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

Appendix Q: Neponset River Basin & Coastal Drainage Area

Commonwealth of Massachusetts
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December 2024

CN 515.1.17

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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 two pathogen-impaired segments in the Neponset River Basin & Coastal Drainage Area, hereinafter referred to as the Boston Harbor: Neponset River 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 two Boston Harbor: Neponset 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: Neponset River Watershed Overview section.

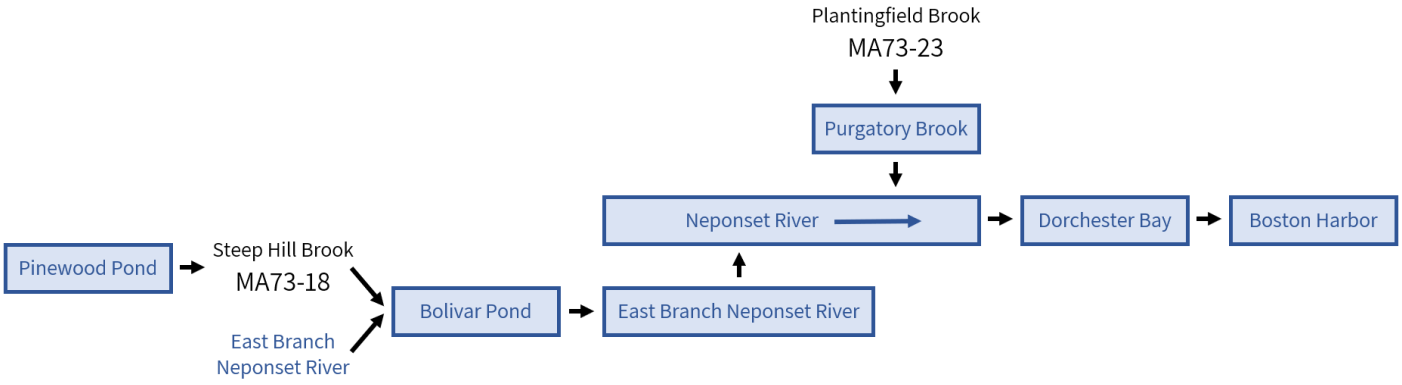


Figure 1-1. Conceptual diagram of water flow through the Boston Harbor: Neponset River Watershed for the two pathogen-impaired segments. Connections between waterbodies are shown with black arrows. Not to scale. Impaired segments are shown with the assessment unit.

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 Neponset 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)					
Steep Hill Brook		R	126	1,100	89%	WLA (24%)	0.7	7.4	74.5	744.9	7,449.0	74,490.4
MA73-18	B			(90 day)		LA (76%)	2.3	23.4	233.8	2,337.8	23,377.8	233,777.6
Plantingfield Brook		R	126	3,077	96%	WLA (23%)	0.7	7.2	71.7	717.4	7,174.3	71,743.3
MA73-23	B			(90 day)		LA (77%)	2.4	23.7	236.5	2,365.2	23,652.5	236,524.8

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 Neponset 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)					
Steep Hill Brook		P	35	NA	-	WLA (24%)	0.2	2.1	20.7	206.9	2,069.2	20,691.8
MA73-18	B					LA (76%)	0.6	6.5	64.9	649.4	6,493.8	64,938.2
Plantingfield Brook		P	35	NA	-	WLA (23%)	0.2	2.0	19.9	199.3	1,992.9	19,928.7
MA73-23	B					LA (77%)	0.7	6.6	65.7	657.0	6,570.1	65,701.3

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

Target TMDL or Total Maximum Daily Load is presented as both SWQS-Based and Flow-Based.
- ***SWQS-Based TMDL Target*** *is the target concentration applicable to the TMDL pollutant indicator bacteria based on the Surface Water Quality Standards (314 CMR 4.00).*
- ***Flow-Based Target TMDL*** *is the target concentration (CFU/100mL) multiplied by the standard flow volume (cubic feet per second or cfs). See Section 4.2.2 in core document for full equation and conversion factors.*

Maximum Geomean *is the highest calculated 30- or 90- day rolling geometric mean for TMDL pollutant indicator bacteria associated with the segment.*
Geomean Percent Reduction *is the percent reduction from the highest calculated 30- or 90- day rolling geomean needed to achieve the target concentration. Percent reductions are for planning purposes only.*

2. Boston Harbor: Neponset River Watershed Overview

The Boston Harbor: Neponset River Watershed covers an area of approximately 117 square miles (mi^2) in eastern Massachusetts (Figure 2-1). It includes the mainstem Neponset River, which flows northeast from the Neponset Reservoir in Foxborough, MA to its mouth at Dorchester Bay in Boston, MA. Major tributaries to the Neponset River include the East Branch Neponset River and Mother Brook, which is a man-made diversion that transfers flow from the Charles River to the Neponset River (Meek, 2010).

Prominent infrastructure along the mainstem of the Neponset River includes 12 dams and several mills. Even prior to the Industrial Revolution, the Neponset River was home to numerous textile, paper, and lumber mills that used the river for power and the disposal of waste. Poor water quality in the Neponset River was recognized in the late 1800s, although this issue was not addressed until the 1960's and 1970's when state and federal legislation was passed to protect the river. Today, the Neponset River is much cleaner due to improved sewer infrastructure and the closure of many industrial facilities along the river (Meek, 2010).

There are two designated Areas of Critical Environmental Concern (ACEC) in the Boston Harbor: Neponset River Watershed, the Neponset River Estuary ACEC and the Fowl Meadow and Ponkapoag Bog ACEC. The Neponset River Estuary ACEC was officially designated on March 27, 1995, and encompasses roughly 1,300 acres in Boston, Milton, and Quincy. This area is composed of floodplains, open water, saltmarsh, and wetlands that serve as habitat for anadromous fish, soft-shell clams, finfish, and numerous bird species. The Fowl Meadow and Ponkapoag Bog ACEC was officially designated on August 20, 1992, and encompassed roughly 8,350 acres in Boston, Canton, Dedham, Milton, Norwood, Randolph, Sharon, and Westwood. This ACEC is home to at least 13 state-listed rare species (Meek, 2010).

The Boston Harbor: Neponset River Watershed overlaps a portion of 14 municipalities in Massachusetts. Of these, only the Town of Northwood is completely contained within the watershed. The majority of Canton, Milton, Sharon, Walpole, and Westwood 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 waterbodies. In addition, these networks are sometimes subject to direct wastewater inflows through illegal cross-connections, leaks from sewer pipes or septic systems, dumping, or other unauthorized wastewater sources, and together these sources are termed illicit discharges.

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

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

- **Neponset River Watershed Association** (NepRWA) is a "grassroots, member-supported conservation group working since 1967 to clean up and protect the Neponset River, its tributaries and surrounding watershed lands" (NepRWA, 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 Neponset River for nutrients and bacteria (MWRA, 2022).
- **Trout Unlimited (TU)** operates two chapters in the geographic area of the Boston Harbor: Neponset River Watershed in Massachusetts, including the Greater Boston (GBTU) and Southeastern Mass (SEMASS). 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). An ongoing TU project in the Neponset includes training volunteers in assessing trout habitat as part of their Embrace A Stream project, whose focus is on culvert assessments, water testing, temperature monitoring and eDNA testing in the Neponset River Watershed (TU, 2021).
- **U.S. Environmental Protection Agency** (USEPA) in coordination with NepRWA began assigning report card grades to 26 stretches of waterbodies in the Neponset River watershed in 2020 (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 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 (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.

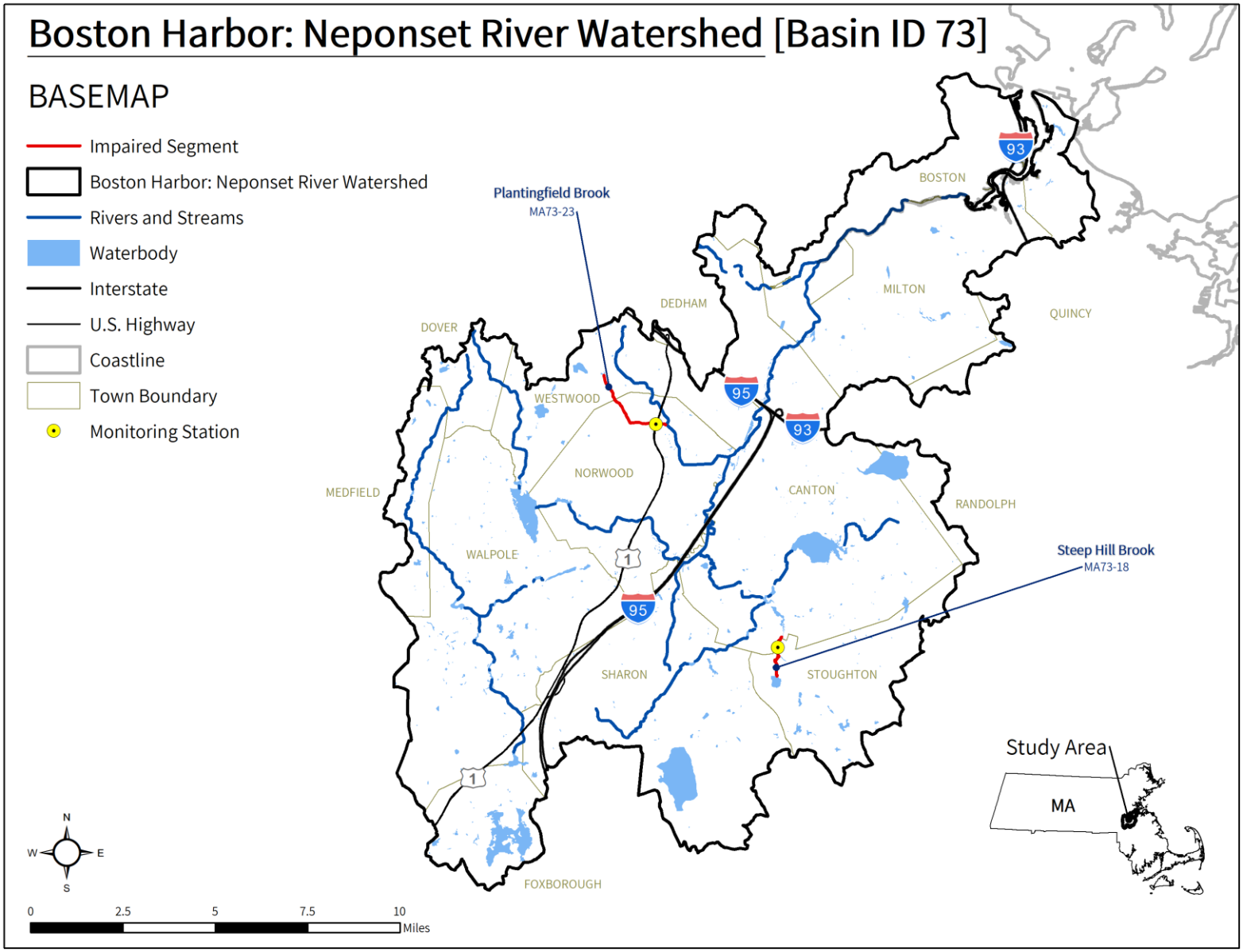


Figure 2-1: Map of all pathogen-impaired segments, water quality monitoring stations, municipal borders, waterbodies, and major roads in the Boston Harbor: Neponset River Watershed.

3. MA73-18 Steep Hill Brook

3.1. Waterbody Overview

Steep Hill Brook segment MA73-18 is 0.9 miles long and begins at the outlet of Pinewood Pond in Stoughton, MA. The segment flows north to its mouth at the inlet of Bolivar Pond in Canton, MA.

There are a few unnamed tributaries to Steep Hill Brook segment MA73-18. Lakes and ponds in the watershed include Pinewood Pond, Town Pond, Woods Pond, Brittons Pond, and a few small unnamed waterbodies. The segment flows through mainly developed areas upstream of Erin Road, and through wetland areas downstream of there. Some portions of this segment are culverted and underground.

Key landmarks in the watershed include the Stoughton Town Center, Stoughton High School, a portion of the Bird Street Conservation Area/Stoughton Memorial Conservation Land, Chemung Hill Area, and a portion of the Village Shoppes Plaza in Canton. From upstream to downstream, segment MA73-18 is crossed by Lakewood Drive, Central Street/MA-27 (culvert), and Ethyl Way (culvert), all in Stoughton.

Steep Hill Brook (MA73-18) drains a total area of 6.0 square miles (mi^2), of which 1.4 mi^2 (24%) are impervious and 1.0 mi^2 (17%) are directly connected impervious area (DCIA). Most of the watershed is served by public sewer provided by the Massachusetts Water Resources Authority (87%) and the remaining watershed is served by on-site septic systems (in Sharon[1]). The entire watershed 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 3-1.

The Steep Hill Brook segment MA73-18 watershed is located in a highly developed part of Massachusetts. Almost half of the watershed

Reduction from Highest Calculated Geomean: 89%

Watershed Area (Acres): 3,811

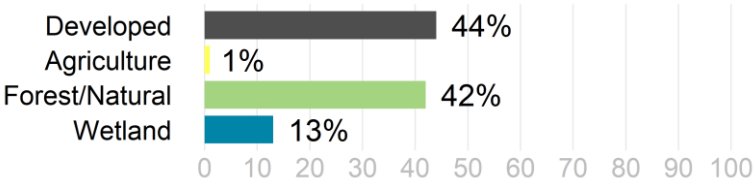
Segment Length (Miles): 0.9

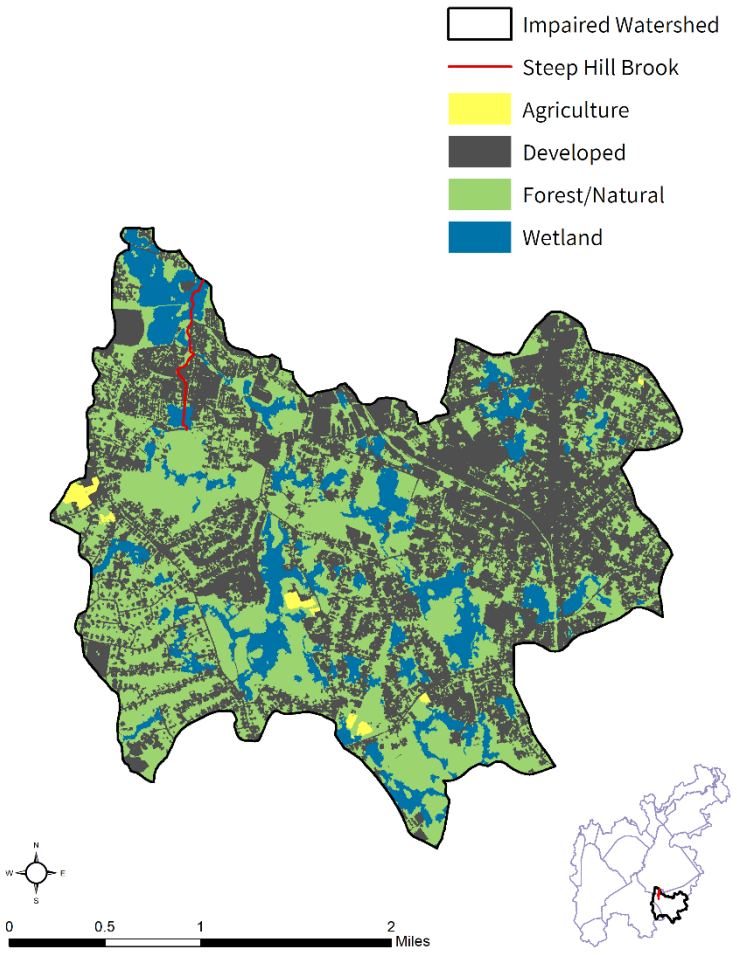
Impairment(s): *E. coli* (Primary Contact Recreation)

Class (Qualifier): B

Impervious Area (Acres, %): 921 (24%)

DCIA Area (Acres, %): 631 (17%)





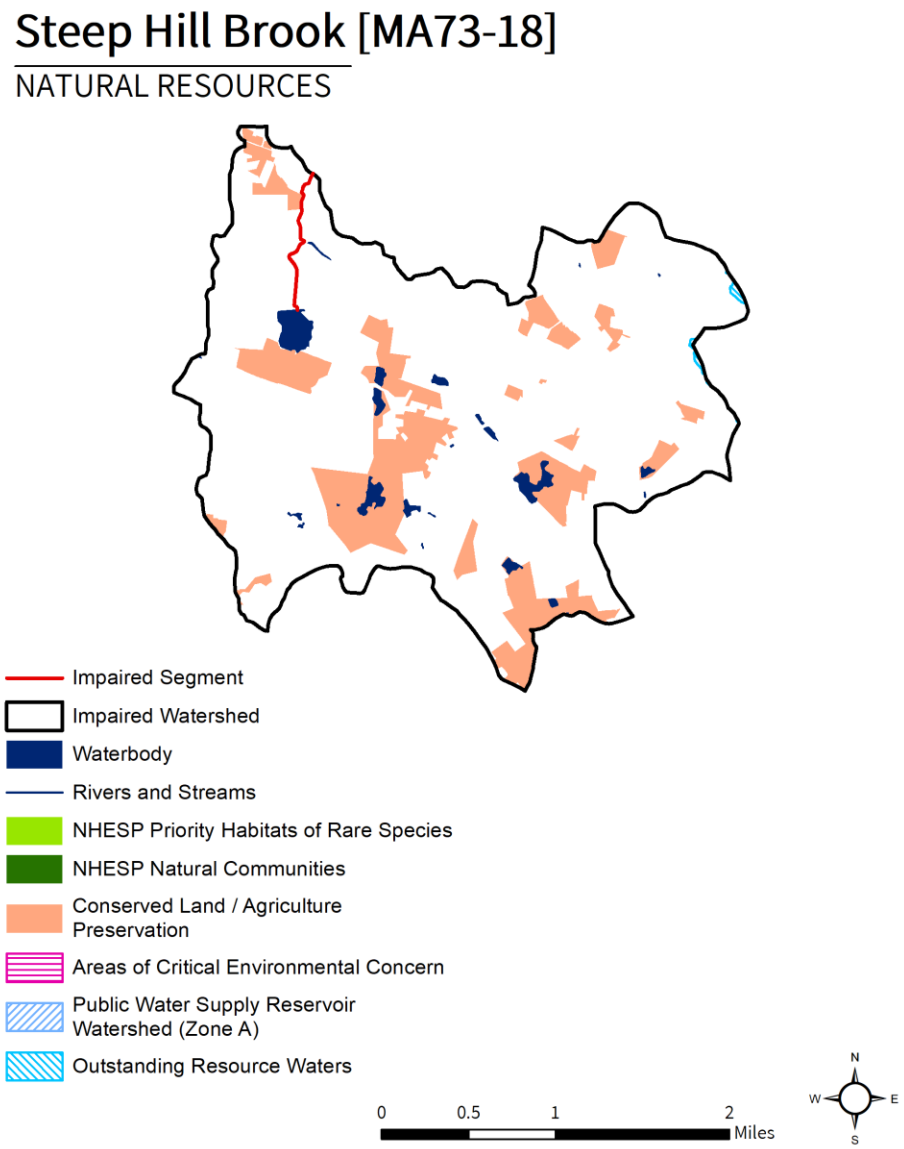
[1] Estimated percentage of developed areas with wastewater infrastructure in the watershed was based on available information: MWRA service areas, MassDEP's Water Utility Infrastructure Mapping Project (MassDEP, 2021b), MS4 reports, and local knowledge.

consists of development (44%); the remaining half (approximate) consists of forest and natural lands (42%) and wetland areas (13%). There is a very small amount of agriculture in the watershed (1%), consisting of a dairy operation and cultivated or pasture/hay fields. The development primarily consists of residential areas in the southwest half of the watershed and commercial and industrial development in the northeast.

In the Steep Hill Brook (MA73-18) watershed, there are no Priority Habitats of Rare Species or Priority Natural Vegetation Communities, as defined by the Natural Heritage and Endangered Species Program. There are also no acres under Public Water Supply protection or within designated Areas of Critical Environmental Concern, and six acres (<1%) of Outstanding Resource Waters. Overall, there are 585 acres (15%) of land protected in perpetuity[2], part of 638 acres (17%) 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.



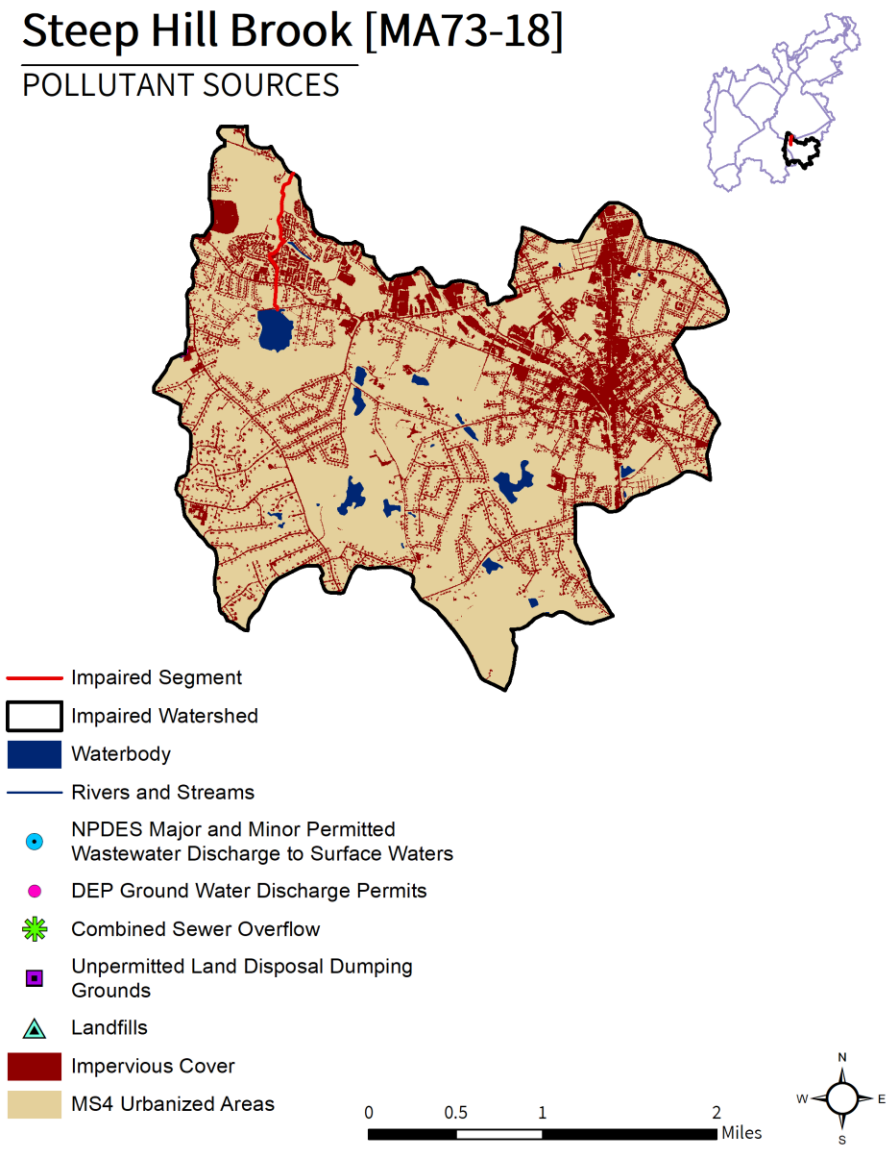


Figure 3-1. Natural resources and potential pollution sources draining to the Steep Hill Brook segment MA73-18. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollutant sources, including impervious cover, MS4 areas, permitted facilities, etc.

3.2. Waterbody Impairment Characterization

Steep Hill Brook (MA73-18) is a Class B Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS at the stations 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 W1944; 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.

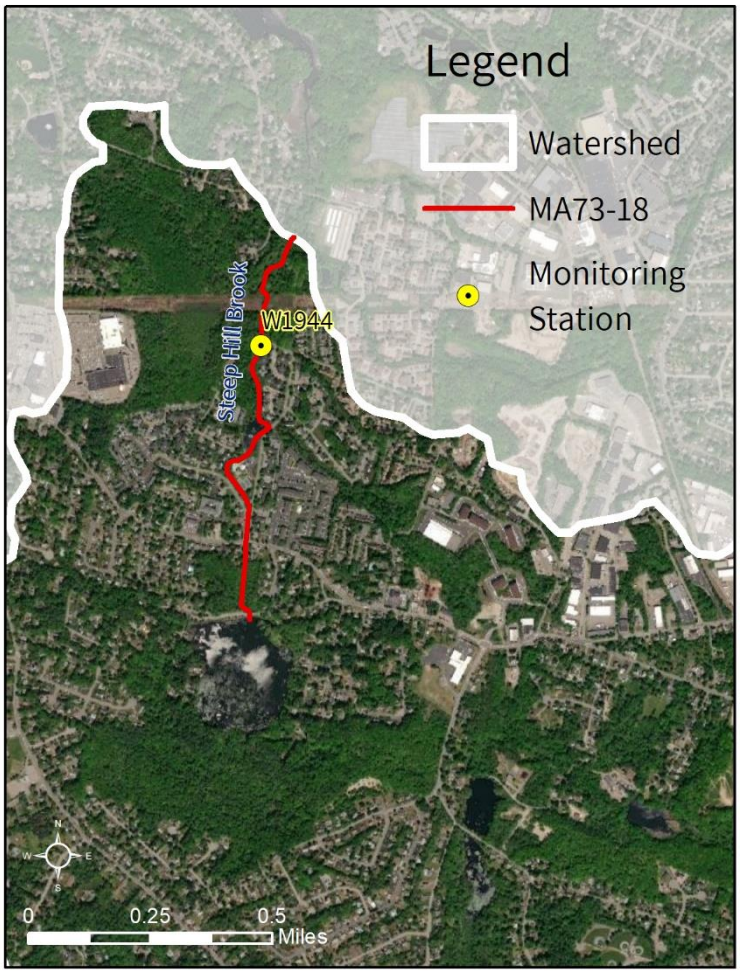


Figure 3-2. Location of monitoring station(s) along the impaired segment.

Table 3-1. Summary of indicator bacteria sampling results by station for Steep Hill Brook (MA73-18). 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
W1944	4/28/2009	9/15/2009	6	1,100	6	2

Table 3-2. Indicator bacteria data by station, indicator, and date for Steep Hill Brook (MA73-18). 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)
W1944	*E. coli*	4/28/2009	DRY	1,100	1,100	
W1944	*E. coli*	6/2/2009	DRY	460	711	
W1944	*E. coli*	7/7/2009	WET	160	433	
W1944	*E. coli*	8/11/2009	WET	370	301	
W1944	*E. coli*	8/27/2009	DRY	280	296	
W1944	*E. coli*	9/15/2009	DRY	230	248	

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 Steep Hill Brook (MA73-18) 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. Certain types of septic system malfunctions, such as rainwater infiltration or saturated disposal fields which overflow during precipitation, may also result in elevated levels of indicator bacteria during wet weather 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 major sources of pathogens.

Each potential pathogen source is described in further detail below.

Urban Stormwater: The watershed is highly developed (44%), consisting mostly of medium density residential areas, with some industrial and commercial development in the east. Within the watershed, 100% of the land area is subject to MS4 permit conditions, 24% is classified as impervious area, and 17% 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 Canton and Stoughton, provided by the Massachusetts Water Resources Authority. Sewer-related risks to water quality include leaking infrastructure (pipes, pump stations, etc.) and sanitary sewer overflows (SSOs), which may be caused by undersized infrastructure, blockages, or excessive infiltration of groundwater or rainwater into pipes, exceeding system capacity. Illicit connections of wastewater to stormwater conveyances are also a potential source.

On-Site Wastewater Disposal Systems: Some development in the watershed utilizes on-site septic systems for wastewater treatment in the town of Sharon. 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 very small portion (1%) of the total land use. This agricultural land is comprised of a dairy farm operation and other pasture/hay or cultivated fields. Manure storage and spreading activities, if not properly conducted, are possible sources of pathogens to waterbodies.

Pet Waste: Most of Steep Hill Brook segment MA73-18 is surrounded by residential neighborhoods, though no parks are directly adjacent to the segment. 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 large open (emergent) wetland areas located directly adjacent to the impaired segment in its downstream reach. 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 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 Canton

The entirety of Canton is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041031), 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. Canton completed an illicit discharge detection and elimination (IDDE) plan in 2007, an erosion and sedimentation control (ESC) plan in 2003, and post-construction stormwater regulations in 2016. According to the town's NOI, pathogen-impaired MS4 receiving waters include 19 outfalls to Pecunit Brook (MA73-25) and 37 outfalls to the Neponset River (MA73-01) within Canton, both of which are impaired by *E. coli*. Additionally, there are 54 outfalls to Ponkapoag Brook (MA73-27) and 62 outfalls to the Canton River (also known as East Branch Neponset River, MA73-05). Both of these waterbodies are impaired by both *E. coli* and fecal coliform.

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

- Wetland protection bylaw;
- Stormwater regulation and utility bylaw, which mentions Title 5 supplemental regulations; and
- Pet Waste: None found.

Canton's 2020 Master Plan is broken into three separate reports: a baseline report, a road map to guide actions, and an action plan listing specific changes over the next 20 years. All three aspects of this plan mention the environment in some form. The baseline report is comparable to other towns' master or comprehensive plans and focuses on natural resources, natural hazards and climate change, as well as open space and recreation planning. These sections address stormwater runoff, and describe their MS4 compliance program. Impaired waterbodies within the town are also identified, but no specific mention is made of pathogen impairment (pg. 90). There is a section highlighting the town's water/sewer division. The town has a public sewer system but does not operate a wastewater treatment facility. All wastewater is transported elsewhere or processed by on-site wastewater treatment systems (pg. 123). Canton also has a 2019 Open Space and Recreation Plan, which includes additional inventory and analysis of water resources (Town of Canton, 2021).

Town of Sharon

About 90% of Sharon is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041061), 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. Sharon has 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 six outfalls into School Meadow Brook (MA73-06), three outfalls into Traphole Brook (MA73-17, though the 2018/20 IR lists it as attaining primary and secondary contact recreation use), and seven outfalls into an unnamed tributary (MA73-31).

Sharon has the following ordinances and bylaws, mostly accessible online via the town website https://www.townofsharon.net/ (Town of Sharon, 2021):

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

Sharon has a 2019 Master Plan, which includes a section on Open Space and Natural Resources. This section lacks an in-depth inventory and analysis of the town's natural resources, particularly waterbodies. There is a stormwater management section, which discusses the specifics of MS4 permitting, but does not name any impaired waters. Sharon has no municipal wastewater system (pg. 141). Sharon has an Open Space and Recreation Plan (OSRP) from 2009. The 2019 Master Plan mentions an update to Sharon's OSRP, but it was not found online (Town of Sharon, 2021).

Town of Stoughton

All of Stoughton is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041063), 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 2006, Stoughton 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, *E. coli*-impaired MS4 receiving waters include 16 stormwater outfalls into Steep Hill Brook (MA73-18) and nine outfalls into an unnamed tributary flowing into Steep Hill Brook (MA73-32).

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

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

Stoughton has a 2013 Master Plan, which includes a section about existing natural resources within the town. There is also a separate stormwater section with the Public Works section. Stoughton owns and maintains 109 miles of sewer mains. Stoughton also has a 2017 Open Space and Recreation Plan (Town of Stoughton, 2021).

4. MA73-23 Plantingfield Brook

4.1. Waterbody Overview

The Plantingfield Brook segment MA73-23 is 1.9 miles long and begins at its headwaters east of Thatcher Street in Westwood, MA. The segment flows southeast before bending and flowing east to its confluence with Purgatory Brook in Northwood, MA. A portion is culverted.

There is one small unnamed tributary to the Plantingfield Brook segment MA73-23. Lakes and ponds in the watershed include Lymans Pond and a few small unnamed waterbodies. Much of the segment flows through wetlands, though some flows through developed areas. Some portions of this segment are culverted and underground, including a 1,200-ft reach (approximate) between Route 1A/Upland Road and Neponsett Street, Westwood .

Key landmarks in the watershed include Ellis Gardens Playground, Oldham Elementary School, the Rice Reservation, and a northern portion of the Westwood High School and the Thurston Middle School campuses. From upstream to downstream, segment MA73-23 is crossed by Clapboardtree Street (Westwood), two unnamed roads (Norwood), Upland Road (culvert; Norwood), Washington Street (culvert; Norwood), Earle Street (culvert; Norwood), Neponset Street (culvert; Norwood), and Providence Highway/U.S. Route 1 (southbound and northbound; Norwood).

Plantingfield Brook (MA73-23) drains a total area of 1.5 square miles (mi^2), of which 0.4 mi^2 (23%) are impervious and 0.2 mi^2 (16%) are directly connected impervious area (DCIA). The watershed is served by a public sewer system in Norwood and Westwood operated by the Massachusetts Water Resources Authority[4]; 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 or unpermitted land disposal dumping

Reduction from Highest Calculated Geomean: 96%

Watershed Area (Acres): 959

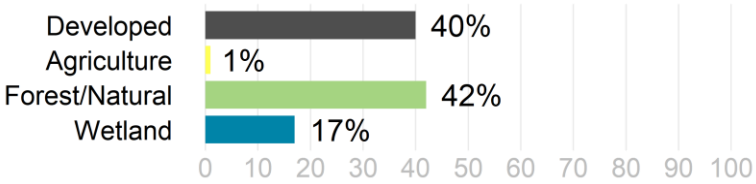
Segment Length (Miles): 1.9

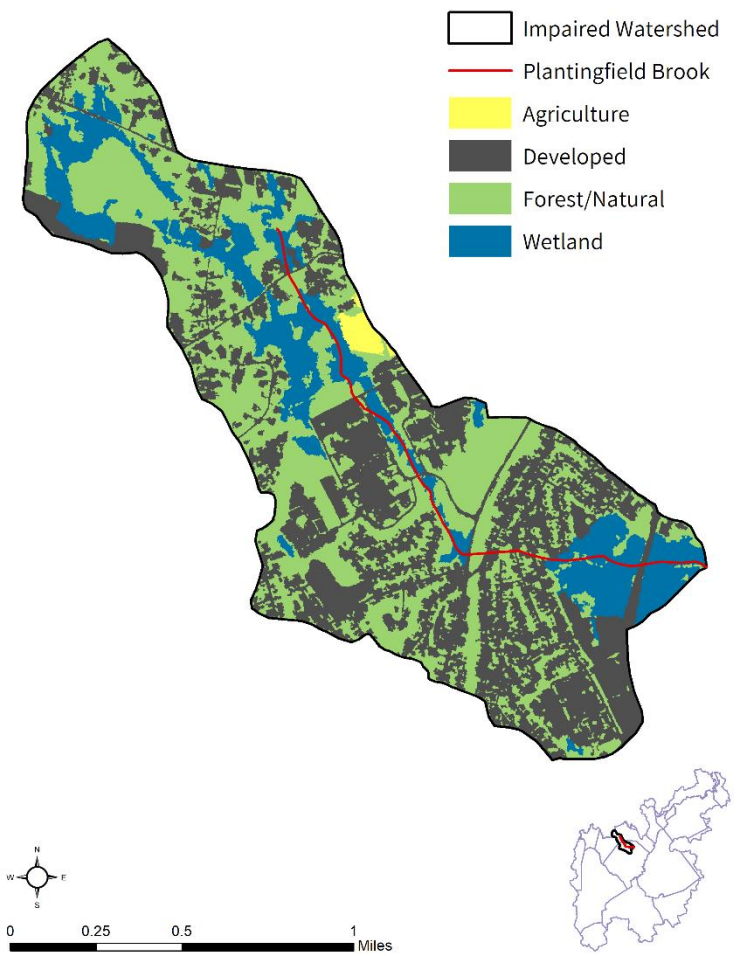
Impairment(s): *E. coli* (Primary and Secondary Contact Recreation)

Class (Qualifier): B

Impervious Area (Acres, %): 223 (23%)

DCIA Area (Acres, %): 151 (16%)





[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.

grounds within the segment watershed. See Figure 4-1.

The Plantingfield Brook segment MA73-23 watershed is located in a moderately- to highly-developed part of Massachusetts with 40% of the watershed covered by development. Almost half the watershed consists of forest and natural lands (42%), and 17% consist of wetland areas. There is a small amount of agriculture in the watershed (1%), consisting of cultivated crop fields. The development consists mostly of residential neighborhoods with some industrial development, and little commercial development.

In the Plantingfield Brook (MA73-23) watershed, there are no Priority Habitats of Rare Species or Priority Natural Vegetation Communities, as defined by the Natural Heritage and Endangered Species Program. There are also no acres under Public Water Supply protection, 23 acres (2%) within the Fowl Meadow and Ponkapoag Bog Area of Critical Environmental Concern, and no Outstanding Resource Waters. Overall, there are 131 acres (14%) of land protected in perpetuity[5], part of 159 acres (17%) 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.

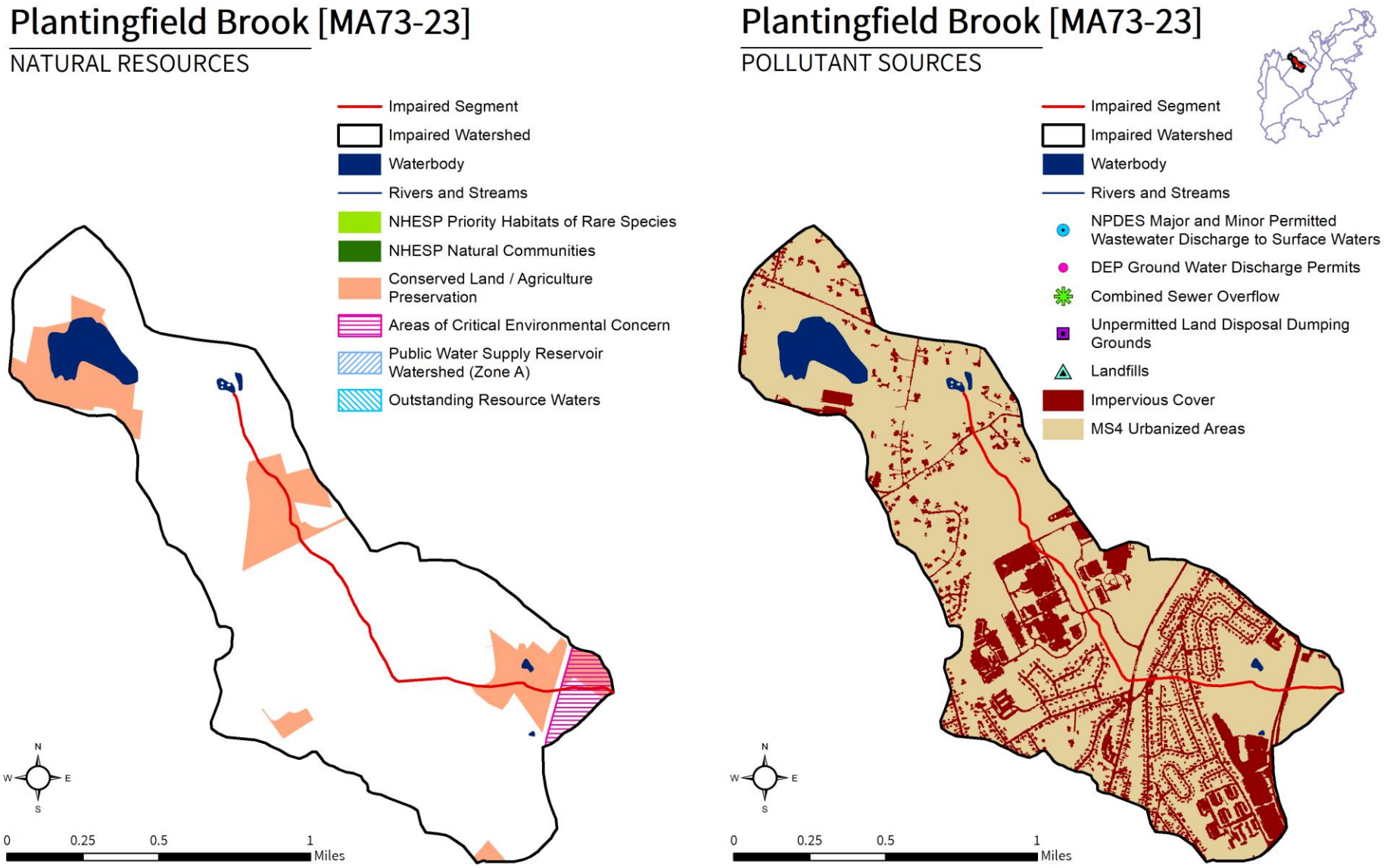


Figure 4-1. Natural resources and potential pollution sources draining to the Plantingfield Brook segment MA73-23. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollutant sources, including impervious cover, MS4 areas, permitted facilities, etc.

4.2. Waterbody Impairment Characterization

Plantingfield Brook (MA73-23) is a Class B Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS at the station identified 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, five samples were collected at W1947data 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 Statistical Threshold Value (STV) criterion was applied to single sample results. Out of five samples, three exceeded the STV criterion, two during wet weather and one during dry weather.

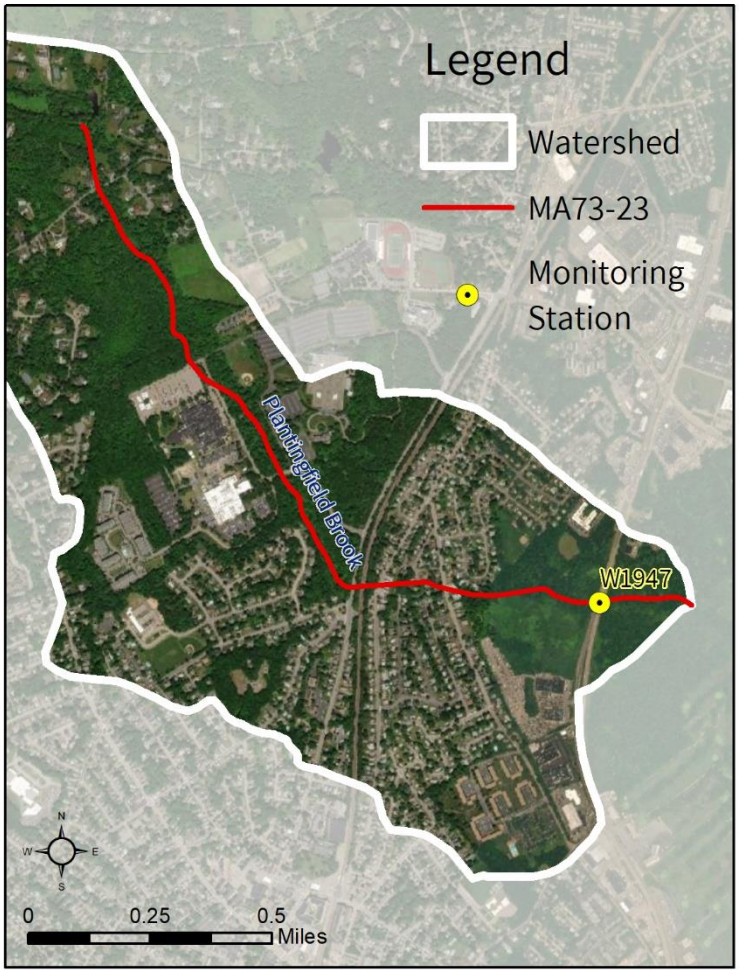


Figure 4-2. Location of monitoring station(s) along the impaired segment.

Table 4-1. Summary of indicator bacteria sampling results by station for Plantingfield Brook (MA73-23). 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
W1947	4/28/2009	9/15/2009	5	3,077	3	3

Table 4-2. Indicator bacteria data by station, indicator, and date for Plantingfield Brook (MA73-23). 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)
W1947	*E. coli*	4/28/2009	DRY	60	60	
W1947	*E. coli*	6/2/2009	DRY	180	104	
W1947	*E. coli*	7/7/2009	WET	2,800	312	
W1947	*E. coli*	8/11/2009	WET	8,000*	1,592	
W1947	*E. coli*	9/15/2009	DRY	1,300	3,077	

* Value above the Method Detection Limit (MDL) of 8,000 CFU/100mL; the MDL is reported and used to calculate the geometric means for *E. coli*.

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 Plantingfield Brook (MA73-23) 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. Additional sampling under dry conditions would likely help identify pollutant sources.

Each potential pathogen source is described in further detail below.

Urban Stormwater: There is a large amount of development in the watershed (40%), with residential areas and industrial and commercial development concentrated around the downstream portions of the segment. Within the watershed, 100% of the land area is subject to MS4 permit conditions, 23% is classified as impervious area, and 16% 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 Norwood and Westwood through the Massachusetts Water Resources Authority. The Town of Norwood has completed infrastructure improvements in the Plantingfield Brook watershed, focusing on problem areas identified in Bacteria Source Tracking surveys conducted by MassDEP from 2015-2018. Although *E. coli* levels remain elevated, BST data indicate significant reductions in contamination have occurred. 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: The entire watershed is served by sewer, and none of the development in the watershed appears to utilize on-site systems for wastewater treatment. Septic systems are not likely a major source of pathogens.

Agriculture: Agricultural activities in the watershed account for a small portion (1%) of the total land use. This agricultural land is comprised of cultivated fields. Manure storage and spreading activities, if not properly conducted, are possible sources of pathogens to waterbodies.

Pet Waste: There are a few residential neighborhoods near the Plantingfield Brook segment MA73-23 in the southern reach and directly adjacent conservation lands along multiple reaches of the segment. 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 open fields near the segment and a large open (emergent) wetland area 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 Norwood

All of Norwood is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041053), and the town has an EPA-approved Notice of Intent (NOI). The town has mapped 100% of its MS4 system and the year-one Annual Report has been submitted. In its 2019 annual MS4 report, Norwood indicated that it had not yet completed an illicit discharge detection and elimination (IDDE) plan, although an outfall sampling plan had been active since 2017. An erosion and sedimentation control (ESC) has been completed. Post-construction stormwater regulations would be drafted in the following year. According to the NOI, pathogen impaired MS4 receiving waters include 14 outfalls into Germany Brook (MA73-15), 16 outfalls to Hawes Brook (MA73-16), 27 outfalls to the Neponset River (MA73-01), 15 outfalls Purgatory Brook (MA73-24), and 19 outfalls into an unnamed tributary (MA73-33), all of which are impaired by *E. coli*.

No bylaws other than zoning were found online via the town website http://www.norwoodma.gov/ (Town of Norwood, 2021).

No town-wide Master Plan was found for Norwood, but the town does have an Open Space and Recreation Plan (OSRP) from 2020. The OSRP includes a section on surface water, which identifies impaired waterbodies by category. Enforcing stormwater regulations is identified as an objective of the plan. The town's water and sewer utilities are provided by the Massachusetts Water Resources Authority (MWRA; Town of Norwood, 2021).

Town of Westwood

The majority of Westwood is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041069), 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 2015, Westwood 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, pathogen impaired MS4 receiving waters include five stormwater outfalls to Germany Brook (MA73-15), which is impaired by *E. coli*.

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

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

Westwood has a 2020 Comprehensive Plan, which includes a natural resources section. Within this section, stormwater is identified as a major source of pollution and a threat to water quality within the town. No specific waterbodies are identified as impaired. Portions of the town are served by municipal sewer systems. No Open Space and Recreation Plan outside of that included in the 2020 Comprehensive Plan was found (Town of Westwood, 2021).

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