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

Appendix O: Mystic River Basin and Coastal Drainage Area

Commonwealth of Massachusetts
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December 2024

CN 515.1.15

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Suggested Citation
MassDEP. 2024. Final Massachusetts Statewide Total Maximum Daily Load for Pathogen-Impaired Waterbodies. CN 515.1, Massachusetts Department of Environmental Protection, Bureau of Water Resources, Division of Watershed Management, Watershed Planning Program. Worcester, MA.

Available Online

https://www.mass.gov/lists/total-maximum-daily-loads-by-watershed

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

References to trade names, commercial products, manufacturers, or distributors in this report constituted neither endorsement nor recommendations by the Massachusetts Department of Environmental Protection.

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TABLE OF CONTENTS

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 three pathogen-impaired segments in the Mystic River Basin and Coastal Drainage Area, hereinafter referred to as the Boston Harbor: Mystic 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 into two categories: point sources (waste load allocation, WLA) and nonpoint sources (load allocation, LA), based on an analysis of watershed percent impervious cover. This appendix identifies the percent reduction in indicator bacteria pollutant load from current conditions required to meet the TMDL, based on the highest levels of indicator bacteria recorded in the monitoring data, if applicable. The TMDLs for the three Boston Harbor: Mystic 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: Mystic Watershed Overview section.

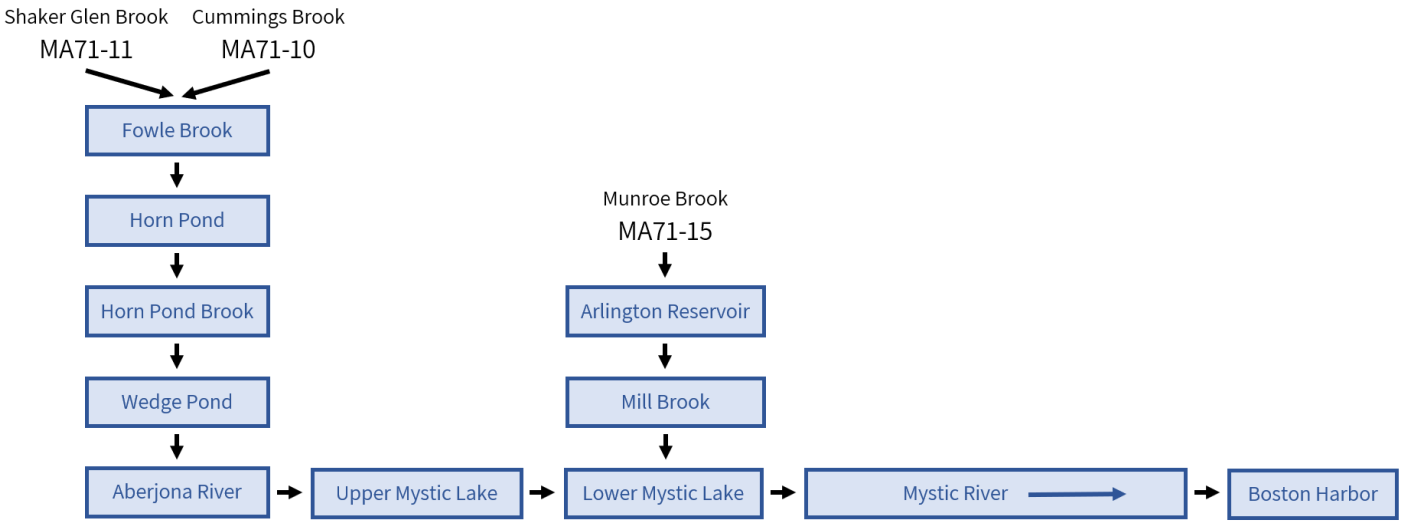


Figure 1-1. Conceptual diagram of water flow through the Boston Harbor: Mystic watershed for the three pathogen-impaired segments. Connections between waterbodies are shown with black arrows. Not to scale. Impaired segments are shown with the assessment unit.

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 Mystic 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)					
Cummings Brook		R	126	425	70%	WLA (35%)	1.1	10.8	107.8	1,077.7	10,777.2	107,771.7
MA71-10	B			(90 day)		LA (65%)	2.0	20.0	200.5	2,005.0	20,049.6	200,496.3
Shaker Glen Brook		R	126	1,100	89%	WLA (23%)	0.7	7.0	69.9	699.3	6,992.9	69,928.6
MA71-11	B			(90 day)		LA (77%)	2.4	23.8	238.3	2,383.4	23,833.9	238,339.4
Munroe Brook		R	126	630	80%	WLA (23%)	0.7	7.1	70.8	708.1	7,081.0	70,809.6
MA71-15	B			(90 day)		LA (77%)	2.4	23.7	237.5	2,374.6	23,745.8	237,458.5

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 Mystic 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)					
Cummings Brook		P	35	NA	-	WLA (35%)	0.3	3.0	29.9	299.4	2,993.7	29,936.6
MA71-10	B					LA (65%)	0.6	5.6	55.7	556.9	5,569.3	55,693.4
Shaker Glen Brook		P	35	NA	-	WLA (23%)	0.2	1.9	19.4	194.2	1,942.5	19,424.6
MA71-11	B					LA (77%)	0.7	6.6	66.2	662.1	6,620.5	66,205.4
Munroe Brook		P	35	NA	-	WLA (23%)	0.2	2.0	19.7	196.7	1,966.9	19,669.3
MA71-15	B					LA (77%)	0.7	6.6	66.0	659.6	6,596.1	65,960.7

Class *defined in the Massachusetts Surface Water Quality Standards (SWQS) at 314 CMR 4.02.*
Qualifiers *that identify segments with special characteristics are defined in at 314 CMR 4.06(1)(d)*
Pathogen bacteria units are presented in colony-forming units or CFU per 100 milliliter or ml.
TMDL Type *identifies the restorative or protective action approach:*
- ***R*** *= Restorative TMDL addressing a pathogen impairment identified in the 2018/2020 Integrated List of Waters*
- ***R**** *= Restorative TMDL addressing a historic impairment of former indicator bacteria for which no current applicable criteria are available See Section 2.3 of the core document for summary of water quality criteria and designated uses.*
- ***P*** *= Protective TMDL addressing all applicable uses, regardless of impairment status, for the associated pathogen (refer to the Massachusetts SWQS:314 CMR 4.00)*

Target TMDL or Total Maximum Daily Load is presented as both SWQS-Based and Flow-Based.
- ***SWQS-Based TMDL Target*** *is the target concentration applicable to the TMDL pollutant indicator bacteria based on the Surface Water Quality Standards (314 CMR 4.00).*
- ***Flow-Based Target TMD****L 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. Mystic Watershed Overview

The Boston Harbor: Mystic watershed covers an area of approximately 65 square miles (mi^2) in eastern Massachusetts (Figure 2-1). It includes the mainstem of the Mystic River, which generally flows southeast from Arlington/Medford, MA to Boston Harbor in Boston, MA. There are numerous tributaries in the watershed that drain into the Mystic River, including most notably (listed from upstream to downstream) the Aberjona River (the headwaters to the Mystic River), Mill Brook, Alewife Brook, Malden River, and Chelsea Creek.

The mainstem of the Mystic River begins at the outlet of Lower Mystic Lake in Arlington/Medford, MA and flows for approximately 10 miles before reaching Boston Harbor. Prominent water infrastructure along the Mystic River includes the Amelia Earhart Dam, which was built in 1966 just downstream of the river's confluence with the Malden River (Carr, 2010). The Rumney Marshes Area of Critical Environmental Concern (ACEC) is in the watershed within the municipalities of Boston, Lynn, Revere, Saugus, and Winthrop. This ACEC contains at least five species listed by the State of Massachusetts to be endangered, threatened, or of special concern, and was officially designated on August 22, 1988.

The Boston Harbor: Mystic watershed overlaps a portion of 19 municipalities in Massachusetts. Of these municipalities, two are completely contained within the watershed (Medford and Winchester). Large sections of the highly urbanized northern Greater Boston area are located within the watershed (Carr, 2010). 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 one Regional Planning Agency (RPA) includes the Boston Harbor: Mystic watershed. RPAs are public organizations advising municipalities, private business groups, and state and federal governments on a range of matters. Their research, coordination and technical assistance are especially valuable in addressing watershed-level issues such as pathogen pollutants and stormwater that cross town boundaries. The Boston Harbor: Mystic watershed RPA is:

- Metropolitan Area Planning Council (MAPC, 2022)

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

- The MAPC utilizes the Integrated Water Management (IWM) approach to coordinate planning across the wastewater, drinking water, and stormwater sectors.
- The MAPC has developed two tools that assist MS4 regulated communities in fulfilling the requirements of the permit. These tools are:
    - Stormwater Utility/Funding Starting Kit (MAPC, 2014)
    - GIS toolkit to calculate MS4 outfall catchments, which is a requirement under the MS4 General Permit, created by MAPC and the Neponset River Watershed Association (MAPC, 2018).

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:

- **Mystic River Watershed Association** (MyRWA) whose mission is "to protect and restore the Mystic River, its tributaries and watershed lands for the benefit of present and future generations and to celebrate the value, importance and great beauty of these natural resources" (MyRWA, 2022).
- **Conservation Law Foundation** (CLF) is helping to protect the Mystic River from industrial pollutants by initiating lawsuits through its Enforcement Project. Settlements from these lawsuits have led to industrial facilities funding a Supplemental Environmental Project (SEP) for the Mystic River to monitor phosphorus levels in the water (CLF, 2022).
- **Massachusetts Office of Coastal Zone Management** (CZM) has a Boston Regional office that "serves the coastal communities from Winthrop to Weymouth." (CZM, 2022a).
- **Massachusetts Water Resources Authority** (MWRA) conducts routine water quality monitoring in the Mystic River for nutrients and bacteria (MWRA, 2022).
- **The Boston Foundation** (TBF) has a Mystic River Watershed Environmental Fund that "provides grants to improve water quality and access to the river while developing strong environmental stewardship, advocacy, and leadership in the watershed communities, especially among new immigrants, and the next generation of residents" (TBF, 2022).
- **Trout Unlimited (TU)** operates the Greater Boston and Nor'east chapters in the geographic area of the Boston Harbor: Mystic watershed. 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).
- **U.S. Environmental Protection Agency** (USEPA) oversees the Mystic River Watershed Initiative, which is a collaborative effort to "improve water quality and environmental conditions as well as create and protect open space and public access to the Mystic River and its tributaries through safe public pathways and access points" (USEPA, 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 access to 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 (CZM, 2022b). 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*. Any sewage discharges from boats or boating infrastructure in the waters covered by this TMDL are therefore illicit discharges.

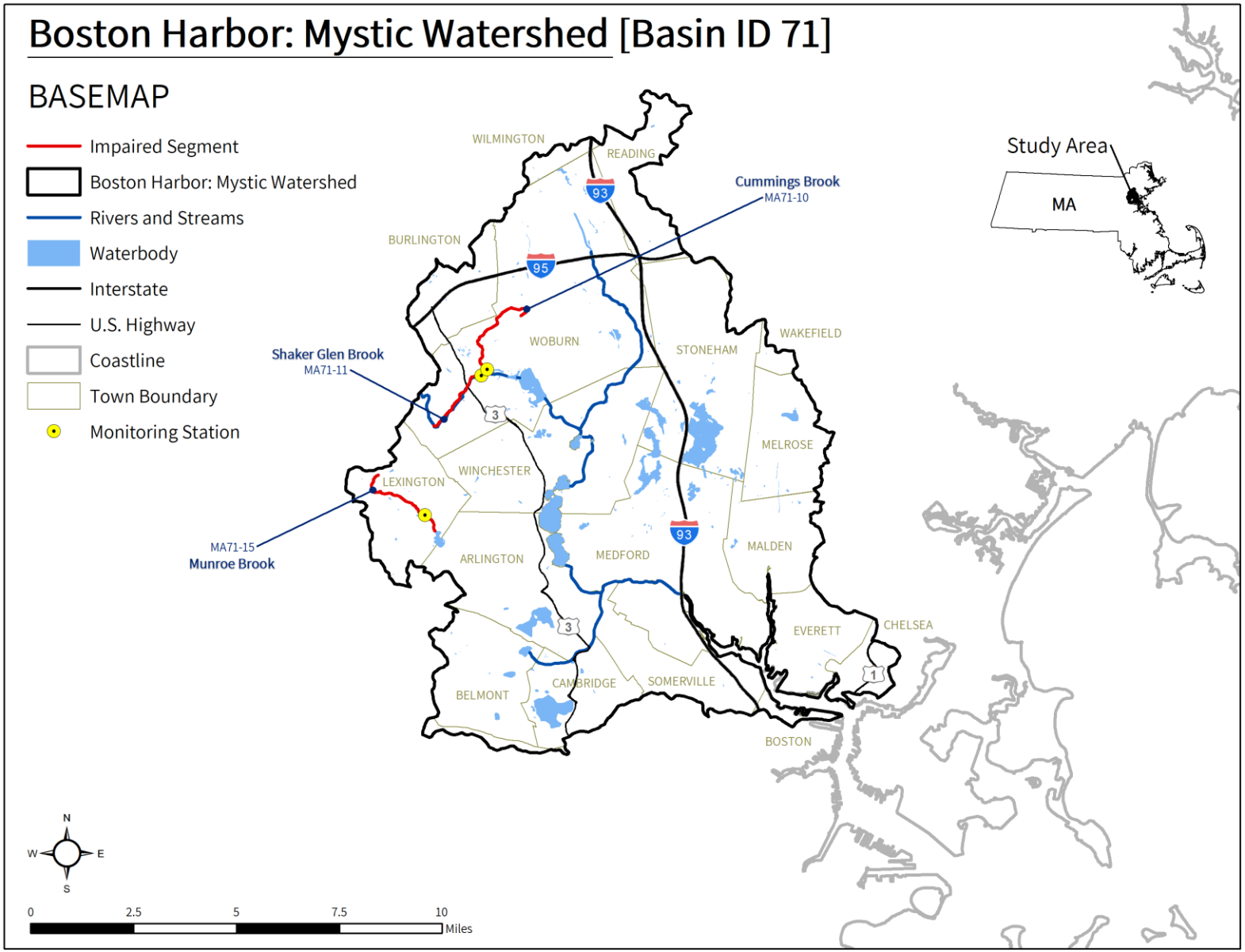


Figure 2-1: Map of all pathogen-impaired segments, water quality monitoring stations, municipal borders, waterbodies, and major roads in the Boston Harbor: Mystic watershed.

3. MA71-10 Cummings Brook

3.1. Waterbody Overview

Cummings Brook segment MA71-10 is 2.1 miles long and begins east of Wright Street in Woburn, MA. The segment flows southwest for approximately 1.7 miles, then south to the confluence with Fowle Brook in Woburn, MA.

Tributaries to Cummings Brook segment MA71-10 include Little Brook and an unnamed stream. Lakes and ponds in the watershed include a few unnamed waterbodies. The river flows through wetland, forest, other natural areas, and high-density development.

Key landmarks in the watershed include several hotels such as the Boston Marriot in Burlington, Crowne Plaza Boston-Woburn, Hyatt House Boston/Burlington and IHG Hotel; office parks including Burlington Woods Office Park and The Center at Corporate Drive, as well as other businesses such as Heimlich's Nursery & Garden, and car dealerships; Northeastern University-Innovation Campus at Burlington (ICBM); Burlington Ice Palace, O'Brien Rink, and Joyce Middle School Park; James L. McKeown Boys & Girls Club; Whispering Hill Park, Woburn Community Gardens, Rag Rock Hill Park, Hurd Park, Well Field; and the Woburn Fire Department. From upstream to downstream, segment MA71-10 is crossed by Park Drive Extension, Winn Street, Sheridan Street, Bamberg Drive, Burlington Street, Willow Street, Bedford Road, South Bedford Street, Locust Street, Willow Street again, and Lexington Street, all in Woburn.

Cummings Brook (MA71-10) drains a total area of 4.0 square miles (mi^2), of which 1.4 mi^2 (35%) are impervious and 1.0 mi^2 (26%) are directly connected impervious area (DCIA). The watershed is partially served by public sewer systems in Woburn and Burlington[1], and the entire 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

Reduction from Highest Calculated Geomean: 70%

Watershed Area (Acres): 2,548

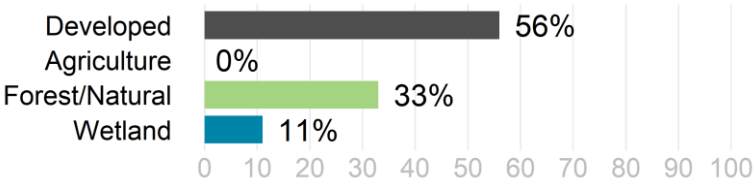
Segment Length (Miles): 2.1

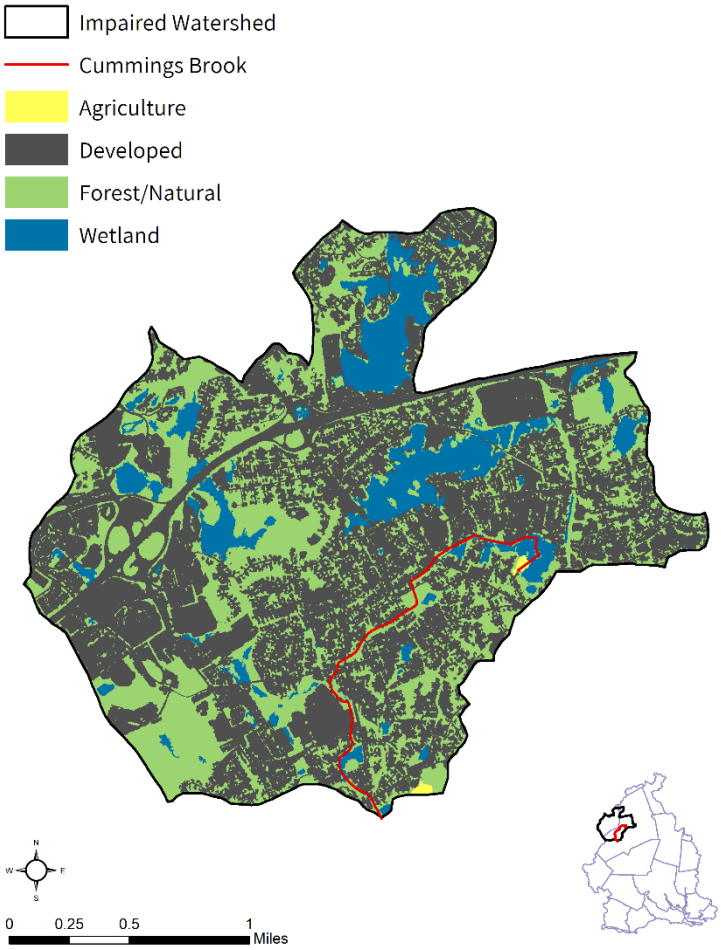
Impairment(s): *E. coli* (Primary Contact Recreation)

Class (Qualifier): B

Impervious Area (Acres, %): 891 (35%)

DCIA Area (Acres, %): 651 (26%)





[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.

overflows (CSOs) within the watershed. There are also no landfills or unpermitted land disposal dumping grounds within the segment watershed. See Figure 3-1.

The Cummings Brook segment MA71-10 watershed is located in a highly-developed part of Massachusetts. A moderate portion of the watershed consists of forest and natural lands (33%) and 11% consists of wetland areas. Over half of the watershed is covered by development (56%), consisting of residential areas, industrial and commercial development, and an interstate highway corridor. There is no agricultural activity within the watershed.

In the Cummings Brook (MA71-10) watershed, under the Natural Heritage and Endangered Species Program, there are nine acres (<1%) of Priority Habitats of Rare Species and no Priority Natural Vegetation Communities. There are no acres under Public Water Supply protection or within Areas of Critical Environmental Concern, and 2,210 acres (87%) of Outstanding Resource Waters. Overall, there are 226 acres (9%) of land protected in perpetuity[2], part of 275 acres (11%) of Protected and Recreational Open Space[3]. 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.

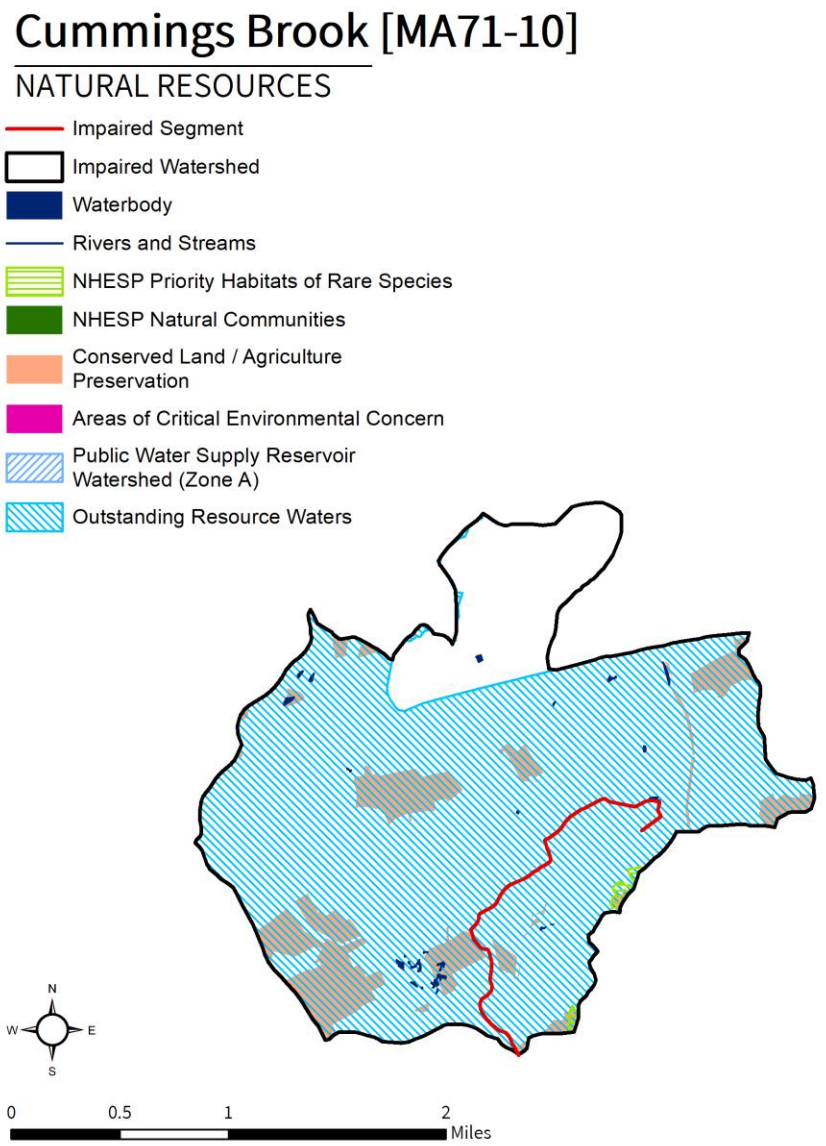


Figure 3-1. Natural resources and potential pollution sources draining to the Cummings Brook segment MA71-10. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollutant sources, including impervious cover, MS4 areas, permitted facilities, etc.

3.2. Waterbody Impairment Characterization

Cummings Brook (MA71-10) 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 W1971; 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, three exceeded the STV criterion, two during wet weather and one during dry weather.

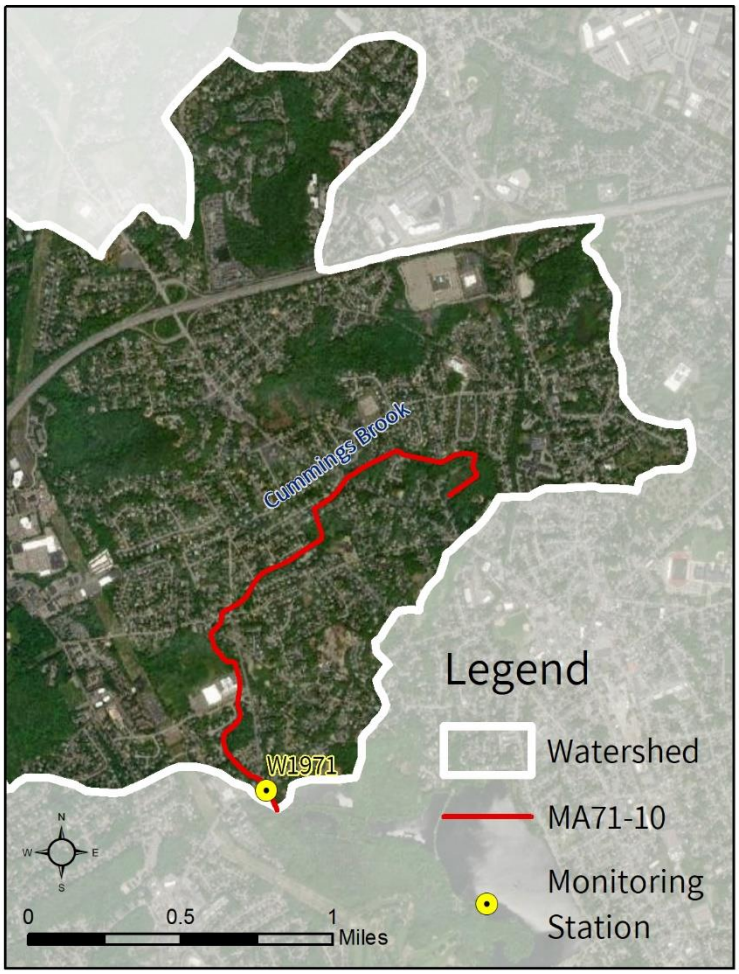


Figure 3-2. Location of monitoring station(s) along the impaired segment.

Table 3-1. Summary of indicator bacteria sampling results by station for Cummings Brook (MA71-10). 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
W1971	4/21/2009	9/8/2009	6	425	6	3

Table 3-2. Indicator bacteria data by station, indicator, and date for Cummings Brook (MA71-10). 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)
W1971	*E. coli*	4/21/2009	WET	320	320	
W1971	*E. coli*	5/26/2009	DRY	200	253	
W1971	*E. coli*	6/30/2009	WET	460	309	
W1971	*E. coli*	7/23/2009	WET	430	341	
W1971	*E. coli*	8/4/2009	DRY	500	375	
W1971	*E. coli*	9/8/2009	DRY	330	425	

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 Cummings Brook (MA71-10) were elevated during both wet 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 that overflow during precipitation events. 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 (56%), which consists of high-density residential areas as well as industrial and commercial development. The entire land area is subject to MS4 permit conditions, 35% is classified as impervious area, and 26% is classified as DCIA. Stormwater runoff from urban areas is likely a substantial source of pathogens.

Illicit Sewage Discharges: Public sewer service is available in the watershed within the towns of Woburn and Burlington. Sewerage-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 risk.

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 show 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 Cummings Brook segment MA71-10. 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 a few small open wetland areas directly adjacent to the impaired segment as well as open fields. 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 Woburn

All of Woburn is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041073), and the city has an EPA-approved Notice of Intent (NOI). The city has mapped 100% of its MS4 system and the year-one and year-two Annual Reports have been submitted. In 2007, Woburn completed an illicit discharge detection and elimination (IDDE) plan, an erosion and sedimentation control (ESC) plan, and post-construction stormwater regulations. According to the city's NOI, *E. coli* -impaired MS4 receiving waters include 53 stormwater outfalls into the Aberjona River (MA71-01).

Woburn has the following ordinances and bylaws, mostly accessible online via the municipal website https://www.woburnma.gov/ (City of Woburn, 2021):

- Stormwater control bylaw and utility fee
- Wetland protection bylaw
- Pet Waste: None found

Woburn has a 2005 Master Plan with a 2020 planning horizon. The town web site indicates that a 2015 update of the plan was started, but a finished plan was not found. The 2005 plan includes a natural resources section, though it does not identify or describe water resources within the city; instead, the plan identifies areas where conservation efforts can be improved. The city operates its own stormwater piping system. Wastewater treatment is not addressed in the plan, but it is noted that the city is served by municipal water systems (City of Woburn, 2021).

Town of Burlington

All of Burlington is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041030), and the town has an EPA-approved Notice of Intent (NOI). The town has mapped 90% of its MS4 system and the year-one and year-two Annual Reports have been submitted. The town has an illicit discharge detection and elimination (IDDE) plan, an erosion and sedimentation control (ESC) plan, and post-construction stormwater regulations, all completed in 2006. No pathogen-impaired waterbodies within the Boston Harbor: Mystic watershed were reported on the town's NOI.

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

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

Burlington's 2018 Master Plan features in-depth sections relating to the environment and stormwater in general. Stormwater runoff is addressed as it pertains to enriching the towns resources (pg. 90) and in the natural resources section (pg. 93). The plan notes specific watersheds that are impaired (pg. 84). Additionally, open space and wetland protection are included in both the Master Plan and the town's 2019 Open Space and Recreation Plan. Burlington boasts its own sewer system, constructed in the mid 1900's (pg. 138), and the town currently provides water and sewer services throughout the municipality (pg. 140). This plan does not specifically address bacterial impairment or freshwater beach resources (Town of Burlington, 2021).

4. MA71-11 Shaker Glen Brook

4.1. Waterbody Overview

Shaker Glen Brook segment MA71-11 is 1.5 miles long and begins west of Dix Road Extension in Woburn, MA. The segment flows northeast before ending at the confluence with Fowle Brook in Woburn, MA. One reach of the segment is culverted and underground.

Tributaries to Shaker Glen Brook segment MA71-11 include a few unnamed streams, and the segment watershed includes a few small unnamed waterbodies. Much of the river flows through wetlands and other natural areas.

Key landmarks in the watershed include the Primrose School of Woburn, Reeves Elementary School, Vinson Owen Elementary School and Science Park, Waverly Square Daycare; the YMCA of Greater Boston and Winchester Swim and Tennis Club; Woburn Animal Hospital; Winning Farm retirement community and many condominium communities; Gillis Field; Battle Road Woodland Area, Sachem Swamp, and Shaker Glen Conservation Area. From upstream to downstream, segment MA71-11 is crossed by Dix Road Extension, Russell Street, Old Cambridge Road, US Route 3, Lexington Street, and Totman Drive, all in Woburn.

Shaker Glen Brook (MA71-11) drains a total area of 2.8 square miles (mi^2), of which 0.6 mi^2 (23%) are impervious and 0.4 mi^2 (14%) are directly connected impervious area (DCIA). The watershed is partially served by public sewer in Woburn, Winchester, and Lexington[4], and the entire 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 or unpermitted land disposal dumping grounds within the segment watershed. See Figure 4-1.

The Shaker Glen Brook segment MA71-11 watershed is located in a highly-developed part of

Reduction from Highest Calculated Geomean: 89%

Watershed Area (Acres): 1,775

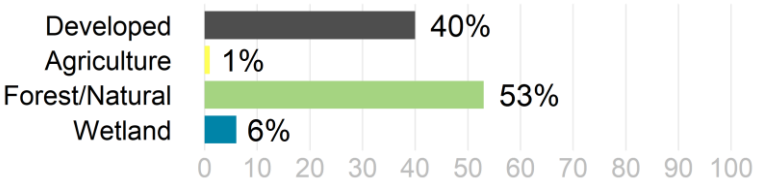
Segment Length (Miles): 1.5

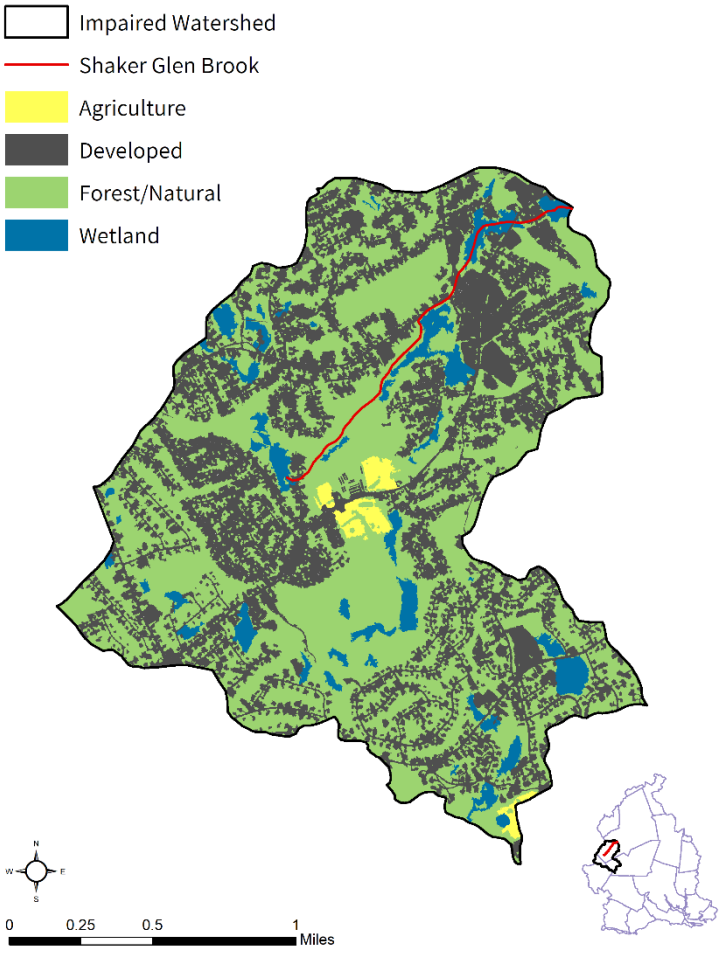
Impairment(s): *E. coli* (Primary Contact Recreation)

Class (Qualifier): B

Impervious Area (Acres, %): 403 (23%)

DCIA Area (Acres, %): 247 (14%)





[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.

Massachusetts. More than half of the watershed consists of forest and natural lands (53%) and 6% consists of wetland areas. The remainder of the watershed is primarily covered by development (40%) as there is very little agricultural activity (1%). Most of the development consists of dense residential areas with some 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 Shaker Glen Brook (MA71-11) watershed, under the Natural Heritage and Endangered Species Program, there are 19 acres (1%) of Priority Habitats of Rare Species and no Priority Natural Vegetation Communities. There are no acres under Public Water Supply protection or within Areas of Critical Environmental Concern, and 1,750 acres (99%) of Outstanding Resource Waters. Overall, there are 109 acres (6%) of land protected in perpetuity[5], part of 151 acres (9%) of Protected and Recreational Open Space[6]. See Figure 4-1.

[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.

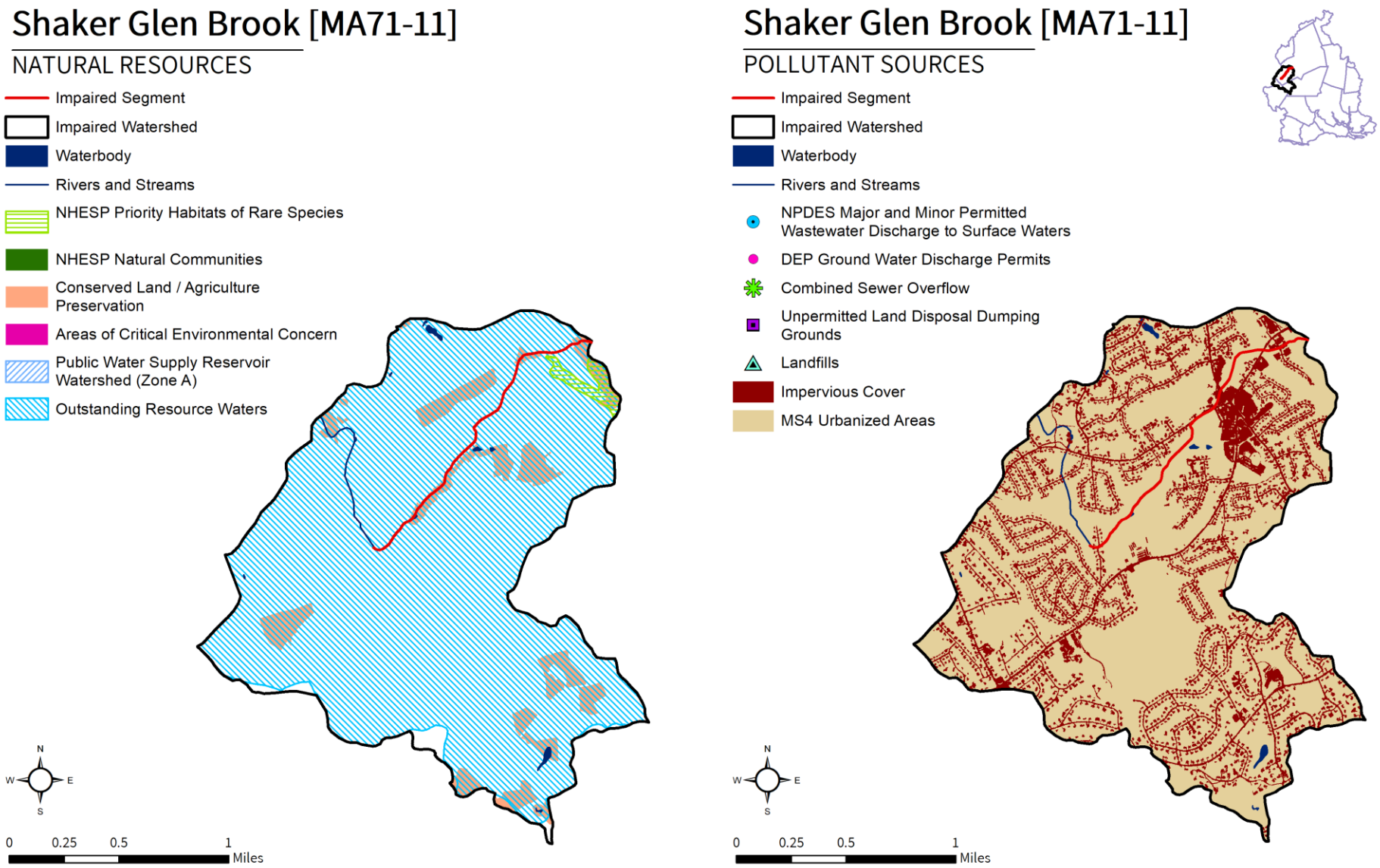


Figure 4-1. Natural resources and potential pollution sources draining to the Shaker Glen Brook segment MA71-11. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollutant sources, including impervious cover, MS4 areas, permitted facilities, etc.

4.2. Waterbody Impairment Characterization

Shaker Glen Brook (MA71-11) 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 4-1, 4-2; 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 W1972; 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, five exceeded the STV criterion, three during wet weather and two during dry weather.

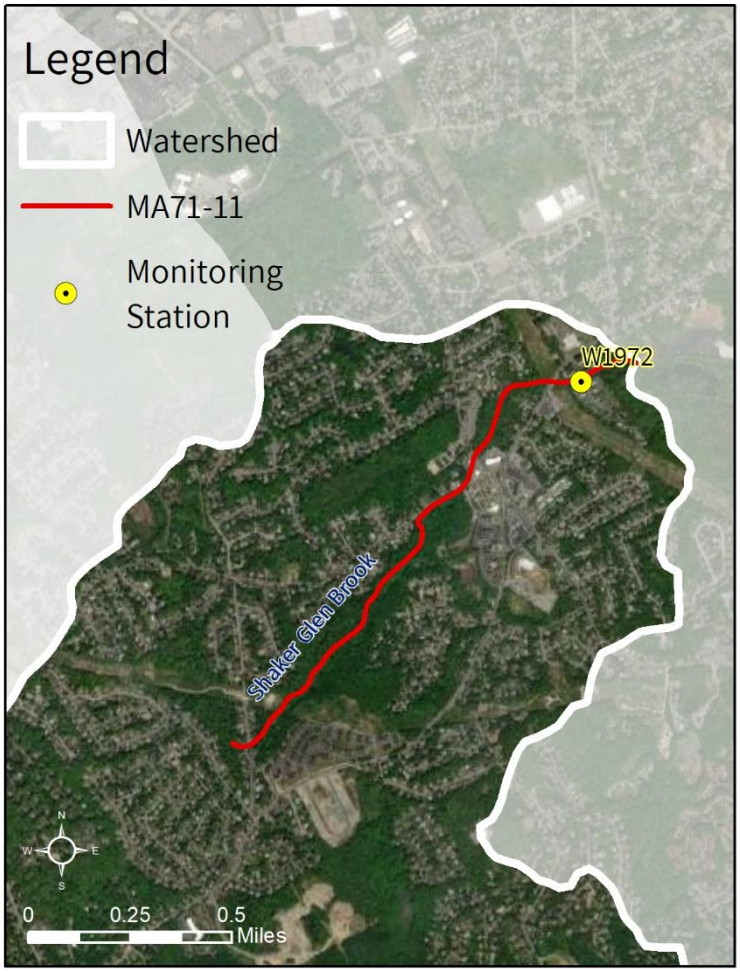


Figure 4-2. Location of monitoring station(s) along the impaired segment.

Table 4-1. Summary of indicator bacteria sampling results by station for Shaker Glen Brook (MA71-11). 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
W1972	4/21/2009	9/8/2009	6	1,100	6	5

Table 4-2. Indicator bacteria data by station, indicator, and date for Shaker Glen Brook (MA71-11). 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)
W1972	*E. coli*	4/21/2009	WET	1,100	1,100	
W1972	*E. coli*	5/26/2009	DRY	560	785	
W1972	*E. coli*	6/30/2009	WET	750	773	
W1972	*E. coli*	7/23/2009	WET	480	586	
W1972	*E. coli*	8/4/2009	DRY	1,300	715	
W1972	*E. coli*	9/8/2009	DRY	250	585	

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 Shaker Glen Brook (MA71-11) were elevated during both wet 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 high amount of development in the watershed (40%), most of which consists of residential areas with some industrial and commercial development as well. The entire land area is subject to MS4 permit conditions, 23% is classified as impervious area, and 14% is classified as DCIA. Stormwater runoff from urban areas is likely a substantial source of pathogens.

Illicit Sewage Discharges: Public sewer service is available in the watershed within the towns of Woburn, Winchester, and Lexington. 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: Agricultural activities in the watershed account for a small portion (1%) of the total land use. A few pasture/hay and cultivated fields are located next to wetland areas within the watershed. Manure storage and spreading activities, if not properly conducted, are possible sources of pathogens to waterbodies.

Pet Waste: There are many residential neighborhoods and parks near the Shaker Glen Brook segment MA71-11. Conservation lands, parks, and ballfields popular for dog-walking, especially where paths or residential neighborhoods are adjacent to rivers, ponds, or wetlands, represent possible sources of pathogens.

Wildlife Waste: A few open wetland areas and ball fields 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.

City of Woburn. See Section 3.4

Town of Lexington

All of Lexington is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041042), 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 2016, Lexington 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: Mystic watershed were reported on the town's NOI.

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

- Stormwater control bylaw
- Wetland protection bylaw
- Stormwater Regulations and Utility: None found

Lexington has a 2003 Comprehensive Plan. Environmental resources are noted in the natural and cultural resources section, which mentions EPA stormwater management requirements. This section also notes that 94% of dwellings in Lexington are served by public sewer. The Open Space and Recreation Plan section of the Master Plan was updated in 2015. This plan includes extensive inventories and analysis of critical environmental resources; updates to the stormwater policies and bylaws as required by the MS4; and identification of stormwater runoff and impairments specific to waterbodies and the watershed (4-11) (Town of Lexington, 2021).

Town of Winchester

All of Winchester is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041072), 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. Winchester completed an illicit discharge detection and elimination (IDDE) plan in 2007, an erosion and sedimentation control (ESC) plan in 2011, and post-construction stormwater regulations in 2007. According to the town's NOI, *E. coli*-impaired MS4 receiving waters include 76 stormwater outfalls into the Aberjona River (MA71-01).

Winchester has the following ordinances and bylaws, mostly accessible online via the town website https://www.winchester.us/ (Town of Winchester, 2021):

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

Winchester has a 2020 Master Plan, which includes a section dedicated to ensuring and increasing the sustainability of the town. No natural resources inventory was found in the plan. Stormwater is briefly mentioned and is identified as a potentially growing problem due to predicted increases in storm size and frequency. The town's sewer system is reported to need improvements, but no other details are provided (Town of Winchester, 2021).

5. MA71-15 Munroe Brook

5.1. Waterbody Overview

Munroe Brook segment MA71-15 is 1.8 miles long and begins north of Solomon Pierce Road in Lexington, MA. The segment flows south for approximately a half mile, then turns to flow southeast for the remainder of the segment before ending at Arlington Reservoir in Lexington, MA. One reach of the segment is culverted and underground.

Tributaries to Munroe Brook segment MA71-15 include a few small unnamed streams. Lakes and ponds in the watershed include many small unnamed waterbodies. Much of the segment's headwaters flow through wetland and agricultural areas, while the remainder flows through mostly forest, other natural areas, and development.

Key landmarks in the watershed include the Harrington Elementary School, Lexington Christian Academy, Pelham Academy, Lexington Children's Place, and First Circle Learning Center—Lexington; Lexington Community Center; Munroe Center for the Arts and Scottish Rite Masonic Museum & Library; Seasons Four outdoor furniture store and Gold Star Nursery; Muzzey Field; and Arlington's Great Meadows, Pheasant Brook and Brown Homestead natural areas and trails. From upstream to downstream, segment MA71-15 is crossed by Solomon Pierce Road, Maple Street/MA-2A, Bryant Road, and Lillian Road, all in Lexington.

Munroe Brook (MA71-15) drains a total area of 1.5 square miles (mi^2), of which 0.3 mi^2 (23%) are impervious and 0.2 mi^2 (14%) are directly connected impervious area (DCIA). The watershed is partially served by public sewer systems in Lexington[7], and the entire 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 or unpermitted land disposal dumping grounds within the segment watershed. See Figure 5-1.

Reduction from Highest Calculated Geomean: 80%

Watershed Area (Acres): 952

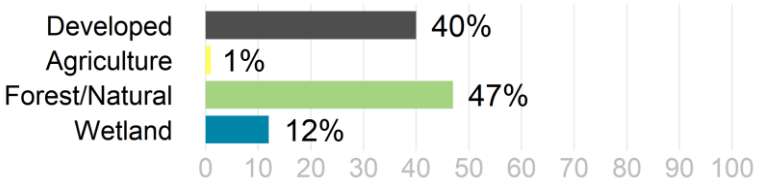
Segment Length (Miles): 1.8

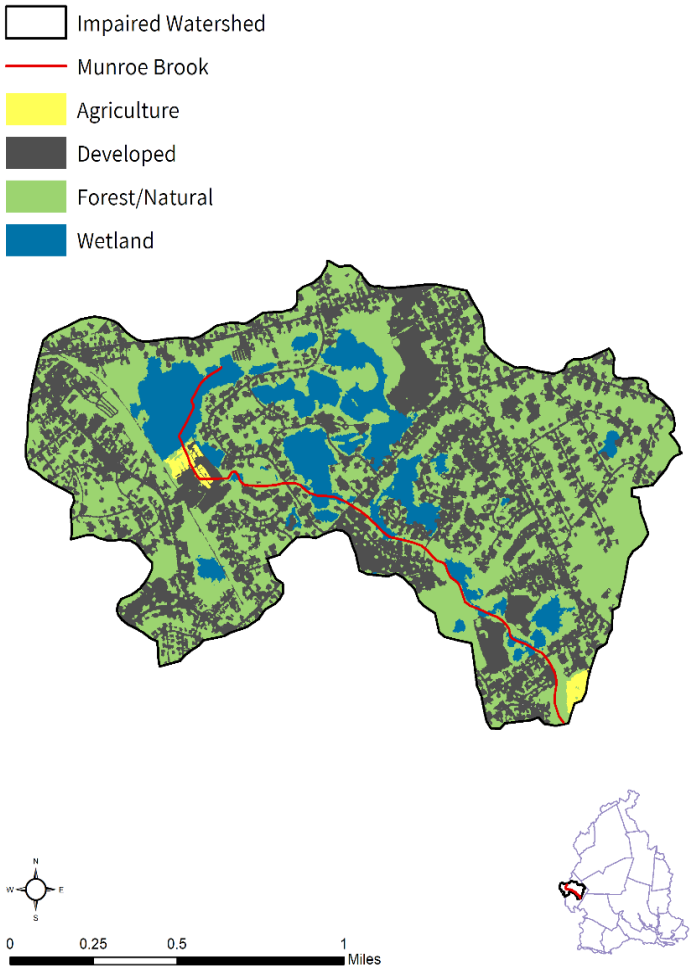
Impairment(s): *E. coli* (Primary Contact Recreation)

Class (Qualifier): B

Impervious Area (Acres, %): 219 (23%)

DCIA Area (Acres, %): 131 (14%)





[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.

The Munroe Brook segment MA71-15 watershed is located in a highly-developed part of Massachusetts. Almost half of the watershed consists of forest and natural lands (47%) and 12% consists of wetland areas. The remainder of the watershed is primarily covered by development (40%) as there is very little agricultural activity (1%). Most of the development consists of high-density residential areas with some industrial and commercial development. Most agricultural activity consists of pasture/hay and cultivated fields located directly adjacent to wetland areas in the watershed.

In the Munroe Brook (MA71-15) watershed, under the Natural Heritage and Endangered Species Program, there are 0.4 acres (<1%) of Priority Habitats of Rare Species and no Priority Natural Vegetation Communities. There are no acres under Public Water Supply protection or within Areas of Critical Environmental Concern, and six acres (<1%) of Outstanding Resource Waters. Overall, there are 79 acres (8%) of land protected in perpetuity[8], part of 137 acres (14%) of Protected and Recreational Open Space[9]. 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.

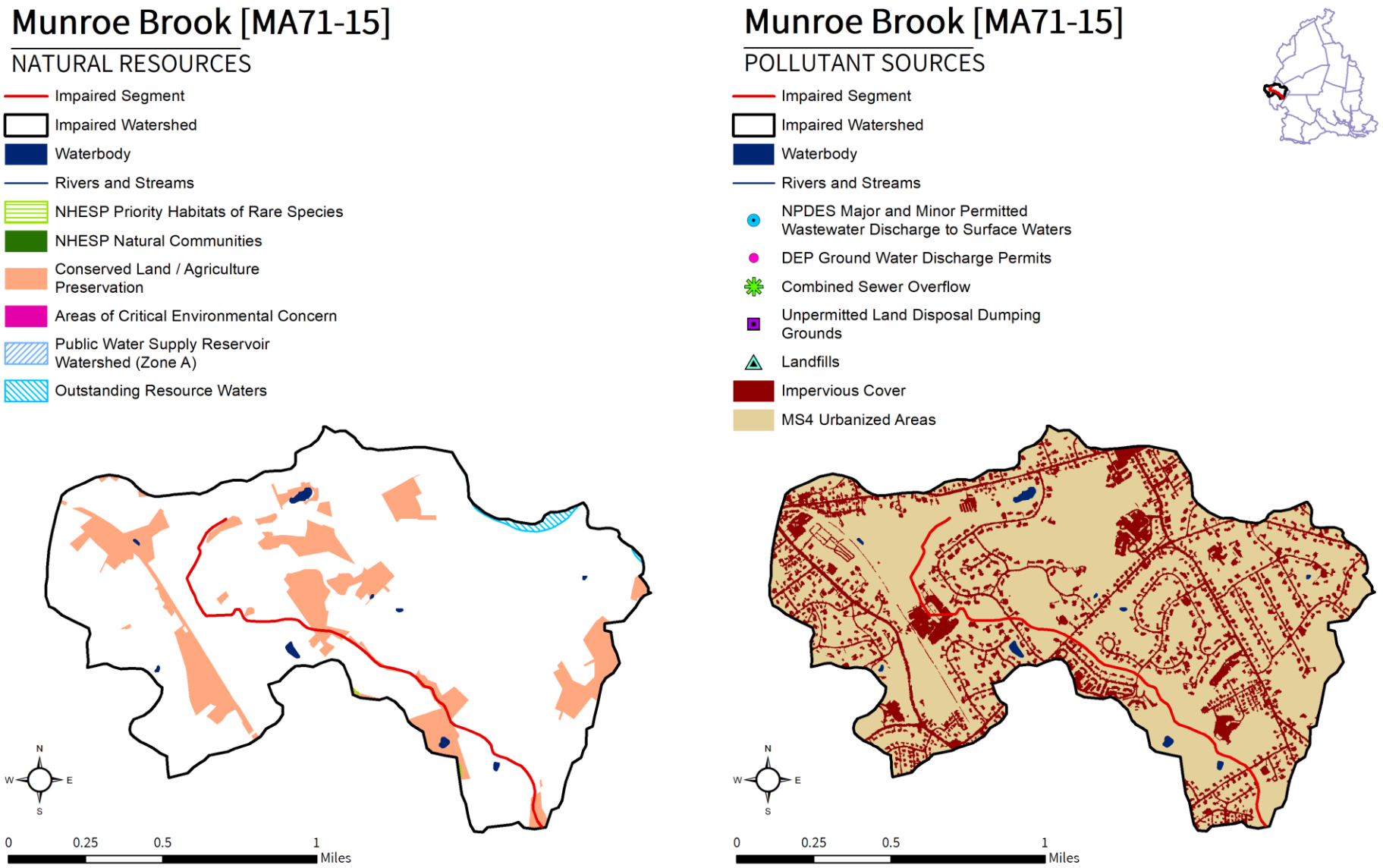


Figure 5-1. Natural resources and potential pollution sources draining to the Munroe Brook segment MA71-15. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollutant sources, including impervious cover, MS4 areas, permitted facilities, etc.

5.2. Waterbody Impairment Characterization

Munroe Brook (MA71-15) 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 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 W1977; data indicate 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, three exceeded the STV criterion during wet weather.

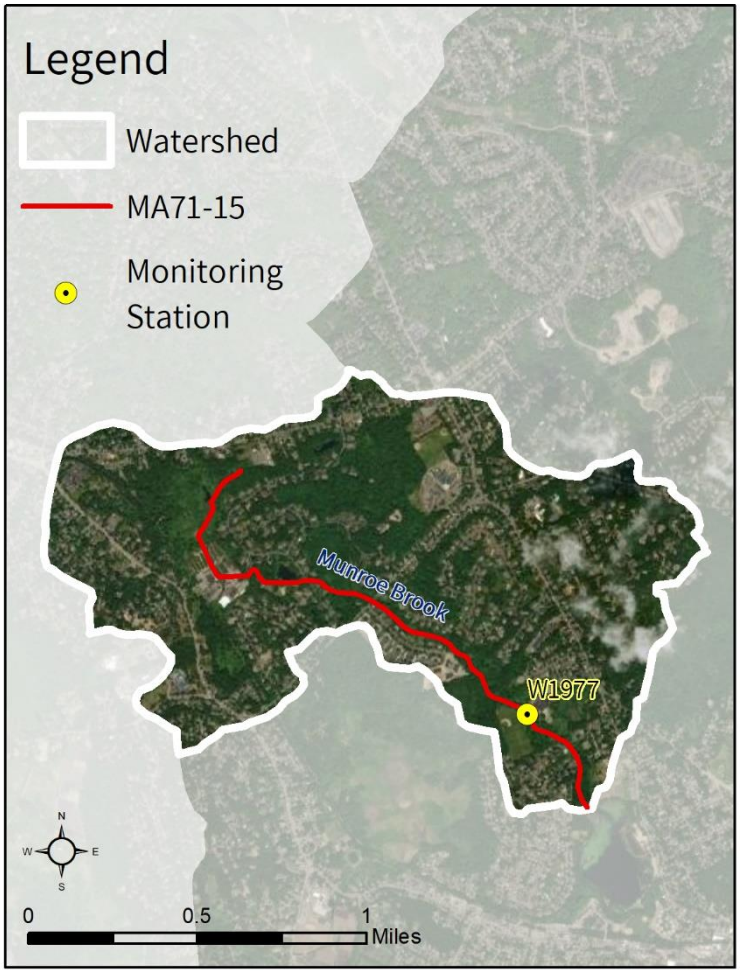


Figure 5-2. Location of monitoring station(s) along the impaired segment.

Table 5-1. Summary of indicator bacteria sampling results by station for Munroe Brook (MA71-15). 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
W1977	4/21/2009	9/8/2009	6	630	6	3

Table 5-2. Indicator bacteria data by station, indicator, and date for Munroe Brook (MA71-15). 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)
W1977	*E. coli*	4/21/2009	WET	630	630	
W1977	*E. coli*	5/26/2009	DRY	390	496	
W1977	*E. coli*	6/30/2009	WET	570	519	
W1977	*E. coli*	7/23/2009	WET	660	527	
W1977	*E. coli*	8/4/2009	DRY	240	433	
W1977	*E. coli*	9/8/2009	DRY	260	391	

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 Munroe Brook (MA71-15) were elevated during wet 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.

Each potential pathogen source is described in further detail below.

Urban Stormwater: There is a high amount of development in the watershed (40%), most of which consists of residential areas with some industrial and commercial development as well. The entire land area is subject to MS4 permit conditions, 23% is classified as impervious area, and 14% is classified as DCIA. Stormwater runoff from urban areas is likely a substantial source of pathogens.

Illicit Sewage Discharges: Public sewer service is available in the watershed within the Massachusetts town of Lexington. 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 risk.

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

Pet Waste: There are many residential neighborhoods and parks near the Munroe Brook segment MA71-15. Conservation lands, parks, and ballfields popular for dog-walking, especially where paths or residential neighborhoods are adjacent to rivers, ponds, or wetlands, represent possible sources of pathogens.

Wildlife Waste: A few open 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 Lexington. See Section 4.4

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