permits for Wastewater Treatment Facilities (WWTF) in the segment watershed. Only permits unique to this segment watershed are shown. WWTF are identified as either municipal (MUN) or other (OTH), if applicable.

NPDES ID	NAME	TOWN	WWTF
MA0032433	OAK POINT RETIREMENT COMMUNITY	MIDDLEBOROUGH	OTH
MA0101591	MIDDLEBOROUGH WPCF	MIDDLEBOROUGH	MUN
MA0102237	MCI-BRIDGEWATER WPCF	BRIDGEWATER	MUN

¹ Estimated percentage of developed areas with wastewater infrastructure in the watershed was based on available information: MWRA service areas, MassDEP's Water Utility Infrastructure Mapping Project (MassDEP, 2021b), MS4 reports, and local knowledge including Horsley Witten Group, Inc. (2008).

² Land protected in perpetuity includes conservation restrictions, agricultural preservation, private deed restrictions, wetland restrictions, aquifer protection, historic preservation, etc. Refer to Mass GIS metadata for the Protected and Recreational Open Space data layer.

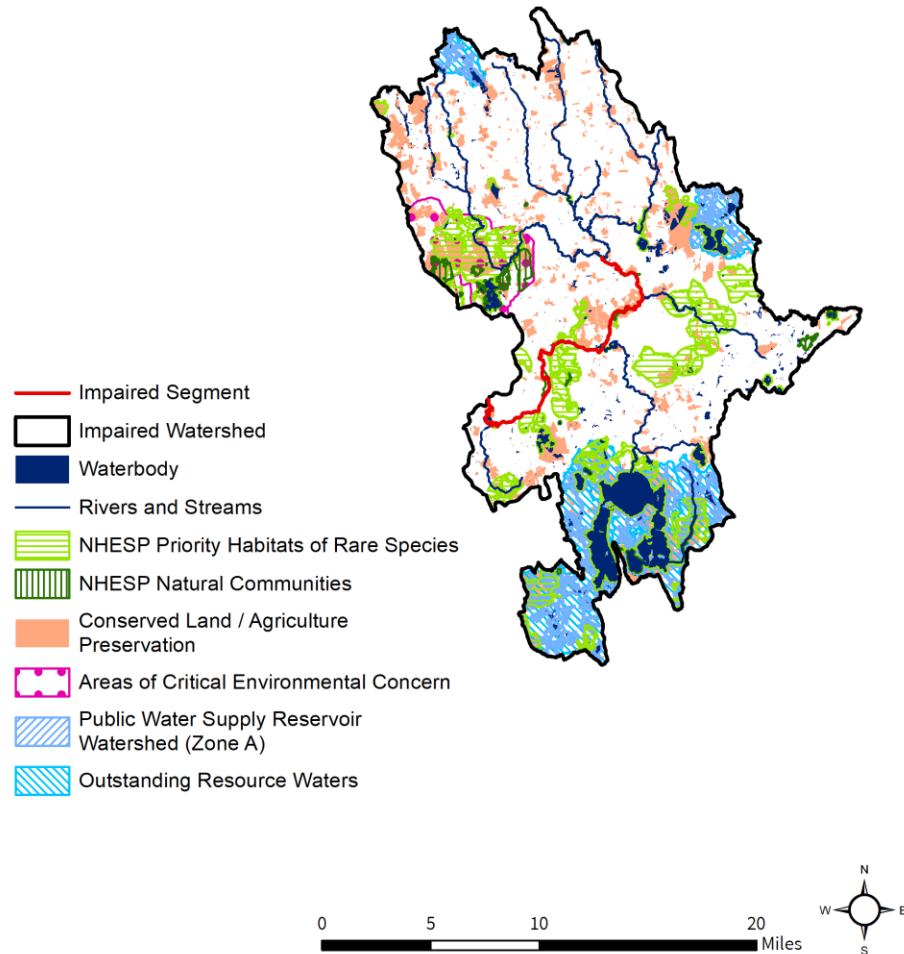
³ All Protected and Recreational Open Space land is shown on the natural resources map.

Table 3-2. Groundwater discharge permits in the segment watershed. Only permits unique to this segment watershed are shown. PERR = permit number plus renewal number. TYPE = type of groundwater discharge. FLOW = permitted effluent in gallons per day (gpd).

PERR	NAME	TOWN	TYPE	FLOW (GPD)
392-3	KENSINGTON COURT	LAKEVILLE	Sanitary Discharge	39,900
614-3	WALMART	HALIFAX	Sanitary Discharge	7,500
876-1M1	THE RESIDENCES AT LEBARON HILLS	LAKEVILLE	Sanitary Discharge	57,900
910-0	NEMASKET HEALTHCARE CENTER	MIDDLEBORO	Sanitary Discharge	15,300
912-0	KOA CAMPGROUND	MIDDLEBORO	Sanitary Discharge	24,480
919-0	HANNAH B SHAW HOME FOR THE AGED, INC.	MIDDLEBORO	Sanitary Discharge	16,050
970-0	HALIFAX MOBILE HOMES, INC	HALIFAX	Sanitary Discharge	47,300

Taunton River [MA62-01]

NATURAL RESOURCES



Taunton River [MA62-01]

POLLUTANT SOURCES

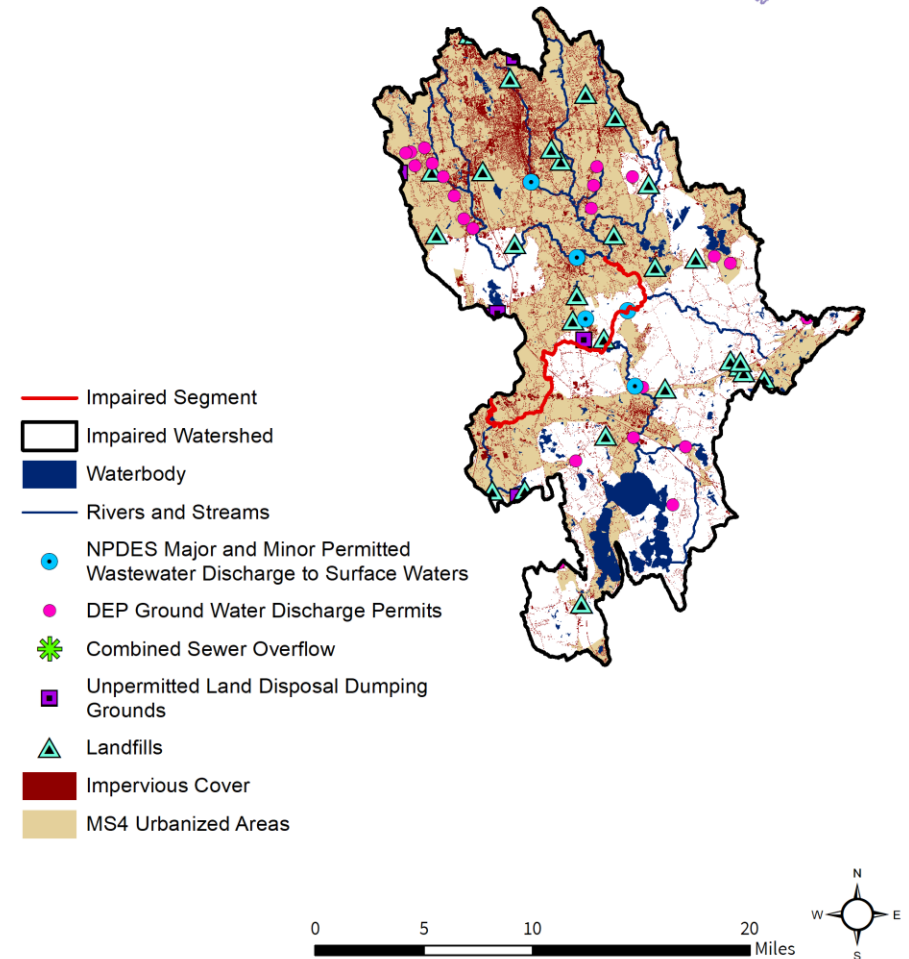


Figure 3-1. Natural resources and potential pollution sources draining to the Taunton River segment MA62-01. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollutant sources, including impervious cover, MS4 areas, permitted facilities, etc.

3.2 Waterbody Impairment Characterization

The Taunton River (MA62-01) is a Class B, Warm Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS at the stations listed below (refer to Tables 3-3, 3-4; Figure 3-2) using the indicator bacteria *E. coli*. Data were evaluated against the SWQS geomean criterion of 126 CFU/100 mL for *E. coli* indicator bacteria and the Statistical Threshold Value (STV) criterion of 410 CFU/100 mL for *E. coli*. The geomean and STV criteria for the impaired segment apply to data on a year-round, 30-day rolling basis.

- In 2006, four samples were collected at W1502; data indicated three days when the 30-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the Statistical Threshold Value (STV) criterion was applied to single sample results. Out of four samples, one exceeded the STV criterion during dry weather.
- In 2006, four samples were collected at W1503; data indicated that the 30-day rolling geomean did not exceed the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of four samples, none exceeded the STV criterion.
- In 2006, four samples were collected at W1504, resulting in no days when the 30-day rolling geomean did not exceed the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of four samples, none exceeded the STV criterion.

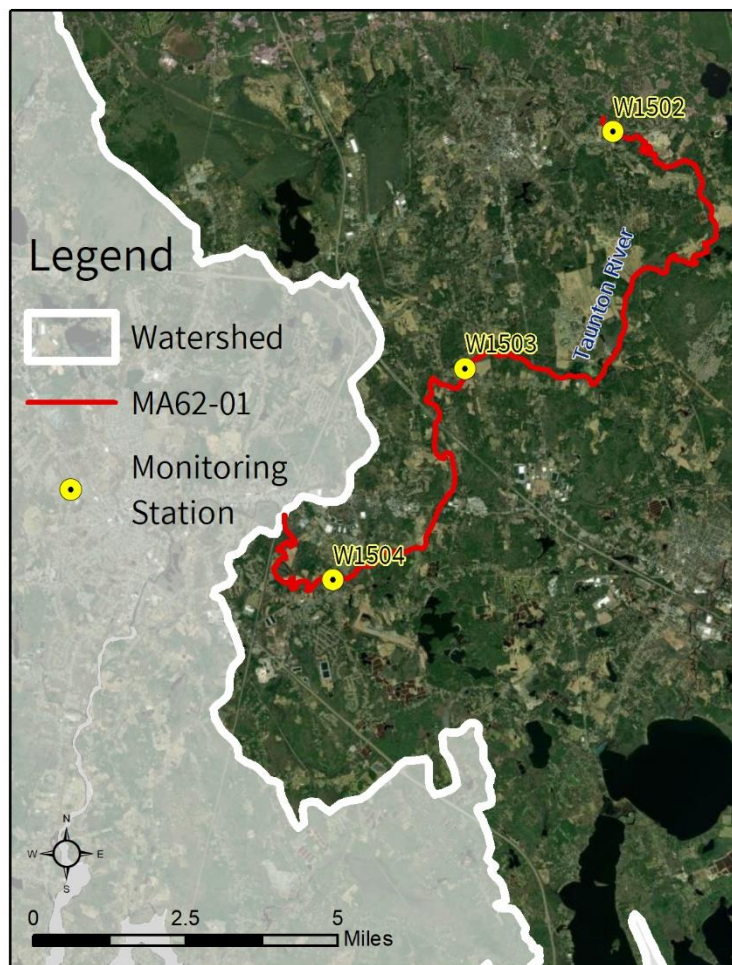


Figure 3-2. Location of monitoring station(s) along the impaired segment.

Table 3-3. Summary of indicator bacteria sampling results by station for the Taunton River (MA62-01). The maximum 30-day rolling geometric mean (geomean), the number of days exceeding the geomean criterion of 126 CFU/100 mL for *E. coli* indicator bacteria, and the number of single samples exceeding the STV criterion of 410 CFU/100 mL for *E. coli* indicator bacteria are shown. The STV criterion is applied to the single sample results if less than 10 samples were collected within a calendar year at a site. The highest maximum 30-day rolling geomean of the site is used to calculate the percent load reduction required to meet SWQS.

Unique Station ID	First Sample	Last Sample	Count	Maximum 30-Day Rolling Geomean (CFU/100mL)	Number Geomean Exceedances	Number STV Exceedances
W1502	5/24/2006	10/5/2006	4	283	3	1
W1503	5/24/2006	10/5/2006	4	75	0	0
W1504	5/24/2006	10/5/2006	4	60	0	0

Table 3-4. Indicator bacteria data by station, indicator, and date for the Taunton River (MA62-01). Each sample date was designated as representing wet or dry weather conditions with wet weather defined as more than 0.5 inches of precipitation in the previous 72 hours. Red text in the Results column highlights criteria exceedances of 410 CFU/100 mL (applied to single-sample “Result” since there were no more than 10 samples in a year to calculate the STV) for *E. coli* indicator bacteria; and red text in the Geomean column highlights exceedances of the 126 CFU/100 mL criterion (applied to rolling 30-day geomean) for *E. coli* indicator bacteria.

Unique Station ID	Indicator	Date	Wet/Dry	Result (CFU/100mL)	30-Day Rolling Geomean (CFU/100mL)	30-Day Rolling STV (CFU/100mL)
W1502	<i>E. coli</i>	5/24/2006	DRY	260	260	
W1502	<i>E. coli</i>	8/9/2006	DRY	180	180	
W1502	<i>E. coli</i>	9/14/2006	DRY	50	50	
W1502	<i>E. coli</i>	10/5/2006	DRY	1,600*	283	
W1502	Fecal Coliform	5/24/2006	DRY	310		
W1502	Fecal Coliform	8/9/2006	DRY	210		
W1502	Fecal Coliform	9/14/2006	DRY	150		
W1502	Fecal Coliform	10/5/2006	DRY	1,600*		
W1503	<i>E. coli</i>	5/24/2006	DRY	75	75	
W1503	<i>E. coli</i>	8/9/2006	DRY	60	60	
W1503	<i>E. coli</i>	9/14/2006	DRY	40	40	
W1503	<i>E. coli</i>	10/5/2006	DRY	45	42	
W1503	Fecal Coliform	5/24/2006	DRY	75		
W1503	Fecal Coliform	8/9/2006	DRY	60		
W1503	Fecal Coliform	9/14/2006	DRY	60		
W1503	Fecal Coliform	10/5/2006	DRY	70		
W1504	<i>E. coli</i>	5/24/2006	DRY	50	50	
W1504	<i>E. coli</i>	8/9/2006	DRY	60	60	
W1504	<i>E. coli</i>	9/14/2006	DRY	45	45	
W1504	<i>E. coli</i>	10/5/2006	DRY	25	34	
W1504	Fecal Coliform	5/24/2006	DRY	55		
W1504	Fecal Coliform	8/9/2006	DRY	60		
W1504	Fecal Coliform	9/14/2006	DRY	75		
W1504	Fecal Coliform	10/5/2006	DRY	65		

* Value above the Method Detection Limit (MDL) of 1,600 CFU/100mL; the MDL is reported and used to calculate the geometric means for *E. coli*.

3.3 Potential Pathogen Sources

Comparing data collected during wet weather versus dry weather conditions provides an indication of the types of sources present, information that can be used to focus pollutant reduction activities. Pathogen levels (as

estimated by indicator bacteria) are usually higher in wet weather conditions as storm sewer systems overflow and/or stormwater runoff carries fecal matter that has accumulated on the landscape to surface waters via overland flow and stormwater conduits. Wet weather sources include wildlife and domesticated animal waste (including pets), urban stormwater runoff (including MS4 areas), CSOs, and sanitary sewer overflows (SSOs). In other cases, dry weather pathogen and associated indicator bacteria concentrations can be high when there is a constant flow of pollutants during dry weather, which then becomes diluted during periods of precipitation. Dry weather sources include leaking sewer pipes, illicit connections of sanitary sewers to storm drains, failing septic systems, recreational use (such as swimmers), and direct wildlife and domesticated animal waste (including pets).

Indicator bacteria data for the Taunton River (MA62-01) were elevated during dry weather (wet weather data were not available). Elevated results during dry weather suggest that baseflow sources, such as leaking pipes, illegal cross connections, other illicit discharges, and failing septic systems, are likely to be major sources of pathogens. Additional sampling under wet conditions would likely help identify other pollutant sources.

Each potential pathogen source is described in further detail below.

Urban Stormwater: There is a moderate amount of development in the watershed (22%) consisting of residential areas as well as industrial and commercial development in larger town centers. 56% of the land area is subject to MS4 permit conditions, 11% is classified as impervious area, and 6% is classified as DCIA. Stormwater runoff from urban areas is a likely source of pathogens.

Illicit Sewage Discharges: Public sewer service is available in the watershed within Abington, Avon, Bridgewater, Brockton, Easton, Holbrook, Middleborough, New Bedford, Raynham, Rockland, Stoughton, Taunton, Weymouth, and Whitman. Sewer-related risks to water quality include leaking infrastructure (pipes, pump stations, etc.) and sanitary sewer overflows (SSOs), which may be caused by undersized infrastructure, blockages, or excessive infiltration of groundwater or rainwater into pipes, exceeding system capacity. Illicit connections of wastewater to stormwater conveyances are also a potential source.

On-Site Wastewater Disposal Systems: Some development in the watershed utilizes on-site systems for wastewater treatment. Additionally, there are 20 MassDEP permits for on-site wastewater discharges to groundwater. In addition to these permitted point sources, it is likely that some septic systems are not properly maintained and are discharging untreated effluent to groundwater.

Agriculture: Agricultural activities in the watershed account for a moderate portion (6%) of the total land use. This agricultural land is comprised predominately of cranberry bogs in the southern and eastern portions of the watershed and pasture/hay and cultivated fields in the central and northern portions of the watershed. Manure storage and spreading activities, if not properly conducted, are possible sources of pathogens to waterbodies.

Pet Waste: There are a few residential neighborhoods and nature preserves near the Taunton River segment MA62-01. Conservation lands, parks, and ballfields popular for dog-walking, especially where paths or residential neighborhoods are adjacent to rivers, ponds, or wetlands, represent possible sources of pathogens.

Wildlife Waste: A few open fields and wetland areas are located directly adjacent to the impaired segment. Large mowed areas, fields, or wetlands with a clear sightline to a waterbody may attract large congregations of waterfowl, resulting in elevated indicator bacteria counts in the water.

3.4 Existing Local Management

This section identifies the major municipalities immediately surrounding the impaired segment and its contributing watershed. For a complete view of upstream municipalities and waterbodies, see the map in Figure 2-1.

City of Taunton

The majority of Taunton is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041164), and the city has an EPA-approved Notice of Intent (NOI). The city has mapped 100% of its MS4 system and the year-two Annual Report has been submitted. In 2016, Taunton completed an illicit discharge detection and elimination (IDDE) plan, an erosion and sedimentation control (ESC) plan, and post-construction stormwater regulations. According to the city's NOI, fecal coliform-impaired MS4 receiving waters

include 40 stormwater outfalls into the Taunton River (MA62-02), 16 outfalls into the Three Mile River (MA62-56, though not listed as pathogen-impaired in the 2018/20 IR; and MA62-57), and one outfall into Prospect Hill Pond (MA62149, though indicated as “no uses assessed” in the 2018/20 IR).

Taunton has the following ordinances and bylaws, mostly accessible online via the city website at <https://www.taunton-ma.gov/> (City of Taunton, 2021):

- Wetland protection bylaw
- Stormwater control bylaw
- Pet waste disposal bylaw
- Stormwater Utility: None found

Taunton has a 2019 Comprehensive Master Plan, including a section with an inventory of waterbodies within the city, although it does not specify impairment status. Reducing the environmental impact of stormwater runoff is included as a goal of the city’s public works department and in the sustainable development and practices section. Taunton is facing expensive sewer upgrades necessary to achieve a healthier environment within the city and to mitigate discharges into the Taunton River. Taunton also has a 2015 Open Space and Recreation Plan, meant to inform planning through the year 2022. This plan inventories surface water resources within the town and identifies stormwater runoff as a contributor to water quality issues (City of Taunton, 2021).

Town of Bridgewater

The majority of Bridgewater is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041097), and the town has an EPA-approved Notice of Intent (NOI). The town has mapped 100% of its MS4 system and the year-one and year-two Annual Reports have been submitted. In 2019, Bridgewater completed an erosion and sedimentation control (ESC) plan and post-construction stormwater regulations, but does not yet have an illicit discharge detection and elimination (IDDE) plan. According to the NOI, the Matfield River (MA62-32) receives water from three outfalls and is impaired by fecal coliform.

Bridgewater has the following ordinances and bylaws, mostly accessible online via the town website at <https://www.bridgewaterma.org/> (Town of Bridgewater, 2021):

- Wetland protection bylaw
- A stormwater ordinance
- Pet Waste: None found

No current Master Plan was found online for Bridgewater, although the website provides a 2021 Master Plan update draft. The 2021 Master Plan draft contains sections on impaired waters (p. 143) and the stormwater system (p. 200). Bridgewater has a 2017 Open Space and Recreation Plan, which includes an inventory and analysis of existing water resources and notes the potential for improving water quality through the reduction of stormwater runoff. Bridgewater also has a 2019 Municipal Vulnerability Preparedness Plan, which includes a high priority recommendation to review and update the town’s stormwater ordinance (Town of Bridgewater, 2021).

Town of Halifax

About 70% of Halifax is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041035), and the town has an EPA-approved Notice of Intent (NOI). The town has mapped 100% of its MS4 system and the year-one and year-two Annual Reports have been submitted. No illicit discharge detection and elimination (IDDE) plan was found online for Halifax. Additionally, the town has not completed an erosion and sedimentation control (ESC) plan or the required post-construction stormwater regulations. The town has a Stormwater Management Plan (SWMP) from 2020. According to the NOI, no pathogen-impaired waterbodies are receiving waters for the town’s MS4 system.

Halifax has the following ordinances and bylaws, mostly accessible online via the town website at <http://www.halifax-ma.org/> (Town of Halifax, 2021):

- Wetland protection bylaw
- Stormwater regulation bylaw
- Stormwater Utility: None found

- Pet Waste: None found

Halifax's 2010 Master Plan includes a section on the natural and cultural resources present within the town, including descriptions of the waterbodies. The section also cites the limitations to septic systems in town, where about half of the soils are not suited for on-site waste disposal and other disposal methods are used (III-3). The Master Plan also features an Open Space and Recreation section that includes a list of current public land holdings and outlines tangible conservation goals (Town of Halifax, 2021).

Town of Middleborough

About 60% of Middleborough is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041134), and the town has an EPA-approved Notice of Intent (NOI). The town has mapped 100% of its MS4 system and the year-one and year-two Annual Reports have been submitted. In 2013, Middleborough completed an illicit discharge detection and elimination (IDDE) plan, an erosion and sedimentation control (ESC) plan, and post-construction stormwater regulations. No pathogen-impaired waterbodies were reported on the town's NOI.

Middleborough has the following ordinances and bylaws, mostly accessible online via the town website at <https://www.middleboroughma.gov/> (Town of Middleborough, 2021):

- Stormwater control bylaws and utility fees
- Pet waste disposal by law
- Wetland Protection Bylaw: None Found

Middleborough has a 2002 Master Plan, which includes an inventory of waterbodies and the environmental problems associated with them, to inform planning efforts. This plan also includes a discussion of increasing the implementation of environmental regulatory standards, such as stormwater management requirements (pg. 36). Middleborough has a public sewer system which (as of 2002) served about 30% of the population (pg. 179). Middleborough also has a 2008 Open Space and Recreation Plan (Town of Middleborough, 2021).

Town of Raynham

The majority of Raynham is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041151), and the town has an EPA-approved Notice of Intent (NOI). The town has mapped 100% of its MS4 system and the year-one and year-two Annual Reports have been submitted. In 2019, Raynham completed an illicit discharge detection and elimination (IDDE) plan, an erosion and sedimentation control (ESC) plan, and post-construction stormwater regulations. According to the NOI, there are no pathogen-impaired MS4 receiving waters in the MS4 area.

Raynham has the following ordinances and bylaws, mostly accessible online via the town website at <https://www.town.raynham.ma.us/> (Town of Raynham, 2021):

- Wetland protection bylaw
- Stormwater Control Bylaw and Utility: None Found
- Pet Waste: None found

Raynham has a Master Plan from 2000, with a section on natural resources, including surface waters. Neither impairments nor stormwater are mentioned. The sewer systems around the town are mentioned, but no section outlines sewer infrastructure within the town. An updated Raynham Master Plan is under development (Town of Raynham, 2021).

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