

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

Appendix R: Weymouth & Weir River Basin & Coastal Drainage Area

Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
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December 2024

CN 515.1.18



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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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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 six pathogen-impaired segments in the Weymouth & Weir River Basin & Coastal Drainage Area, hereinafter referred to as the Boston Harbor: Weymouth & Weir watershed (Figure 1-1). The core document and appendix together complete the TMDL for each of these pathogen-impaired segments.

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 in 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 TMDLs for the six Boston Harbor: Weymouth & Weir segments were calculated with the flow-based equation. Refer to Tables 1-1 and 1-2.

Finally, for each 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 Boston Harbor: Weymouth & Weir Watershed Overview section.

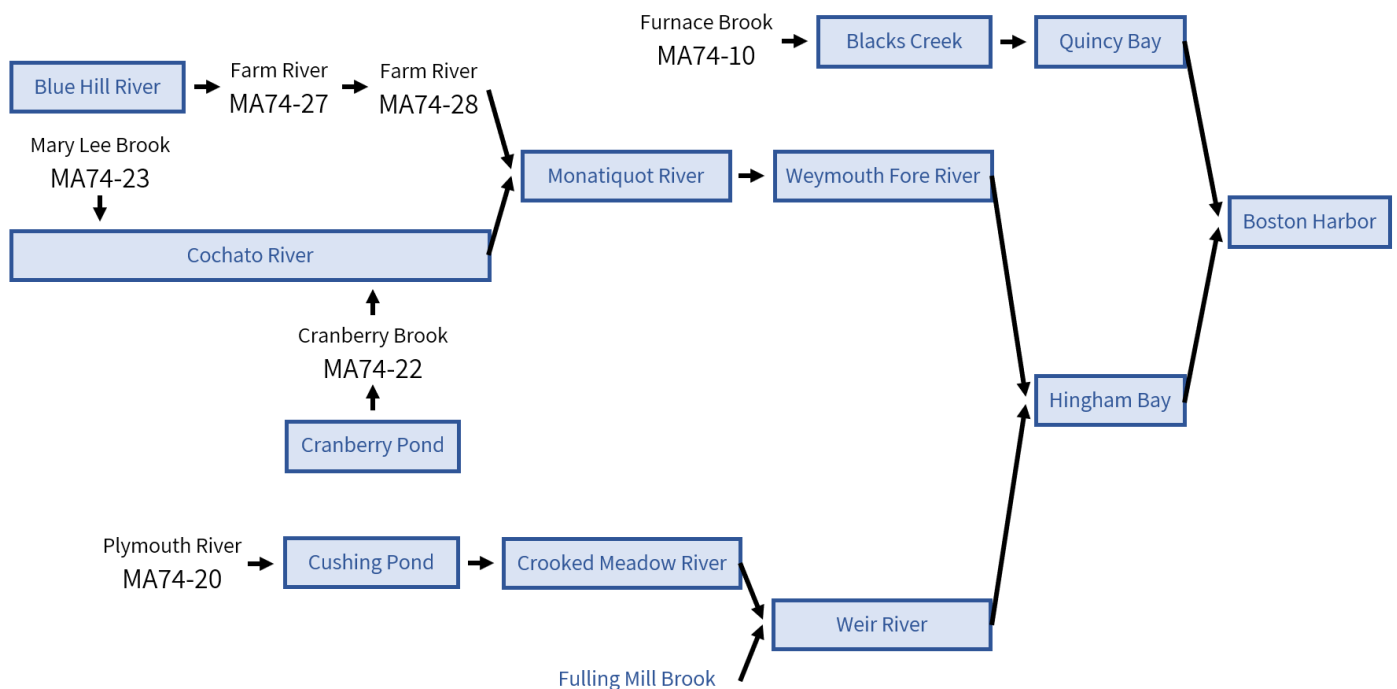


Figure 1-1. Conceptual diagram of water flow through the Boston Harbor: Weymouth & Weir watershed for the six pathogen-impaired segments. Connections between waterbodies are shown with black arrows. Not to scale. Impaired segments are shown with the assessment unit.

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 Weymouth & Weir River Basin and Coastal Drainage Area

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)					
Furnace Brook MA74-10	B	R	126	367 (90 day)	66%	WLA (29%) LA (71%)	0.9 2.2	9.0 21.9	89.6 218.6	896.3 2,186.4	8,962.7 21,864.1	89,626.6 218,641.4
Plymouth River MA74-20	B	R	126	900 (90 day)	86%	WLA (17%) LA (83%)	0.5 2.5	5.4 25.4	53.8 254.5	538.0 2,544.7	5,379.9 25,446.9	53,799.1 254,468.9
Cranberry Brook MA74-22	B (ORW)	R	126	3,700 (90 day)	97%	WLA (18%) LA (82%)	0.5 2.5	5.4 25.4	54.2 254.0	542.5 2,540.2	5,424.8 25,402.0	54,248.1 254,019.9
Mary Lee Brook MA74-23	B	R	126	3,700 (90 day)	97%	WLA (17%) LA (83%)	0.5 2.5	5.4 25.4	53.9 254.4	538.5 2,544.2	5,385.1 25,441.7	53,851.1 254,416.9
Farm River MA74-27	A (PWS, ORW)	R	126	1,500 (90 day)	92%	WLA (21%) LA (79%)	0.6 2.4	6.5 24.4	64.6 243.7	646.0 2,436.6	6,460.4 24,366.4	64,603.9 243,664.1
Farm River MA74-28	B	R	126	43 (90 day)	-	WLA (21%) LA (79%)	0.6 2.4	6.5 24.4	64.5 243.7	645.4 2,437.3	6,454.1 24,372.7	64,540.8 243,727.2

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 Weymouth & Weir River Basin and Coastal Drainage Area

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)					
Furnace Brook MA74-10	B	P	35	NA	-	WLA (29%) LA (71%)	0.2 0.6	2.5 6.1	24.9 60.7	249.0 607.3	2,489.6 6,073.4	24,896.3 60,733.7
Plymouth River MA74-20	B	P	35	NA	-	WLA (17%) LA (83%)	0.1 0.7	1.5 7.1	14.9 70.7	149.4 706.9	1,494.4 7,068.6	14,944.2 70,685.8
Cranberry Brook MA74-22	B (ORW)	P	35	NA	-	WLA (18%) LA (82%)	0.2 0.7	1.5 7.1	15.1 70.6	150.7 705.6	1,506.9 7,056.1	15,068.9 70,561.1
Mary Lee Brook MA74-23	B	P	35	NA	-	WLA (17%) LA (83%)	0.1 0.7	1.5 7.1	15.0 70.7	149.6 706.7	1,495.9 7,067.1	14,958.6 70,671.4
Farm River MA74-27	A (PWS, ORW)	P	35	NA	-	WLA (21%) LA (79%)	0.2 0.7	1.8 6.8	17.9 67.7	179.5 676.8	1,794.6 6,768.4	17,945.5 67,684.5
Farm River MA74-28	B	P	35	NA	-	WLA (21%) LA (79%)	0.2 0.7	1.8 6.8	17.9 67.7	179.3 677.0	1,792.8 6,770.2	17,928.0 67,702.0

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).

ORW = Outstanding Resource Waters; waters designated for protection under 314 CMR 4.04(2);

PWS =Public Water Supply; may be subject to more stringent criteria in accordance with 310 CMR 22.00, and may have restricted use;

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.

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SWQS-Based TMDL Target is the target concentration applicable to the TMDL pollutant indicator bacteria based on 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. Boston Harbor: Weymouth & Weir Watershed Overview

The Boston Harbor: Weymouth & Weir watershed covers an area of approximately 89 square miles (mi²) in eastern Massachusetts (Figure 2-1). It is comprised of five primary river systems: Furnace Brook, Town River, Weymouth Fore River, Weymouth Back River, and Weir River (Reardon, 2010). Of these river systems, Furnace Brook flows into Quincy Bay while the other four flow into Hingham Bay.

Furnace Brook begins at the headwaters north of the Blue Hills Reservoir in Quincy, MA, flowing northeast before draining into Blacks Creek and then Quincy Bay. The Town River System begins at the headwaters of Town Brook in Braintree, MA, where the stream generally flows northeast before draining into the Town River, Town River Bay, Weymouth Fore River, and then Hingham Bay. The Weymouth Fore River System begins at Lake Holbrook in Holbrook, MA, where the Cochato River originates. The Cochato River flows north and joins the Farm River in Braintree, MA to form the Monatiquot River, which flows into the Weymouth Fore River and then Hingham Bay. The Weymouth Back River System begins at the headwaters of the Old Swamp River in Rockland, MA and the Mill River in Weymouth, MA, both of which drain into Whitman Pond. The Weymouth Back River begins at the outlet of Whitman Pond and flows north into the Weymouth Back River Estuary and then Hingham Bay. The Weir River System begins at the headwaters of the Plymouth River in Weymouth, MA, where the river generally flows northeast into Cushing Pond. The Crooked Meadow River flows from Cushing Pond to join Fulling Mill Brook in Hingham, MA to form the Weir River, which flows northeast into The Weir River Estuary and then Hingham Bay (Reardon, 2010).

The Boston Harbor: Weymouth & Weir watershed overlaps a portion of 16 municipalities in Massachusetts. Of these municipalities, only the Town of Braintree is completely contained within the watershed. The majority of Hingham, Holbrook, Quincy, Randolph and Weymouth also lie 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. The networks of drains and pipes in MS4 systems convey polluted runoff from streets and developed areas to surface waters. 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 two Regional Planning Agencies (RPAs) includes the Boston Harbor: Weymouth & Weir watershed, although one of them, the Old Colony Planning Council, only contains a small fraction of the 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 issues such as pathogen pollutants and stormwater that cross town boundaries. These Boston Harbor: Weymouth & Weir watershed RPAs include:

- Metropolitan Area Planning Council (MAPC, 2022)
- Old Colony Planning Council (OCPC, 2022)

The following RPA initiatives and tools utilized in the Boston Harbor: Weymouth & Weir watershed are especially noteworthy:

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

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- 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).

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:

- **Back River Watershed Association (BRWA)** whose mission is to “preserve, protect, and promote the Back River and its watershed in Weymouth, Hingham and parts of Abington, Rockland and Braintree” (BRWA, 2022).
- **Fore River Watershed Association (FRWA)** whose mission is to “restore, protect, enhance, and promote the resources of the Fore River and its watershed” (FRWA, 2022).
- **Weir River Watershed Association (WRWA)** is a “501(3)c nonprofit group committed to promoting awareness and stewardship of the Weir River Watershed” (WRWA, 2022).
- **Massachusetts Office of Coastal Zone Management (CZM)** has a Boston Regional office that “serves the coastal communities from Winthrop to Weymouth.” (CZM, 2022a).
- **Trout Unlimited (TU)** operates two chapters in the geographic area of the Boston Harbor: Weymouth & Weir watershed, including the Southeastern Mass (SEMASS) and the Greater Boston. Their mission is to conserve, protect and restore our country’s coldwater fisheries and their watersheds; some of their activities include river cleanups, scientific assessments (e.g., trout habitat, culvert connectivity) and restoration projects (TU, 2022).

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.

Sanitary wastes associated with boating activities are a potential source of pathogens to surface waters. Since 2014, all Massachusetts waters are designated as a No-Discharge Zone (NDZ) in which the discharge of boat sewage is prohibited. Many free boat pump-out services are available at various sites along the coast, funded by the Clean Vessel Act. The Massachusetts CZM webpage maintains online maps of these boat pump-out facilities, and the Clean Vessel Act Program offers a *Boaters Pocket Guide to Pumpout Facilities* (CZM, 2022b). Any sewage discharges from boats or boating infrastructure in the waters covered by this TMDL are therefore illicit discharges

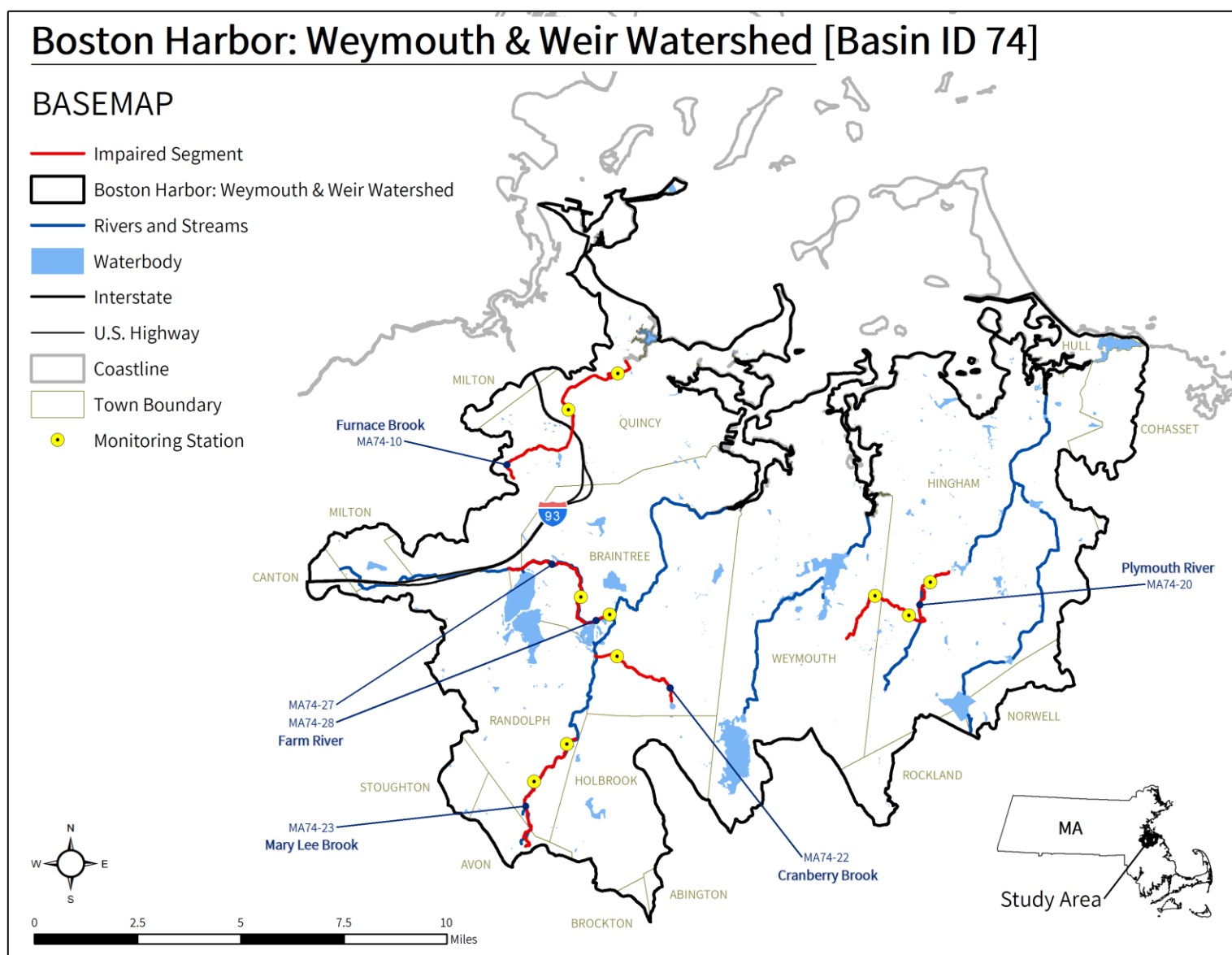


Figure 2-1: Map of all pathogen-impaired segments, water quality monitoring stations, municipal borders, waterbodies, and major roads in the Boston Harbor: Weymouth & Weir watershed.

3. MA74-10 Furnace Brook

3.1. Waterbody Overview

Furnace Brook segment MA74-10 is 4.2 miles long and begins north of Blue Hills Reservoir in Quincy, MA. The segment flows northeast before ending at the confluence with Blacks Creek in Quincy, MA.

Tributaries to Furnace Brook segment MA74-10 include an unnamed tributary. Lakes and ponds in the watershed include a few small unnamed waterbodies. Much of the upper segment flows through wetlands and forest, while the remainder of the river flows through a highly-developed landscape. Some portions of this segment are culverted and underground.

Key landmarks in the watershed include the Granite Links golf club and the Furnace Brook Golf Club; Quincy Tennis Club; the Neighborhood Club of Quincy and Tirrell Room function facility; Quincy Auto Action; Adams Montessori School and Jack n' Jill Child Care Centers of West Quincy; Pine Hill Cemetery and Quincy Cemetery; Quincy Quarries Reservation, Blue Hill Range and Blue Hills Skyline hiking trail, Whitwell Street Playground, Cunningham Park; many apartment and condominium complexes; and many other businesses along the Interstate 93 corridor in Quincy. From upstream to downstream, segment MA74-10 is crossed by Wampatuck Road, Bunker Hill Lane, Hayden Street, Furnace Brook Parkway (three times in various locations), Willard Street (three times in various locations), Larry Street, I-93, Miller Street, Cross Street, Copeland Street, Crescent Street, an unnamed road, Reardon Street, Quarry Street, Adams Street, Newport Avenue, Hancock Street, and Armory Street, all in Quincy.

Furnace Brook (MA74-10) drains a total area of 3.9 square miles (mi²), of which 1.1 mi² (29%) are impervious and 0.8 mi² (21%) are directly connected impervious area (DCIA). The watershed is almost entirely served by public sewer systems in Quincy and Milton¹; and 100% of the total land area is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (USEPA, 2020). There are no NPDES permits on file governing point source discharges of pollutants to surface waters,

Reduction from Highest Calculated Geomean: 66%

Watershed Area (Acres): 2,526

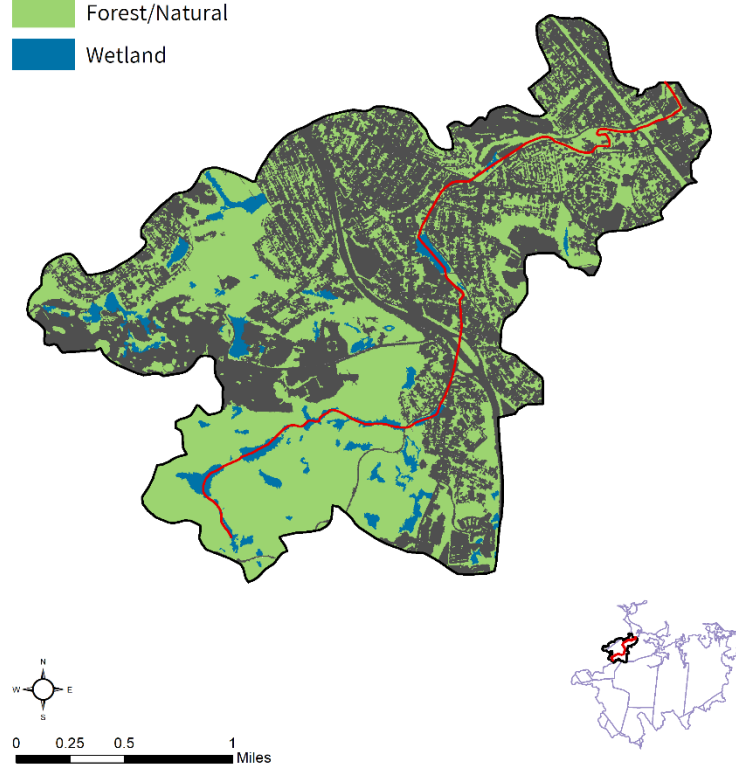
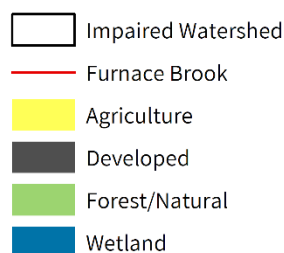
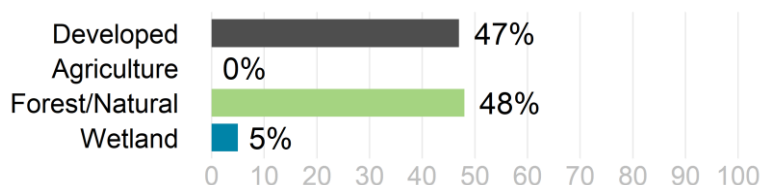
Segment Length (Miles): 4.2

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

Class (Qualifier): B

Impervious Area (Acres, %): 734 (29%)

DCIA Area (Acres, %): 532 (21%)



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.

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MassDEP discharge-to-groundwater permits for on-site wastewater discharges, or combined sewer overflows (CSOs) within the watershed. There are no landfills and one unpermitted land disposal dumping ground within the segment watershed. See Figure 3-1.

The Furnace Brook segment MA74-10 watershed is located in a highly-developed part of Massachusetts. Almost half of the watershed consists of forest and natural lands (48%) and 5% consists of wetland areas. The remainder of the watershed is covered by development (47%) consisting of high density residential areas, as well as industrial and commercial development. There is no agricultural activity within the watershed.

In the Furnace Brook (MA74-10) watershed, under the Natural Heritage and Endangered Species Program, there are 542 acres (21%) of Priority Habitats of Rare Species and no Priority Natural Vegetation Communities. There are also no acres under Public Water Supply protection, within Areas of Critical Environmental Concern, or Outstanding Resource Waters. Overall, there are 648 acres (26%) of land protected in perpetuity², part of 1,046 acres (41%) of Protected and Recreational Open Space³. See Figure 3-1.

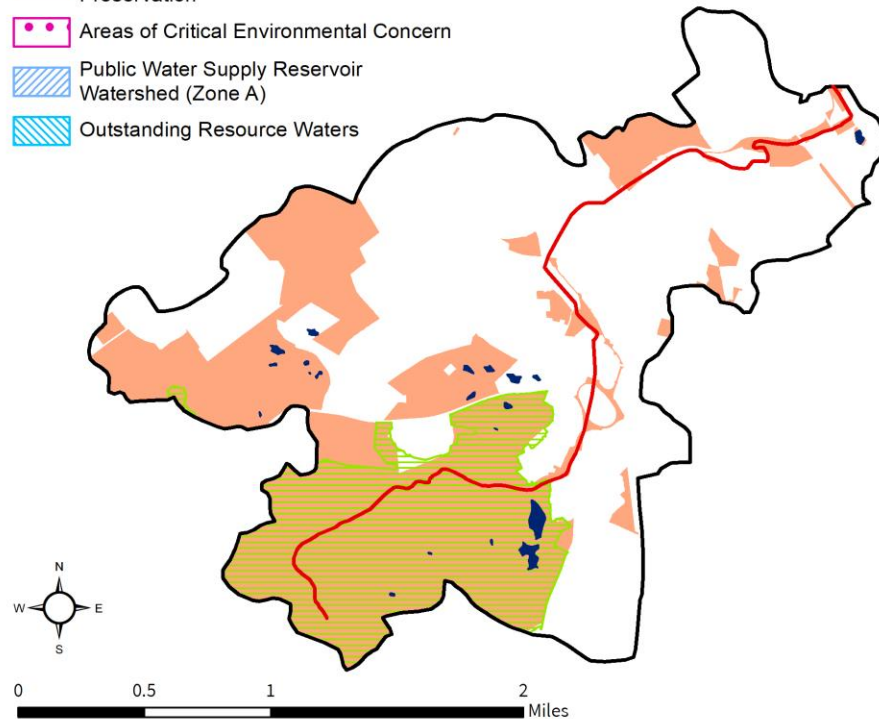
² Land protected in perpetuity includes conservation restrictions, agricultural preservation, private deed restrictions, wetland restrictions, aquifer protection, historic preservation, etc. Refer to Mass GIS metadata for the Protected and Recreational Open Space data layer.

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

Furnace Brook [MA74-10]

NATURAL RESOURCES

- Impaired Segment
- Impaired Watershed
- Waterbody
- Rivers and Streams
- ▨ NHESP Priority Habitats of Rare Species
- ▨ NHESP Natural Communities
- Conserved Land / Agriculture Preservation
- Areas of Critical Environmental Concern
- ▨ Public Water Supply Reservoir Watershed (Zone A)
- ▨ Outstanding Resource Waters



Furnace Brook [MA74-10]

POLLUTANT SOURCES

- Impaired Segment
- Impaired Watershed
- Waterbody
- Rivers and Streams
- NPDES Major and Minor Permitted Wastewater Discharge to Surface Waters
- DEP Ground Water Discharge Permits
- ✱ Combined Sewer Overflow
- Unpermitted Land Disposal Dumping Grounds
- ▲ Landfills
- Impervious Cover
- MS4 Urbanized Areas

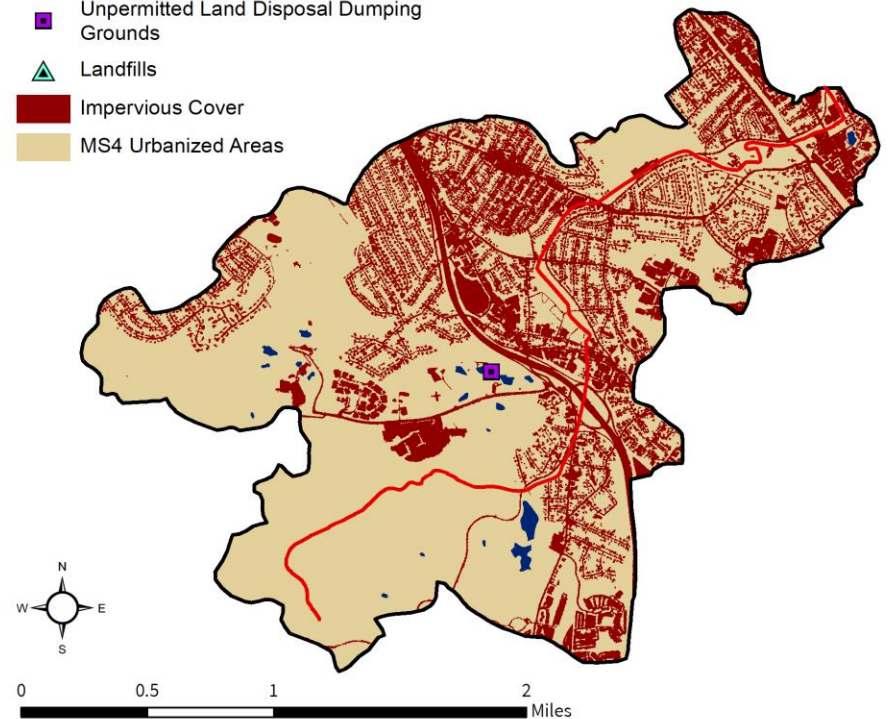


Figure 3-1. Natural resources and potential pollution sources draining to the Furnace Brook segment MA74-10. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollutant sources, including impervious cover, MS4 areas, permitted facilities, etc.

3.2. Waterbody Impairment Characterization

Furnace Brook (MA74-10) is a Class B Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS at the station listed below (refer to Tables 3-1, 3-2; 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, 90-day rolling basis.

- In 2009, six samples were collected at W2026; data indicated six days when the 90-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 six samples, two exceeded the STV criterion during dry weather.
- In 2009, six samples were collected at W2027; data indicated six days when the 90-day rolling geomean exceeded 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 six samples, one exceeded the STV criterion during dry weather.

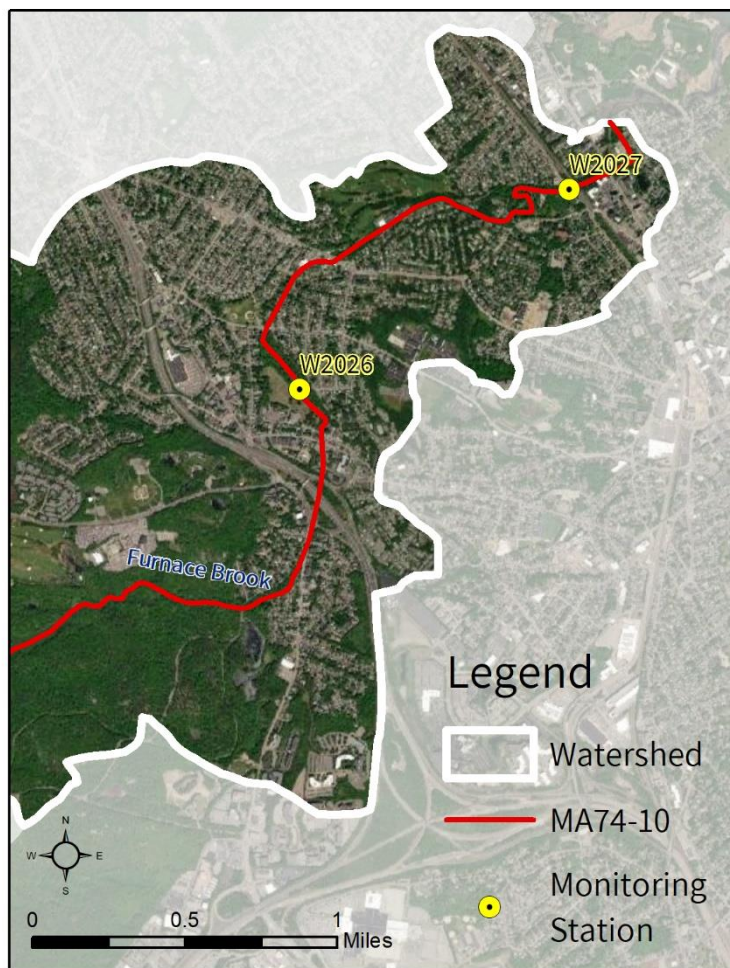


Figure 3-2. Location of monitoring station(s) along the impaired segment.

Table 3-1. Summary of indicator bacteria sampling results by station for Furnace Brook (MA74-10). The maximum 90-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 90-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 90-Day Rolling Geomean (CFU/100mL)	Number Geomean Exceedances	Number STV Exceedances
W2026	5/5/2009	9/22/2009	6	367	6	2
W2027	5/5/2009	9/22/2009	6	325	6	1

Table 3-2. Indicator bacteria data by station, indicator, and date for Furnace Brook (MA74-10). 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 90-day geomean) for *E. coli* indicator bacteria.

Unique Station ID	Indicator	Date	Wet/Dry	Result (CFU/100mL)	90-Day Rolling Geomean (CFU/100mL)	90-Day Rolling STV (CFU/100mL)
W2026	<i>E. coli</i>	5/5/2009	WET	140	140	
W2026	<i>E. coli</i>	6/9/2009	DRY	420	242	
W2026	<i>E. coli</i>	7/14/2009	DRY	280	254	
W2026	<i>E. coli</i>	8/18/2009	DRY	420	367	
W2026	<i>E. coli</i>	9/10/2009	DRY	360	349	
W2026	<i>E. coli</i>	9/22/2009	DRY	100	255	
W2027	<i>E. coli</i>	5/5/2009	WET	140	140	
W2027	<i>E. coli</i>	6/9/2009	DRY	510	267	
W2027	<i>E. coli</i>	7/14/2009	DRY	270	268	
W2027	<i>E. coli</i>	8/18/2009	DRY	250	325	
W2027	<i>E. coli</i>	9/10/2009	DRY	170	226	
W2027	<i>E. coli</i>	9/22/2009	DRY	310	244	

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 Furnace Brook (MA74-10) were elevated during dry weather. 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 the major sources of pathogens.

Each potential pathogen source is described in further detail below.

Urban Stormwater: There is a large amount of development in the watershed (47%), consisting of high-density residential areas as well as industrial and commercial development. 100% of the land area is subject to MS4 permit conditions, 29% is classified as impervious area, and 21% is classified as DCIA. Stormwater runoff from urban areas is likely a substantial source of pathogens.

Illicit Sewage Discharges: Sewer service is widely available in the watershed within Quincy and Milton. 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: Although most of the watershed has public sewer available, Milton indicated in 2014 that 5% of the town was not served by public sewer. Thus, there appears to be a small portion of development in the watershed that utilizes on-site systems for wastewater treatment. It is likely that some septic systems are not properly maintained and are discharging untreated effluent to groundwater.

Agriculture: According to land use maps, there is no agricultural activity in the watershed. As a result, stormwater runoff from agricultural land is not a likely source of pathogens to the impaired segment.

Pet Waste: There are many residential neighborhoods and a few parks near the Furnace Brook segment MA74-10. Conservation lands, cemeteries, 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 wetland areas and mowed recreational lands are 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 Quincy

All of Quincy is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041081). The city has mapped 100% of its MS4 system and the year-one and year-two Annual Reports have been submitted. In 2005, Quincy 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 27 outfalls to Town Brook (MA74-09), 21 outfalls to the Town River Bay (MA74-15), and 44 outfalls to the Weymouth Fore River (MA74-14), all pathogen-impaired based on fecal coliform data.

Quincy has the following ordinances and bylaws, mostly accessible online via the town website <https://www.quincyma.gov> (City of Quincy, 2021):

- Stormwater control bylaw and utility fee;
- Wetland protection bylaw; and
- Pet waste control bylaws.

No city-wide Master Plan or Open Space and Recreation Plan was found online for Quincy. The city maintains a Storm Drain Management Program webpage with Stormwater Management Program (SWMP), MS4 annual reports and the MS4 NOI, water quality sampling results, an SSO inventory, IDDE investigation and abatement reports, and a 2021 Nutrient Source Identification Report for Quincy by the Neponset River Watershed Association (NepRWA; City of Quincy, 2021).

The City of Quincy was awarded a grant under Section 604(b) of the Clean Water Act for Federal Fiscal Year 2019 (Project 19-02 604b). The City of Quincy, in partnership with the Neponset River Watershed Association, will identify, prioritize, and inspect town-owned properties to determine suitability for the installation of structural stormwater Best Management Practices (BMPs). Conceptual designs for potential future implementation projects will be produced for the top three priority sites. (MassDEP 2021c).

Town of Milton

All of Milton is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041079), and the town has an EPA-approved Notice of Intent (NOI). The town has mapped 97% of its MS4 system and the year-one and year-two Annual Reports have been submitted. Milton completed an illicit discharge detection and elimination (IDDE) plan in 2003, an erosion and a sedimentation control (ESC) plan and post-construction stormwater regulations in 2006. No pathogen-impaired waterbodies within the Boston Harbor: Weymouth & Weir watershed were reported on the town's NOI.

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

- Stormwater bylaws;
- Wetland protection bylaw; and
- Pet Waste: None found.

APPENDIX R: Weymouth & Weir River Basin & Coastal Drainage Area

The 2014 Milton Master Plan includes language aimed at protecting the environment through adopting more sustainable municipal actions. The plan states that 95% of town residents are connected to Milton's public sewer system. The plan includes action items to control the quality and quantity of stormwater runoff, including continued implementation of the town's Storm Water System Improvement Plan and ongoing efforts to establish a Stormwater Utility (Part 1, pg. 193). The Department of Public Works received a grant to establish a regional stormwater collaborative with MAPC. No separate Open Space and Recreation Plan was found (Town of Milton, 2021).

4. MA74-20 Plymouth River

4.1. Waterbody Overview

Plymouth River segment MA74-20 is 3.6 miles long and begins north of Route 3 (Pilgrim Highway) in Weymouth, MA. The segment flows generally northeast before ending at the Cushing Pond inlet in Hingham, MA.

Tributaries to Plymouth River segment MA74-20 include a few unnamed streams and Eel River. Lakes and ponds in the watershed include several small unnamed ponds. Much of the river flows through wetland areas surrounded by development. A large section of the segment is channelized and culverted under highly-developed areas.

Key landmarks in the watershed include the Black Rock Country Club and Boston Golf Club; South Shore Dance Academy; Notre Dame Academy and sports fields, Plymouth River Elementary School and tennis courts, Old Colony Montessori School, and East Weymouth Kindercare; Sarah Brassil Playground, Bradford Hawes Park, and the Ward Street Fields; J.F. Price landscaping supply store, Aggregate Industries, a portion of the Derby Street Shops shopping center, and a commercial office park along Woodrock Road in Weymouth; assisted living facilities such as The Residence at Penniman Hill and Linden Ponds Senior Living Community; many residential neighborhoods; and the Eel River Reservation and Plymouth River Complex and nature trails. From upstream to downstream, segment MA74-20 flows through a culvert beneath Moore Road (Weymouth), Woodrock Road (Weymouth), and Washington Street/MA-53 (Weymouth); the river then resurfaces and is crossed by Colonels Lane (Weymouth), Colonels Drive (Weymouth), Olde Quarry Way (Hingham), an unnamed road (Hingham), and Ward Street (Hingham).

Plymouth River (MA74-20) drains a total area of 4.2 square miles (mi²), of which 0.7 mi² (17%) are impervious and 0.5 mi² (11%) are directly connected impervious area (DCIA). The watershed is partially served by public sewer systems in Hingham and Weymouth⁴. 100% of the total land area is subject to stormwater regulations under the NPDES General MS4 Stormwater

Reduction from Highest Calculated Geomean: 86%

Watershed Area (Acres): 2,711

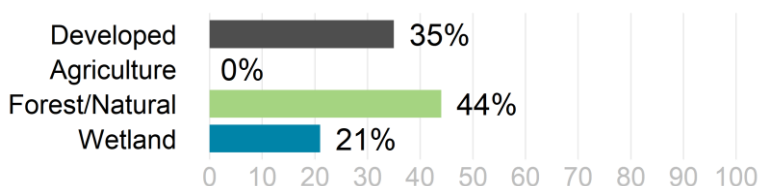
Segment Length (Miles): 3.6

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

Class (Qualifier): B

Impervious Area (Acres, %): 473 (17%)

DCIA Area (Acres, %): 295 (11%)



Impaired Watershed

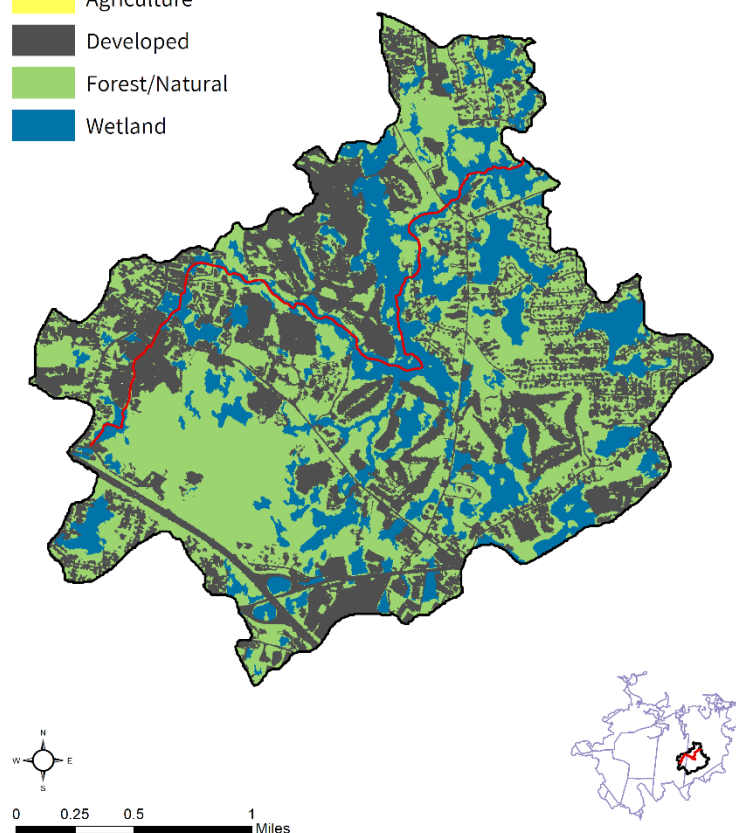
Plymouth River

Agriculture

Developed

Forest/Natural

Wetland



⁴ 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.

Permit (USEPA, 2020). There are no NPDES permits on file governing point source discharges of pollutants to surface waters, four MassDEP discharge-to-groundwater permits for on-site wastewater discharge, and no combined sewer overflows (CSOs) within the watershed (Table 4-1). There are no landfills or unpermitted land disposal dumping grounds either. See Figure 4-1.

The Plymouth River segment MA74-20 watershed is in a moderately-developed part of Massachusetts. About half of the watershed consists of forest and natural lands (44%) and 21% consists of wetland areas. The remainder of the watershed is covered by development (35%); there is no agricultural activity within the watershed. The development consists of residential areas as well as industrial and commercial development.

In the Plymouth River (MA74-20) watershed, under the Natural Heritage and Endangered Species Program, there are no Priority Habitats of Rare Species or Priority Natural Vegetation Communities. There are 24 acres (<1%) under Public Water Supply protection, no Areas of Critical Environmental Concern, and 112 acres (4%) of Outstanding Resource Waters. Overall, there are 107 acres (4%) of land protected in perpetuity⁵, part of 163 acres (6%) of Protected and Recreational Open Space⁶. See Figure 4-1.

Table 4-1. Groundwater discharge permits in the segment watershed. Only permits unique to this segment 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)
703-2	BLACK ROCK GOLF COMMUNITY	HINGHAM	Sanitary Discharge	56,065
736-2	DERBY STREET SHOPPES	HINGHAM	Sanitary Discharge	54,000
772-1	LINDEN PONDS AT HINGHAM	HINGHAM	Sanitary Discharge	306,000
976-0	THE RESIDENCE AT PENNIMAN HILL	HINGHAM	Sanitary Discharge	15,300

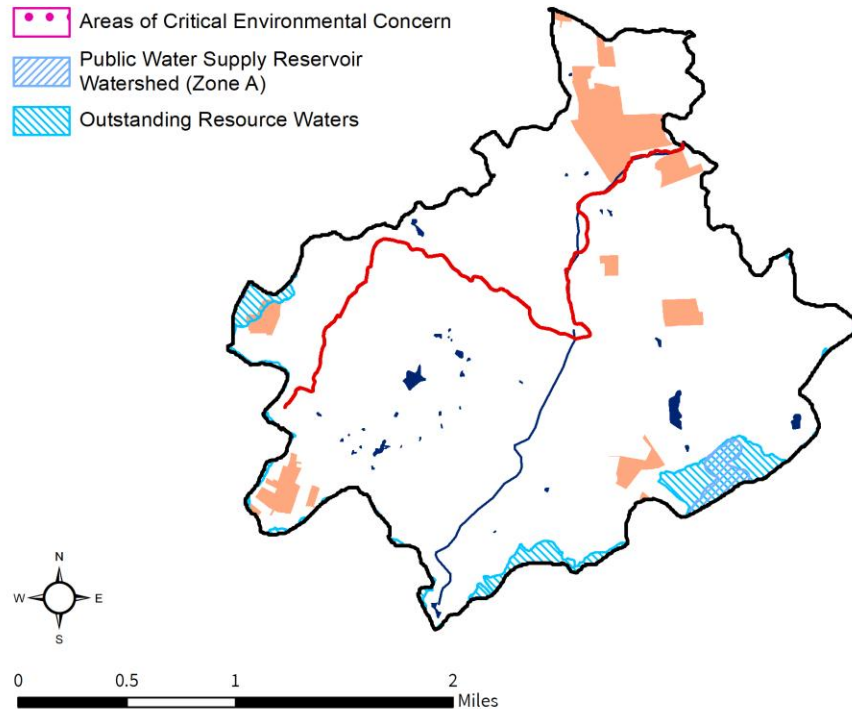
⁵ Land protected in perpetuity includes conservation restrictions, agricultural preservation, private deed restrictions, wetland restrictions, aquifer protection, historic preservation, etc. Refer to Mass GIS metadata for the Protected and Recreational Open Space data layer.

⁶ All Protected and Recreational Open Space land is shown on the natural resources map.

Plymouth River [MA74-20]

NATURAL RESOURCES

- Impaired Segment
- Impaired Watershed
- Waterbody
- Rivers and Streams
- ▨ NHESP Priority Habitats of Rare Species
- ▨ NHESP Natural Communities
- Conserved Land / Agriculture Preservation
- Areas of Critical Environmental Concern
- ▨ Public Water Supply Reservoir Watershed (Zone A)
- ▨ Outstanding Resource Waters



Plymouth River [MA74-20]

POLLUTANT SOURCES

- Impaired Segment
- Impaired Watershed
- Waterbody
- Rivers and Streams
- NPDES Major and Minor Permitted Wastewater Discharge to Surface Waters
- DEP Ground Water Discharge Permits
- ✱ Combined Sewer Overflow
- Unpermitted Land Disposal Dumping Grounds
- ▲ Landfills
- Impervious Cover
- MS4 Urbanized Areas

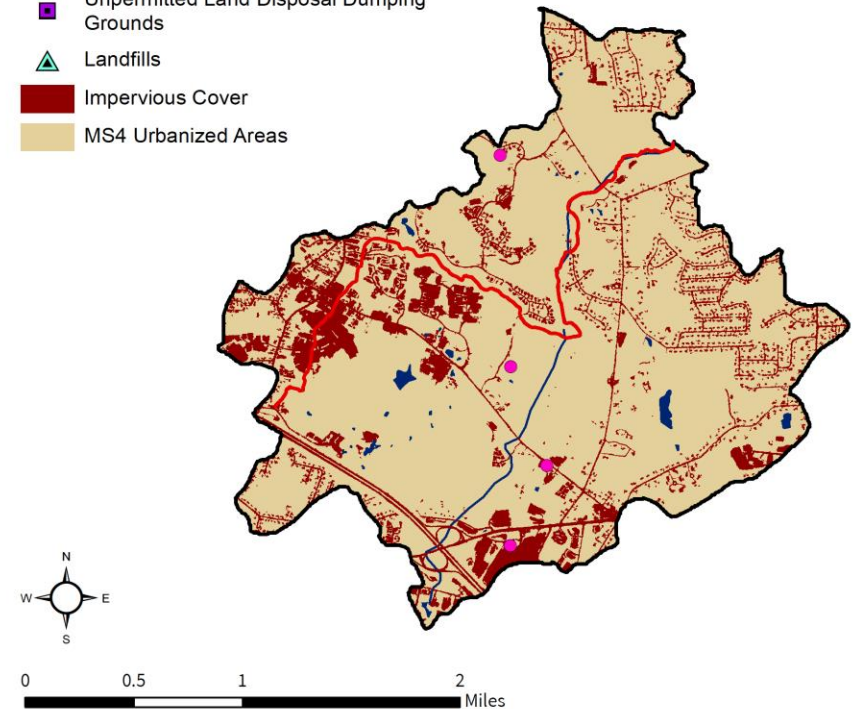


Figure 4-1. Natural resources and potential pollution sources draining to the Plymouth River segment MA74-20. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollutant sources, including impervious cover, MS4 areas, permitted facilities, etc.

4.2. Waterbody Impairment Characterization

The Plymouth River (MA74-20) is a Class B Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS at the station listed below (refer to Tables 4-2, 4-3; Figure 4-2) 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, 90-day rolling basis.

- In 2009, six samples were collected at W2039; data indicated six days when the 90-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 six samples, two exceeded the STV criterion, one during wet weather and one during dry weather.
- In 2018, three samples were collected at W2039; data indicated three days when the 90-day rolling geomean exceeded 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 three samples, none exceeded the STV criterion.
- In 2018, three samples were collected at W2918; data indicated three days when the 90-day rolling geomean exceeded 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 three samples, one exceeded the STV criterion during dry weather.
- In 2018, three samples were collected at W2919; data indicated three days when the 90-day rolling geomean exceeded 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 three samples, one exceeded the STV criterion during dry weather.

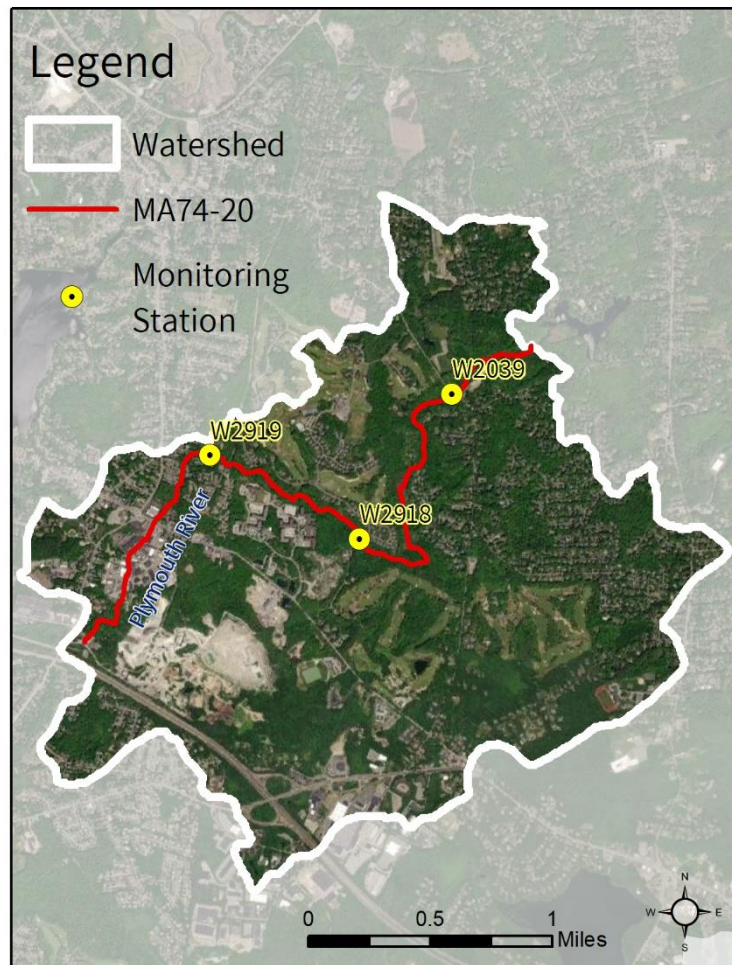


Figure 4-2. Location of monitoring station(s) along the impaired segment.

Table 4-2. Summary of indicator bacteria sampling results by station for the Plymouth River (MA74-20). The maximum 90-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 90-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 90-Day Rolling Geomean (CFU/100mL)	Number Geomean Exceedances	Number STV Exceedances
W2039	5/5/2009	9/22/2009	6	900	6	2
W2039	6/13/2018	7/31/2018	3	218	3	0
W2918	6/13/2018	7/31/2018	3	429	3	1
W2919	6/13/2018	7/31/2018	3	248	3	1

Table 4-3. Indicator bacteria data by station, indicator, and date for the Plymouth River (MA74-20). 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 90-day geomean) for *E. coli* indicator bacteria.

Unique Station ID	Indicator	Date	Wet/Dry	Result (CFU/100mL)	90-Day Rolling Geomean (CFU/100mL)	90-Day Rolling STV (CFU/100mL)
W2039	<i>E. coli</i>	5/5/2009	WET	900	900	
W2039	<i>E. coli</i>	6/9/2009	DRY	280	502	
W2039	<i>E. coli</i>	7/14/2009	DRY	160	343	
W2039	<i>E. coli</i>	8/18/2009	DRY	600	300	
W2039	<i>E. coli</i>	9/10/2009	DRY	310	310	
W2039	<i>E. coli</i>	9/22/2009	DRY	250	294	
W2039	<i>E. coli</i>	6/13/2018	DRY	186	186	
W2039	<i>E. coli</i>	7/2/2018	DRY	162	174	
W2039	<i>E. coli</i>	7/31/2018	DRY	345	218	
W2918	<i>E. coli</i>	6/13/2018	DRY	308	308	
W2918	<i>E. coli</i>	7/2/2018	DRY	261	284	
W2918	<i>E. coli</i>	7/31/2018	DRY	980	429	
W2919	<i>E. coli</i>	6/13/2018	DRY	133	133	
W2919	<i>E. coli</i>	7/2/2018	DRY	461	248	
W2919	<i>E. coli</i>	7/31/2018	DRY	173	220	

4.3. 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 Plymouth River (MA74-20) were elevated during both wet (one data point) and dry weather. Elevated results during wet weather are consistent with urban stormwater, pet waste, and wildlife

pathogen sources, as are certain types of septic system malfunctions, such as rainwater infiltration or saturated disposal fields which overflow during precipitation. 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 the major sources of pathogens.

Each potential pathogen source is described in further detail below.

Urban Stormwater: There is a large amount of development in the watershed (35%), which consists of residential areas as well as industrial and commercial development. 100% of the land area is subject to MS4 permit conditions, 17% is classified as impervious area, and 11% is classified as DCIA. Stormwater runoff from urban areas is a likely source of pathogens.

Illicit Sewage Discharges: Sewer service is available in the watershed within Weymouth and may be available within Hingham. 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 of the development in the watershed utilizes on-site systems for wastewater treatment. Additionally, there are four 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: Land use maps indicate no agricultural activity in the watershed. As a result, stormwater runoff from agricultural land is not a likely source of pathogens to the impaired segment.

Pet Waste: There are many residential neighborhoods and parks near the Plymouth River segment MA74-20. 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: Many large open wetland areas are 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.

4.4. 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.

Town of Hingham

The majority of Hingham is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041038), 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. Hingham completed an illicit discharge detection and elimination (IDDE) plan in 2009, and an erosion and sedimentation control (ESC) plan and post-construction stormwater regulations in 2008. According to the NOI, pathogen-impaired MS4 receiving waters in town include 42 outfalls to the Weir River (MA74-02 and MA74-11) impaired by fecal coliform, and 14 outfalls to the Weymouth Back River (MA74-13), also impaired by fecal coliform. In addition, three outfalls drain to Bouve Pond (tributary to Weymouth Back River (MA74-13), which is not listed as impaired in the 2018/2020 Integrated List.

Hingham has the following ordinances and bylaws, mostly accessible online via the town website <https://www.hingham-ma.gov/> (Town of Hingham, 2021):

- Wetland protection bylaw;
- Stormwater Regulations and Utility: None found; and
- Pet Waste: None found.

Hingham has a 2014 Master Plan update, (although only a draft version was found online), with stated environmental goals for the town. One goal is to update the natural resources section to include modern

technologies, specifically related to energy (pg. 7). The plan prioritizes mitigating stormwater runoff (pg. 28). Hingham also has a 2016 Open Space and Recreation Plan meant to guide planning from 2016-2023. This plan includes an inventory of natural resources including water resources (pg. 23), and an analysis of recreation and conservation needs within Hingham. This section identifies the Weir River as “highly stressed” and that the protection of this resource is paramount (pg. 55; Town of Hingham, 2021).

Town of Weymouth

All of Weymouth (legally a city, but formally named “Town of”) is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041070), 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 2008, Weymouth completed an illicit discharge detection and elimination (IDDE) plan, an erosion and sedimentation control (ESC) plan, and post-construction stormwater regulations. According to the town’s NOI, fecal coliform-impaired MS4 receiving waters include 49 stormwater outfalls to the Mill River (MA74-04), 42 outfalls to the Old Swamp River (MA74-03), 16 outfalls to the Weymouth Back River (MA74-05), 21 outfalls to the Weymouth Back River (MA74-13), and 36 outfalls to the Weymouth Fore River (MA74-14).

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

- Stormwater control ordinance and utility fee;
- Pet waste control ordinance; and
- Weymouth does not have any supplementary regulations beyond the MassDEP regulations for wetland protection.

Weymouth has a 2004 Master Plan, which includes a section about water resources within the town. This section does not specifically identify impaired waterbodies but does identify stormwater as a contributor of fecal coliform. About 90% of the town is served through public sewer systems and the remaining 650 homes have on-site septic systems. As of 2004, all of the town’s sewage is collected in a municipally-managed local sewer system, that then discharges to the MWRA system. The Master Plan also noted that the town’s sewer system experiences ongoing problems common to older sewer systems, including Inflow and Infiltration (I/I); I/I is often associated with sewage leaks that can impact nearby soils, wetlands, and waterbodies (pg. 41-42). The town has a 2014 Open Space and Recreation Plan, which has more in-depth descriptions of individual waterbodies (Town of Weymouth, 2021).

5. MA74-22 Cranberry Brook

5.1. Waterbody Overview

Cranberry Brook segment MA74-22 is 1.9 miles long and begins at the outlet of Cranberry Pond in Braintree, MA. The segment flows northeast before ending at the confluence with the Cochato River, also in Braintree, MA.

Tributaries to Cranberry Brook segment MA74-22 include a few unnamed streams mostly associated with the adjacent wetland areas. Lakes and ponds in the watershed include Cranberry Pond and a few small unnamed waterbodies. Much of the river flows through wetland, forest, and other natural areas. The majority of development adjacent to the segment occurs south of the stream corridor.

Key landmarks in the watershed include the Braintree Fire Department Station 2; the Highlands Elementary School; Thayer Sports Complex; expansive clearings for utility rights-of-way and a large power substation; Devon Wood Condominiums and many residential neighborhoods; Braintree Town Forest, Cranberry Pond natural area, conservation land and trails, and a portion of the Holbrook Town Forest. From upstream to downstream, segment MA74-22 is crossed by Old Liberty Street, Liberty Street, and then Washington Street/MA-37, all in Braintree.

Cranberry Brook (MA74-22) drains a total area of 1.8 square miles (mi²), of which 0.3 mi² (18%) are impervious and 0.2 mi² (11%) are directly connected impervious area (DCIA). The watershed is partially served by public sewer systems in Braintree and Holbrook⁷, and 100% of the total land area is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (USEPA, 2020). There are no NPDES permits on file governing point source discharges of pollutants to surface waters, MassDEP discharge-to-groundwater permits for on-site wastewater discharge, or combined sewer overflows (CSOs) within the watershed. There are no landfills, and one unpermitted land disposal dumping ground within the segment watershed. See Figure 5-1.

The Cranberry Brook segment MA74-22 watershed is located in a moderately-developed

Reduction from Highest Calculated Geomean: 97%

Watershed Area (Acres): 1,165

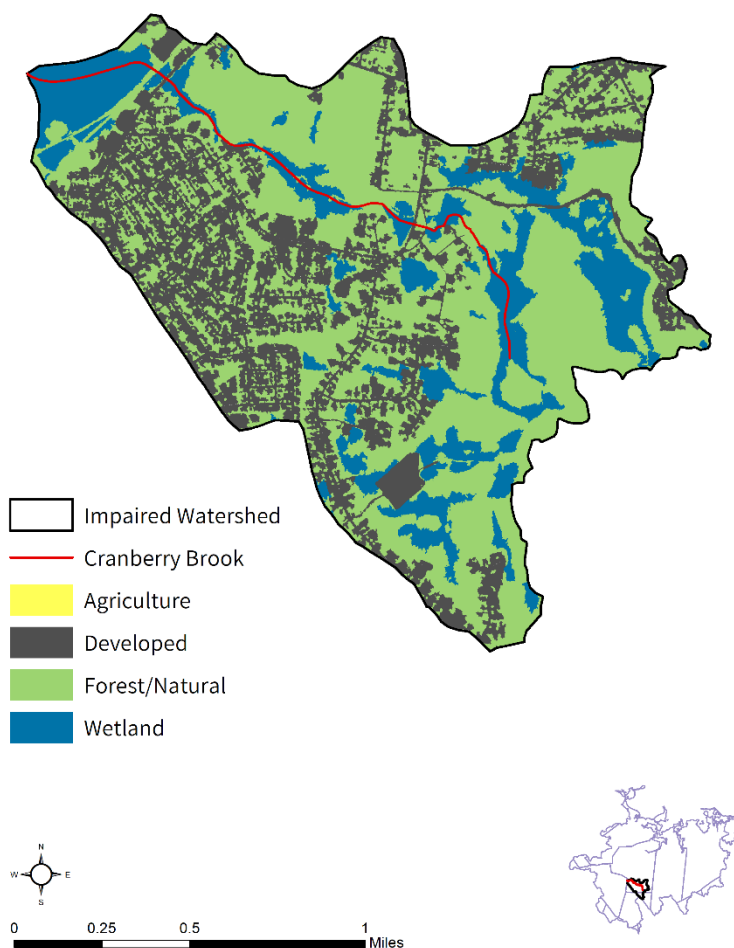
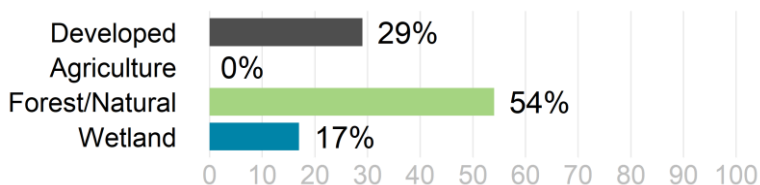
Segment Length (Miles): 1.9

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

Class (Qualifier): B (Outstanding Resource Water)

Impervious Area (Acres, %): 205 (18%)

DCIA Area (Acres, %): 127 (11%)



⁷ 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.

APPENDIX R: Weymouth & Weir River Basin & Coastal Drainage Area

part of Massachusetts. More than half of the watershed consists of forest and natural lands (54%) and 17% consists of wetland areas. The remainder of the watershed is primarily covered by development (29%); there is no agricultural activity. Most of the development consists of residential areas with some industrial and commercial development.

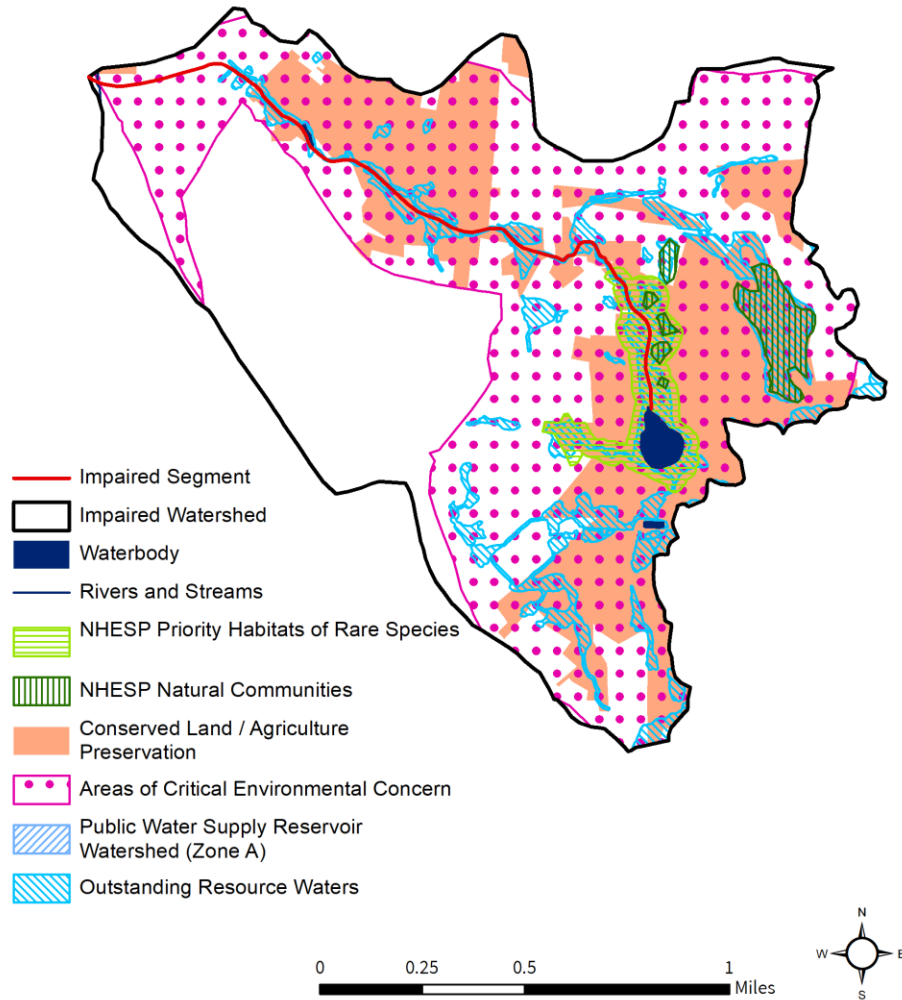
In the Cranberry Brook (MA74-22) watershed, under the Natural Heritage and Endangered Species Program, there are 51 acres (4%) of Priority Habitats of Rare Species and 26 acres (2%) of Priority Natural Vegetation Communities. There are no acres under Public Water Supply protection, 868 acres (74%) within the Cranberry Brook Watershed Area of Critical Environmental Concern, and 135 acres (12%) of Outstanding Resource Waters. Overall, there are 428 acres (37%) of land protected in perpetuity⁸, part of 434 acres (37%) of Protected and Recreational Open Space⁹. See Figure 5-1.

⁸ 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.

⁹ All Protected and Recreational Open Space land is shown on the natural resources map.

Cranberry Brook [MA74-22]

NATURAL RESOURCES



Cranberry Brook [MA74-22]

POLLUTANT SOURCES

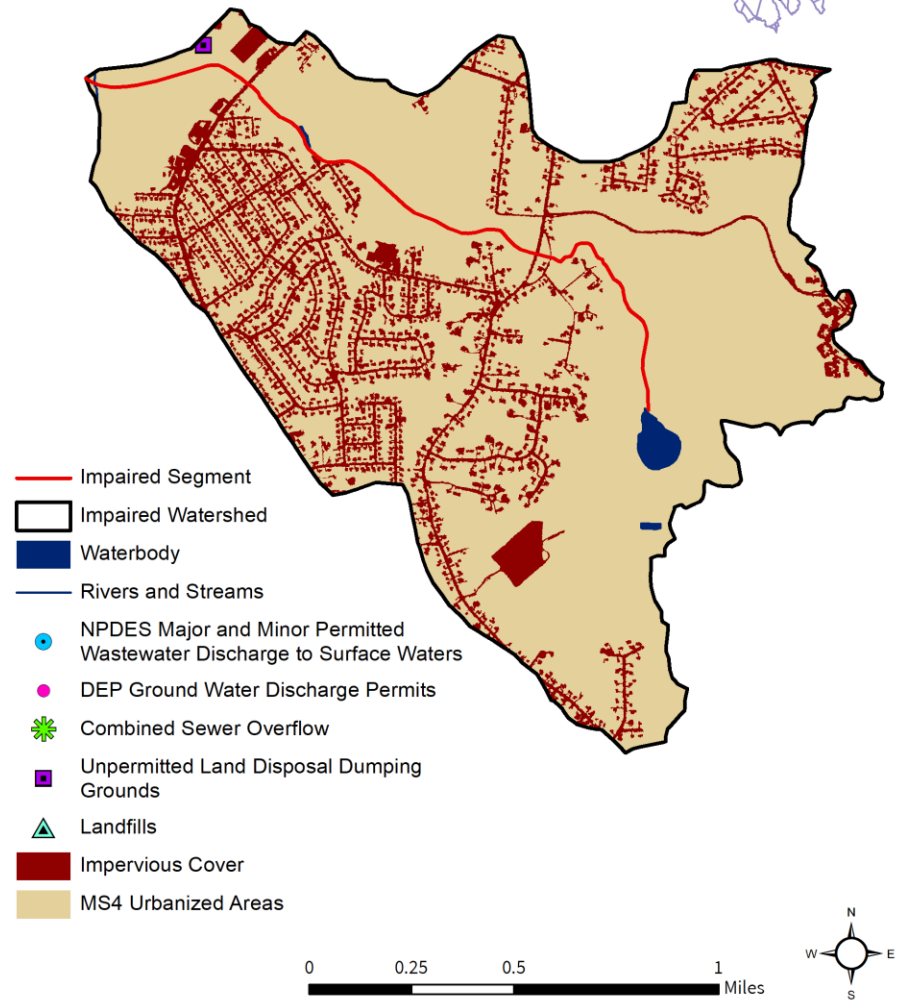


Figure 5-1. Natural resources and potential pollution sources draining to the Cranberry Brook segment MA74-22. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollutant sources, including impervious cover, MS4 areas, permitted facilities, etc.

5.2. Waterbody Impairment Characterization

Cranberry Brook (MA74-22) is a Class B, Outstanding Resource Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS at the station listed below (refer to Tables 5-1, 5-2; Figure 5-2) 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, 90-day rolling basis.

- In 2009, six samples were collected at W2049; data indicated six days when the 90-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 six samples, one exceeded the STV criterion during wet weather. Field crews noted the smell of “raw sewage” and highly turbid water on the May 5th, 2009, sampling date.



Figure 5-2. Location of monitoring station(s) along the impaired segment.

Table 5-1. Summary of indicator bacteria sampling results by station for Cranberry Brook (MA74-22). The maximum 90-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 90-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 90-Day Rolling Geomean (CFU/100mL)	Number Geomean Exceedances	Number STV Exceedances
W2049	5/5/2009	9/22/2009	6	3,700	6	1

Table 5-2. Indicator bacteria data by station, indicator, and date for Cranberry Brook (MA74-22). 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 90-day geomean) for *E. coli* indicator bacteria.

Unique Station ID	Indicator	Date	Wet/Dry	Result (CFU/100mL)	90-Day Rolling Geomean (CFU/100mL)	90-Day Rolling STV (CFU/100mL)
W2049	<i>E. coli</i>	5/5/2009	WET	3,700	3,700	
W2049	<i>E. coli</i>	6/9/2009	DRY	110	638	
W2049	<i>E. coli</i>	7/14/2009	DRY	210	440	
W2049	<i>E. coli</i>	8/18/2009	DRY	120	140	
W2049	<i>E. coli</i>	9/10/2009	DRY	130	149	
W2049	<i>E. coli</i>	9/22/2009	DRY	120	141	

5.3. 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 Cranberry Brook (MA74-22) were elevated during wet weather (one data point). Elevated results during wet weather are consistent with urban stormwater, pet waste, and wildlife pathogen sources, as are certain types of septic system malfunctions, such as rainwater infiltration or saturated disposal fields which overflow during precipitation. Given the relatively small sample set, additional sampling under both wet and dry conditions, ideally at more than one location, would likely help identify specific pollutant sources.

Each potential pathogen source is described in further detail below.

Urban Stormwater: There is a substantial amount of development in the watershed (29%), most of which consists of residential areas with some industrial and commercial development as well. 100% of the land area is subject to MS4 permit conditions, 18% is classified as impervious area, and 11% is classified as DCIA. Stormwater runoff from urban areas is a likely source of pathogens.

Illicit Sewage Discharges: Sewer service is available in the watershed within Braintree and Holbrook. 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 of the development in the watershed utilizes on-site systems for wastewater treatment. It is likely that some septic systems are not properly maintained and are discharging untreated effluent to groundwater.

Agriculture: Land use maps indicate no agricultural activity in the watershed. As a result, stormwater runoff from agricultural land is not a likely source of pathogens to the impaired segment.

Pet Waste: There are many residential neighborhoods and recreation trails near the Cranberry Brook segment MA74-22. 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: Several large open wetland areas are 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.

5.4. 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.

Town of Braintree

The entirety of Braintree (legally a city, but formally named “Town of”) is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041029), 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. Braintree completed an illicit discharge detection and elimination (IDDE) plan in 2018, and an erosion and sedimentation control (ESC) plan and post-construction stormwater regulations in 2004. According to Braintree’s NOI, there are 10 stormwater outfalls to Cranberry Brook (MA74-22) and 11 outfalls to the Farm River (formerly segment MA74-07, it was split into MA74-27 and MA74-28 in the 2018-20 Integrated List), both of which are impaired based on *E. coli* data. Additionally, there are two stormwater outfalls to the Cochato River (MA74-06), 37 outfalls to the Monatiquot River (MA74-08), 10 outfalls to Town Brook (MA74-09), and six outfalls to Weymouth Fore River (MA74-14), all impaired based on enterococcus and fecal coliform data.

Braintree has the following ordinances and bylaws, mostly accessible online via the town website <https://braintreema.gov/> (Town of Braintree, 2022):

- Wetland protection bylaw;
- Stormwater bylaw;
- Pet Waste Control bylaw; and
- Stormwater Utility.

Braintree has a 1998 master plan which has a Natural Resources section. This section mentions multiple water resources but does not specifically address any impairments or stormwater treatment. The goal of protecting natural resources is identified. Recommendations to further protect water resources include expanding wetland protection bylaws and regulations. Braintree also has a 2018 Open Space and Recreation Plan, which includes a comprehensive environmental analysis (Town of Braintree, 2022).

Town of Holbrook

The entirety of Holbrook is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041039), and the town has an EPA-approved Notice of Intent (NOI). The town has mapped 70% of its MS4 system and the year-one and year-two Annual Reports have been submitted. In 2007, Holbrook 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, pathogen impaired MS4 receiving waters include two stormwater outfalls into the Cochato River (MA74-06), which is impaired based on fecal coliform data (now also *E. coli* data).

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

- Wetland protection bylaw;
- Stormwater bylaw and stormwater utility fee; and
- Pet Waste: None found.

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No Master Plan or Open Space and Recreation Plan was found online for the town of Holbrook (Town of Holbrook, 2021).

6. MA74-23 Mary Lee Brook

6.1. Waterbody Overview

Mary Lee Brook segment MA74-23 is 2.7 miles long and begins north of West High Street in Avon, MA. The segment flows northeast before ending at the confluence with the Cochato River in Randolph, MA.

Tributaries to Mary Lee Brook segment MA74-23 include Glovers Brook, Tumbling Brook, and a few unnamed streams. Lakes and ponds in the watershed include a few small unnamed waterbodies. Much of the river flows through wetland areas at the beginning of the segment, then through forest and other natural areas bordered by development.

Key landmarks in the watershed include Martin E. Young Elementary School and fields; Randolph Animal Hospital; Greater Vision Tabernacle Church and Tabernacle of Praise Church; the Randolph Marketplace; as well as Lokitis and South Randolph Conservation Areas. From upstream to downstream, segment MA74-23 is crossed by South Main Street/MA-28, Nightingale Circle, South Street, Union Street/MA-139, Lancaster Road, Wilmarth Road, and Mill Street, all in Randolph.

Mary Lee Brook (MA74-23) drains a total area of 1.4 square miles (mi²), of which 0.25 mi² (17%) are impervious and 0.16 mi² (12%) are directly connected impervious area (DCIA). The watershed is partially served by public sewer systems in Avon and Randolph¹⁰, and 100% of the total land area is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (USEPA, 2020). There are no NPDES permits on file governing point source discharges of pollutants to surface waters, MassDEP discharge-to-groundwater permits for on-site wastewater discharge, or combined sewer overflows (CSOs) within the watershed. There are also no landfills or unpermitted land disposal dumping grounds within the segment watershed. See Figure 6-1.

The Mary Lee Brook segment MA74-23 watershed is located in a moderately-developed part of Massachusetts. About half of the watershed

Reduction from Highest Calculated Geomean: 97%

Watershed Area (Acres): 898

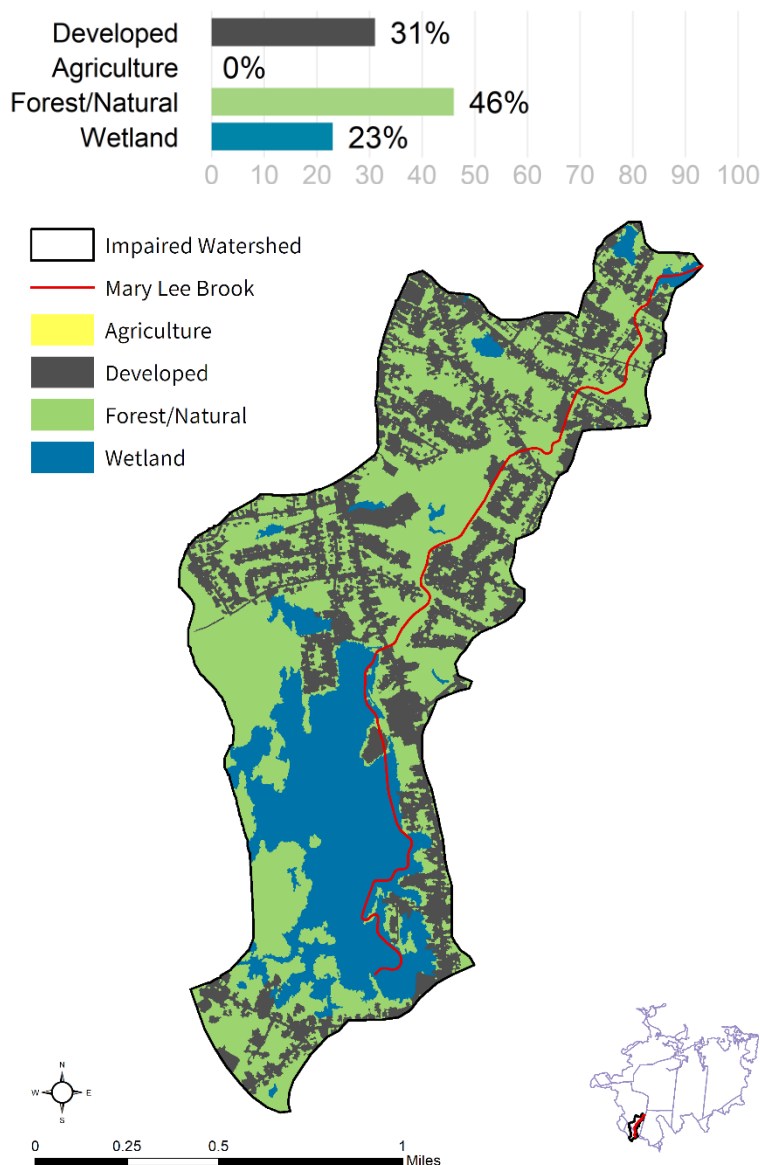
Segment Length (Miles): 2.7

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

Class (Qualifier): B

Impervious Area (Acres, %): 157 (17%)

DCIA Area (Acres, %): 105 (12%)



¹⁰ 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.

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consists of forest and natural lands (46%) and 23% consists of wetland areas. The remainder is primarily covered by development (31%); there is no agricultural activity. Most of the development consists of residential areas with some industrial and commercial development.

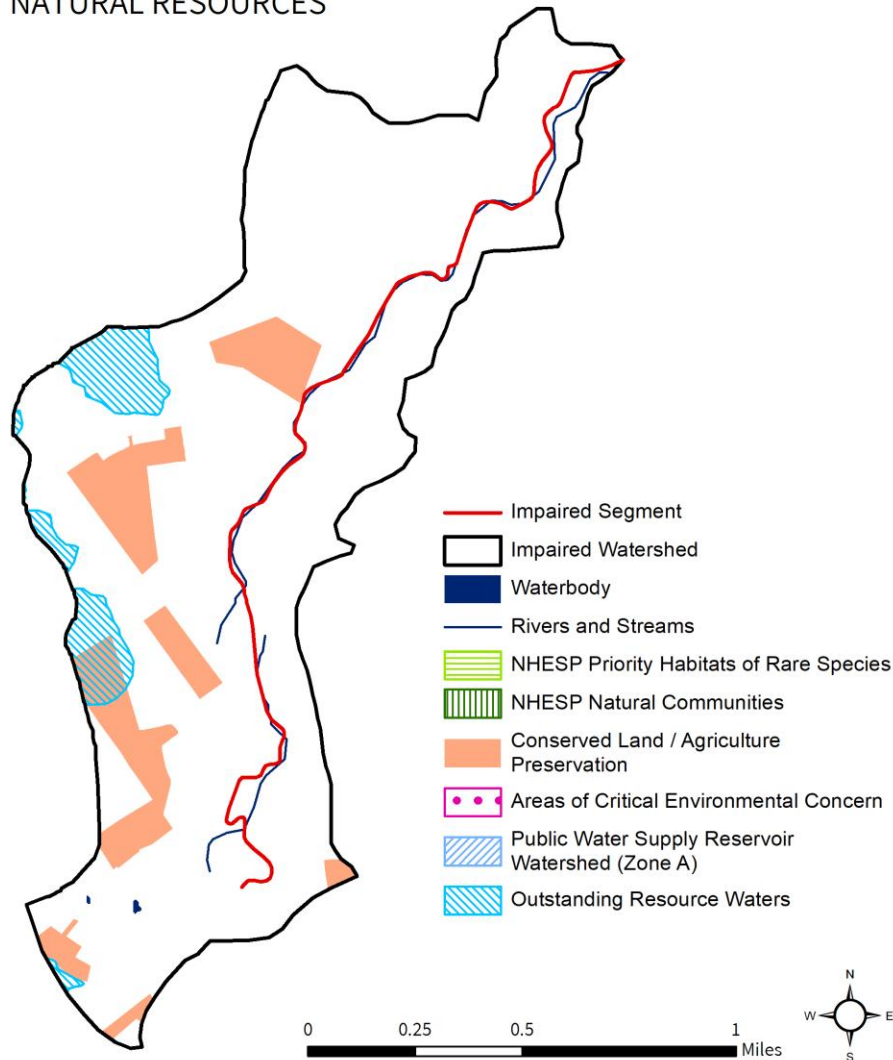
In the Mary Lee Brook (MA74-23) watershed, under the Natural Heritage and Endangered Species Program, there are no Priority Habitats of Rare Species or Priority Natural Vegetation Communities. There are also no acres under Public Water Supply protection or within Areas of Critical Environmental Concern, and 47 acres (5%) of Outstanding Resource Waters. Overall, there are 75 acres (8%) of land protected in perpetuity¹¹, part of 96 acres (11%) of Protected and Recreational Open Space¹². See Figure 6-1.

¹¹ 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.

¹² All Protected and Recreational Open Space land is shown on the natural resources map.

Mary Lee Brook [MA74-23]

NATURAL RESOURCES



Mary Lee Brook [MA74-23]

POLLUTANT SOURCES

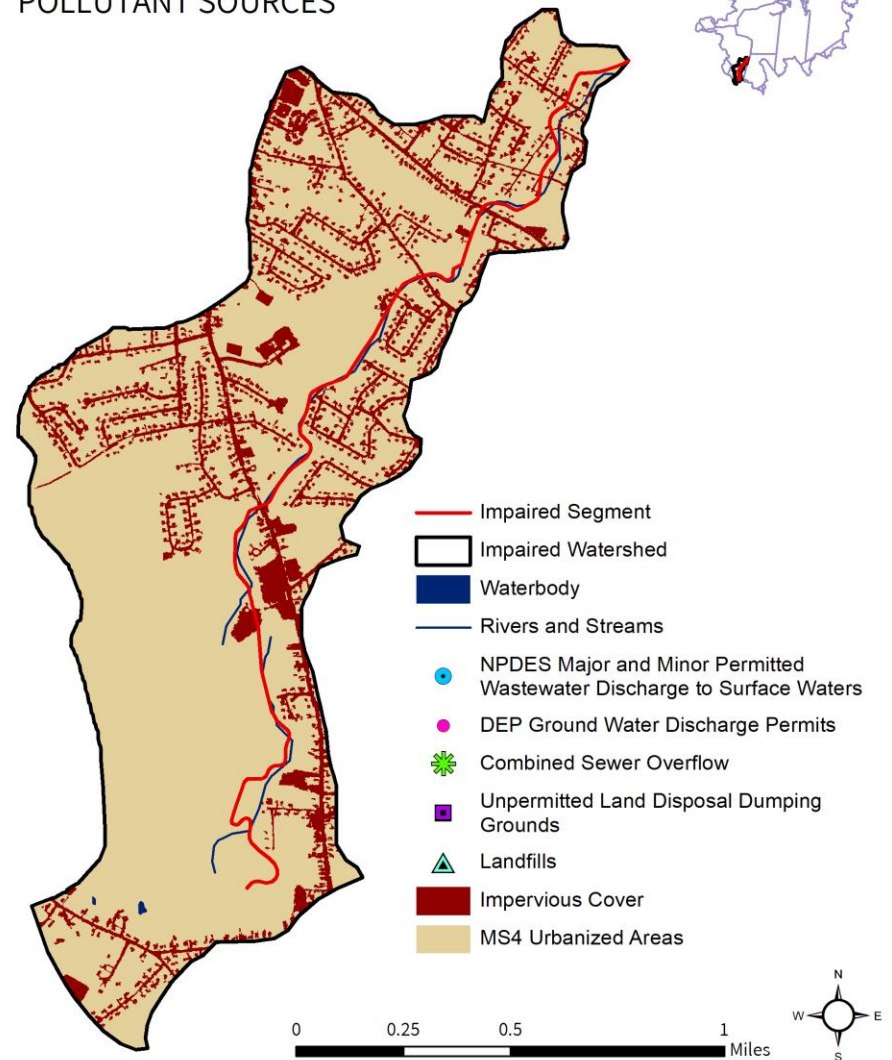


Figure 6-1. Natural resources and potential pollution sources draining to the Mary Lee Brook segment MA74-23. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollutant sources, including impervious cover, MS4 areas, permitted facilities, etc.

6.2. Waterbody Impairment Characterization

Mary Lee Brook (MA74-23) is a Class B Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS at the station listed below (refer to Tables 6-1, 6-2; Figure 6-2) 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, 90-day rolling basis.

- In 2009, six samples were collected at W2050; data indicated six days when the 90-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 six samples, one exceeded the STV criterion during wet weather.
- In 2017, two samples were collected at W2730; data indicated two days when the 90-day rolling geomean exceeded 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 two samples, one exceeded the STV criterion during dry weather.

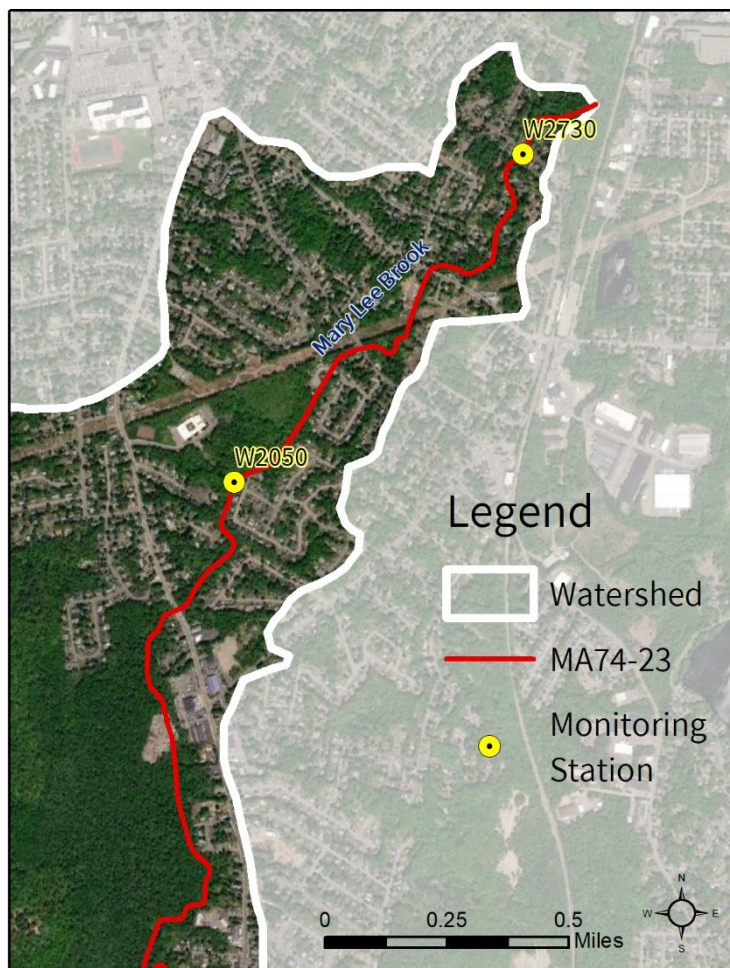


Figure 6-2. Location of monitoring station(s) along the impaired segment.

Table 6-1. Summary of indicator bacteria sampling results by station for Mary Lee Brook (MA74-23). The maximum 90-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 90-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 90-Day Rolling Geomean (CFU/100mL)	Number Geomean Exceedances	Number STV Exceedances
W2050	5/5/2009	9/22/2009	6	3,700	6	1
W2730	7/6/2017	8/9/2017	2	460	2	1

Table 6-2. Indicator bacteria data by station, indicator, and date for Mary Lee Brook (MA74-23). 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 90-day geomean) for *E. coli* indicator bacteria.

Unique Station ID	Indicator	Date	Wet/Dry	Result (CFU/100mL)	90-Day Rolling Geomean (CFU/100mL)	90-Day Rolling STV (CFU/100mL)
W2050	<i>E. coli</i>	5/5/2009	WET	3,700	3,700	
W2050	<i>E. coli</i>	6/9/2009	DRY	330	1,105	
W2050	<i>E. coli</i>	7/14/2009	DRY	230	655	
W2050	<i>E. coli</i>	8/18/2009	DRY	330	293	
W2050	<i>E. coli</i>	9/10/2009	DRY	340	296	
W2050	<i>E. coli</i>	9/22/2009	DRY	240	281	
W2730	<i>E. coli</i>	7/6/2017	DRY	326	326	
W2730	<i>E. coli</i>	8/9/2017	DRY	649	460	

6.3. 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 Mary Lee Brook (MA74-23) were elevated during both wet (one data point) and dry weather. Elevated results during wet weather are consistent with urban stormwater, pet waste, and wildlife pathogen sources, as are certain types of septic system malfunctions, such as rainwater infiltration or saturated disposal fields which overflow during precipitation. 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 the major sources of pathogens.

Each potential pathogen source is described in further detail below.

Urban Stormwater: There is a substantial amount of development in the watershed (31%), most of which consists of residential areas with some industrial and commercial development as well. 100% of the land area is subject to MS4 permit conditions, 17% is classified as impervious area, and 12% is classified as DCIA. Stormwater runoff from urban areas is a likely source of pathogens.

Illicit Sewage Discharges: Sewer service is available in the watershed within Avon and Randolph. 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 of the development in the watershed utilizes on-site systems for wastewater treatment. It is likely that some septic systems are not properly maintained and are discharging untreated effluent to groundwater.

Agriculture: Land use maps indicate no agricultural activity in the watershed. As a result, stormwater runoff from agricultural land is not a likely source of pathogens to the impaired segment.

Pet Waste: There are residential neighborhoods and conservation lands near the Mary Lee Brook segment MA74-23. 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 large open wetland areas and conservation lands are 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.

6.4. 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.

Town of Avon

All of Avon is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041089), and the town has an EPA-approved Notice of Intent (NOI). The town has mapped 100% of its MS4 system and a year-two Annual Report has been submitted. Avon was previously denied authorization under MS4 permit due to an incomplete NOI but reapplied in 2019. There was no 2018 MS4 report present, presumably because Avon was not authorized under MS4 until 2019. In 2019, Avon 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 within the Boston Harbor: Weymouth & Weir watershed were reported on the town's NOI.

Avon has the following ordinances and bylaws, mostly accessible online via the town website <https://www.avon-ma.gov/> (Town of Avon, 2021):

- Wetland protection bylaw;
- Stormwater control bylaw;
- Stormwater Utility: None found; and
- Pet Waste: None found.

No Master Plan was found on the town's website. Avon is in the process of creating an Open Space and Recreation Plan (Town of Avon, 2021).

Town of Randolph

All of Randolph (legally a city, but formally named "Town of") is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041055), 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 2018, Randolph 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 five stormwater outfalls to the pathogen-impaired MS4 receiving water, the Cochato River (MA74-06), based on both fecal coliform and *E. coli* data.

Randolph has the following ordinances and bylaws, mostly accessible online via the town website <https://www.randolph-ma.gov/> (Town of Randolph, 2021):

- Stormwater control bylaw;
- Wetland protection bylaw;
- Stormwater Utility: None found; and
- Pet Waste: None found.

Randolph has a 2017 Comprehensive Master Plan, which includes a natural resources section, containing a list of waterbodies within the town, and a description of each. The plan also has a stormwater section which includes

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water quality sampling procedures. Randolph has a public sewer system, but many residents rely on private septic systems. An Open Space and Recreation Plan is currently being created (Town of Randolph, 2021).

7. MA74-27 Farm River

7.1. Waterbody Overview

Farm River segment MA74-27 is 2.6 miles long and begins at the Randolph and Braintree town line near the Blue Hills Reservation in Braintree, MA; upstream of this point, the stream is named the Blue Hill River. The segment flows generally eastward, then south before ending north of the Richardi Reservoir and Braintree Water and Sewer Department's public water supply intake in Braintree, MA. This segment was formerly part of Farm River segment MA74-07.

Tributaries to Farm River segment MA74-27 include Bouncing Brook and an unnamed stream. Lakes and ponds in the watershed include Great Pond, Great Pond Upper Reservoir, Norroway Pond, Houghtons Pond, Duck Pond and several small, unnamed waterbodies. The upper portion of the river segment flows through wetland and natural areas; the lower section of the segment is surrounded by high density development.

Key landmarks in the watershed include the Randolph Community Middle School and Randolph High School; Meditech, Stoughton Recycling Technologies, Central Rock (a rock-climbing gym), and a commercial park centered around Campanelli Drive; Blue Hill Cemetery; Brookwood Community Farm, Historic Prowse Farm, and Harmony Hill Farm; Houghton's Pond Recreation Area and Hollingsworth Park and fields; Bear Swamp, Great Cedar Swamp, and Marigold Marsh natural areas; and Blue Hills Preserve and recreation trails. From upstream to downstream, segment MA74-27 is crossed by West Street, Lundquist Drive, Campanelli Drive, Granite Street, Pond Street east and west bound, all in Braintree.

Farm River (MA74-27) drains a total area of 12.7 square miles (mi²), of which 2.7 mi² (21%) are impervious and 1.9 mi² (15%) are directly connected impervious area (DCIA). The watershed is partially served by public sewer systems in Braintree, Canton, Milton, Randolph, and Quincy¹³, and 100% of the total land area is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (USEPA, 2020). There are two additional NPDES

Reduction from Highest Calculated Geomean: 92%

Watershed Area (Acres): 8,140

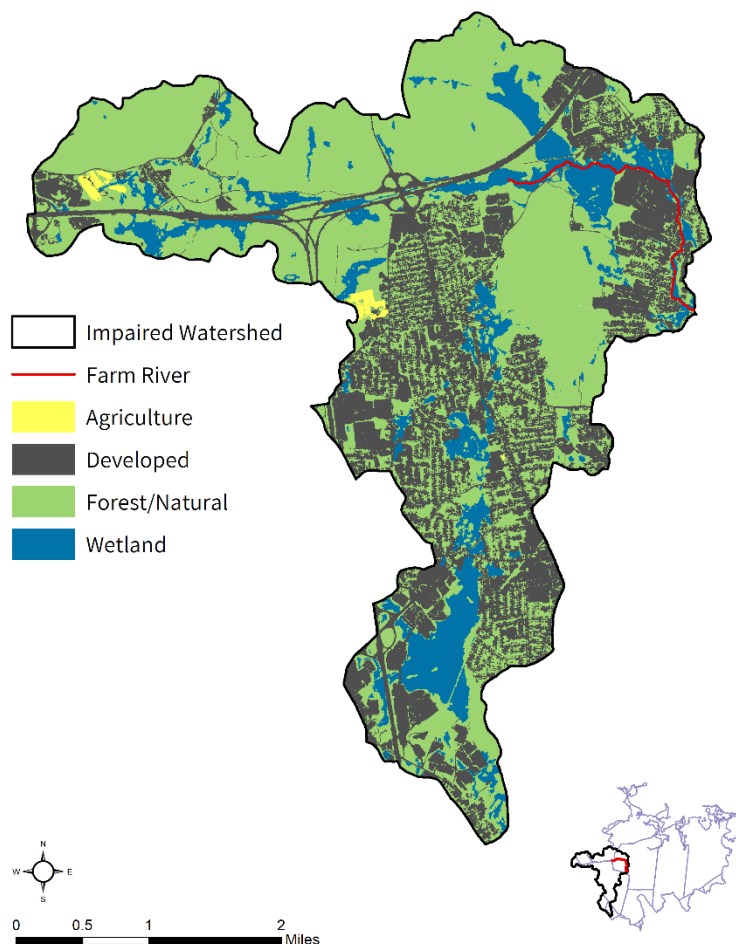
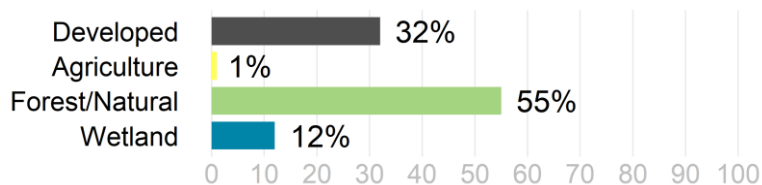
Segment Length (Miles): 2.6

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

Class (Qualifier): A (Public Water Supply, Outstanding Resource Water)

Impervious Area (Acres, %): 1,706 (21%)

DCIA Area (Acres, %): 1,218 (15%)



¹³ 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.

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permits on file governing point source discharges of pollutants to surface waters, neither of which are permits for wastewater treatment facilities. There are no MassDEP discharge-to-groundwater permits for on-site wastewater discharge or combined sewer overflows (CSOs) within the watershed. There are two landfills and no unpermitted land disposal dumping grounds within the segment watershed. See Figure 7-1.

The Farm River segment MA74-27 watershed is located in a moderately-developed part of Massachusetts. More than half of the watershed consists of forest and natural lands (55%) and 12% consists of wetland areas. The remainder of the watershed is primarily covered by development (32%) as there is very little agricultural activity (1%). Most of the development consists of residential areas, as well as some with concentrations of industrial and commercial development. Most of the agricultural activity consists of pasture/hay and cultivated fields located directly adjacent to wetland areas in the watershed.

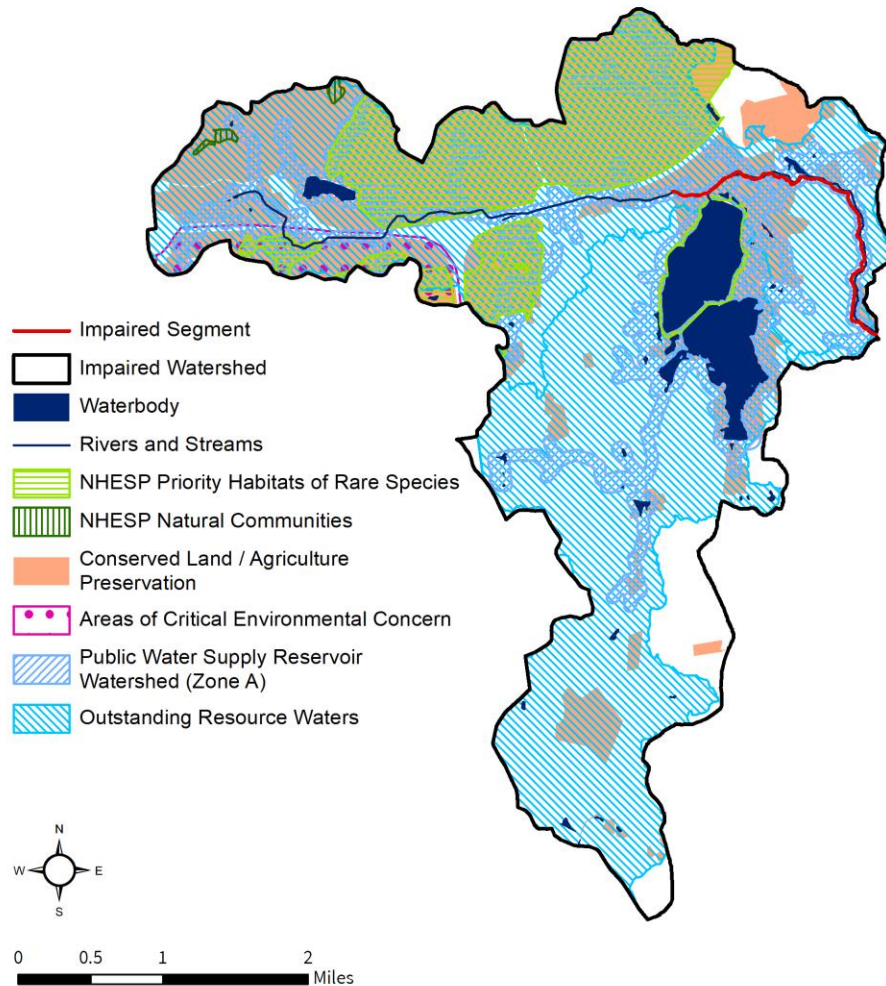
In the Farm River (MA74-27) watershed, under the Natural Heritage and Endangered Species Program, there are 1,817 acres (22%) of Priority Habitats of Rare Species and 18 acres (<1%) of Priority Natural Vegetation Communities. There are also 1,651 acres (20%) under Public Water Supply protection, 358 acres (4%) within the Fowl Meadow and Ponkapoag Bog Area of Critical Environmental Concern, and 7,414 acres (91%) of Outstanding Resource Waters. Overall, there are 3,409 acres (42%) of land protected in perpetuity¹⁴, part of 3,605 acres (44%) of Protected and Recreational Open Space¹⁵. See Figure 7-1.

¹⁴ 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.

¹⁵ All Protected and Recreational Open Space land is shown on the natural resources map.

Farm River [MA74-27]

NATURAL RESOURCES



Farm River [MA74-27]

POLLUTANT SOURCES

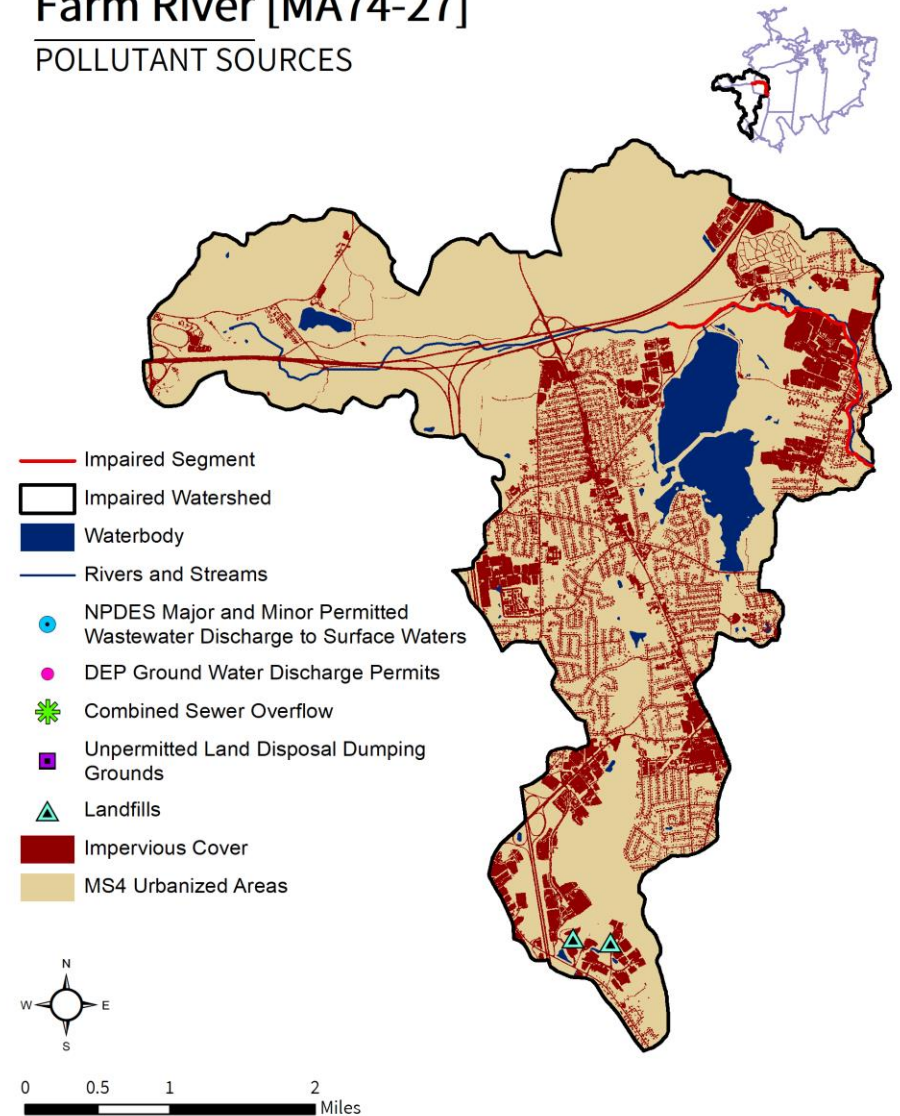


Figure 7-1. Natural resources and potential pollution sources draining to the Farm River segment MA74-27. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollutant sources, including impervious cover, MS4 areas, permitted facilities, etc.

7.2. Waterbody Impairment Characterization

The Farm River (MA74-27) is a Class A, Public Water Supply, and Outstanding Resource Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS at the station listed below (refer to Tables 7-1, 7-2; Figure 7-2) 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, 90-day rolling basis.

- In 2009, six samples were collected at W2053; data indicated four days when the 90-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 six samples, two exceeded the STV criterion, one during wet weather and one during dry weather. In addition, the segment is listed as impaired due to historical data from former Farm River segment MA74-07 (split into segments MA74-27 and MA74-28 in 2018).

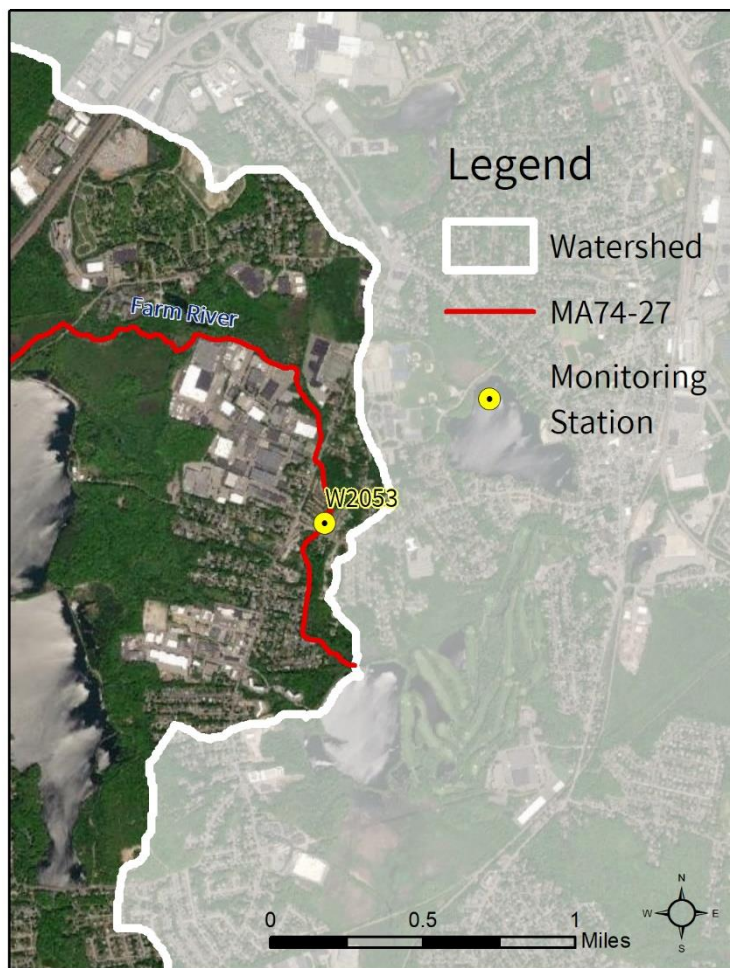


Figure 7-2. Location of monitoring station(s) along the impaired segment.

Table 7-1. Summary of indicator bacteria sampling results by station for the Farm River (MA74-27). The maximum 90-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 90-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 90-Day Rolling Geomean (CFU/100mL)	Number Geomean Exceedances	Number STV Exceedances
W2053	5/5/2009	9/22/2009	6	1,500	4	2

Table 7-2. Indicator bacteria data by station, indicator, and date for the Farm River (MA74-27). 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 90-day geomean) for *E. coli* indicator bacteria.

Unique Station ID	Indicator	Date	Wet/Dry	Result (CFU/100mL)	90-Day Rolling Geomean (CFU/100mL)	90-Day Rolling STV (CFU/100mL)
W2053	<i>E. coli</i>	5/5/2009	WET	1,500	1,500	
W2053	<i>E. coli</i>	6/9/2009	DRY	620	964	
W2053	<i>E. coli</i>	7/14/2009	DRY	90	437	
W2053	<i>E. coli</i>	8/18/2009	DRY	70	157	
W2053	<i>E. coli</i>	9/10/2009	DRY	180	104	
W2053	<i>E. coli</i>	9/22/2009	DRY	140	112	

7.3. 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 Farm River (MA74-27) were elevated during both wet (one data point) and dry weather. Elevated results during wet weather are consistent with urban stormwater, pet waste, and wildlife pathogen sources, as are certain types of septic system malfunctions, such as rainwater infiltration or saturated disposal fields which overflow during precipitation. 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 the major sources of pathogens.

Each potential pathogen source is described in further detail below.

Urban Stormwater: There is substantial development in the watershed (32%), most of which consists of residential areas with some industrial and commercial development as well. 100% of the land area is subject to MS4 permit conditions, 21% is classified as impervious area, and 15% is classified as DCIA. Stormwater runoff from urban areas is a likely source of pathogens.

Illicit Sewage Discharges: Sewer service is available in the watershed within Braintree, Canton, Milton, Randolph, and Quincy. 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 of the development in the watershed may utilize on-site systems for wastewater treatment. 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 relatively small portion (1%) of the total land use. A few pasture/hay and cultivated fields are located next to wetland areas. Manure storage and spreading activities, if not properly conducted, are possible sources of pathogens to waterbodies.

Pet Waste: There are many residential neighborhoods, nature trails, and parks near the Farm River segment MA74-27. 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: There are several large open wetland areas and fields 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.

7.4. 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 Quincy. See Section 3.4

Town of Braintree. See Section 5.4

Town of Randolph. See Section 6.4

8. MA74-28 Farm River

8.1. Waterbody Overview

Farm River segment MA74-28 is 0.5 miles long and begins north of the Richardi Reservoir and Braintree Water and Sewer Department's public water supply intake in Braintree, MA. The segment flows east before ending at the confluence with the Cochato River abutting the Braintree Municipal Golf Course in Braintree, MA.

There are no tributaries to Farm River segment MA74-28. Lakes and ponds in the watershed include Great Pond, Great Pond Upper Reservoir, Norrway Pond, Houghtons Pond, Farm Pond, and several unnamed waterbodies. The upper portion of the river segment flows through wetland areas and natural areas; the lower section of the segment is surrounded by high density development.

Key landmarks in the watershed include the Randolph Community Middle School and Randolph High School; Meditech, Stoughton Recycling Technologies, Central Rock rock climbing gym, and a commercial park centered around Campanelli Drive; Braintree Municipal Golf Course; Braintree Rehabilitation Outpatient Hospital; Blue Hill Cemetery; Brookwood Community Farm, Historic Prowse Farm, and Harmony Hill Farm; Houghton's Pond Recreation Area and Hollingsworth Park and fields; Bear Swamp, Great Cedar Swamp, and Marigold Marsh natural areas; and Blue Hills Preserve and recreation trails. The segment is not crossed by any roads, pedestrian bridges, etc.

Farm River (MA74-28) drains a total area of 12.9 square miles (mi²), of which 2.7 mi² (21%) are impervious and 1.9 mi² (15%) are directly connected impervious area (DCIA). The watershed is partially served by public sewer systems in Braintree, Canton, Milton, Randolph, and Quincy¹⁶, and 100% of the total land area is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (USEPA, 2020). There are no additional NPDES permits on file governing point source discharges of pollutants to surface waters in the immediate drainage area of the impaired segment. There are no MassDEP discharge-to-groundwater permits

Reduction from Highest Calculated Geomean: NA

Watershed Area (Acres): 8,268

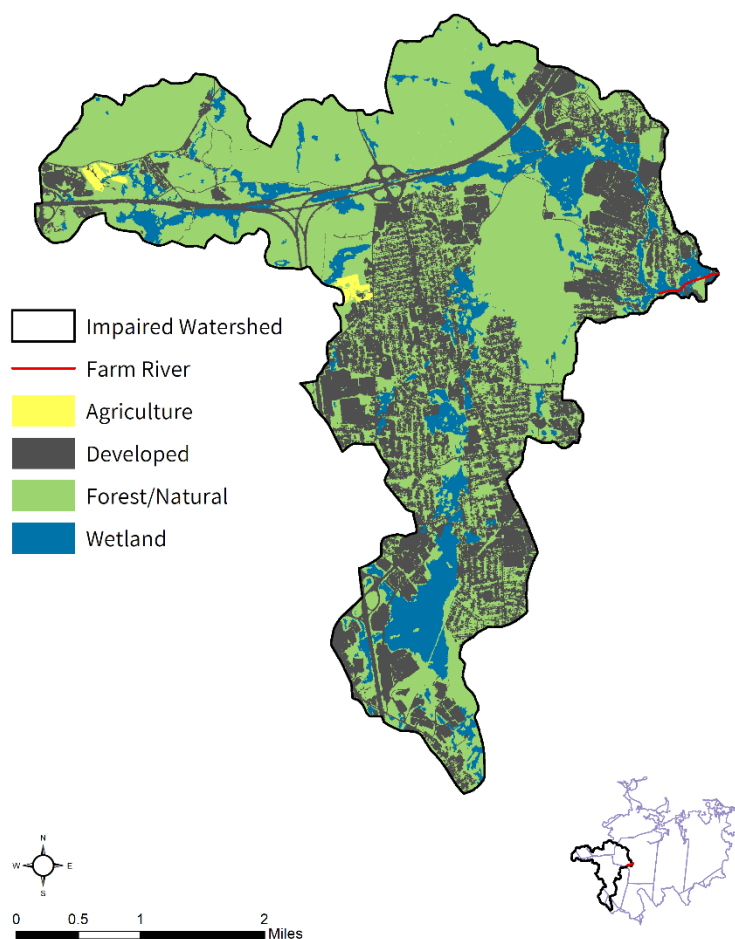
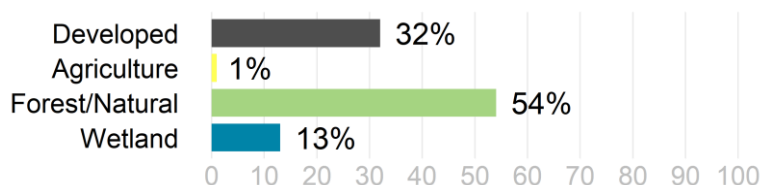
Segment Length (Miles): 0.5

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

Class (Qualifier): B

Impervious Area (Acres, %): 1,731 (21%)

DCIA Area (Acres, %): 1,235 (15%)



¹⁶ 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.

for on-site wastewater discharge or combined sewer overflows (CSOs) within the watershed. There are two landfills and no unpermitted land disposal dumping grounds within the segment watershed. See Figure 8-1.

The Farm River segment MA74-28 watershed is located in a moderately-developed part of Massachusetts. More than half of the watershed consists of forest and natural lands (54%) and 13% consists of wetland areas. The remainder of the watershed is primarily covered by development (32%) as there is very little agricultural activity (1%). The development consists of residential areas as well as industrial and commercial development. Most of the agricultural activity consists of pasture/hay and cultivated fields located directly adjacent to wetland areas in the watershed.

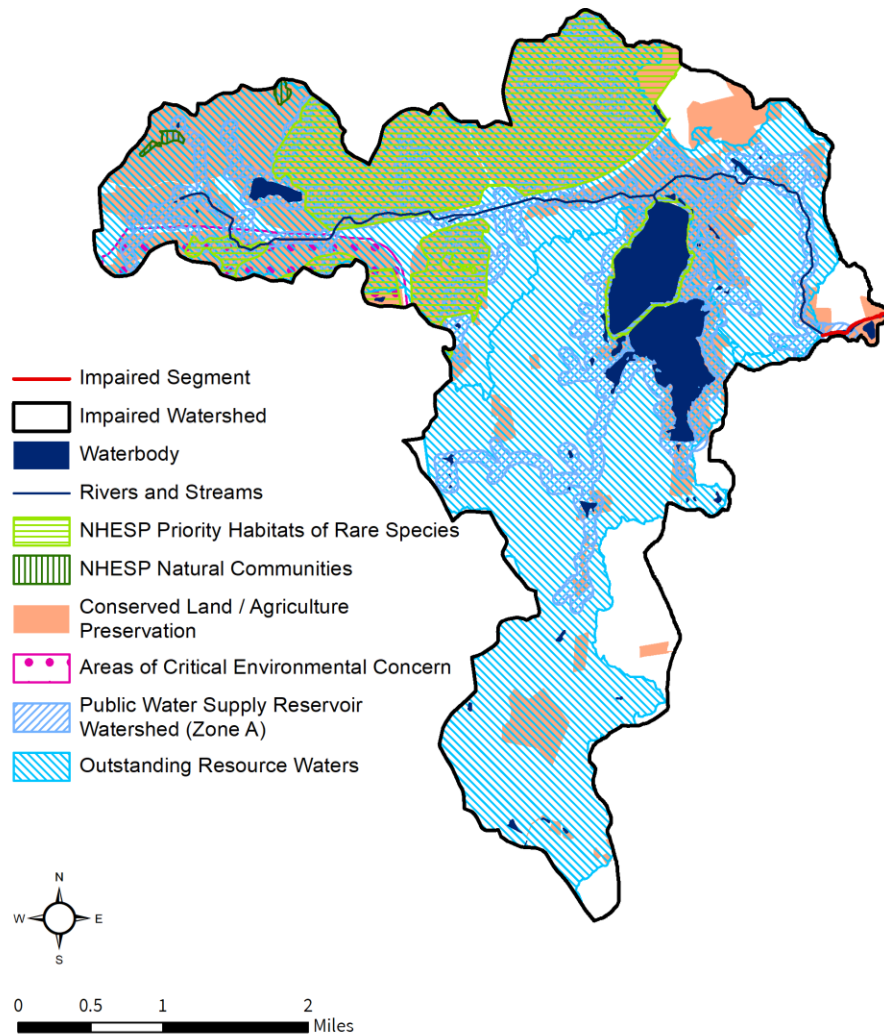
In the Farm River (MA74-28) watershed, under the Natural Heritage and Endangered Species Program, there are 1,817 acres (22%) of Priority Habitats of Rare Species and 18 acres (<1%) of Priority Natural Vegetation Communities. There are also 1,651 acres (20%) under Public Water Supply protection, 358 acres (4%) within the Fowl Meadow and Ponkapoag Bog Areas of Critical Environmental Concern, and 7,420 acres (90%) of Outstanding Resource Waters. Overall, there are 3,453 acres (42%) of land protected in perpetuity¹⁷, part of 3,649 acres (44%) of Protected and Recreational Open Space¹⁸. See Figure 8-1.

¹⁷ 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.

¹⁸ All Protected and Recreational Open Space land is shown on the natural resources map.

Farm River [MA74-28]

NATURAL RESOURCES



Farm River [MA74-28]

POLLUTANT SOURCES

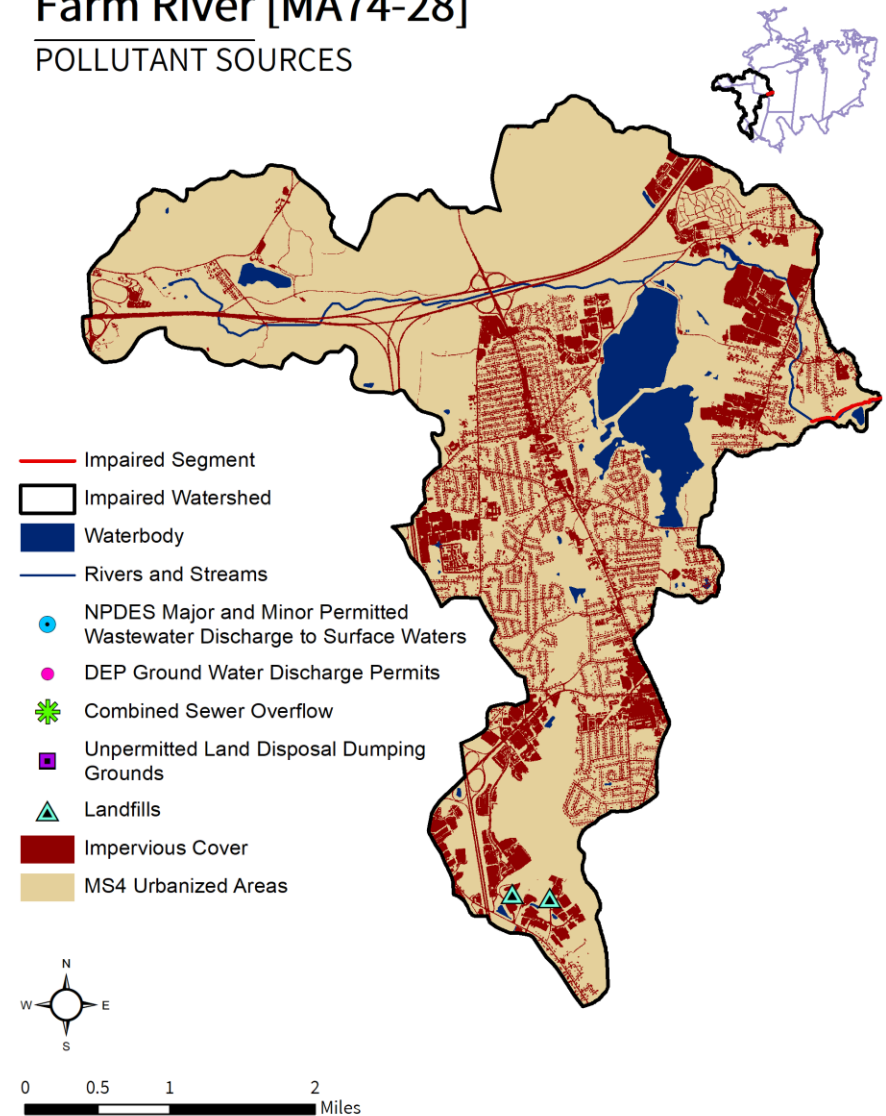


Figure 8-1. Natural resources and potential pollution sources draining to the Farm River segment MA74-28. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollutant sources, including impervious cover, MS4 areas, permitted facilities, etc.

8.2. Waterbody Impairment Characterization

The Farm River (MA74-28) is a Class B Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS at the station listed below (refer to Tables 8-1, 8-2; Figure 8-2) 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, 90-day rolling basis.

- In 2017, two samples were collected at W2732. Data indicated that the 90-day rolling geomean did not exceed 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 two samples, none exceeded the STV criterion. The segment is listed as impaired due to historical data from former Farm River segment MA74-07 (split into segments MA74-27 and MA74-28 in 2018). A restorative TMDL is maintained until such time as additional data indicate a lack of impairment and segment MA74-28 is delisted (at which time the TMDL would be considered protective).

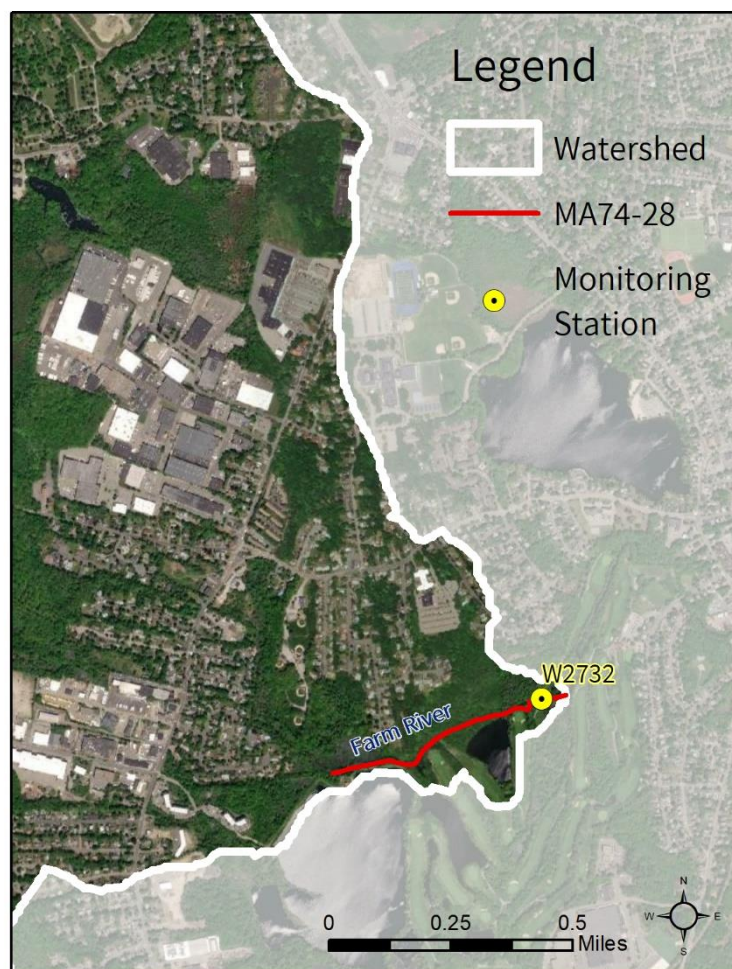


Figure 8-2. Location of monitoring station(s) along the impaired segment.

Table 8-1. Summary of indicator bacteria sampling results by station for the Farm River (MA74-28). The maximum 90-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 90-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 90-Day Rolling Geomean (CFU/100mL)	Number Geomean Exceedances	Number STV Exceedances
	7/6/2017	8/9/2017	2	43	0	0

Table 8-2. Indicator bacteria data by station, indicator, and date for the Farm River (MA74-28). 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 90-day geomean) for *E. coli* indicator bacteria.

Unique Station ID	Indicator	Date	Wet/Dry	Result (CFU/100mL)	90-Day Rolling Geomean (CFU/100mL)	90-Day Rolling STV (CFU/100mL)
W2732	<i>E. coli</i>	7/6/2017	DRY	43	43	
W2732	<i>E. coli</i>	8/9/2017	DRY	34	38	

8.3. Potential Pathogen Sources

Each potential pathogen source is described in further detail below.

Urban Stormwater: There is a moderate amount of development in the watershed (32%), which consists of residential areas as well as industrial and commercial development as well. 100% of the land area is subject to MS4 permit conditions, 21% is classified as impervious area, and 15% 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 Braintree, Canton, Milton, Randolph, and Quincy. 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.

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Agriculture: Agricultural activities in the watershed account for a relatively small portion (1%) of the total land use. A few pasture/hay and cultivated fields are located next to wetland and other natural areas within the watershed. Manure storage and spreading activities, if not properly conducted, are possible sources of pathogens to waterbodies.

Pet Waste: There are residential neighborhoods and parks near the Farm River segment MA74-28. 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: Some open wetland areas are 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.

8.4. Existing Local Management

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City of Quincy. See Section 3.4

Town of Braintree. See Section 5.4

Town of Randolph. See Section 6.4

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APPENDIX R: Weymouth & Weir River Basin & Coastal Drainage Area

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