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

Appendix K: Ten Mile River Basin

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

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

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Massachusetts Department of Environmental Protection

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

Watershed Planning Program

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

Acknowledgements

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

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Contact Information

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

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1. Introduction

This appendix to the Massachusetts Statewide Total Maximum Daily Load (TMDL) for Pathogen-Impaired Waterbodies provides additional information to support the determination of the Total Maximum Daily Load (TMDL) for seven pathogen-impaired river segments in the Ten Mile River watershed (Figure 1-1). The core document and appendix together complete the TMDL for each of these pathogen-impaired river 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. For water quality data, the Method Detection Limit (MDL) is reported and used for values below the MDL when calculating geometric means.

This appendix 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 also 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. 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 Ten Mile River Watershed Overview section.

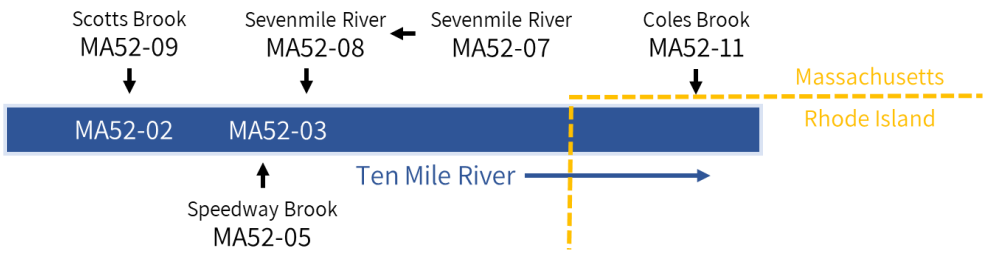


Figure 1-1. Conceptual diagram of water flow routing through the Ten Mile River watershed for the 7 pathogen-impaired river segments. Mainstem segments of the Ten Mile River are highlighted in blue. Tributary segments to the river are shown with arrows to the blue mainstem. Not to scale.

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 Ten Mile River Basin

Waterbody & Assessment Unit	Class (Qualifier)	TMDL Type	SWQS-Based TMDL target (CFU/100ml)	Maximum Geomean (CFU/100ml)	Geomean Percent Reduction	TMDL Allocation	*Flow (cfs)* 1	10	100	1,000	10,000	100,000
							Flow-Based Target TMDL (CFU/day*10^9)					
Ten Mile River MA52-02	B (WW, HQW*)	R	126	1,041 (90 day)	88%	WLA (22%) LA (78%)	0.7 2.4	6.8 24.1	67.6 240.7	675.9 2,406.8	6,758.8 24,068.0	67,587.9 240,680.1
Ten Mile River MA52-03	B (WW)	R	126	687 (30 day)	82%	WLA (21%) LA (79%)	0.6 2.4	6.4 24.4	63.8 244.5	637.8 2,444.9	6,377.7 24,449.1	63,777.5 244,490.5
Speedway Brook MA52-05	B (WW)	R	126	8,160 (90 day)	98%	WLA (20%) LA (80%)	0.6 2.5	6.1 24.7	61.2 247.0	612.4 2,470.3	6,123.7 24,703.1	61,237.2 247,030.8
Sevenmile River MA52-07	A (PWS, ORW)	R	126	431 (90 day)	71%	WLA (11%) LA (89%)	0.3 2.7	3.3 27.5	33.4 274.9	333.8 2,748.8	3,338.4 27,488.4	33,383.9 274,884.1
Sevenmile River MA52-08	B	R	126	858 (90 day)	85%	WLA (16%) LA (84%)	0.5 2.6	5.0 25.9	49.5 258.8	495.2 2,587.5	4,951.7 25,875.1	49,517.1 258,750.9
Scotts Brook MA52-09	B	R	126	1,194 (90 day)	89%	WLA (13%) LA (87%)	0.4 2.7	4.0 26.8	40.1 268.2	401.0 2,681.7	4,010.0 26,816.8	40,100.2 268,167.8
Coles Brook MA52-11	B	R	126	885 (90 day)	86%	WLA (9%) LA (91%)	0.3 2.8	2.6 28.2	26.4 281.9	263.6 2,819.1	2,636.1 28,190.7	26,361.1 281,906.9

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

Waterbody & Assessment Unit	Class (Qualifier)	TMDL Type	SWQS-Based TMDL target (CFU/100ml)	Maximum Geomean (CFU/100ml)	Geomean Percent Reduction	TMDL Allocation	*Flow (cfs)* 1	10	100	1,000	10,000	100,000
							Flow-Based Target TMDL (CFU/day*10^9)					
Ten Mile River MA52-02	B (WW, HQW*)	P	35	250 (90 day)	86%	WLA (22%) LA (78%)	0.2 0.7	1.9 6.7	18.8 66.9	187.7 668.6	1,877.4 6,685.6	18,774.4 66,855.6
Ten Mile River MA52-03	B (WW)	P	35	NA	-	WLA (21%) LA (79%)	0.2 0.7	1.8 6.8	17.7 67.9	177.2 679.1	1,771.6 6,791.4	17,716.0 67,914.0
Speedway Brook MA52-05	B (WW)	P	35	1,600 (90 day)	98%	WLA (20%) LA (80%)	0.2 0.7	1.7 6.9	17.0 68.6	170.1 686.2	1,701.0 6,862.0	17,010.3 68,619.7
Sevenmile River MA52-07	A (PWS, ORW)	P	35	NA	-	WLA (11%) LA (89%)	0.1 0.8	0.9 7.6	9.3 76.4	92.7 763.6	927.3 7,635.7	9,273.3 76,356.7
Sevenmile River MA52-08	B	P	35	130 (90 day)	73%	WLA (16%) LA (84%)	0.1 0.7	1.4 7.2	13.8 71.9	137.5 718.8	1,375.5 7,187.5	13,754.7 71,875.3
Scotts Brook MA52-09	B	P	35	NA	-	WLA (13%) LA (87%)	0.1 0.7	1.1 7.4	11.1 74.5	111.4 744.9	1,113.9 7,449.1	11,139.0 74,491.0
Coles Brook MA52-11	B	P	35	NA	-	WLA (9%) LA (91%)	0.1 0.8	0.7 7.8	7.3 78.3	73.2 783.1	732.3 7,830.7	7,322.5 78,307.5

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).*
- ***HQW*** *= High Quality Water; waters designated for protection under 314 CMR 4.04(2); (*) designation only applies to a portion of the segment*
- ***ORW*** *= Outstanding Resource Waters; waters designated for protection under 314 CMR 4.04(2);*
- ***PWS*** *=Public Water Supply; may be subject to more stringent criteria in accordance with 310 CMR 22.00, and may have restricted use;*
- ***WW*** *= Warm Water; waters that meet the warm water fisheries (WWF) definition at 314 CMR 4.02 and are subject to WWF dissolved oxygen and temperature criteria*

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

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

The Ten Mile River watershed covers an area of approximately 50 square miles in southeastern Massachusetts along the eastern Rhode Island border (Figure 2-1) and is the smallest of the 27 major watersheds within Massachusetts. The Ten Mile River watershed includes two major tributaries, the Sevenmile River and the Bungay River. Overall, there are seven named rivers; approximately 36 named river miles; many smaller unnamed rivers; and 45 lakes, ponds, and impoundments in the watershed (MassDEP, 2006).

The Sevenmile River begins at the outlet of Hoppin Hill Reservoir in North Attleborough and flows generally south over six miles before joining the Ten Mile River in Seekonk. The river flows through a mix of forest, residential, and commercial land uses, and most of the watershed is held as a Public Water Supply Reservoir Watershed (Zone A). There are no major wastewater treatment facilities (WWTF) along the Sevenmile River. There are two pathogen-impaired river segments along the Sevenmile River (MassDEP, 2022).

The Bungay River begins in North Attleborough at the outlet of Greenwood Lake, though the headwaters to Greenwood Lake and the Bungay River extend north into Foxborough. The Bungay River flows generally south for over five miles before its confluence with the Ten Mile River in Attleboro. The river is classified as a Class B Warm Water Fishery, and the watershed is primarily forested (MassDEP, 2006). There are no pathogen-impaired river segments within the Bungay River watershed (MassDEP, 2022).

The Ten Mile River flows over 15 miles through many impoundments before reaching the Seekonk and Providence Rivers on its way to Narragansett Bay. The Ten Mile River contains many impoundments along its course to the Seekonk and Providence Rivers. Watershed land use is primarily forested, with higher concentrations of residential, commercial, and industrial development in downstream areas near the city center of Attleboro. There are two major WWTFs holding NPDES major and/or minor permits for discharging wastewater to surface waters along the Ten Mile River (MassDEP, 2006). Excluding those in the Sevenmile River drainage area, there are five pathogen-impaired segments within the Ten Mile River watershed, two of which are on the mainstem (MassDEP, 2022).

The Ten Mile River watershed overlaps at least partially with eight municipalities in Massachusetts. Of these, five were identified as being direct sources of pathogen loading to the pathogen-impaired river segments in this TMDL. The efforts of these municipalities to reduce pollutant loading are described in the segment-specific sections below. For each segment, the cities and towns that contain or border the impaired segment were identified. Towns comprising more than 10% of the impaired stream segment's sub-basin (that portion of its watershed not shared with upstream segments) were also included. In addition, towns which may not meet the above characteristics, but which have land area in the sub-basin near the impaired segment (e.g., City of Attleboro for the Sevenmile River segment MA52-07), were included on a case-by-case basis. See Figure 2-1 for a map showing impaired segments and municipalities.

Many municipalities operate and maintain municipal separate storm sewer systems (MS4s) in urban areas. These networks of drains and pipes convey polluted runoff from streets and developed areas to streams. 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 July 1, 2018. 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 requirement to reduce pollutants to the Maximum Extent Practicable (USEPA, 2020, Appendix F).

In addition to municipalities, there are two Regional Planning Agencies (RPAs) in the Ten Mile River watershed. These are public organizations advising municipalities, private business groups, and state and federal governments on a range of matters. Their research, coordination, and technical assistance is especially valuable on watershed issues such as pathogen pollutants and stormwater that cross town boundaries.

- Southeastern Regional Planning & Economic Development District: http://www.srpedd.org/ (SRPEDD, 2021)
- Metropolitan Area Planning Council: http://www.mapc.org/ (MAPC, 2021)

The following RPA initiatives and tools are especially noteworthy:

- There are regional stormwater coalitions within some RPAs, and these are noted in the segment-specific sections below.
- Stormwater Utility/Funding Starting Kit: https://www.mapc.org/resource-library/stormwater-financing-utility-starter-kit/. (MAPC, 2014)
- MAPC and the Neponset River Watershed Association created a GIS toolkit to calculate MS4 outfall catchments, which is a requirement under the MS4 General Permit (MAPC, 2018).
- The SPREDD has a resource library for environmental reports, including
    - the Ten Mile/Mt. Hope Bay Watershed Regional Open Space & Recreation Plan 2001-2005 (Langhauser & Napolitano, 2000), and
    - the 2004 Mount Hope And Narragansett Bay Watershed Five-Year Action Plan https://www.mass.gov/files/2017-07/Mount%20Hope-Narragansett%20Bay%20watershed%20Action%20Plan.pdf (Geosyntec, 2004).

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 in the “Think Blue” campaign https://www.thinkbluemassachusetts.org/about-us (Think Blue Massachusetts, 2019).

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

The **Ten Mile River Watershed Council** works to inspire the community to protect the Ten Mile River through outreach activities, https://tenmileriver.net/ (Ten Mile River Watershed Council, n.d.)

The following actions will help reduce pathogen loads to the streams. The list is a starting point and is not comprehensive. For a more detailed discussion of pollutant reduction actions, see Section 5 “Implementation” of the core TMDL document.

- Collect additional water quality data for all segments for which existing data are all older than five years.
- **Municipalities:** Continue to implement requirements of the MS4 permit, which includes specific requirements for waterbodies with an approved Bacteria/Pathogen TMDL, such as prioritization and reporting, enhanced BMPs, IDDE work, and education (USEPA, 2020).
- **Regional Planning Agencies (RPAs) and municipalities:** Continue and expand collaboration on MS4 and stormwater issues. Cooperatively developing tools and sharing knowledge has many advantages, including reduced costs, increased innovation, and more consistent and effective stream restoration efforts at the watershed scale.
    - Two tools developed by MAPC are potentially valuable in all MS4 communities in the state. Municipalities and other RPAs (with permission from MAPC) should consider adapting and/or expanding on these tools in their area:
        - Stormwater Utility/Funding Starting Kit (MAPC, 2014).
        - MAPC and the Neponset River Watershed Association created a GIS toolkit to calculate MS4 outfall catchments, which is a requirement under the MS4 General Permit (MAPC, 2018).
- **USDA NRCS and landowners:** Develop comprehensive nutrient management plans for agriculture, using local connections to farmers for outreach.
- **Parks departments, schools, private landowners, and others** who maintain large, mowed fields with direct access to water should consider maintaining a vegetative buffer along the water’s edge. Buffers slow and filter stormwater runoff, provide a visual screen that can reduce large aggregations of waterfowl, and have many other water quality benefits at low cost.

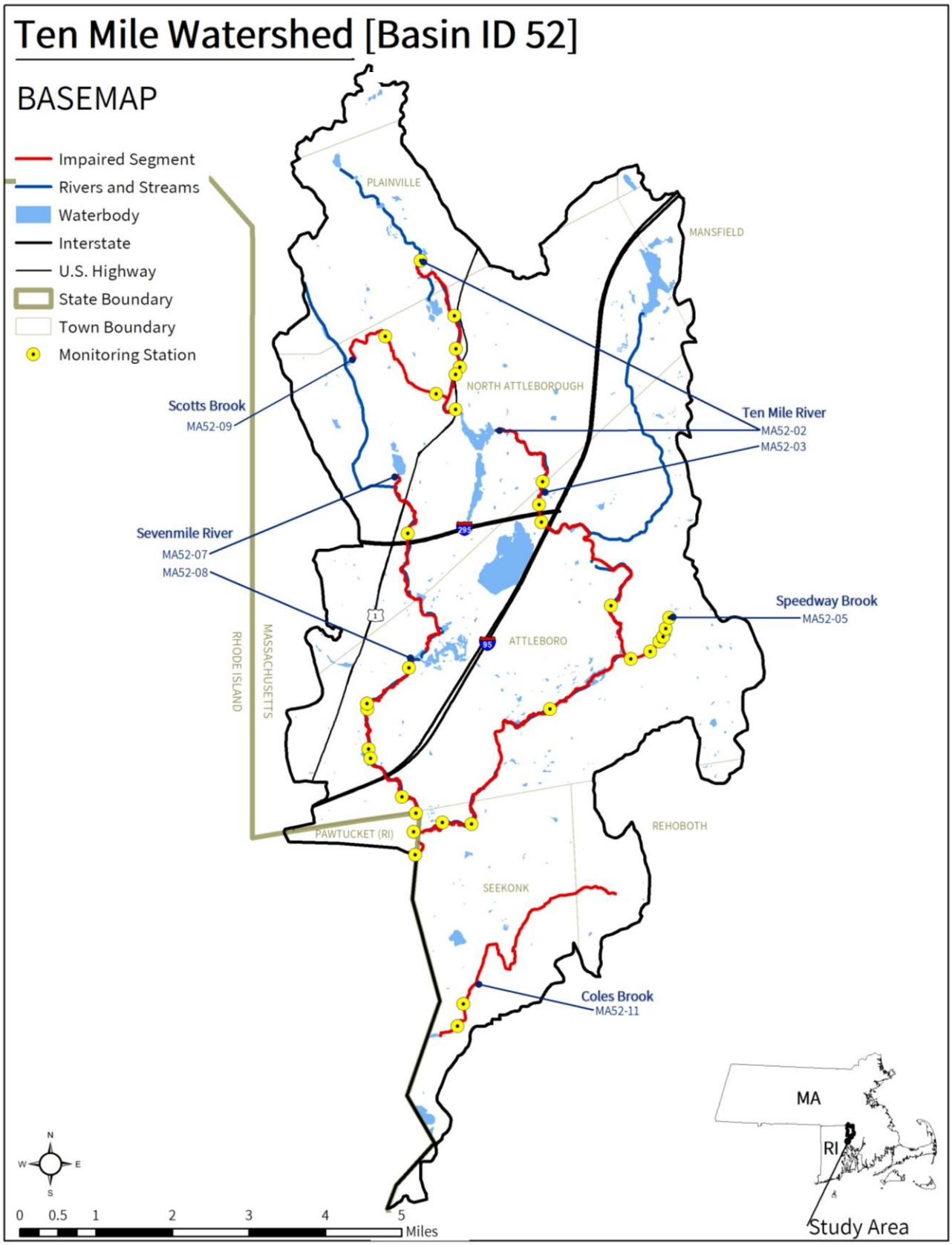


Figure 2-1: Map of all pathogen-impaired river segments, water quality monitoring stations, municipal borders, waterbodies, and roads in the Ten Mile River watershed.

3. MA52-02 Ten Mile River

3.1. Waterbody Overview

The Ten Mile River segment MA52-02 is 4.1 miles long and begins north of West Bacon Street in Plainville, MA, near 36 Bacon Square. The segment flows south through Wetherells Pond (formerly segment MA52041) which is included, then through the village center of North Attleborough, then through Falls Pond (segment MA52013), which is excluded from the segment. The segment ends at the North Attleborough WWTP discharge (NPEDS: MA0101036) in Attleboro, MA. The High Quality Water (HQW) qualifier only applies to the portion of the river upstream of Whiting Pond Dam (NATID: MA00859).

Tributaries to the Ten Mile River segment MA52-02 include the upstream unimpaired section of the Ten Mile River, pathogen-impaired Scotts Brook (MA52-09), and other unnamed streams. Lakes and ponds in the watershed include Chestnut Street Pond, Cargill Pond, Fuller Pond, and Plainville Pond along the Ten Mile River upstream of the segment; and also along the segment are Wetherells Pond (flow path is included in the segment) and Falls Pond (flow path is excluded from the segment). Other lakes and ponds in the watershed include East Fuller Street Pond, Whiting Pond, Peck Pond, and Towne Street Pond.

Key landmarks in the watershed include the Plainville and North Attleborough town centers, the Heather Hill Country Club, the North Attleboro World War I Memorial Park, Riley Conservation Area, and the Martin Conservation Area. The Ten Mile River segment MA52-02 is crossed by West Bacon Street and Wetherell Place in Plainville; and Whiting Street, Park Street, North Washington Street, Fisher Street, Orne Street, Elm Street, Chestnut Street, East Washington Street/US-1/1A (twice), Mount Hope Street, Towne Street, Freeman Street, and Cedar Road in North Attleborough.

The Ten Mile River (MA52-02) drains an area of 11 square miles, of which 2.4 mi^2 (22%) is impervious and 1.6 mi^2 (14%) is directly connected impervious

Reduction from Highest Calculated Geomean: 88%

Watershed Area (Acres): 7,040

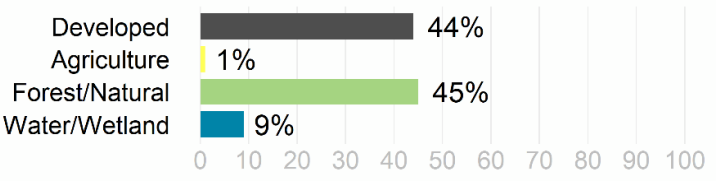
Segment Length (Miles): 4.1

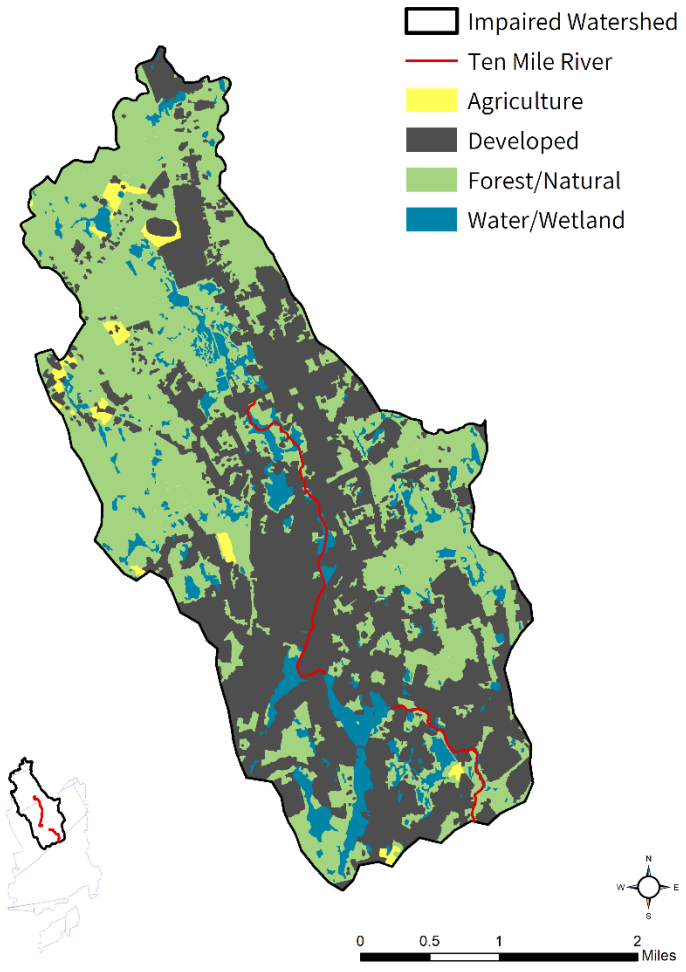
Impairment(s): *E. coli*, fecal coliform (Primary Contact Recreation)

Class (Qualifiers): B (Warm Water, High Quality Water)

Impervious Area (Acres, %): 1,543 (22%)

DCIA Area (Acres, %): 999 (14%)





area (DCIA). The watershed is partially[1] served by public sewer and 85% 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 within the watershed and no MassDEP discharge to groundwater permits for on-site wastewater. There is one landfill but no combined sewer overflows or unpermitted land disposal dumping grounds within the segment watershed. See Figure 3-1.

Forested land use (45%) is about equal to developed land use (44%) in the watershed; however, development density in developed areas is high. The upper reaches of the watershed contain portions of the Wrentham Village outlets with expansive parking and buildings, and just downstream are two large quarries. The segment itself flows through medium to high density mixed residential and commercial development in the villages of North Attleborough Center and Attleboro Falls. About a quarter mile of the river is buried in culverts along East Washington Street, starting near Orne Street. In most of the central portion of the segment, there is little to no vegetative buffer along the river corridor, with dense housing and commercial development within a few meters of the river's edge, especially near Chestnut Street and Riverside Drive in North Attleborough.

In the watershed of the Ten Mile River (MA52-02), under the Natural Heritage and Endangered Species Program, there are 109 acres (2%) of Priority Habitats of Rare Species. There are 68 acres (1%) under Public Water Supply protection, but no Areas of Critical Environmental Concern or Outstanding Resource Waters identified in the watershed. Over 43 acres (1%) of land protected in perpetuity[2] exist within the segment watershed, which is part of a total of 927 acres (13%) of Protected and Recreational Open Space[3]. See Figure 3-1.

[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 https://www.mass.gov/guides/water-utility-resilience-program (MassDEP, 2021b), MS4 reports, and local knowledge.

[2] Land protected in perpetuity include several interests such as conservation restriction, 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] Only land protected in perpetuity is shown on the natural resources map. Protected and Recreational Open Space estimates reflect areas in the State of Massachusetts only (and thus reflect only a portion of the total open space for watersheds that extend outside the State of Massachusetts).

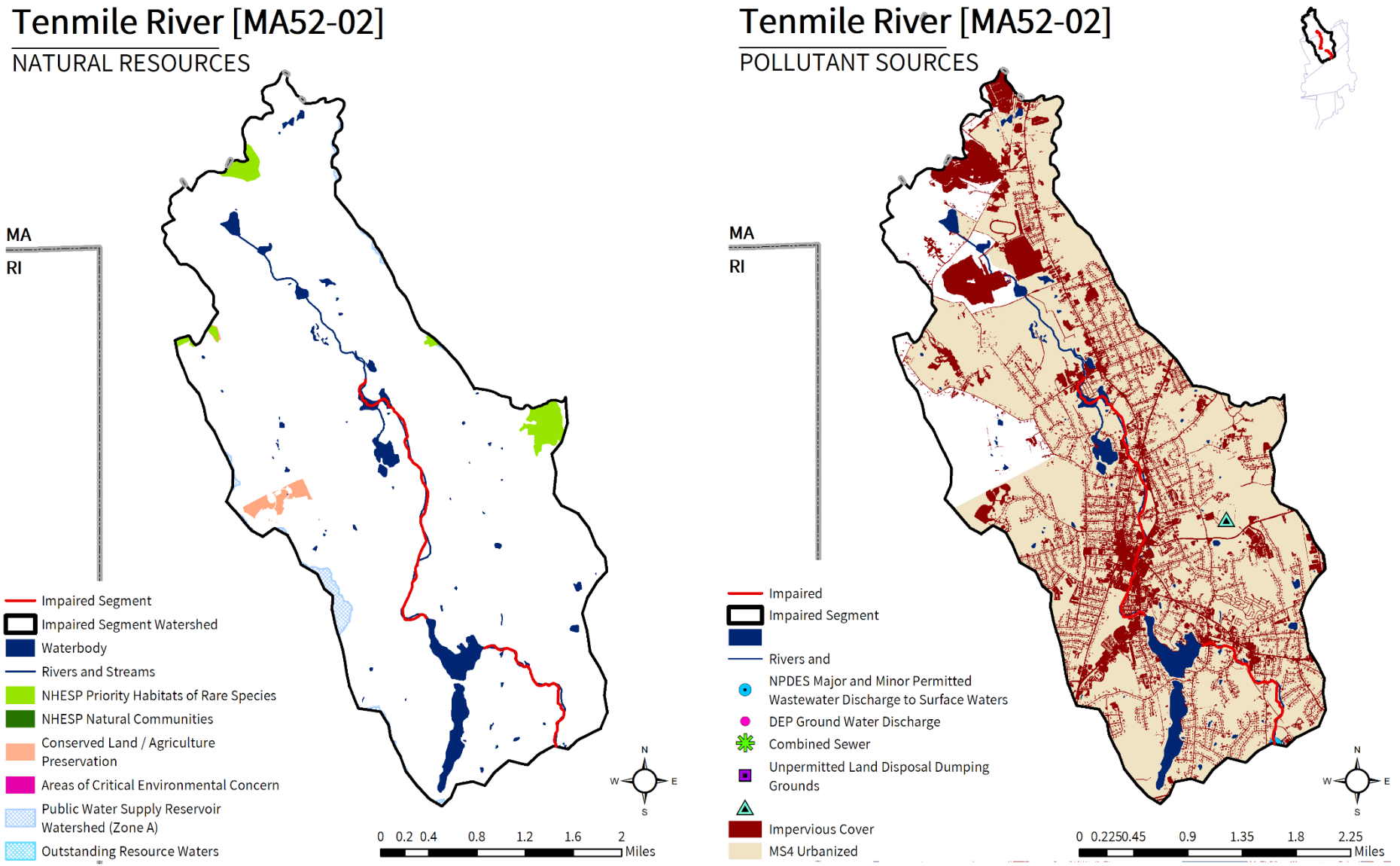


Figure 3-1. Natural resources and potential pollution sources draining to the Tenmile River segment MA52-02. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollution sources, including impervious cover, MS4 areas, and permitted facilities.

3.2. Waterbody Impairment Characterization

The Ten Mile River (MA52-02) is a Class B, Warm Water and High Quality Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS using the indicator bacteria *E. coli* at the stations listed below (refer to Tables 3-1, 3-2; Figure 3-2). 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. Only stations with five or more samples are described below.

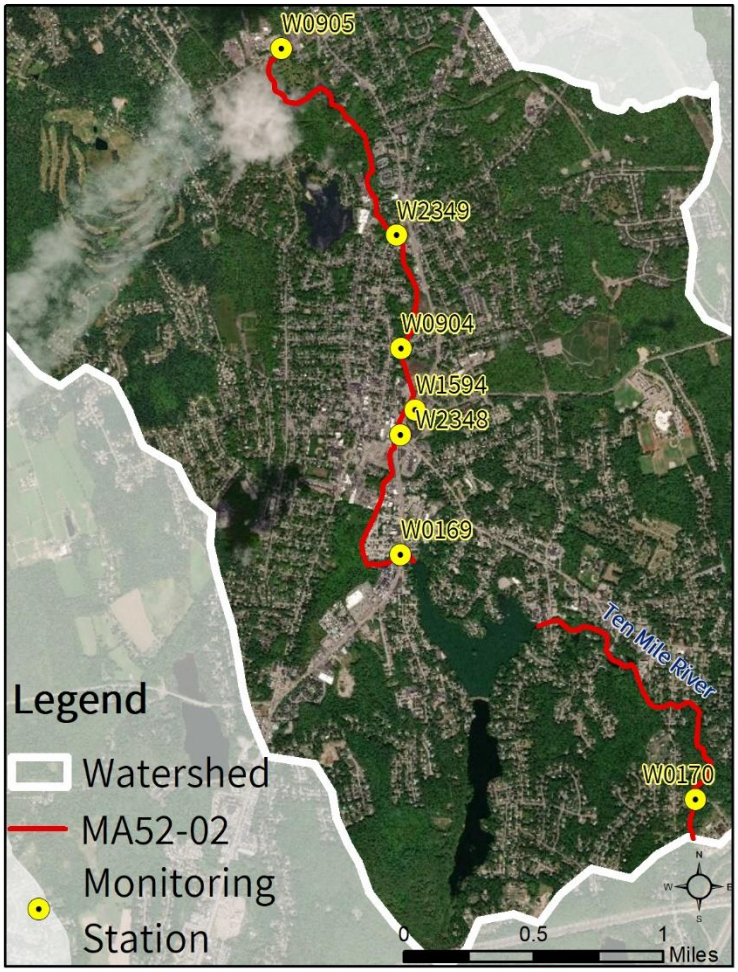


Figure 3-2. Location of monitoring station(s) along the impaired river segment.

- In 2007, five samples were collected at W0169, resulting in five days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of five samples, two exceeded the STV criterion during dry weather.
- In 2007, five samples were collected at W0170, resulting in three days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of five samples, none exceeded the STV criterion.
- In 2007, five samples were collected at W0905, resulting in one day when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of five samples, one exceeded the STV criterion during dry weather.
- Between 2007-2013, eight samples were collected at W1594, resulting in six days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of eight samples, three exceeded the STV criterion during dry weather.
- Between 2012-2013, three samples were collected at W2348, resulting in three days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of three samples, two exceeded the STV criterion during dry weather.
- Between 2012-2013, three samples were collected at W2349, resulting in two days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of three samples, one exceeded the STV criterion during dry weather.

Table 3-1. Summary of indicator bacteria sampling results by station for the Ten Mile River (MA52-02). 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 Statistical Threshold Value (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 sites 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
W0169	4/18/2007	9/4/2007	5	1041	5	2
W0170	4/18/2007	9/4/2007	5	278	3	0
W0904	6/26/2013	8/7/2013	2	236	2	0
W0905	4/18/2007	9/4/2007	5	168	1	1
W1594	4/18/2007	10/16/2013	8	901	6	3
W2348	8/8/2012	8/7/2013	3	770	3	2
W2349	8/8/2012	8/7/2013	3	921	2	1

Table 3-2. Indicator bacteria data by station, indicator, and date for the Ten Mile River (MA52-02). Each sample date was designated wet or dry weather with wet weather defined as more than 0.5 inches of precipitation in the previous 72 hours. Red text 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 Statistical Threshold Value or STV) and 126 CFU/100 mL (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)
W0169	*E. coli*	4/18/2007	WET	160	160	
W0169	*E. coli*	5/22/2007	DRY	140	150	
W0169	*E. coli*	7/2/2007	DRY	3100	411	
W0169	*E. coli*	7/31/2007	DRY	2600	1041	
W0169	*E. coli*	9/4/2007	DRY	76	849	
W0170	*E. coli*	4/18/2007	WET	110	110	
W0170	*E. coli*	5/22/2007	DRY	71	88	
W0170	*E. coli*	7/2/2007	DRY	270	128	
W0170	*E. coli*	7/31/2007	DRY	250	169	
W0170	*E. coli*	9/4/2007	DRY	320	278	
W0904	*E. coli*	6/26/2013	DRY	236	236	
W0904	*E. coli*	8/7/2013	DRY	88	144	
W0905	*E. coli*	4/18/2007	WET	52	52	
W0905	*E. coli*	5/22/2007	DRY	10	23	
W0905	*E. coli*	7/2/2007	DRY	24	23	
W0905	*E. coli*	7/31/2007	DRY	1100	64	
W0905	*E. coli*	9/4/2007	DRY	180	168	
W1594	*E. coli*	4/18/2007	WET	160	160	
W1594	*E. coli*	5/22/2007	DRY	95	123	
W1594	*E. coli*	7/2/2007	DRY	660	216	
W1594	*E. coli*	7/31/2007	DRY	3700	614	
W1594	*E. coli*	9/4/2007	DRY	300	901	
W1594	*E. coli*	6/26/2013	DRY	649	649	
W1594	*E. coli*	8/7/2013	DRY	102	257	
W1594	*E. coli*	10/16/2013	DRY	105	103	
W2348	*E. coli*	8/8/2012	DRY	770	770	
W2348	*E. coli*	6/26/2013	DRY	548	548	
W2348	*E. coli*	8/7/2013	DRY	128	265	

Unique Station ID	Indicator	Date	Wet/Dry	Result (CFU/100mL)	90-Day Rolling Geomean (CFU/100mL)	90-Day Rolling STV (CFU/100mL)
W2349	*E. coli*	8/8/2012	DRY	921	921	
W2349	*E. coli*	6/26/2013	DRY	172	172	
W2349	*E. coli*	8/7/2013	DRY	82	119	

3.3. Potential Pathogen Sources

Comparing data collected during wet weather versus dry weather conditions provides an indication of the types of sources present and 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 the river 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 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).

The indicator bacteria data for the Ten Mile River (MA52-02) were elevated during dry weather. Elevated indicator bacteria 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: Portions of the watershed are highly developed, with 85% of the land area in MS4 and 14% as DCIA. The largest cluster of development occurs around the North Attleborough town center (less than two miles from the segment) where medium to high density residential development, commercial buildings, industrial centers, and transportation infrastructure are present. These development categories are also present throughout the rest of the watershed and contribute to the 44% of developed land area within the watershed. Although indicator bacteria levels exceeded WQS only in dry weather, there was only a single wet weather sample date and therefore a representative range of wet weather conditions has not been sampled. Stormwater runoff from urban areas is likely a significant source of pathogens.

Illicit Sewage Discharges: A portion of the watershed contains municipal sewer services, and the river itself is culverted in an urbanized setting for about half a mile. In addition, dense urban development occurs within a few feet of much of the river corridor, and high indicator bacterial levels were found during dry weather. All these factors strongly indicate illicit discharges are a significant source of pathogens. Sewer related risks include leaking infrastructure (pipes, pump stations, etc.) and sanitary sewer overflows 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 drains are also a risk.

On-Site Wastewater Disposal Systems: A portion of the watershed also relies on septic systems for wastewater treatment. It is likely that a portion of septic systems are not being properly maintained and are discharging untreated effluent to groundwater.

Agriculture: Agricultural activities in the watershed account for 1% of the total land use area and are generally not near the segment. Activities visible on recent aerial photos include open fields and pasturelands. Agricultural activities related to manure storage and spreading, if not well managed, are a possible source of pathogens to waterbodies.

Pet Waste: Most of the segment flows through dense urban development, including many residential neighborhoods. Conservation lands, parks, ballfields, and residential streets popular for dog-walking, especially where paths are adjacent to rivers, ponds, or wetlands, represent a possible source of pathogens.

Wildlife Waste: Large open mowed areas such as golf courses, fields, or wetlands with a clear sightline to a waterbody may attract excessive waterfowl and elevate indicator bacteria counts in the water.

3.4. Existing Local Management

This section identifies the municipalities immediately surrounding the impaired segment and its sub-basin (excludes upstream impaired segment watersheds). For a complete view of upstream municipalities and waterbodies, see the map in Figure 2-1.

City of Attleboro

Approximately 70% of Attleboro is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit. Attleboro (Permit ID #MAR041087) has an EPA approved Notice of Intent (NOI). Attleboro has a Stormwater Management Plan on file (link below). Attleboro has mapped all of its MS4 stormwater systems and adopted illicit discharge detection and elimination (IDDE), erosion and sediment control (ESC), and post-construction stormwater regulations in 2008. There are three stormwater outfalls to the pathogen-impaired Ten Mile River (MA52-02), 55 stormwater outfalls to the pathogen-impaired Ten Mile River (MA52-03), 10 stormwater outfalls to the pathogen-impaired Speedway Brook (MA52-05), nine stormwater outfalls to the Bungay River (MA52-06), and 13 stormwater outfalls to the pathogen-impaired Sevenmile River (MA52-08).

Attleboro Stormwater Management Plan:
https://www.cityofattleboro.us/DocumentCenter/View/2862/Stormwater-management-plan-PDF (City of Attleboro, 2003)

Attleboro has the following relevant ordinances and bylaws:

- Stormwater ordinance https://www.cityofattleboro.us/DocumentCenter/View/669/Local-Stormwater-Ordinance-and-Regulations-PDF (City of Attleboro, 2008)
- Sewer Regulations: Section 16-16 Sewer Main Extension Installation, 16 - 17 Sewer Betterment Assessments, 16 - 18 Sewer Use Rates, 16 - 19 Disposal of Septic Tank Waste: https://www.cityofattleboro.us/DocumentCenter/View/323/City-Ordinances-PDF?bidId= (City of Attleboro, 2021)
- Local Wetlands Protection Ordinance https://www.cityofattleboro.us/DocumentCenter/View/670/Local-Wetland-Ordinance-and-Regulations-PDF (City of Attleboro, 2007)
- Pet waste bylaws: Section 9-39 page 91: Defecation of Dogs https://www.cityofattleboro.us/DocumentCenter/View/323/City-Ordinances-PDF?bidId= (City of Attleboro, 2021)

In addition, Attleboro's Master Plan mentions stormwater and dedicates a section on Water Resources, page 69. https://www.cityofattleboro.us/DocumentCenter/View/394/Comprehensive-Plan-PDF (City of Attleboro, 2012)

Attleboro's Open Space and Recreation Plan:
https://www.cityofattleboro.us/DocumentCenter/View/400/Open-Space-and-Recreation-Plan-PDF?bidId= (City of Attleboro, 2009)

Town of North Attleborough

Most of North Attleborough is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit. North Attleborough (Permit ID #MAR041142) has an EPA approved Notice of Intent (NOI). The town has a Stormwater Management Plan which was submitted as an attachment to the NOI. The town has mapped all of its stormwater infrastructure, and this information was attached to the NOI. The town adopted illicit discharge detection and elimination (IDDE) regulations in 2019, as well as erosion and sediment control (ESC) and post-construction stormwater regulations in 2005. According to the NOI, there are 19 stormwater outfalls into the pathogen-impaired Sevenmile River (MA52-08) and 23 stormwater outfalls into the pathogen-impaired Ten Mile River (MA52-02).

North Attleborough has the following ordinances and bylaws:

- Stormwater Ordinance: https://www.nattleboro.com/conservation-commission/news/town-of-north-attleboro-stormwater-bylaw (Town of North Attleboro, 2020a)
- North Attleborough does not have any supplementary regulations beyond the MassDEP for wetland protection.
- Title 5 Supplementary Regulations: None found.
- Stormwater Utility: None found.
- Pet Waste: None found.

The Master Plan has a Water Resources section in the Natural, Historic, and Cultural Resources chapter, describing the four major watersheds that North Attleborough is broken into, including the Ten Mile River and the Seven Mile River, both pathogen-impaired. The town formed a Stormwater Committee in 2013 and has a proposed stormwater management bylaw in draft form. The plan also recommends a Low Impact Development bylaw in the future to help reduced impervious surfaces and promote greenspaces. The plan's inflow and infiltration problems section notes that the town is working to extend the sewer service to areas of town with septic/on-site failures, as well as replacing aging infrastructure.

Town website: https://www.nattleboro.com/ (Town of North Attleborough, 2021a)

Master Plan: https://srpedd.org/comprehensive-planning/community-master-plans/north-attleborough-master-plan/ (Town of North Attleborough and SRPEDD, 2021)

Stormwater page: https://www.nattleboro.com/department-of-public-works/pages/stormwater-management-program (Town of North Attleboro, 2020b)

Open Space and Recreation Plan: https://www.nattleboro.com/sites/g/files/vyhlif3566/f/file/file/town_of_north_attleboro_consevation_recreation_and_open_space_plan_0.pdf (Town of North Attleboro, 2013) Also: https://www.nattleboro.com/conservation-commission/news/open-space-and-recreation-plan-update (Town of North Attleboro, 2021b)

Town of Plainville

More than 25% of Plainville is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit. Plainville (Permit ID #MAR041149) has an EPA approved Notice of Intent (NOI). Plainville has a webpage dedicated to stormwater management (link below). Plainville has mapped all its MS4 stormwater systems. Plainville adopted illicit discharge detection and elimination (IDDE) regulations in 2015, erosion and sediment control (ESC) regulations in 2009, and post-construction stormwater regulations in 2015. There is one stormwater outfall to the pathogen-impaired Ten Mile River (MA52-02).

Plainville Stormwater Management Plan: https://www.plainville.ma.us/department-public-works/stormwater-management (Town of Plainville, n.d.)

Plainville has the following ordinances and bylaws:

- Sewer Use: Chapter 364 https://ecode360.com/11814567 (Town of Plainville, 2011a)
- Wetlands Protection: Chapter 472 https://ecode360.com/11814969 (Town of Plainville, 2011b)
- Community and water resource protection https://ecode360.com/11815267#11815431 (Town of Plainville, 2014)

Plainville has a Master Plan with Section 8.1.8 dedicated to Water Resources (page 8-8). The Master Plan references stormwater, with Section 7.10 on Water Systems and Section 7.11 on Wastewater Treatment: https://www.plainville.ma.us/sites/g/files/vyhlif4871/f/uploads/plainville_master_plan.pdf (Town of Plainville, 2009).

Plainville is having discussions relating to its open space plan, though a link to the plan itself could not be found https://www.plainville.ma.us/open-space-committee/events/18483 (Town of Plainville, 2018).

4. MA52-03 Ten Mile River

4.1. Waterbody Overview

The Ten Mile River segment MA52-03 is 9.1 miles long and begins at the North Attleborough WWTP discharge (NPDES: MA0101036) in Attleboro, MA. The segment flows generally south through Attleboro and into Seekonk, MA, with a small part of the segment flowing through Pawtucket, RI. The segment includes Farmers Pond (formerly MA52015), Mechanics Pond (formerly MA52027), Dodgeville Pond (formerly MA52011), and Hebronville Pond (formerly MA52020). Segment MA52-03 ends at the Seekonk, MA / Pawtucket, RI border near Central Avenue in Seekonk.

Tributaries to the segment include the pathogen-impaired Ten Mile River (MA52-02), the Bungay River, pathogen-impaired Speedway (Thacher) Brook (MA52-05), the pathogen-impaired Sevenmile River (MA52-08), and other unnamed streams. Pathogen-impaired segments in upstream portions of the watershed (not direct tributaries) include the Sevenmile River (MA52-07) and Scotts Brook (MA52-09). Lakes and ponds exclusive to this segment's watershed, besides those mentioned above, include Witch Pond, Greenwood Lake, and Black Pond in the upper reaches of the watershed.

Key landmarks near the segment include the I-295/I-95 junction, the Highland Country Club, the Attleboro town center, the Attleboro MBTA station, and the Stone E Lea Golf Course Inc. The segment is crossed by I-95 (including five ramps to I-295), West Street, Water Street, Mechanic Street, Hodges Street, County Street/MA-123, Wall Street, Olive Street, Lamb Street, Thacher Street, Tiffany Street, and Bridge Street in Attleboro; and Pond Street in Seekonk.

The Ten Mile River (MA52-03) drains a total area of 42 square miles, of which 8.8 mi^2 (21%) is impervious and 5.7 mi^2 (13%) is directly connected impervious area (DCIA). The segment watershed extends beyond Massachusetts into Rhode Island for only 1% of the total watershed area.

Reduction from Highest Calculated Geomean: 82%

Watershed Area (Acres): 27,123

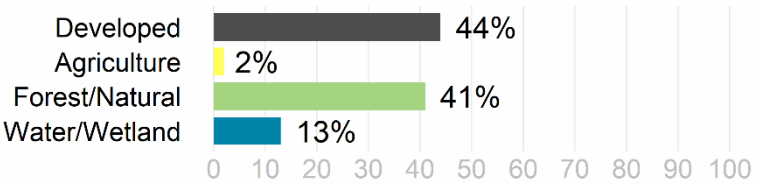
Segment Length (Miles): 9.1

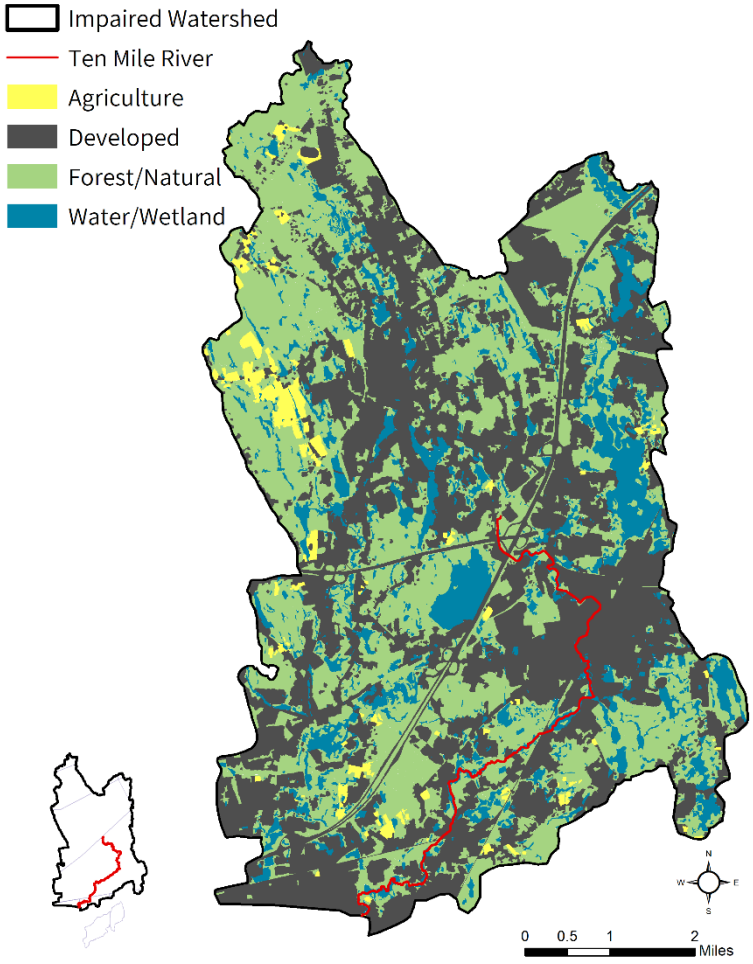
Impairment(s): *E. coli*, fecal coliform (Primary Contact Recreation)

Class (Qualifier): B (Warm Water)

Impervious Area (Acres, %): 5,611 (21%)

DCIA Area (Acres, %): 3,622 (13%)





The watershed is mostly[4] served by public sewer and 94% of the watershed is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (USEPA, 2020). There are two NPDES permits on file governing point source discharges of pollutants to surface waters (Table 4-1). There is one MassDEP discharge to groundwater permit for on-site wastewater discharge in the watershed (not in the immediate drainage area). There is one landfill within MA. There are no combined sewer overflows and no unpermitted land disposal dumping grounds within the segment watershed. See Figure 4-1.

Table 4-1. National Pollutant Discharge Elimination System (NPDES) permits for Wastewater Treatment Facilities (WWTF) in the segment watershed. Only permits unique to this segment watershed are shown. WWTF are identified as either municipal (MUN) or other (OTH), if applicable.

NPDES ID	NAME	TOWN	WWTF
MA0100595	ATTLEBORO WPCF	SEEKONK	MUN
MA0101036	NORTH ATTLEBOROUGH WWTP	ATTLEBORO	MUN

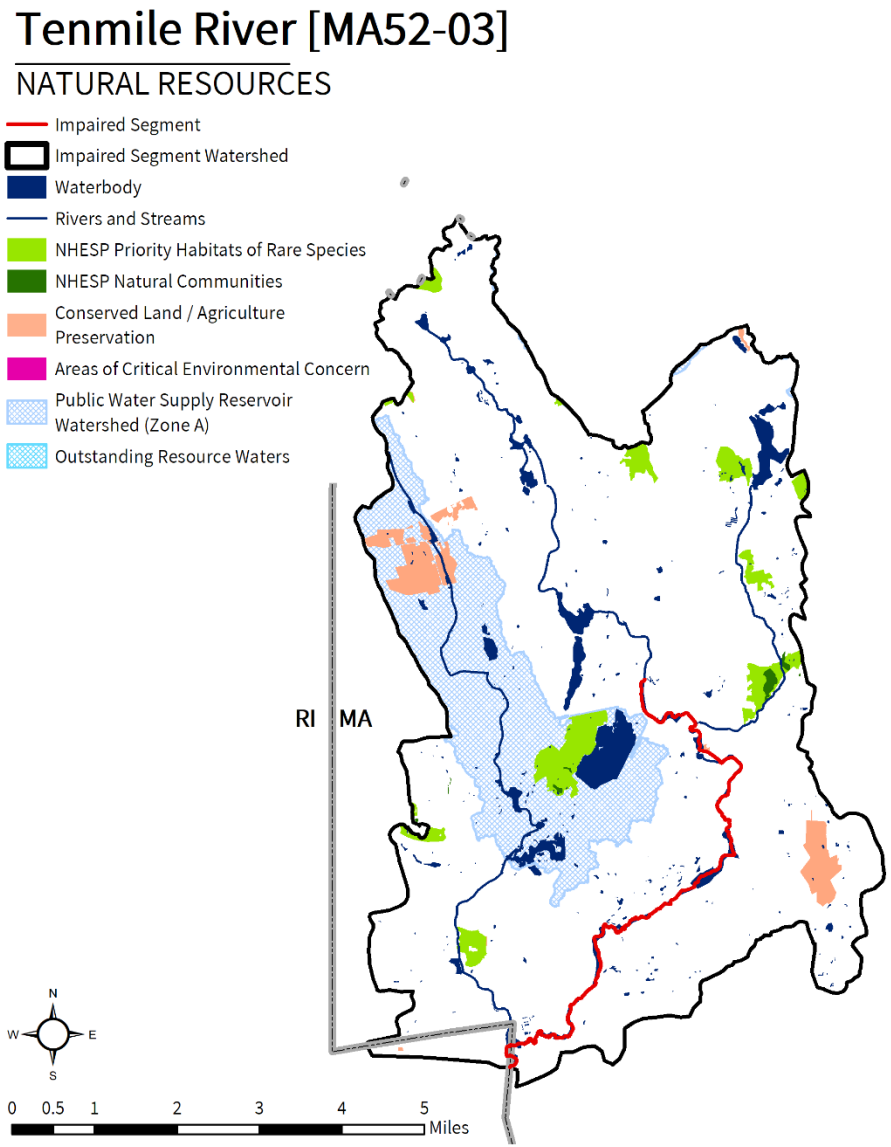
The watershed is largely developed (44%) with areas of high density, especially in the upstream portions around the segment. The segment itself flows through medium to high density mixed development, particularly in downtown Attleboro. Within the immediate river corridor are high density residential neighborhoods, medium density commercial areas, and the Attleboro MBTA train station (though its large parking lot is located on the opposite side of the train station from the river). Despite the development density, most of the lower segment maintains good vegetated buffer, even in its downstream areas around Pawtucket, RI.

In the Ten Mile River (MA52-03) watershed, under the Natural Heritage and Endangered Species Program, there are 826 acres (3%) of Priority Habitats of Rare Species and 41 acres (<1%) of Priority Natural Vegetation Communities. There are 4,754 acres (18%) under Public Water Supply protection, but no Areas of Critical Environmental Concern or Outstanding Resource Waters identified in the watershed. Over 590 acres (2%) of land protected in perpetuity[5] exist within the segment watershed, which is part of a total of 4,534 acres (17%) of Protected and Recreational Open Space[6]. See Figure 4-1.

[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 https://www.mass.gov/guides/water-utility-resilience-program (MassDEP, 2021b), MS4 reports, and local knowledge.

[5] Land protected in perpetuity include several interests such as conservation restriction, 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] Only land protected in perpetuity is shown on the natural resources map. Protected and Recreational Open Space estimates reflect areas in the State of Massachusetts only (and thus reflect only a portion of the total open space for watersheds that extend outside the State of Massachusetts).



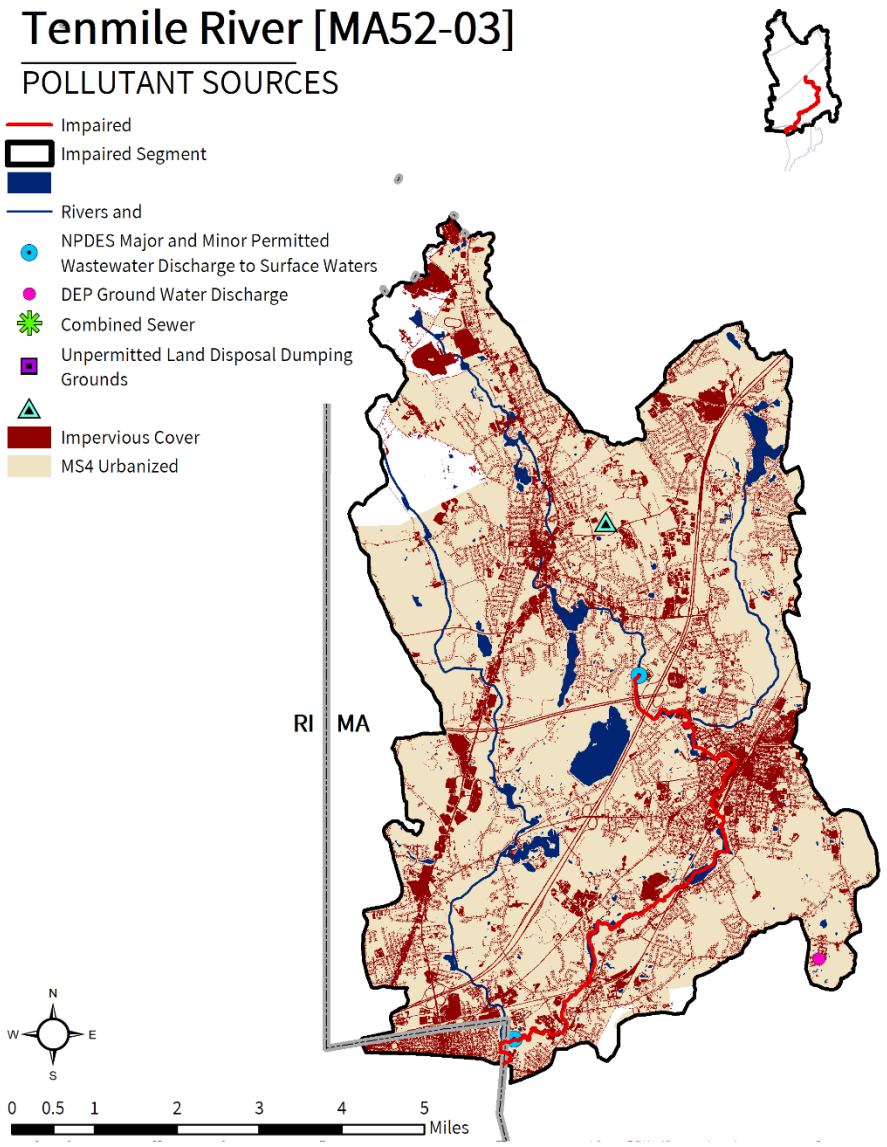


Figure 4-1. Natural resources and potential pollution sources draining to the Tenmile River segment MA52-03. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollution sources, including impervious cover, MS4 areas, and permitted facilities.

4.2. Waterbody Impairment Characterization

Ten Mile River (MA52-03) is a Class B, Warm Water (MassDEP, 2021a).

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

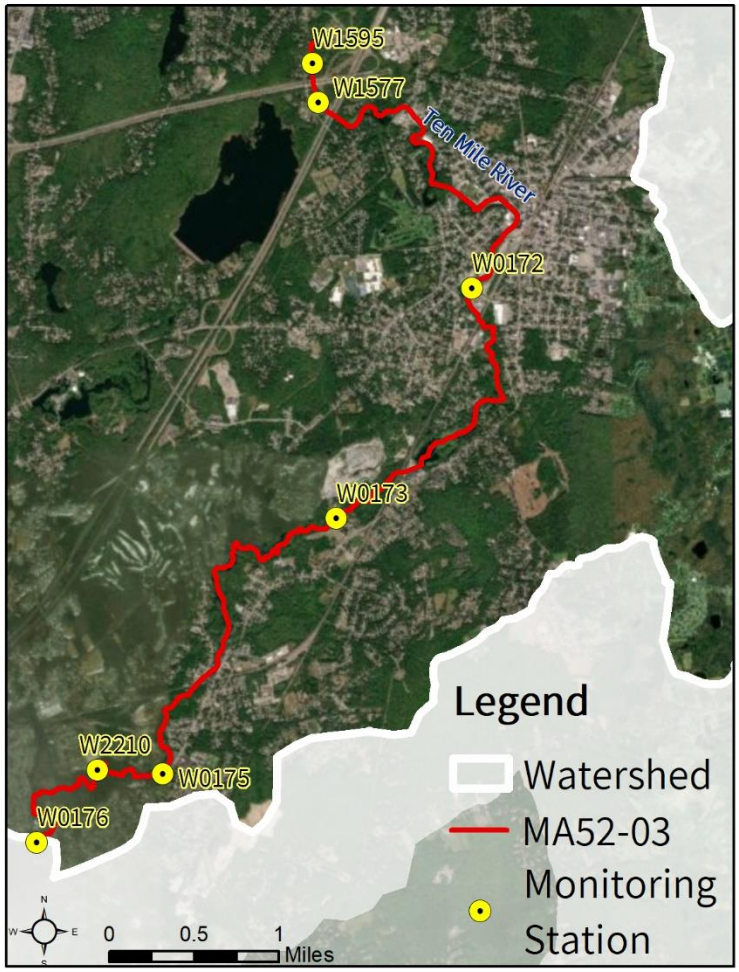


Figure 4-2. Location of monitoring station(s) along the impaired river segment.

- In 2007, five samples were collected at W0172, resulting in three days when the 30-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of five samples, one exceeded the STV criterion during dry weather.
- In 2007, five samples were collected at W0173, resulting in four days when the 30-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of five samples, one exceeded the STV criterion during dry weather.
- In 2007, five samples were collected at W0175, resulting in three days when the 30-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of five samples, one exceeded the STV criterion during dry weather.
- In 2007, five samples were collected at W0176, resulting in five days when the 30-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of five samples, one exceeded the STV criterion during dry weather.
- In 2011, six samples were collected at W2210, resulting in six days when the 30-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of six samples, one exceeded the STV criterion during wet weather.

Table 4-2. Summary of indicator bacteria sampling results by station for the Ten Mile River (MA52-03). The maximum 30-day rolling geometric mean (geomean), the number of days exceeding the geomean criterion of 126 CFU/100 mL for *E. coli* indicator bacteria, and the number of single samples exceeding the Statistical Threshold Value (STV) criterion of 410 CFU/100 mL for *E. coli* indicator bacteria are shown. The STV criterion is applied to the single sample results if less than 10 samples were collected within a calendar year at a site. The highest maximum 30-day rolling geomean of the sites is used to calculate the percent load reduction required to meet SWQS.

Unique Station ID	First Sample	Last Sample	Count	Maximum 30-Day Rolling Geomean (CFU/100mL)	Number Geomean Exceedances	Number STV Exceedances
W0172	4/18/2007	9/4/2007	5	320	3	1
W0173	4/18/2007	9/4/2007	5	514	4	1
W0175	4/18/2007	9/4/2007	5	660	3	1
W0176	4/18/2007	9/4/2007	5	409	5	1
W1577	4/18/2007	4/18/2007	1	100	0	0
W1595	5/22/2007	9/4/2007	4	620	2	1
W2210	5/17/2011	9/26/2011	6	687	6	1

Table 4-3. Indicator bacteria data by station, indicator, and date for the Ten Mile River (MA52-03). Each sample date was designated wet or dry weather with wet weather defined as more than 0.5 inches of precipitation in the previous 72 hours. Red text 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 Statistical Threshold Value or STV) and 126 CFU/100 mL (applied to rolling 30-day geomean) for *E. coli* indicator bacteria.

Unique Station ID	Indicator	Date	Wet/Dry	Result (CFU/100mL)	30-Day Rolling Geomean (CFU/100mL)	30-Day Rolling STV (CFU/100mL)
W0172	*E. coli*	4/18/2007	WET	62	62	
W0172	*E. coli*	5/22/2007	DRY	86	86	
W0172	*E. coli*	7/2/2007	DRY	160	160	
W0172	*E. coli*	7/31/2007	DRY	640	320	
W0172	*E. coli*	9/4/2007	DRY	190	190	
W0173	*E. coli*	4/18/2007	WET	71	71	
W0173	*E. coli*	5/22/2007	DRY	180	180	
W0173	*E. coli*	7/2/2007	DRY	300	300	
W0173	*E. coli*	7/31/2007	DRY	880	514	
W0173	*E. coli*	9/4/2007	DRY	150	150	
W0175	*E. coli*	4/18/2007	WET	76	76	
W0175	*E. coli*	5/22/2007	DRY	95	95	
W0175	*E. coli*	7/2/2007	DRY	150	150	
W0175	*E. coli*	7/31/2007	DRY	2900	660	
W0175	*E. coli*	9/4/2007	DRY	220	220	
W0176	*E. coli*	4/18/2007	WET	290	290	
W0176	*E. coli*	5/22/2007	DRY	260	260	
W0176	*E. coli*	7/2/2007	DRY	190	190	
W0176	*E. coli*	7/31/2007	DRY	880	409	
W0176	*E. coli*	9/4/2007	DRY	170	170	
W1577	*E. coli*	4/18/2007	WET	100	100	
W1595	*E. coli*	5/22/2007	DRY	48	48	
W1595	*E. coli*	7/2/2007	DRY	620	620	
W1595	*E. coli*	7/31/2007	DRY	240	386	
W1595	*E. coli*	9/4/2007	DRY	43	43	
W2210	*E. coli*	5/17/2011	WET	687	687	
W2210	*E. coli*	6/9/2011	DRY	236	403	
W2210	*E. coli*	6/21/2011	DRY	199	217	

Unique Station ID	Indicator	Date	Wet/Dry	Result (CFU/100mL)	30-Day Rolling Geomean (CFU/100mL)	30-Day Rolling STV (CFU/100mL)
W2210	*E. coli*	7/26/2011	DRY	130	130	
W2210	*E. coli*	8/23/2011	DRY	214	167	
W2210	*E. coli*	9/26/2011	WET	178	178	

4.3. Potential Pathogen Sources

Comparing data collected during wet weather versus dry weather conditions provides an indication of the types of sources present and 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 the river 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 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).

The indicator bacteria data for the Ten Mile River (MA52-03) were elevated during both wet and dry weather. Elevated indicator bacteria 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 wet weather indicator bacteria levels. Elevated indicator bacteria 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. More data are required especially during wet weather to better target the potential sources of pathogens.

Each potential pathogen source is described in further detail below.

Urban Stormwater: The watershed is heavily developed and has 94% of the land area in MS4 and 13% as DCIA. Development within the immediate drainage area consists primarily of medium to high density mixed residential, commercial, and industrial development with extensive coverage of impervious surfaces around the upper portion of the segment. Stormwater runoff from urban areas is likely the most significant source of pathogens.

Illicit Sewage Discharges: Most of the downstream portion of the watershed and some of the upstream portion are served by public sewer. The upstream part of the segment flows through dense urban development. Sewer related risks include leaking infrastructure (pipes, pump stations, etc.) and sanitary sewer overflows, 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 drains are also a risk. Given the dense urban development and elevated dry weather indicator bacteria levels, illicit storm drain connections and/or illicit discharges from failing infrastructure such as leaky sewer lines or SSOs are likely a major source of pathogens.

On-Site Wastewater Disposal Systems: There is one groundwater discharge permit for on-site wastewater discharge within the watershed but not within the immediate drainage area. These are large-capacity septic systems (non-residential). Most development in the upstream areas of the watershed relies on septic systems for wastewater treatment. It is likely that a portion of septic systems are not being properly maintained and are discharging untreated effluent to groundwater.

Agriculture: Agricultural activities account for 2% of the total land use area within the watershed, though none are in proximity to the segment. Agricultural activities visible on recent aerial photos were open fields. Agricultural activities related to manure storage and spreading, if not well managed, are a possible source of pathogens to

waterbodies. Stormwater runoff from agricultural lands are likely a relatively small source of pathogens to the segment.

Pet Waste: The upstream half of the segment flows through dense urban development with many residential neighborhoods. Conservation and recreational lands, parks, ballfields, and residential streets popular for dog-walking, especially where paths are adjacent to rivers, ponds, or wetlands, represent a possible source of pathogens.

Wildlife Waste: Large open mowed areas such as conservation and recreational lands, fields, golf courses, and wetlands with a clear sightline to a waterbody may attract excessive waterfowl and elevate indicator bacteria counts in the water.

4.4. Existing Local Management

This section identifies the municipalities immediately surrounding the impaired segment and its sub-basin (excludes upstream impaired segment watersheds). For a complete view of upstream municipalities and waterbodies, see the map in Figure 2-1.

City of Attleboro. See Section 3.4

Town of North Attleborough. See Section 3.4

Town of Plainville. See Section 3.4

Town of Seekonk

Most of Seekonk is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit. Seekonk (Permit ID #MAR041156) has an EPA approved Notice of Intent (NOI). Seekonk has a Stormwater Management Plan available online on the town website. The town has mapped all of its MS4 stormwater system, which is attached to the NOI. It adopted illicit discharge detection and elimination (IDDE), erosion and sediment control (ESC), and post-construction stormwater regulations in 2017. According to the NOI, there are 46 outfalls into the Runnins River (MA53-01), 46 outfalls into the pathogen-impaired Ten Mile River (MA52-03), and 16 outfalls into the Palmer River (MA53-03).

Seekonk has the following ordinances and bylaws:

- Stormwater Ordinance and/or Bylaws:
  Pre-construction (https://www.seekonk-ma.gov/sites/g/files/vyhlif1191/f/uploads/pre.pdf), (Town of Seekonk, n.d., a) and
  post-construction (https://www.seekonk-ma.gov/sites/g/files/vyhlif1191/f/uploads/post.pdf) (Town of Seekonk, n.d., b)
- Stormwater Utility: None found.
- Title 5 Supplementary Regulation: Nothing beyond State of Massachusetts Title V Regulations.
- Wetland Protection Bylaw: Bylaw: Category 41 – Wetlands Protection, page 84 https://www.seekonk-ma.gov/sites/g/files/vyhlif1191/f/uploads/town_by-laws_adopted_11.18.19_effective_3.5.20_1.pdf (Town of Seekonk, 2019a)
- Wetlands regulation: https://www.seekonk-ma.gov/sites/g/files/vyhlif1191/f/uploads/regulations.pdf (Town of Seekonk, 2012)
- Pet Waste Ordinance: Category 14A - Dog Restraint Program. Section 3 page 21.https://www.seekonk-ma.gov/sites/g/files/vyhlif1191/f/uploads/town_by-laws_adopted_11.18.19_effective_3.5.20_1.pdf (Town of Seekonk, 2019b)
- Contact Recreation Ordinance: None found.

The Seekonk Master Plan does not have a section on existing water and environmental conditions, but the plan mentions the importance of using public facilities such as wastewater treatment to prevent negative impacts on

surface water resources. The Runnins River and the Ten Mile River, both impaired segments within the town's boundaries, are mentioned within the plan. Stormwater is also briefly mentioned. The town does not currently have a sewer system but is interested in providing a centralized wastewater treatment plant.

Seekonk Town Website: https://www.seekonk-ma.gov/ (Town of Seekonk, 2021a)

Economic Development Plan: https://www.seekonk-ma.gov/sites/g/files/vyhlif1191/f/pages/master_plan_draft_2019.07.23_mtg.pdf (Town of Seekonk, 2019c)

Stormwater Web Page: https://www.seekonk-ma.gov/public-works/pages/stormwater-information (Town of Seekonk, n.d., c)

Open Space and Recreation Plan: currently under development: https://www.seekonk-ma.gov/sites/g/files/vyhlif1191/f/uploads/meeting_agenda.osrp_.2021.02.01_0.pdf (Town of Seekonk, 2021b)

5. MA52-05 Speedway Brook

5.1. Waterbody Overview

The Speedway Brook (locally known as Thacher Brook) segment MA52-05 is 0.9 miles long and begins at the brook's headwaters in Attleboro, MA, near the Maple Street/Oneil Boulevard intersection. The segment flows southwest to end at an inlet to Dodgeville Pond (a Ten Mile River impoundment) in Attleboro. There are no named tributaries to Speedway Brook segment MA52-05 but several unnamed streams draining wetlands or small ponds. Briggs Corner Pond is located in the upper watershed, south of the segment.

Key landmarks in the watershed include the densely developed Attleboro district between MA-152 and MA-118, the Peter Thacher Elementary School, Mass Audubon's Attleboro Springs Wildlife Sanctuary a La Salette, and the Locust Valley Country Club. The segment is crossed by Dexter Street and South Main Street/MA-152 in Attleboro.

Speedway Brook (MA52-05) drains an area of 3.4 square miles, of which 0.7 mi^2 (20%) is impervious and 0.5 mi^2 (14%) is directly connected impervious area (DCIA). The watershed is mostly[7] served by public sewer and 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. There is one Industrial Stormwater discharge permit (Table 5-1). There is one MassDEP discharge to groundwater permit for on-site wastewater discharge within the watershed (Table 5-2). There are no combined sewer overflows, no landfills, and no unpermitted land disposal dumping grounds within the watershed. See Figure 5-1.

Reduction from Highest Calculated Geomean: 98%

Watershed Area (Acres): 2,174

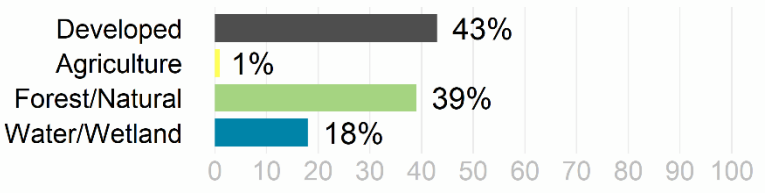
Segment Length (Miles): 0.9

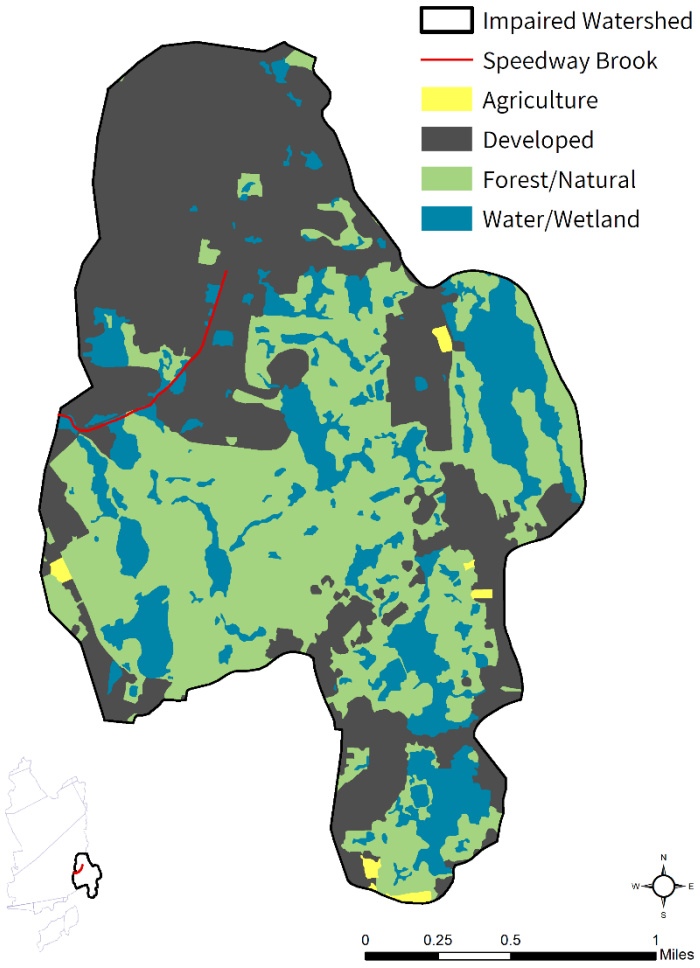
Impairment(s): *E. coli*, fecal coliform (Primary Contact Recreation)

Class (Qualifier): B (Warm Water)

Impervious Area (Acres, %): 432 (20%)

DCIA Area (Acres, %): 313 (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 https://www.mass.gov/guides/water-utility-resilience-program (MassDEP, 2021b), MS4 reports, and local knowledge.

Table 5-1. National Pollutant Discharge Elimination System (NPDES) for Industrial Stormwater discharge. Only permits unique to this segment watershed are shown.

NPDES ID	NAME	TOWN
MA0001791	TEXAS INSTRUMENTS INC.	ATTLEBORO

Table 5-2. Groundwater discharge permits in the segment watershed. Only permits unique to this segment watershed are shown. PERR = permit number plus renewal number. TYPE = type of groundwater discharge. Flow = permitted effluent in gallons per day (gpd).

PERR	NAME	TOWN	TYPE	FLOW (GPD)
940-0	HOMETOWN OAKHILL - MOBILE HOME PARK	ATTLEBOROUGH	Sanitary Discharge	53,400

The watershed is extensively developed (43% of land use), with some forested (39%) and wetland (18%) areas. Most of the natural areas are concentrated in the central and southern portion of the watershed, while the northern portion is almost entirely medium density residential development, with pockets of commercial properties. The segment itself is surrounded by a vegetated buffer zone, despite flowing mostly through developed areas.

In the Speedway Brook (MA52-05) watershed, under the Natural Heritage and Endangered Species Program, there are no areas of Priority Habitats of Rare Species or Priority Natural Vegetation Communities. There are no Areas of Critical Environmental Concern, no areas under Public Water Supply protection, and no areas identified as Outstanding Resource Waters in the watershed. Over 192 acres (9%) of land protected in perpetuity[8] exist within the segment watershed, which is part of a total of 654 acres (30%) of Protected and Recreational Open Space[9]. See Figure 5-1.

[8] Land protected in perpetuity include several interests such as conservation restriction, 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] Only land protected in perpetuity is shown on the natural resources map. Protected and Recreational Open Space estimates reflect areas in the State of Massachusetts only (and thus reflect only a portion of the total open space for watersheds that extend outside the State of Massachusetts).

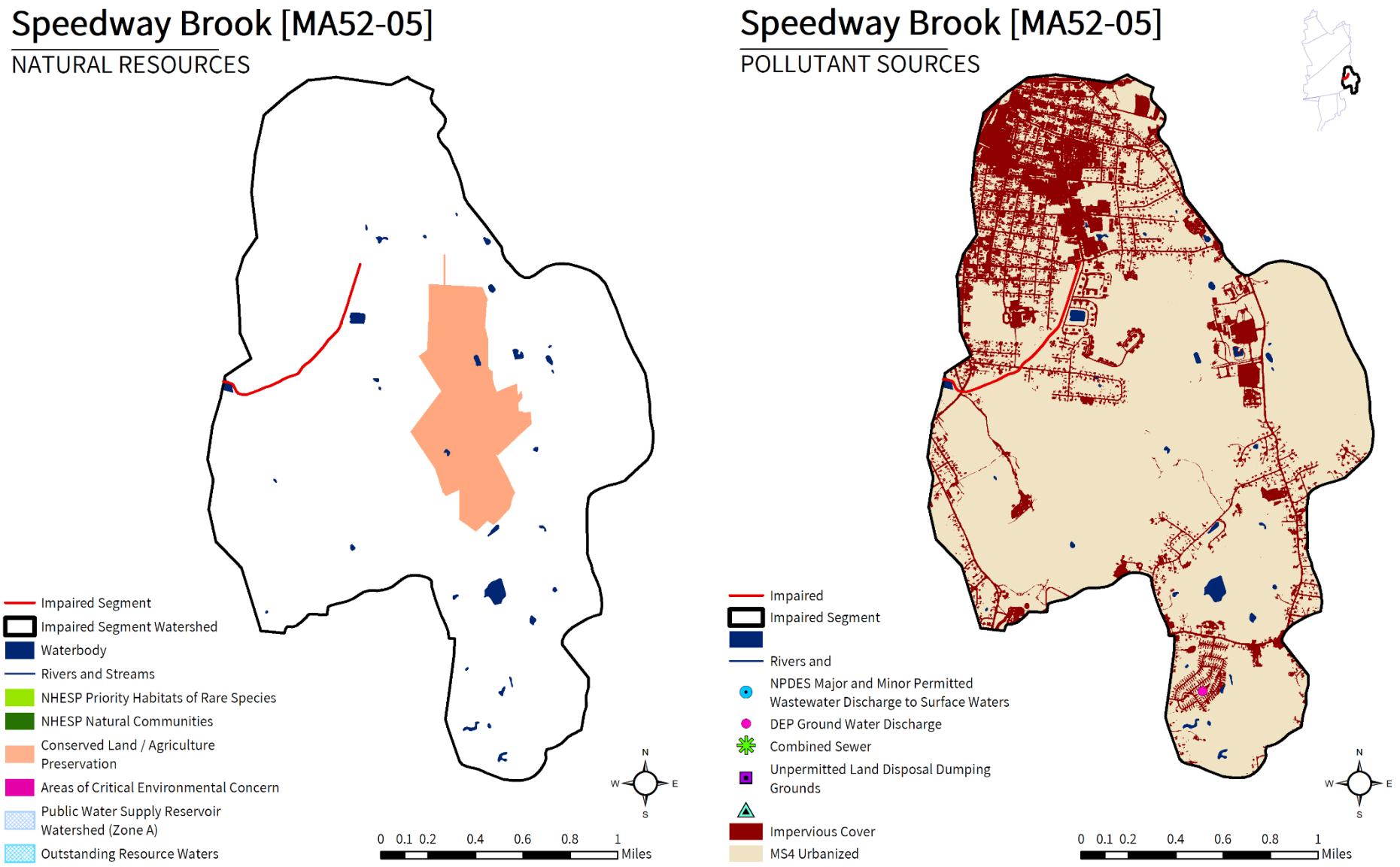


Figure 5-1. Natural resources and potential pollution sources draining to the Speedway Brook segment MA52-05. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollution sources, including impervious cover, MS4 areas, and permitted facilities.

5.2. Waterbody Impairment Characterization

Speedway Brook (MA52-05) is a Class B, Warm Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS using the indicator bacteria *E. coli* at the stations identified below (refer to Tables 5-3, 5-4; Figure 5-2). 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. Only stations with five or more samples are described below.

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

- Between 2006-2014, 15 samples were collected at W0180, resulting in 13 days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of 15 samples, 10 exceeded the STV criterion during both wet and dry weather.
- Between 2006-2014, 15 samples were collected at W1517, resulting in 15 days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of 15 samples, 10 exceeded the STV criterion during both wet and dry weather.
- Between 2006-2014, nine samples were collected at W1618, resulting in nine days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of nine samples, five exceeded the STV criterion during both wet and dry weather.
- In 2006, six samples were collected at W1623, resulting in six days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of six samples, five exceeded the STV criterion during both wet and dry weather.

Table 5-3. Summary of indicator bacteria sampling results by station for Speedway Brook (MA52-05). 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 Statistical Threshold Value (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 sites 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
W0180	5/10/2006	8/19/2014	15	2230	13	10
W1517	5/10/2006	8/19/2014	15	2466	15	10
W1618	9/11/2006	8/19/2014	9	4946	9	5
W1620	8/14/2006	10/4/2006	4	8160	4	4
W1623	7/25/2006	10/4/2006	6	2174	6	5
W2494	7/22/2014	7/30/2014	2	613	2	2

Table 5-4. Indicator bacteria data by station, indicator, and date for Speedway Brook (MA52-05). Each sample date was designated wet or dry weather with wet weather defined as more than 0.5 inches of precipitation in the previous 72 hours. Red text 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 Statistical Threshold Value or STV) and 126 CFU/100 mL (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)
W0180	*E. coli*	5/10/2006	DRY	328	328	
W0180	*E. coli*	6/13/2006	DRY	435	378	
W0180	*E. coli*	7/12/2006	DRY	1550	605	
W0180	*E. coli*	7/25/2006	WET	1990	814	
W0180	*E. coli*	8/14/2006	DRY	4880	1600	
W0180	*E. coli*	9/11/2006	DRY	1642	2230	
W0180	*E. coli*	4/18/2007	WET	95	95	
W0180	*E. coli*	5/22/2007	DRY	160	123	
W0180	*E. coli*	7/2/2007	DRY	2000	312	
W0180	*E. coli*	7/31/2007	DRY	1600	800	
W0180	*E. coli*	9/4/2007	DRY	190	847	
W0180	*E. coli*	6/26/2013	DRY	1010	1010	
W0180	*E. coli*	8/7/2013	DRY	687	833	
W0180	*E. coli*	9/11/2013	DRY	173	493	
W0180	*E. coli*	6/17/2014	DRY	435	435	
W1517	*E. coli*	5/10/2006	DRY	517	517	
W1517	*E. coli*	6/13/2006	DRY	1050	737	
W1517	*E. coli*	7/12/2006	DRY	2420	1095	
W1517	*E. coli*	7/25/2006	WET	1730	1228	
W1517	*E. coli*	8/3/2006	DRY	2420	1406	
W1517	*E. coli*	8/14/2006	DRY	7270	2386	
W1517	*E. coli*	9/11/2006	DRY	1239	2466	
W1517	*E. coli*	9/19/2006	DRY	1427	2251	
W1517	*E. coli*	10/4/2006	WET	199	1592	
W1517	Fecal Coliform	9/19/2006	DRY	1200	1200	
W1517	*E. coli*	6/26/2013	DRY	1440	1440	
W1517	*E. coli*	8/7/2013	DRY	488	838	
W1517	*E. coli*	9/11/2013	DRY	196	516	
W1517	*E. coli*	6/17/2014	DRY	387	387	

Unique Station ID	Indicator	Date	Wet/Dry	Result (CFU/100mL)	90-Day Rolling Geomean (CFU/100mL)	90-Day Rolling STV (CFU/100mL)
W1517	*E. coli*	7/22/2014	DRY	308	345	
W1517	*E. coli*	7/30/2014	DRY	355	348	
W1618	*E. coli*	9/11/2006	DRY	3248	3248	
W1618	*E. coli*	9/19/2006	DRY	7530	4946	
W1618	*E. coli*	10/4/2006	WET	771	2662	
W1618	Fecal Coliform	9/19/2006	DRY	6200	6200	
W1618	*E. coli*	6/2/2011	DRY	248	248	
W1618	*E. coli*	7/6/2011	DRY	980	493	
W1618	*E. coli*	9/20/2011	DRY	146	378	
W1618	*E. coli*	6/17/2014	DRY	556	556	
W1618	*E. coli*	7/22/2014	DRY	196	330	
W1618	*E. coli*	7/30/2014	DRY	105	225	
W1620	*E. coli*	8/14/2006	DRY	8160	8160	
W1620	*E. coli*	9/11/2006	DRY	2569	4579	
W1620	*E. coli*	9/19/2006	DRY	20871	7592	
W1620	*E. coli*	10/4/2006	WET	1070	4652	
W1620	Fecal Coliform	9/19/2006	DRY	14000	14000	
W1623	*E. coli*	7/25/2006	WET	921	921	
W1623	*E. coli*	8/3/2006	DRY	2420	1493	
W1623	*E. coli*	8/14/2006	DRY	4610	2174	
W1623	*E. coli*	9/11/2006	DRY	1449	1964	
W1623	*E. coli*	9/19/2006	DRY	2285	2025	
W1623	*E. coli*	10/4/2006	WET	388	1537	
W1623	Fecal Coliform	9/19/2006	DRY	4000	4000	
W2494	*E. coli*	7/22/2014	DRY	613	613	
W2494	*E. coli*	7/30/2014	DRY	579	596	

5.3. Potential Pathogen Sources

Comparing data collected during wet weather versus dry weather conditions provides an indication of the types of sources present and 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 the river 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 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).

The indicator bacteria data for Speedway Brook (MA52-05) were elevated during both wet and dry weather. Elevated indicator bacteria during wet weather is 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 wet weather indicator bacteria levels. Elevated indicator bacteria 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: Portions of the watershed are heavily developed, especially areas around and upstream of the segment, with the entire watershed in MS4 area and 14% as DCIA. Development within the watershed

consists primarily of medium to high density mixed residential, commercial, and industrial development. Stormwater runoff from urban areas is likely a significant source of pathogens.

Illicit Sewage Discharges: The watershed is mostly served by public sewer. Sewer related risks include leaking infrastructure (pipes, pump stations, etc.) and sanitary sewer overflows 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 drains are also a risk. Indicator bacteria levels exceeding SWQS are consistent in dry weather, suggesting that sewage related illicit discharges such as leaky sewer lines or pump stations, illegal cross connections with storm drains, and/or SSOs are likely the most significant source of pathogens to the river.

On-Site Wastewater Disposal Systems: There is one groundwater discharge permit for on-site wastewater discharge, which is a large-capacity septic system (non-residential). Some development in the watershed relies on septic systems for wastewater treatment. It is likely that a portion of septic systems are not being properly maintained and are discharging untreated effluent to groundwater.

Agriculture: Agricultural activities account for 1% of the total land use within the watershed and are located far away from the segment. Agricultural land uses visible on recent aerial photos within the watershed include open fields and hayfields. Agricultural activities related to manure storage and spreading, if not well managed, are a possible source of pathogens to waterbodies.

Pet Waste: Most of the segment flows through dense residential neighborhoods. Conservation and recreational lands, parks, ballfields, and residential streets popular for dog-walking, especially where paths are adjacent to rivers, ponds, or wetlands, represent a possible source of pathogens.

Wildlife Waste: Large open mowed areas such as conservation and recreational lands, fields, golf courses, and wetlands with a clear sightline to a waterbody may attract excessive waterfowl and elevate indicator bacteria counts in the water.

5.4. Existing Local Management

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

City of Attleboro. See Section 3.4

6. MA52-07 Sevenmile River

6.1. Waterbody Overview

The Sevenmile River segment MA52-07 is 3.2 miles long and begins at the river's headwaters at the outlet of Hoppin Hill Reservoir in North Attleborough, MA. The segment flows south under I-295, through Luther Reservoir (formerly segment MA52025) and into Attleboro where the segment ends at the inlet to Orrs Pond in Attleboro.

Other named lakes and ponds within the segment watershed include Todds Pond in the lower watershed. Tributaries to the Sevenmile River segment MA52-07 include an unimpaired section of the Sevenmile River and many other unnamed streams draining small ponds and wetlands.

Key landmarks in the watershed include the North Attleborough town center, part of the Martin Conservation Area, and the I-295/US-1 intersection. The segment is crossed by Riverview Drive, South Washington Street/US-1, I-295 (including two ramps to US-1), Draper Avenue, and Old Post Road in North Attleborough; and West Street/MA-123 in Attleboro.

The Sevenmile River (MA52-07) drains an area of five square miles, of which 0.5 mi^2 (11%) is impervious and 0.3 mi^2 (6%) is directly connected impervious area (DCIA). The watershed is mostly[10] served by public sewer and 89% 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 sanitary pollutants to surface waters and no MassDEP discharge to groundwater permits for on-site wastewater discharge. There is one NPDES Industrial Stormwater discharge permit in the segment watershed (Table 6-1). There are also no combined sewer overflows, no landfills, and no unpermitted land disposal dumping grounds within the watershed. See Figure 6-1.

The watershed is moderately developed (26% of land area), with the upper watershed consisting primarily of forested areas, large hayfields, and pasture. The segment itself flows through

Reduction from Highest Calculated Geomean: 71%

Watershed Area (Acres): 3,192

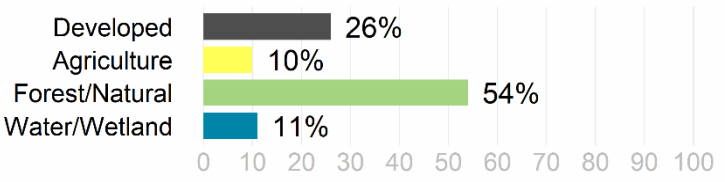
Segment Length (Miles): 3.2

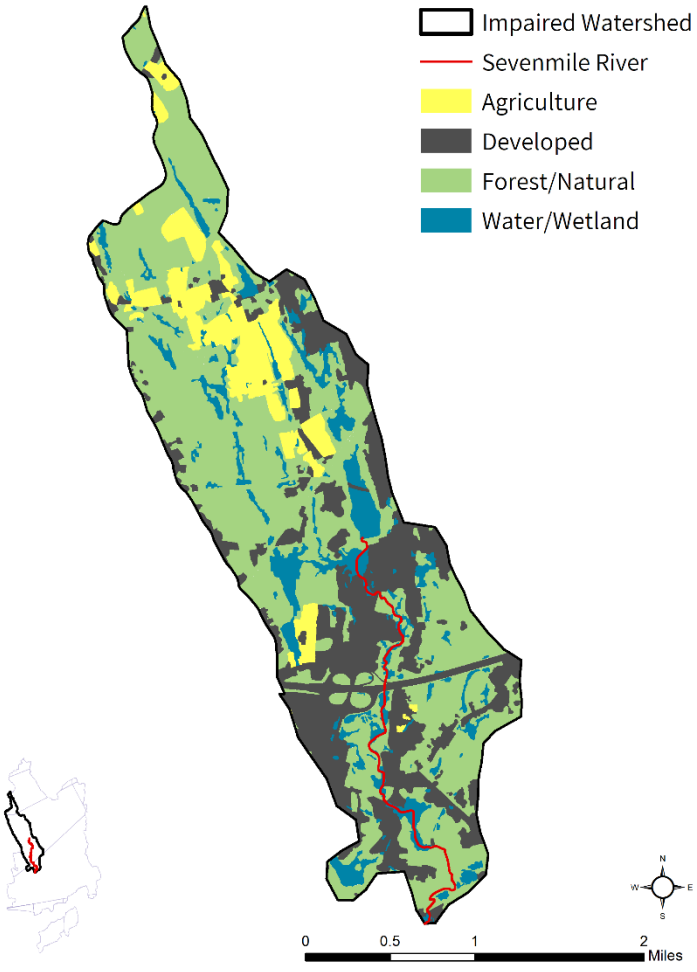
Impairment(s): *E. coli* (Primary Contact Recreation)

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

Impervious Area (Acres, %): 346 (11%)

DCIA Area (Acres, %): 194 (6%)





[10] Estimated percentage of developed areas with wastewater infrastructure in the watershed was based on available information: MWRA service areas, MassDEP's Water Utility Infrastructure Mapping Project https://www.mass.gov/guides/water-utility-resilience-program (MassDEP, 2021b), MS4 reports, and local knowledge.

medium to low density mixed commercial and residential development, mostly concentrated around US-1/1A. There is a wide vegetated buffer around most of the segment, although much of the river flows through forested wetlands which may be hydrologically connected to developed areas.

Table 6-1. National Pollutant Discharge Elimination System (NPDES) for Industrial Stormwater discharge. Only permits unique to this segment watershed are shown.

NPDES ID	NAME	TOWN
MA0030244	EMERALD SQUARE MALL	NORTH ATTLEBOROUGH

In the Sevenmile River (MA52-07) watershed, under the Natural Heritage and Endangered Species Program, there are 47 acres (1%) of the Priority Habitats of Rare Species. There are 3,139 acres (98%) under Public Water Supply protection, but no Areas of Critical Environmental Concern or Outstanding Resource Waters identified in the watershed. Over 314 acres (10%) of land protected in perpetuity[11] exist within the segment watershed, which is part of a total of 588 acres (18%) of Protected and Recreational Open Space[12]. See Figure 6-1.

[11] Land protected in perpetuity include several interests such as conservation restriction, agricultural preservation, private deed restrictions, wetland restrictions, aquifer protection, historic preservation, etc. Refer to Mass GIS metadata for the Protected and Recreational Open Space data layer.

[12] Only land protected in perpetuity is shown on the natural resources map. Protected and Recreational Open Space estimates reflect areas in the State of Massachusetts only (and thus reflect only a portion of the total open space for watersheds that extend outside the State of Massachusetts).

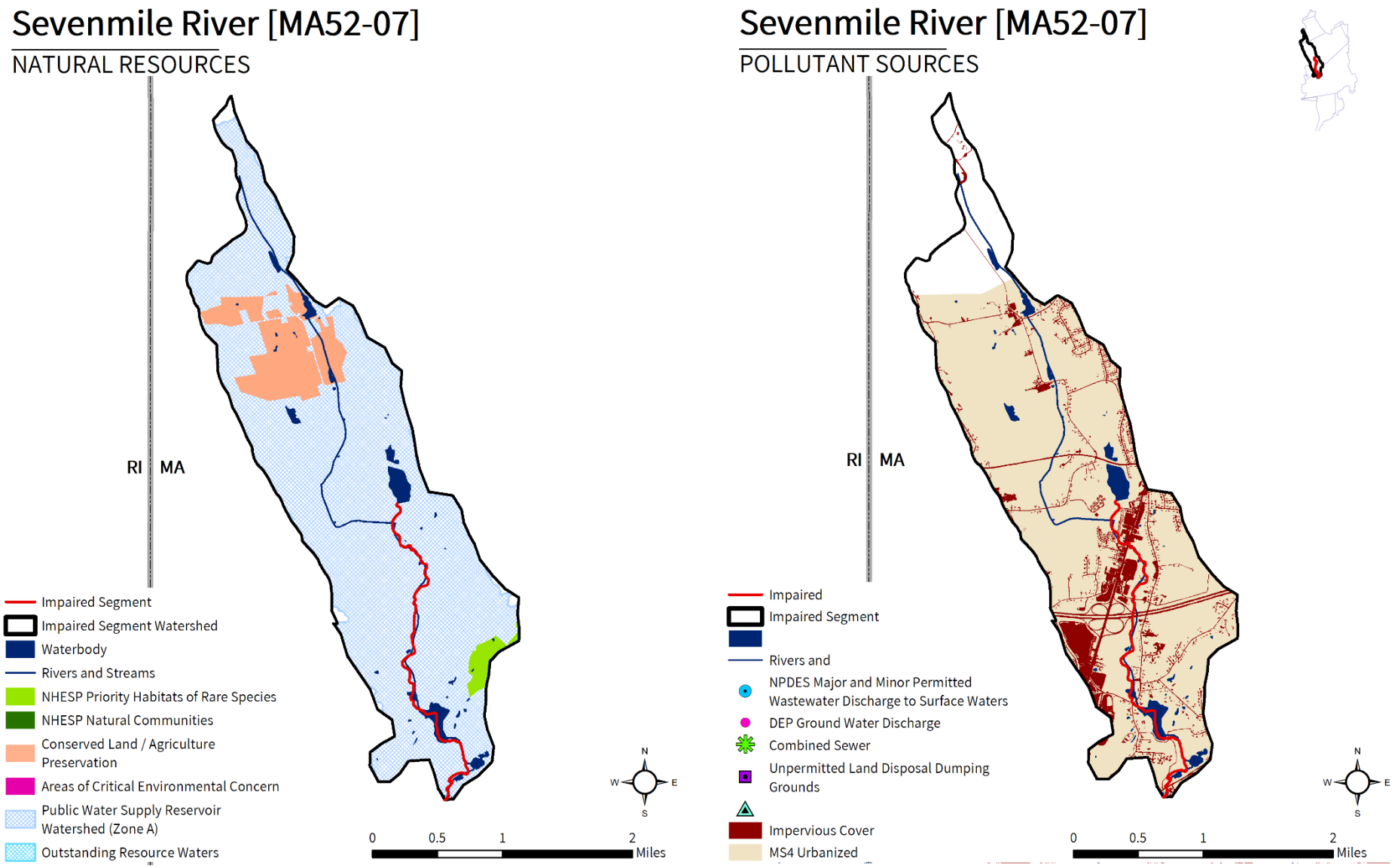


Figure 6-1 Natural resources and potential pollution sources draining to the Sevenmile River segment MA52-07. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollution sources, including impervious cover, MS4 areas, and permitted facilities.

6.2. Waterbody Impairment Characterization

The Sevenmile River (MA52-07) is a Class A, Public Water Supply and Outstanding Resource Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS using the indicator bacteria *E. coli* at the station listed below (refer to Tables 6-2, 6-3; Figure 6-2). 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 2007, five samples were collected at W0182, resulting in two days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of five samples, one exceeded the STV criterion during dry weather.

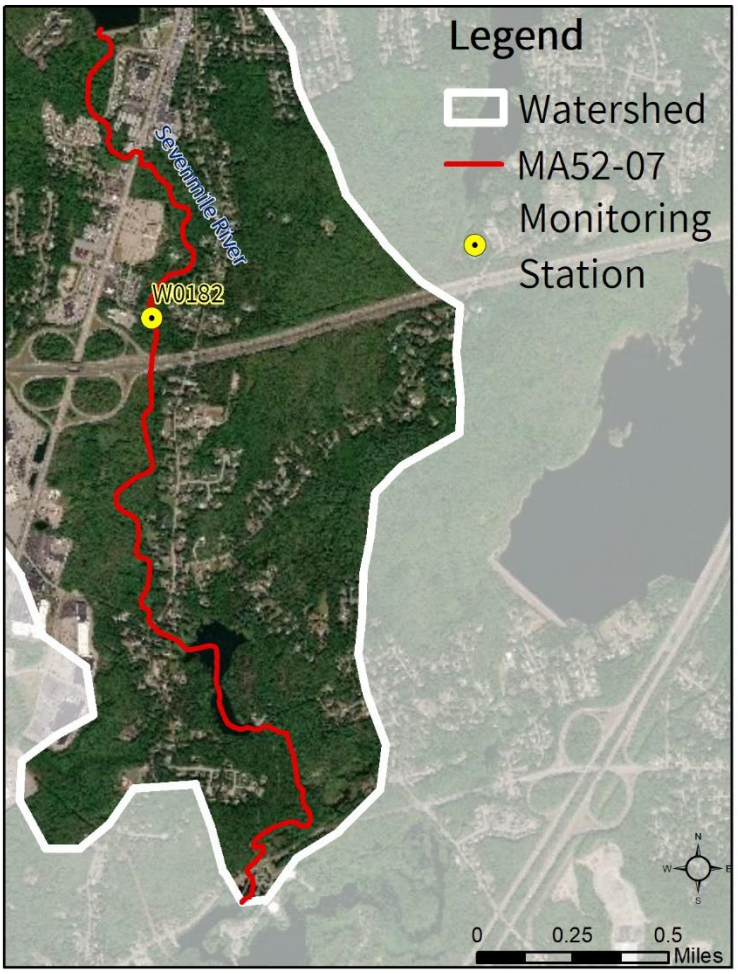


Figure 6-2. Location of monitoring station(s) along the impaired river segment.

Table 6-2. Summary of indicator bacteria sampling results by station for the Sevenmile River (MA52-07). 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 Statistical Threshold Value (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 sites 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
W0182	4/18/2007	9/4/2007	5	431	2	1

Table 6-3. Indicator bacteria data by station, indicator, and date for the Sevenmile River (MA52-07). Each sample date was designated wet or dry weather with wet weather defined as more than 0.5 inches of precipitation in the previous 72 hours. Red text 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 Statistical Threshold Value or STV) and 126 CFU/100 mL (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)
W0182	*E. coli*	4/18/2007	WET	19	19	
W0182	*E. coli*	5/22/2007	DRY	67	36	
W0182	*E. coli*	7/2/2007	DRY	300	73	
W0182	*E. coli*	7/31/2007	DRY	3500	413	
W0182	*E. coli*	9/4/2007	DRY	76	431	

6.3. Potential Pathogen Sources

Comparing data collected during wet weather versus dry weather conditions provides an indication of the types of sources present and 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 the river 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 SSOs. In other cases, dry weather pathogen and associated indicator bacteria concentrations can be high when there is a constant flow of pollutants during dry weather, which then becomes diluted during periods of precipitation. Dry weather sources include leaking sewer pipes, illicit connections of sanitary sewers to storm drains, failing septic systems, recreational use (such as swimmers), and direct wildlife and domesticated animal waste (including pets).

Indicator bacteria data for the Sevenmile River (MA52-07) were elevated during dry weather, but out of the five samples collected, only one was collected during wet weather. More data are needed to better target the potential sources of pathogens to the segment. Elevated indicator bacteria 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: Portions of the watershed are heavily developed and include an interstate highway corridor and exit, with 89% of the land area in MS4 and 6% as DCIA. Development within the watershed consists primarily of low to medium density residential development with commercial, industrial, and transportation infrastructure. Stormwater runoff from urban areas is likely a significant source of pathogens.

Illicit Sewage Discharges: A portion of the watershed contains sewer service areas. Sewer related risks include leaking infrastructure (pipes, pump stations, etc.) and sanitary sewer overflows 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 drains are also a risk. Though data are limited, the indicator bacteria exceeding SWQS in dry weather suggest that illicit storm drain connections and/or illicit discharges from failing infrastructure such as leaky sewer lines or SSOs are likely a contributing source of pathogens.

On-Site Wastewater Disposal Systems: A portion of the residential development in the watershed relies on septic systems for wastewater treatment. It is likely that a portion of septic systems are not being properly maintained and are discharging untreated effluent to groundwater.

Agriculture: Agricultural activities account for 10% of the total land use area within the watershed, and those visible on recent aerial photos within the watershed include open fields, hayfields, and pastureland. Most

agricultural lands are located along the river, but upstream of the segment. Agricultural activities related to manure storage and spreading, if not well managed, are a possible source of pathogens to waterbodies.

Pet Waste: The segment flows through several residential neighborhoods. Conservation and recreational lands, parks, ballfields, and residential streets popular for dog-walking, especially where paths are adjacent to rivers, ponds, or wetlands, represent a possible source of pathogens.

Wildlife Waste: Large open mowed areas such as conservation and recreational lands, fields, and wetlands with a clear sightline to a waterbody may attract excessive waterfowl and elevate indicator bacteria counts in the water.

6.4. Existing Local Management

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

City of Attleboro. See Section 3.4

Town of North Attleborough. See Section 3.4

Town of Plainville. See Section 3.4

7. MA52-08 Sevenmile River

7.1. Waterbody Overview

The Sevenmile River segment MA52-08 is 3.4 miles long and begins at the outlet of Orrs Pond in Attleboro, MA. The segment flows south through Attleboro to end at its confluence with the pathogen-impaired Ten Mile River segment MA52-03 in Pawtucket, RI.

There are several unnamed tributaries to the segment, as well as the pathogen-impaired Sevenmile River segment MA52-07 upstream of Orrs Pond.

Lakes and ponds in the watershed include those in upstream segment MA52-07, as well as Orrs Pond and Lake Como (mapped as not hydrologically connected to the segment by surface flow). Key landmarks near the segment include the Manchester Reservoir, a long section of the I-95 corridor, part of the Stone E Lea Golf Course, and the I-95/MA-1A intersection. The segment is crossed by Read Street, Roy Avenue, Pitas Avenue, I-95, and County Street in Attleboro.

The Sevenmile River (MA52-08) drains a total area of 12.6 square miles, of which 2.0 mi^2 (16%) is impervious and 1.3 mi^2 (10%) is directly connected impervious area (DCIA). The segment watershed extends beyond Massachusetts into Rhode Island for only 1% of the total watershed area.

The watershed is mostly[13] served by public sewer and 96% of the 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 and no MassDEP discharge to groundwater permits for on-site wastewater discharge within the watershed. There are also no combined sewer overflows, no landfills, and no unpermitted land disposal dumping grounds within the segment watershed. See Figure 7-1.

The watershed includes medium to high density mixed residential and commercial development along US-1, including shopping malls with expansive parking lots and some high-density

Reduction from Highest Calculated Geomean: 85%

Watershed Area (Acres): 8,087

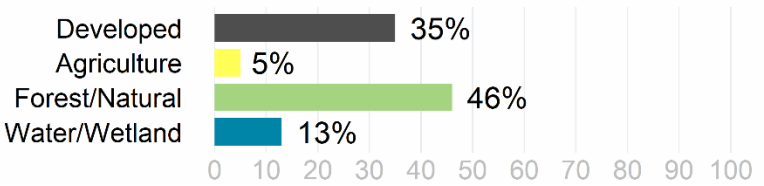
Segment Length (Miles): 3.4

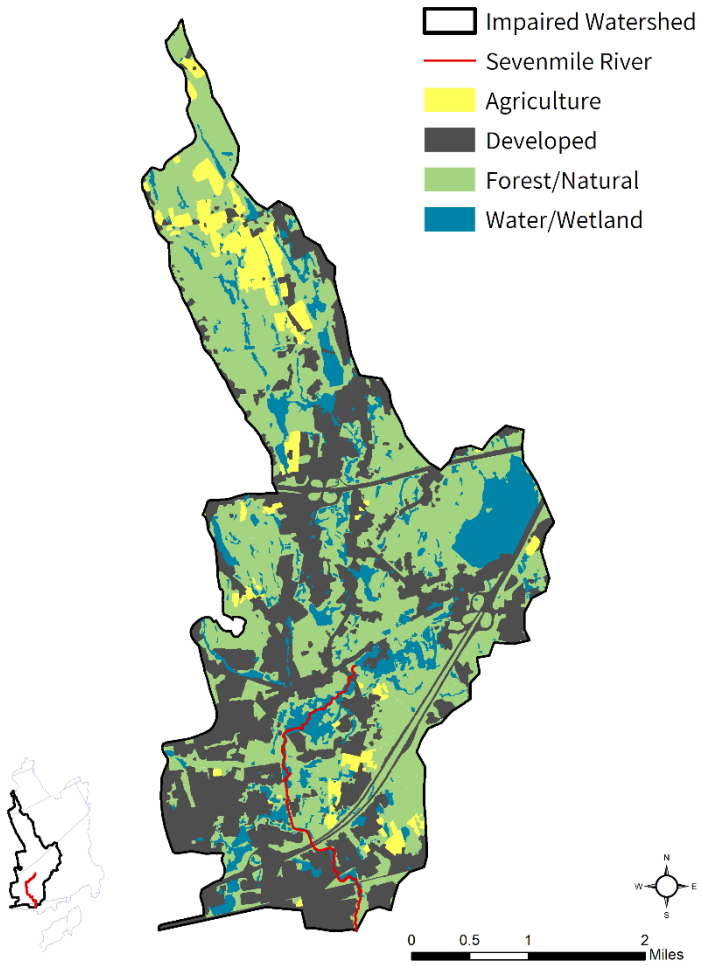
Impairment(s): *E. coli*, fecal coliform (Primary Contact Recreation)

Class (Qualifier): B

Impervious Area (Acres, %): 1,299 (16%)

DCIA Area (Acres, %): 812 (10%)





[13] Estimated percentage of developed areas with wastewater infrastructure in the watershed was based on available information: MWRA service areas, MassDEP's Water Utility Infrastructure Mapping Project https://www.mass.gov/guides/water-utility-resilience-program (MassDEP, 2021b), MS4 reports, and local knowledge.

neighborhoods in and around Pawtucket, RI, in the most downstream part of the segment watershed. The segment itself flows mostly through wide forested wetland buffer areas adjacent to developed areas, which may be hydrologically connected.

In the Sevenmile River (MA52-08) watershed, under the Natural Heritage and Endangered Species Program, there are 396 acres (5%) of Priority Habitats of Rare Species and nine acres (<1%) of Priority Natural Vegetation Communities. There are 4,480 acres (55%) under Public Water Supply protection, but no Areas of Critical Environmental Concern or Outstanding Resource Waters identified in the watershed. Over 342 acres (4%) of land protected in perpetuity[14] exist within the segment watershed, which is part of a total of 1,371 acres (17%) of Protected and Recreational Open Space[15]. See Figure 7-1.

[14] Land protected in perpetuity include several interests such as conservation restriction, agricultural preservation, private deed restrictions, wetland restrictions, aquifer protection, historic preservation, etc. Refer to Mass GIS metadata for the Protected and Recreational Open Space data layer.

[15] Only land protected in perpetuity is shown on the natural resources map. Protected and Recreational Open Space estimates reflect areas in the State of Massachusetts only (and thus reflect only a portion of the total open space for watersheds that extend outside the State of Massachusetts).

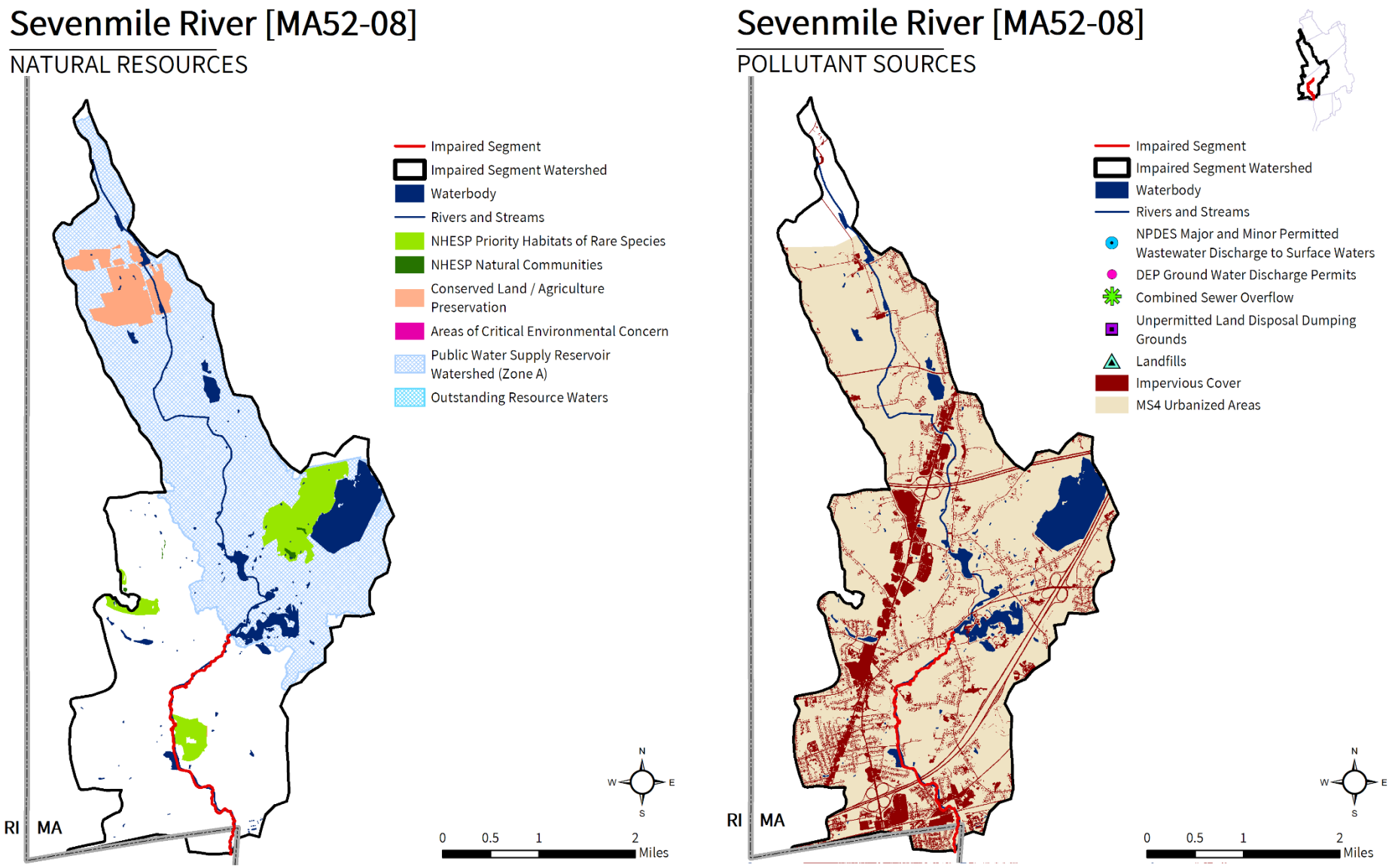


Figure 7-1. Natural resources and potential pollution sources draining to the Sevenmile River segment MA52-08. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollution sources, including impervious cover, MS4 areas, and permitted facilities.

7.2. Waterbody Impairment Characterization

The Sevenmile River (MA52-08) is a Class B Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS using the indicator bacteria *E. coli* at the stations listed below (refer to Tables 7-1, 7-2; Figure 7-2). 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. Only stations with five or more samples are described below.

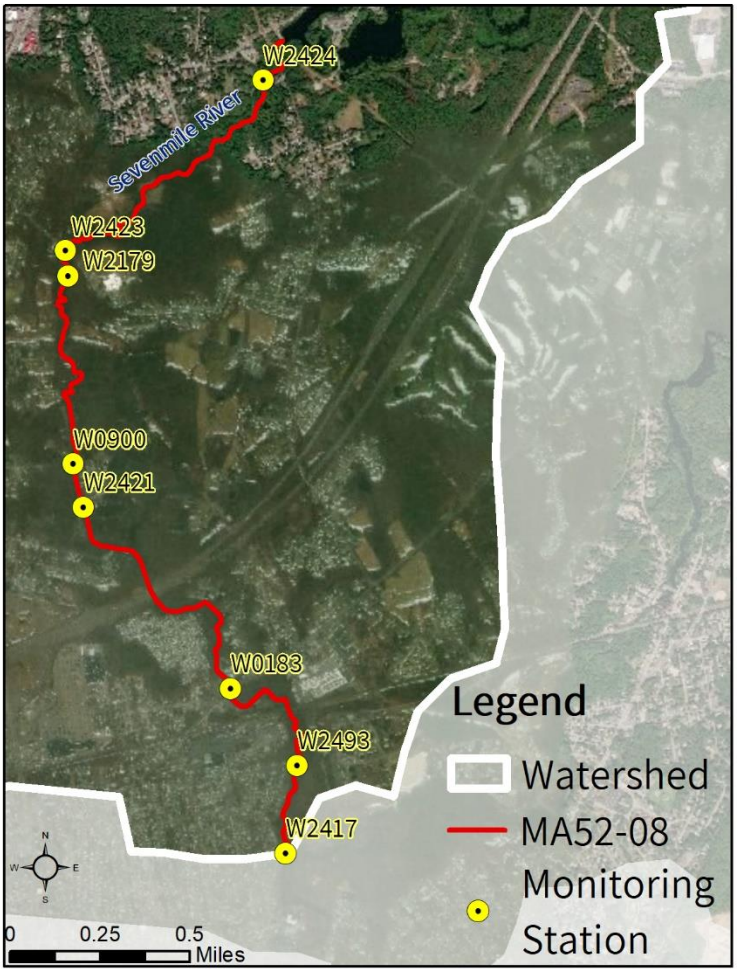


Figure 7-2. Location of monitoring station(s) along the impaired river segment.

- Between 2007-2014, 10 samples were collected at W0183, resulting in eight days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of 10 samples, six exceeded the STV criterion during dry weather.
- In 2007, five samples were collected at W0900, resulting in three days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of five samples, two exceeded the STV criterion during dry weather.
- In 2011, six samples were collected at W2179, resulting in six days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of six samples, four exceeded the STV criterion during dry weather.
- Between 2013-2014, five samples were collected at W2417, resulting in five days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of five samples, two exceeded the STV criterion during both wet and dry weather.

Table 7-1. Summary of indicator bacteria sampling results by station for the Sevenmile River (MA52-08). 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 Statistical Threshold Value (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 sites 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
W0183	4/18/2007	7/22/2014	10	858	8	6
W0900	4/18/2007	9/4/2007	5	557	3	2
W2179	5/17/2011	9/26/2011	6	625	6	4
W2417	6/25/2013	8/19/2014	5	727	5	2
W2421	6/25/2013	8/1/2013	2	326	2	0
W2423	6/25/2013	8/1/2013	2	291	2	0
W2424	6/25/2013	8/1/2013	2	58	0	0
W2493	7/2/2014	7/22/2014	2	579	2	1

Table 7-2. Indicator bacteria data by station, indicator, and date for the Sevenmile River (MA52-08). Each sample date was designated wet or dry weather with wet weather defined as more than 0.5 inches of precipitation in the previous 72 hours. Red text 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 Statistical Threshold Value or STV) and 126 CFU/100 mL (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)
W0183	*E. coli*	4/18/2007	WET	90	90	
W0183	*E. coli*	5/22/2007	DRY	150	116	
W0183	*E. coli*	7/2/2007	DRY	580	199	
W0183	*E. coli*	7/31/2007	DRY	870	423	
W0183	*E. coli*	9/4/2007	DRY	470	619	
W0183	*E. coli*	6/25/2013	DRY	326	326	
W0183	*E. coli*	8/1/2013	WET	365	345	
W0183	*E. coli*	9/11/2013	DRY	517	395	
W0183	*E. coli*	7/2/2014	DRY	613	613	
W0183	*E. coli*	7/22/2014	DRY	1200	858	
W0900	*E. coli*	4/18/2007	WET	38	38	
W0900	*E. coli*	5/22/2007	DRY	190	85	
W0900	*E. coli*	7/2/2007	DRY	300	129	
W0900	*E. coli*	7/31/2007	DRY	620	328	
W0900	*E. coli*	9/4/2007	DRY	930	557	
W2179	*E. coli*	5/17/2011	WET	185	185	
W2179	*E. coli*	6/9/2011	DRY	517	309	
W2179	*E. coli*	6/21/2011	DRY	416	341	
W2179	*E. coli*	7/26/2011	DRY	1730	512	
W2179	*E. coli*	8/23/2011	DRY	411	625	
W2179	*E. coli*	9/26/2011	WET	201	523	
W2417	*E. coli*	6/25/2013	DRY	279	279	
W2417	*E. coli*	8/1/2013	WET	816	477	
W2417	*E. coli*	9/11/2013	DRY	248	384	
W2417	*E. coli*	7/2/2014	DRY	727	727	
W2417	*E. coli*	7/22/2014	DRY	345	501	
W2421	*E. coli*	6/25/2013	DRY	326	326	

Unique Station ID	Indicator	Date	Wet/Dry	Result (CFU/100mL)	90-Day Rolling Geomean (CFU/100mL)	90-Day Rolling STV (CFU/100mL)
W2421	*E. coli*	8/1/2013	WET	326	326	
W2423	*E. coli*	6/25/2013	DRY	291	291	
W2423	*E. coli*	8/1/2013	WET	210	247	
W2424	*E. coli*	6/25/2013	DRY	51	51	
W2424	*E. coli*	8/1/2013	WET	66	58	
W2493	*E. coli*	7/2/2014	DRY	579	579	
W2493	*E. coli*	7/22/2014	DRY	345	447	

7.3. Potential Pathogen Sources

Comparing data collected during wet weather versus dry weather conditions provides an indication of the types of sources present and 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 the river 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 SSOs. In other cases, dry weather pathogen and associated indicator bacteria concentrations can be high when there is a constant flow of pollutants during dry weather, which then becomes diluted during periods of precipitation. Dry weather sources include leaking sewer pipes, illicit connections of sanitary sewers to storm drains, failing septic systems, recreational use (such as swimmers), and direct wildlife and domesticated animal waste (including pets).

Indicator bacteria data for the Sevenmile River (MA52-08) were elevated during both wet and dry weather. Elevated indicator bacteria during wet weather is 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 wet weather indicator bacteria levels. Elevated indicator bacteria 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: Portions of the watershed are heavily developed, with 96% of the land area in MS4 and 10% as DCIA. Development especially in the downstream portions of the watershed consist primarily of medium to high density mixed development. Stormwater runoff from urban areas is likely a significant source of pathogens.

Illicit Sewage Discharges: Most of the downstream portions of the watershed, and some of the upstream portions, are served by public sewer. Sewer related risks include leaking infrastructure (pipes, pump stations, etc.) and sanitary sewer overflows 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 drains are also a risk. Indicator bacteria exceeded SWQS frequently in dry weather, which indicate that illicit storm drain connections and/or illicit discharges from failing infrastructure such as leaky sewer lines or SSOs are likely a major contributing source of pathogens.

On-Site Wastewater Disposal Systems: A portion of development in the watershed relies on septic systems for wastewater treatment. It is likely that a portion of septic systems are not being properly maintained and are discharging untreated effluent to groundwater.

Agriculture: Agricultural activities account for 5% of the total land use area within the watershed, with open fields, hayfields, and pastureland visible on recent aerial photos. Agricultural activities related to manure storage and spreading, if not well managed, are a possible source of pathogens to waterbodies.

Pet Waste: Much of the lower segment flows through dense residential neighborhoods. Conservation and recreational lands, parks, ballfields, and residential streets popular for dog-walking, especially where paths are adjacent to rivers, ponds, or wetlands, represent a possible source of pathogens.

Wildlife Waste: Large open mowed areas such as conservation and recreational lands, fields, golf courses, and wetlands with a clear sightline to a waterbody may attract excessive waterfowl and elevate indicator bacteria counts in the water.

7.4. Existing Local Management

This section identifies the municipalities immediately surrounding the impaired segment and its sub-basin (excludes upstream impaired segment watersheds). For a complete view of upstream municipalities and waterbodies, see the map in Figure 2-1.

City of Attleboro. See Section 3.4

Town of North Attleborough. See Section 3.4

8. MA52-09 Scotts Brook

8.1. Waterbody Overview

The Scotts Brook segment MA52-09 is 2.1 miles long and begins at the brook's headwaters north of High Street and southwest of Ruest Road in North Attleborough, MA. The segment flows generally northeast, then southeast, through Attleborough until its confluence with the pathogen-impaired Ten Mile River segment MA52-02 in North Attleborough, MA. The brook has several small unnamed tributaries and unnamed ponds in its watershed.

Key landmarks in the watershed include the Pitcher Brook forested area, portions of the Heather Hill Country Club, and Roosevelt Avenue Elementary School. The segment is crossed by Pearl Street, Harris Drive, High Street, Cobblestone Lane, Arnold Road, Broadway, Avery Street, Second Street, and South Washington Street in North Attleborough.

Scotts Brook (MA52-09) drains an area of 1.2 square miles, of which 0.2 mi^2 (13%) is impervious and 0.1 mi^2 (7%) is directly connected impervious area (DCIA). The watershed is partially[16] served by public sewer and 56% 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 and no MassDEP discharge to groundwater permits for on-site wastewater discharge within the watershed. There are also no combined sewer overflows, no landfills, and no unpermitted land disposal dumping grounds within the segment watershed. See Figure 8-1.

The watershed is moderately developed (25%), with forested land use (65%) covering most of the upper two-thirds of the watershed. The segment itself flows through low to medium density residential neighborhoods around downtown North Attleborough along High Street, Arnold Road, and Broadway. Agricultural fields in the northern part of the segment watershed appear

Reduction from Highest Calculated Geomean: 89%

Watershed Area (Acres): 791

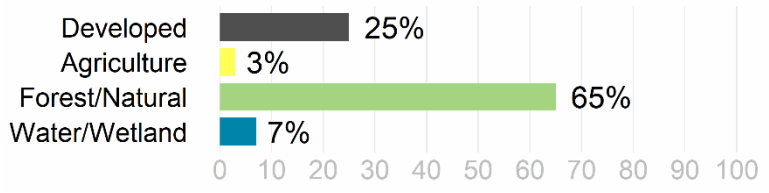
Segment Length (Miles): 2.1

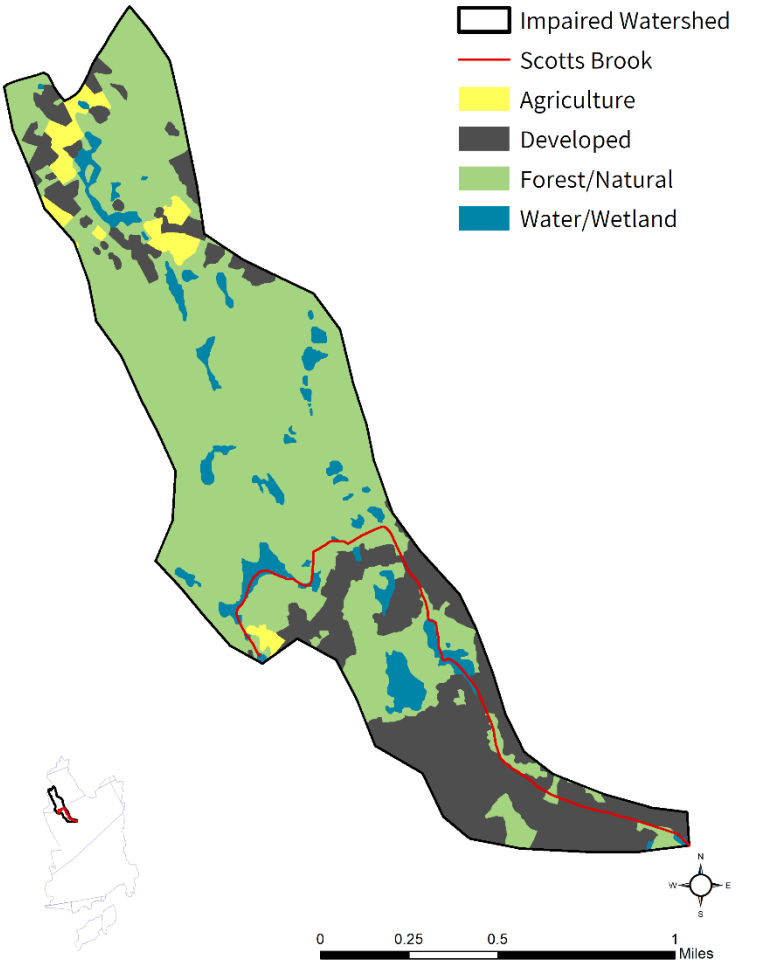
Impairment(s): *E.coli* (Primary Contact Recreation)

Class (Qualifier): B

Impervious Area (Acres, %): 103 (13%)

DCIA Area (Acres, %): 59 (7%)





[16] Estimated percentage of developed areas with wastewater infrastructure in the watershed was based on available information: MWRA service areas, MassDEP's Water Utility Infrastructure Mapping Project https://www.mass.gov/guides/water-utility-resilience-program (MassDEP, 2021b), MS4 reports, and local knowledge.

to primarily be used for livestock. Most of the river corridor consists of at least a moderate wooded buffer.

In the Scotts Brook (MA52-09) watershed, under the Natural Heritage and Endangered Species Program, there are 10 acres (1%) of Priority Habitats of Rare Species. There are 26 acres under Public Water Supply protection, but no Areas of Critical Environmental Concern or Outstanding Resource Waters identified in the watershed. Over 43 acres (5%) of land protected in perpetuity[17] exist within the segment watershed, which is part of a total of 242 acres (31%) of Protected and Recreational Open Space[18]. See Figure 8-1.

[17] Land protected in perpetuity include several interests such as conservation restriction, agricultural preservation, private deed restrictions, wetland restrictions, aquifer protection, historic preservation, etc. Refer to Mass GIS metadata for the Protected and Recreational Open Space data layer.

[18] Only land protected in perpetuity is shown on the natural resources map. Protected and Recreational Open Space estimates reflect areas in the State of Massachusetts only (and thus reflect only a portion of the total open space for watersheds that extend outside the State of Massachusetts).

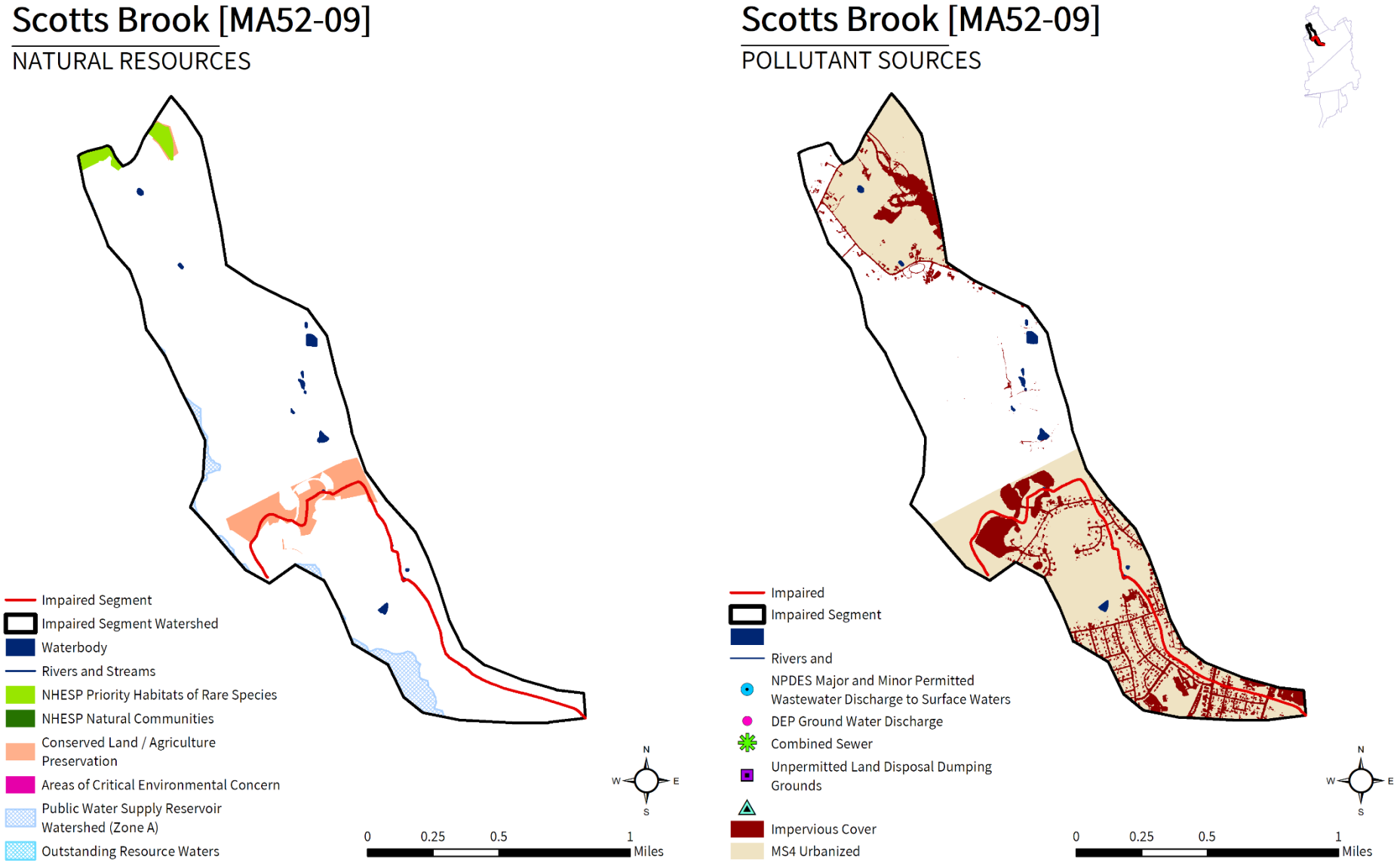


Figure 8-1. Natural resources and potential pollution sources draining to the Scotts Brook segment MA52-09. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollution sources, including impervious cover, MS4 areas, and permitted facilities.

8.2. Waterbody Impairment Characterization

Scotts Brook (MA52-09) is a Class B Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS using the indicator bacteria *E. coli* at the stations listed below (refer to Tables 8-1, 8-2; Figure 8-2). 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 2007, four samples were collected at W1580, resulting in three days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of four samples, one exceeded the STV criterion during dry weather.
- In 2007, three samples were collected at W1581, resulting in three days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of three samples, one exceeded the STV criterion during dry weather.

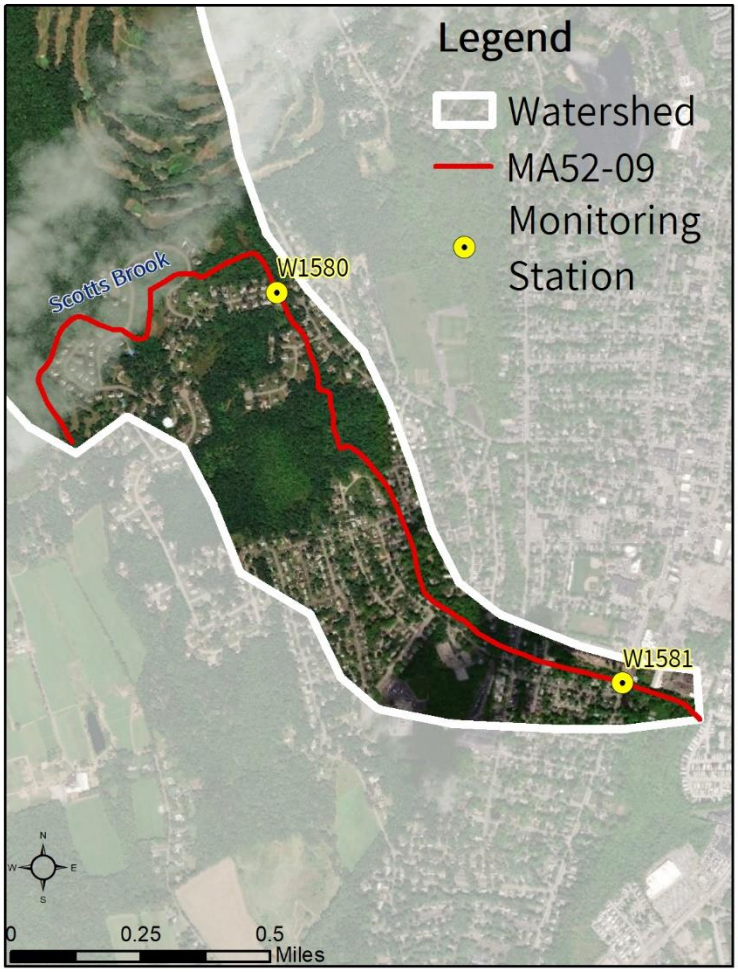


Figure 8-2. Location of monitoring station(s) along the impaired river segment.

Table 8-1. Summary of indicator bacteria sampling results by station for Scotts Brook (MA52-09). 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 Statistical Threshold Value (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 sites 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
W1580	4/18/2007	7/31/2007	4	532	3	1
W1581	4/18/2007	7/31/2007	3	1194	3	1

Table 8-2. Indicator bacteria data by station, indicator, and date for Scotts Brook (MA52-09). Each sample date was designated wet or dry weather with wet weather defined as more than 0.5 inches of precipitation in the previous 72 hours. Red text 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 Statistical Threshold Value or STV) and 126 CFU/100 mL (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)
W1580	*E. coli*	4/18/2007	WET	71	71	
W1580	*E. coli*	5/22/2007	DRY	230	128	
W1580	*E. coli*	7/2/2007	DRY	160	138	
W1580	*E. coli*	7/31/2007	DRY	4100	532	
W1581	*E. coli*	4/18/2007	WET	130	130	
W1581	*E. coli*	5/22/2007	DRY	250	180	
W1581	*E. coli*	7/31/2007	DRY	5700	1194	

8.3. Potential Pathogen Sources

Comparing data collected during wet weather versus dry weather conditions provides an indication of the types of sources present and 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 the river 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 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).

The indicator bacteria data for Scotts Brook (MA52-09) were elevated during dry weather, which is consistent with baseflow sources, such as leaking pipes, illegal cross connections, other illicit discharges, and failing septic systems. Due to the small sample size (especially for wet weather conditions), more data are needed to better target potential sources of pathogens within the Scotts Brook (MA52-09) watershed.

Each potential pathogen source is described in further detail below.

Urban Stormwater: Portions of the watershed, especially around the downstream section of the segment, are heavily developed, with 56% of the land area in MS4 and 7% as DCIA. Development within the watershed consists primarily of medium density residential development with some mixed commercial and industrial areas. Although there was only a single sample date during wet weather, stormwater runoff from urban areas is likely a significant source of pathogens given the land use patterns surrounding the brook.

Illicit Sewage Discharges: Some of the watershed contains sewer service areas. Sewer related risks include leaking infrastructure (pipes, pump stations, etc.) and sanitary sewer overflows 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 drains are also a risk. Indicator bacteria levels that exceeded SWQS at two sites during dry weather suggest that illicit storm drain connections and/or illicit discharges from failing infrastructure such as leaky sewer lines or SSOs are likely a large contributing source of pathogens.

On-Site Wastewater Disposal Systems: Some development in the watershed relies on septic systems for wastewater treatment. It is likely that a portion of septic systems are not being properly maintained and are discharging untreated effluent to groundwater.

Agriculture: Agricultural activities account for 3% of the total land use area within the watershed, including one area near the brook's headwaters. Agricultural land uses visible on recent aerial photos within the watershed include open fields and pastureland. Agricultural activities related to manure storage and spreading, if not well managed, are a possible source of pathogens to waterbodies.

Pet Waste: Most of the segment is surrounded by medium density residential neighborhoods. Conservation and recreational lands, parks, ballfields, and residential streets popular for dog-walking, especially where paths are adjacent to rivers, ponds, or wetlands, represent a possible source of pathogens.

Wildlife Waste: Large open mowed areas such as conservation and recreational lands, fields, golf courses, and wetlands with a clear sightline to a waterbody may attract excessive waterfowl and elevate indicator bacteria counts in the water.

8.4. Existing Local Management

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

City of Attleboro. See Section 3.4

Town of North Attleborough. See Section 3.4

Town of Plainville. See Section 3.4

9. MA52-11 Coles Brook

9.1. Waterbody Overview

The Coles Brook segment MA52-11 is 4.2 miles long and begins at its headwaters in Grassie Swamp west of Allens Lane in Rehoboth, MA. The segment generally flows southwest through Seekonk to end at an inlet to Central Pond. There are several small unnamed tributaries and unnamed ponds in the Coles Brook watershed, including large wetlands in the upper watershed.

Key landmarks in the watershed include the John W. Brown Conservation Area and a commercial district along US-20. The segment is crossed by Pine Street, Fairway Drive (twice), Thompson Drive, and Newman Avenue/MA-152 in Seekonk.

Coles Brook (MA52-11) drains an area of 3.3 square miles, of which 0.3 mi^2 (9%) is impervious and 0.1 mi^2 (3%) is directly connected impervious area (DCIA). The watershed is likely not[19] served by public sewer and 15% 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 and no MassDEP discharge to groundwater permits for on-site wastewater discharge within the watershed. There are also no combined sewer overflows, one landfill, and no unpermitted land disposal dumping grounds within the watershed. See Figure 9-1.

The watershed is predominantly forested (56%), with developed land area (23%) concentrated in the downstream area around Pawtucket, RI. The upper segment flows through expansive wooded areas and low-density residential development. The middle reach of Coles Brook flows through Ledgemont Country Club golf course, where portions of the stream have no wooded buffer and only a small corridor of rough vegetation about five meters wide in other areas. Downstream of the golf course, the brook continues through medium density residential development within a wooded buffer. In the Coles Brook (MA52-11) watershed, under the Natural Heritage and Endangered Species Program, there are no areas of Priority Habitats of Rare Species or Priority Natural Vegetation Communities. There are no Areas of

Reduction from Highest Calculated Geomean: 86%

Watershed Area (Acres): 2,092

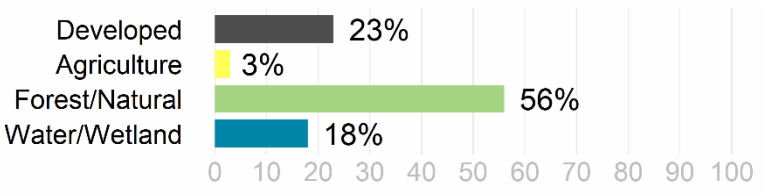
Segment Length (Miles): 4.2

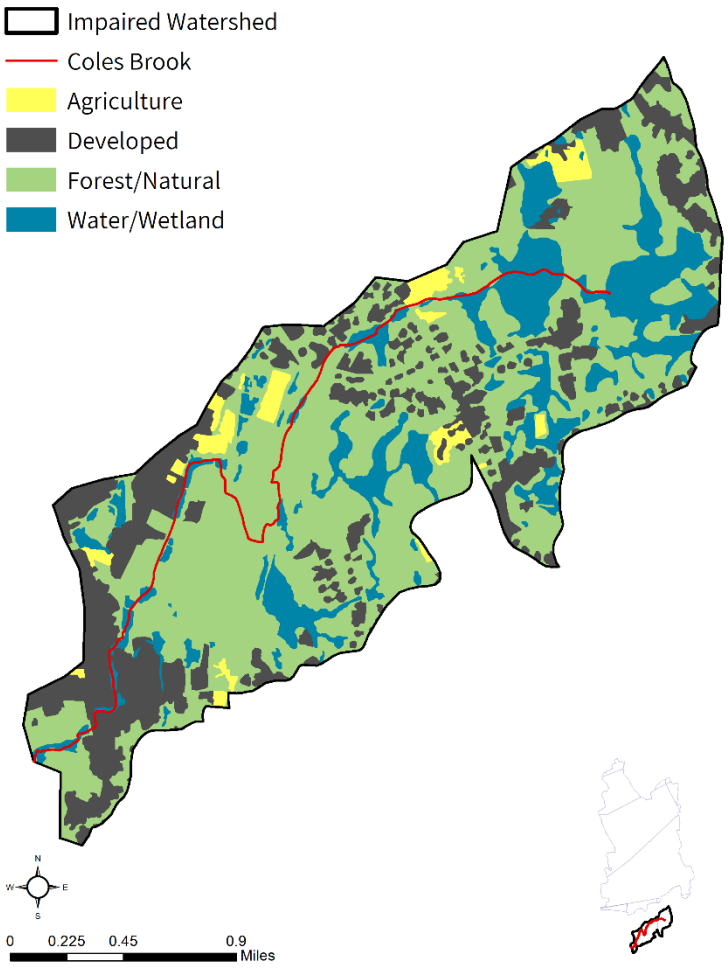
Impairment(s): *E. coli* (Primary Contact Recreation)

Class (Qualifier): B

Impervious Area (Acres, %): 179 (9%)

DCIA Area (Acres, %): 67 (3%)





[19] 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 https://www.mass.gov/guides/water-utility-resilience-program (MassDEP, 2021b), MS4 reports, and local knowledge.

Critical Environmental Concern, no areas under Public Water Supply protection, and no areas identified as Outstanding Resource Waters in the watershed. Over 219 acres (10%) of land protected in perpetuity[20] exist within the segment watershed, which is part of a total of 369 acres (18%) of Protected and Recreational Open Space[21]. See Figure 9-1.

[20] Land protected in perpetuity include several interests such as conservation restriction, 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.

[21] Only land protected in perpetuity is shown on the natural resources map. Protected and Recreational Open Space estimates reflect areas in the State of Massachusetts only (and thus reflect only a portion of the total open space for watersheds that extend outside the State of Massachusetts).

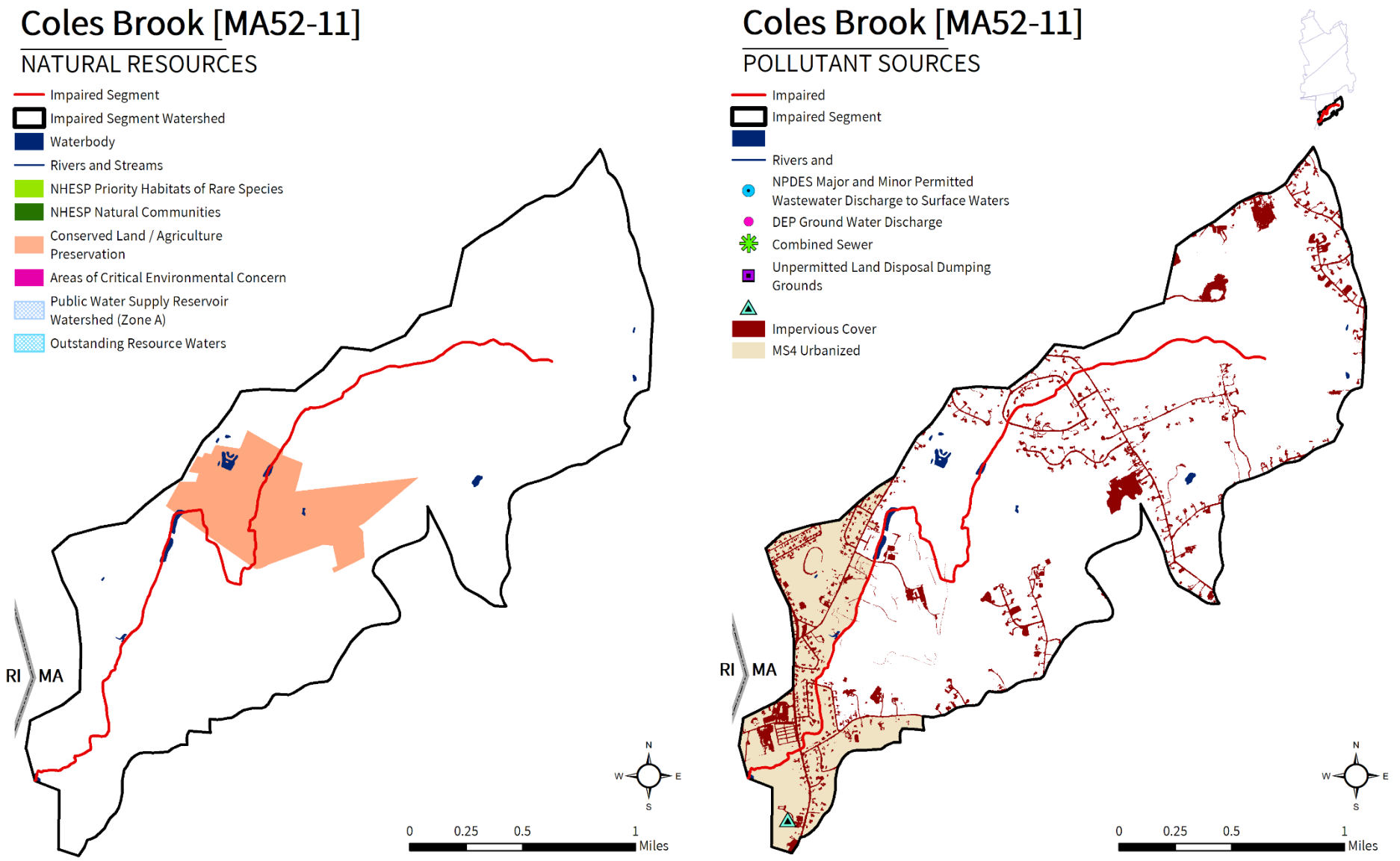


Figure 9-1. Natural resources and potential pollution sources draining to the Coles Brook segment MA52-11. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollution sources, including impervious cover, MS4 areas, and permitted facilities.

9.2. Waterbody Impairment Characterization

Coles Brook (MA52-11) is a Class B Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS using the indicator bacteria *E. coli* at the stations listed below (refer to Tables 9-1, 9-2; Figure 9-2). 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 2007, four samples were collected at W0184, resulting in two days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of four samples, two exceeded the STV criterion during dry weather.
- In 2007, five samples were collected at W1932, resulting in two days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the STV criterion was applied to single sample results. Out of five samples, one exceeded the STV criterion during dry weather.

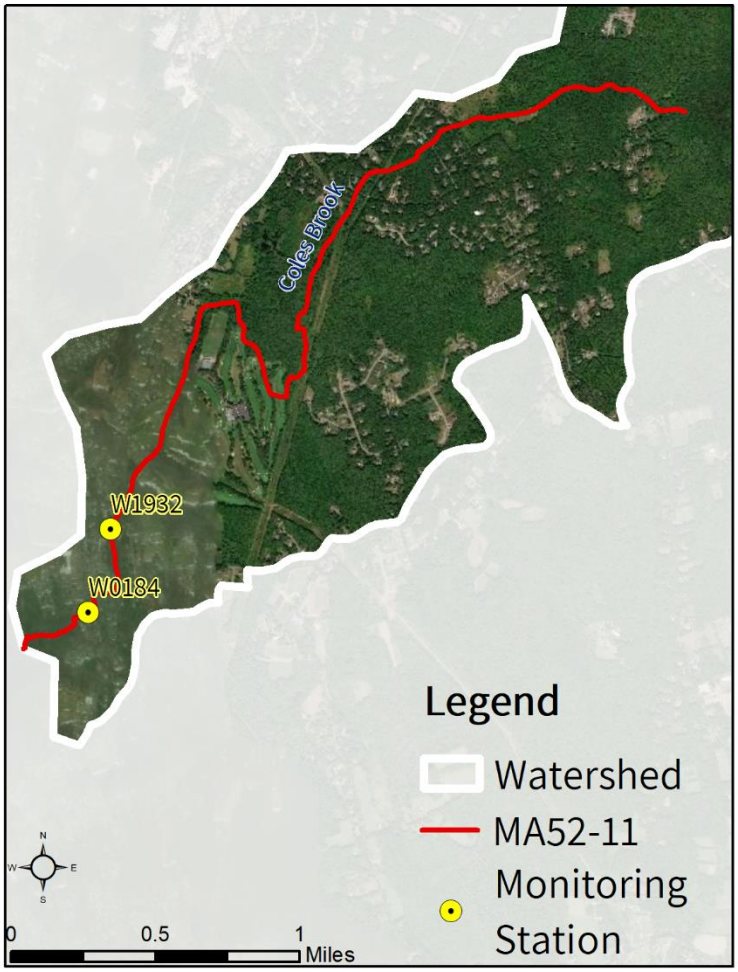


Figure 9-2. Location of monitoring station(s) along the impaired river segment.

Table 9-1. Summary of indicator bacteria sampling results by station for Coles Brook (MA52-11). 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 Statistical Threshold Value (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 sites 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
W0184	4/18/2007	7/31/2007	4	885	2	2
W1932	4/18/2007	9/4/2007	5	344	2	1

Table 9-2. Indicator bacteria data by station, indicator, and date for Coles Brook (MA52-11). Each sample date was designated wet or dry weather with wet weather defined as more than 0.5 inches of precipitation in the previous 72 hours. Red text 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 Statistical Threshold Value or STV) and 126 CFU/100 mL (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)
W0184	*E. coli*	4/18/2007	WET	120	120	
W0184	*E. coli*	5/22/2007	DRY	110	115	
W0184	*E. coli*	7/2/2007	DRY	1000	236	
W0184	*E. coli*	7/31/2007	DRY	6300	885	
W1932	*E. coli*	4/18/2007	WET	95	95	
W1932	*E. coli*	5/22/2007	DRY	67	80	
W1932	*E. coli*	7/2/2007	DRY	120	91	
W1932	*E. coli*	7/31/2007	DRY	970	198	
W1932	*E. coli*	9/4/2007	DRY	350	344	

9.3. Potential Pathogen Sources

Comparing data collected during wet weather versus dry weather conditions provides an indication of the types of sources present and 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 the river 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 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).

The indicator bacteria data for Coles Brook (MA52-11) were elevated during dry weather. Elevated indicator bacteria 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. Due to the small sample size (especially during wet weather conditions), more data are needed to better target potential sources of pathogens within the Coles Brook (MA52-11) watershed.

Each potential pathogen source is described in further detail below.

Urban Stormwater: Portions of the watershed are moderately developed, with 15% of the land area in MS4 and 3% as DCIA. Development within the watershed consists primarily of low to medium density residential development with some commercial areas. Stormwater runoff from urban areas is likely a significant source of pathogens.

Illicit Sewage Discharges: It is likely that none of the watershed contains sewer service areas. There may be private wastewater infrastructure, such as building wastewater drains, which may intersect with storm drainage. Leaky wastewater lines and illicit connections are a possible source of pathogens, though not at the same scale as more urbanized environments. Other forms of illicit discharges may occur, including unauthorized dumping of wastewater from pump-out trucks, campers, or other sources. Indicator bacterial levels which exceeded SWQS during dry weather on two sample dates suggest that some form(s) of illicit discharge(s) may be a significant source of pathogens to the brook.

On-Site Wastewater Disposal Systems: It is likely that the entire watershed uses septic systems for wastewater treatment and that a portion of septic systems are not being properly maintained and are discharging untreated effluent to groundwater. The brook flows through fringing wetlands, which may provide a hydrologic connection between septic leach fields and the brook, contributing to the high indicator bacteria levels observed during dry weather.

Agriculture: Agricultural activities account for 3% of the total land use area within the watershed. Areas visible on recent aerial photos within the watershed include open and early successional fields, suggesting that formerly active agricultural lands may now be inactive. Stormwater runoff from agricultural lands are likely a small contributing source of pathogens to the segment.

Pet Waste: The segment flows through several low to medium density residential neighborhoods. Conservation and recreational lands, parks, ballfields, school fields, and residential streets popular for dog-walking, especially where paths are adjacent to rivers, ponds, or wetlands, represent a possible source of pathogens.

Wildlife Waste: The segment flows through the Ledgemont Country Club golf course, where there is no vegetative buffer around the brook in some areas. Large open mowed areas such as conservation and recreational lands, fields, golf courses, and wetlands with a clear sightline to a waterbody may attract excessive waterfowl and elevate indicator bacteria counts in the water.

9.4. Existing Local Management

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

Town of Rehoboth

A small portion of Rehoboth is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit. Rehoboth (Permit ID #MAR041152) has an EPA approved Notice of Intent (NOI). Rehoboth has a Stormwater Management Plan available at the Town Highway Department at 345 Anawan Street, Rehoboth, MA. The town has mapped all of its MS4 stormwater system, which is available online. It adopted illicit discharge detection and elimination (IDDE) regulations in 2019, as well as erosion and sediment control (ESC) and post-construction stormwater regulations in 2008. According to the NOI, there are five outfalls into the Palmer River.

Rehoboth has the following ordinances and bylaws:

- Stormwater Ordinance and/or Bylaws: page L1-17: https://www.town.rehoboth.ma.us/sites/g/files/vyhlif4911/f/uploads/general_by_law_10-29-19-stm-final-2-3-2020.pdf (Town of Rehoboth, 2020a)
- Stormwater Utility: None found.
- Title 5 Supplementary Regulation: Nothing beyond State of Massachusetts Title V Regulations.
- Wetland Protection Bylaw: page N-1, N-2 https://www.town.rehoboth.ma.us/sites/g/files/vyhlif4911/f/uploads/general_by_law_10-29-19-stm-final-2-3- (Town of Rehoboth, 2020b)
- Pet Waste Ordinance: None found.
- Contact Recreation Ordinance: None found.

The Rehoboth Master Plan and other planning documents, while referenced on the town website, are not available online. An Open Space and Recreation Plan is not available for the Town of Rehoboth.
Rehoboth Town Website: https://www.town.rehoboth.ma.us/ (Town of Rehoboth, 2021).

Town of Seekonk. See Section 4.4

10. References

City of Attleboro. (2003) [online]. *Stormwater Management Plan.* City of Attleboro, Massachusetts. July 2003. Available at https://www.cityofattleboro.us/DocumentCenter/View/2862/Stormwater-Management-Plan-PDF?bidId=

City of Attleboro. (2008) [online]. *Local Wetlands Protection Ordinance and Local Wetlands Protection Rules and Regulations.* Conservation Commission. City of Attleboro, Massachusetts. Adopted October 2, 2001. Amended December 12, 2007. Available at https://www.cityofattleboro.us/DocumentCenter/View/670/Local-Wetland-Ordinance-and-Regulations-PDF

City of Attleboro. (2008) [online]. *Stormwater Management Ordinance of the Attleboro Conservation Commission.* Section 19 of the Revised Ordinances of the City of Attleboro, as amended. Adopted April 15, 2008. Effective July 14, 2008. Attleboro, MA. Available at https://www.cityofattleboro.us/DocumentCenter/View/669/Local-Stormwater-Ordinance-and-Regulations-PDF

City of Attleboro. (2009) [online]. *Open Space and Recreation Plan.* City of Attleboro, Massachusetts. Prepared by the City of Attleboro Open Space and Recreation Plan Committee, with assistance from the Department of Planning and Development, Department of Parks and Forestry, and the Recreation Department. July 2009. Available at https://www.cityofattleboro.us/DocumentCenter/View/400/Open-Space-and-Recreation-Plan-PDF?bidId=

City of Attleboro. (2012) [online]. *Comprehensive Plan.* City of Attleboro, Massachusetts. Prepared by the City of Attleboro, Mayor's Comprehensive Plan Steering Committee with assistance from the Planning Board, Department of Planning and Development, and Community Opportunities Group, Inc. Boston, MA. Adopted on June 5, 2012. Available at https://www.cityofattleboro.us/DocumentCenter/View/394/Comprehensive-Plan-PDF

City of Attleboro. (2021) [online]. *Revised Ordinances of the City of Attleboro.* Adopted on January 22, 1976, effective March 1, 1976 –and Incorporating all Subsequent Amendments Adopted by the Municipal Council through January 5, 2021. Available at https://www.cityofattleboro.us/DocumentCenter/View/323/City-Ordinances-PDF?bidId=

Geosyntec. (2004) [online]. *2004 Mount Hope Bay and Narragansett Watershed Five-Year Action Plan.* Prepared by Geosyntec Consultants. Available at https://www.mass.gov/files/2017-07/Mount%20Hope-Narragansett%20Bay%20watershed%20Action%20Plan.pdf

Langhauser and Napolitano. (2000). *Regional Open Space & Recreation Plan. 2001-2005. Ten Mile/Mt. Hope Bay Watershed.* Andrea Langhauser. Massachusetts Executive Office of Environmental Affairs. Massachusetts Watershed Initiative. Boston, MA. And Bill Napolitano Southeastern Regional Planning and Economic Development District. Taunton, MA.

MassDEP. (2006) [online]. *Ten Mile River Watershed 2002 Water Quality Assessment Report.* Massachusetts Department of Environmental Protection. Worcester, MA. Available at https://www.mass.gov/files/documents/2016/08/vk/52wqar.pdf

MassDEP. (2021a). *314 CMR 4.00: Massachusetts Surface Water Quality Standards.* Massachusetts Department of Environmental Protection. Boston, MA. Available at https://www.mass.gov/regulations/314-CMR-4-the-massachusetts-surface-water-quality-standards#current-regulations

MassDEP. (2021b). Water Utility Resilience Program. Retrieved from home page: https://www.mass.gov/guides/water-utility-resilience-program

MassDEP. (2022). *Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle.* CN 505.1. Massachusetts Department of Environmental Protection, Bureau of Water Resources, Division of Watershed Management, Watershed Planning Program. Worcester, MA. Available at

https://www.mass.gov/doc/final-massachusetts-integrated-list-of-waters-for-the-clean-water-act-20182020-reporting-cycle/download

MAPC. (2014) [online]. *Stormwater Financing/Utility Starter Kit*. Metropolitan Area Planning Council. Boston, MA. Available at https://www.mapc.org/resource-library/stormwater-financing-utility-starter-kit/

MAPC. (2018) [online]. *MS4 Outfall Catchment Calculator.* Metropolitan Area Planning Council. Boston, MA. Available at https://www.mapc.org/resource-library/ms4-outfall-catchment-calculator/

SRPEEDD. (2021) [online]. *Southeast Regional Planning & Economic Development District*. Taunton, MA. Available at https://srpedd.org/

Ten Mile River Watershed Council. (n.d.) [online]. *Making Our Community A Better Place.* Ten Mile River Watershed Council. Available at https://tenmileriver.net/

Think Blue Massachusetts. (2019) [online]. *About Think Blue Massachusetts.* Available at https://www.thinkbluemassachusetts.org/about-us

Town of North Attleborough. (2013) [online]. *North Attleborough Conservation, Recreation and Open Space Plan. 2013-2020.* Prepared by the Open Space Committee. North Attleborough, MA. Available at https://www.nattleboro.com/sites/g/files/vyhlif3566/f/file/file/town_of_north_attleboro_consevation_recreation_and_open_space_plan_0.pdf

Town of North Attleborough. (2020a) [online]. *Town of North Attleboro Stormwater Bylaw.* North Attleborough, Massachusetts. Adopted on March 9, 2020. Available at https://www.nattleboro.com/conservation-commission/news/town-of-north-attleboro-stormwater-bylaw

Town of North Attleborough. (2020b) [online]. *Stormwater Management Program.* Department of Public Works. North Attleborough, MA. Available at https://www.nattleboro.com/department-of-public-works/pages/stormwater-management-program

Town of North Attleborough. (2021a) [online]. *Town of North Attleborough, Massachusetts.* Available at https://www.nattleboro.com/

Town of North Attleborough. (2021b) [online]. *Open Space and Recreation Plan Update.* Open Space Committee. North Attleboro, MAs. February 3, 2021. Available at https://www.nattleboro.com/conservation-commission/news/open-space-and-recreation-plan-update

Town of North Attleborough and SRPEDD. (2021) [online]. *North Attleborough Master Plan.* Community Master Plans. Under development by the Town of North Attleborough and the Southeastern Regional Planning and Economic Development District (SRPEDD). Available at https://srpedd.org/comprehensive-planning/community-master-plans/north-attleborough-master-plan/

Town of Plainville. (n.d.) [online]. *Stormwater Management.* Plainville, Massachusetts. Available at https://www.plainville.ma.us/department-public-works/stormwater-management

Town of Plainville. (2009) [online]. *Plainville Master Plan.* Town of Plainville, Mass. SRPEDD. Executive Office of Housing and Economic Development. December 2009. Available at https://www.plainville.ma.us/sites/g/files/vyhlif4871/f/uploads/plainville_master_plan.pdf

Town of Plainville. (2011a) [online]. *Chapter 264 Sewer Use.* Town of Plainville, MA / Division 1: General Bylaws / Part II: General Legislation. Adopted by the Town Meeting of the Town of Plainville 6-6-2011. Available at https://ecode360.com/11814567

Town of Plainville. (2011b) [online]. *Chapter 472 Wetlands Protection.* Town of Plainville, MA / Division 1: General Bylaws/ Part II: General Legislation. Adopted by the Town Meeting of the Town of Plainville 6-6-2011. Available at https://ecode360.com/11814969

Town of Plainville. (2014) [online]. *Section 500-37 Community and water resource protection.* Town of Plainville, MA / Division 1: General Bylaws / Division 2: Zoning Bylaws / Zoning. Article III General Regulations. Amended 6-2-2014. Available at https://ecode360.com/11815267#11815431

Town of Plainville. (2018) [online]. *Open Space and Recreation Committee.* Plainville, Massachusetts. Available at https://www.plainville.ma.us/open-space-committee/events/18483

Town of Rehoboth. (2020a) [online]. *General By-Laws.* Stormwater discharge, Land Disturbance & Post construction Stormwater Runoff*, L1-17.* Town of Rehoboth, Mass. Including Amendments through February 3, 2020. Available at https://www.town.rehoboth.ma.us/sites/g/files/vyhlif4911/f/uploads/general_by_law_10-29-19-stm-final-2-3-2020.pdf

Town of Rehoboth. (2020b) [online]. *General By-Laws.* Wetland Protection By-Law. Page N-1, N-2. Town of Rehoboth, Mass. Including Amendments through February 3, 2020. Available at https://www.town.rehoboth.ma.us/sites/g/files/vyhlif4911/f/uploads/general_by_law_10-29-19-stm-final-2-3-2020.pdf

Town of Rehoboth. (2021) [online]. *Rehoboth, Massachusetts.* Available at https://www.rehobothma.gov/

Town of Seekonk. (n.d., a) [online]. *Category 20B – Stormwater Management.* Construction – Erosion and Sedimentation Control. Seekonk, MA. Available at https://www.seekonk-ma.gov/sites/g/files/vyhlif1191/f/uploads/pre.pdf

Town of Seekonk. (n.d., b) [online]. *Category 20 C – Stormwater Management.* Post-Construction – New Developments and Redevelopments. Seekonk, MA. Available at https://www.seekonk-ma.gov/sites/g/files/vyhlif1191/f/uploads/post.pdf

Town of Seekonk. (2012) [online]. *Conservation Commission Regulations*. Town of Seekonk. Mass. Pursuant to the Seekonk General Wetlands Protection By-Law. Amended December 10, 2012. Available at https://www.seekonk-ma.gov/sites/g/files/vyhlif1191/f/uploads/regulations.pdf

Town of Seekonk. (n.d., c) [online]. *Stormwater Information.* Seekonk, Massachusetts. Available at https://www.seekonk-ma.gov/public-works/pages/stormwater-information

Town of Seekonk. (2019a) [online]. *Town By-Laws.* Category 41 – Wetlands Protection, page 84. Seekonk, Massachusetts. May 13, 2019. Adopted at November 18, 2019 Fall Town Meeting, effective March 5, 2020. Available at https://www.seekonk-ma.gov/sites/g/files/vyhlif1191/f/uploads/town_by-laws_adopted_11.18.19_effective_3.5.20_1.pdf and https://www.seekonk-ma.gov/sites/g/files/vyhlif1191/f/uploads/regulations.pdf

Town of Seekonk. (2019b) [online]. *Town By-Laws.* Category 14A – Dog Restraint Program. B. Provisions. Section 3 – pet waste, page 21. Seekonk, Massachusetts. May 13, 2019. Adopted at November 18, 2019 Fall Town Meeting, effective March 5. 2020. Available at https://www.seekonk-ma.gov/sites/g/files/vyhlif1191/f/uploads/town_by-laws_adopted_11.18.19_effective_3.5.20_1.pdf

Town of Seekonk. (2019c) [online]. *Draft Economic Development Master Plan Element and Land Use Roundtable.* Seekonk Planning Board. Seekonk, Massachusetts. Available at https://www.seekonk-ma.gov/sites/g/files/vyhlif1191/f/pages/master_plan_draft_2019.07.23_mtg.pdf

Town of Seekonk. (2021a) [online]. *Seekonk, Massachusetts.* Available at https://www.seekonk-ma.gov/

Town of Seekonk. (2021b) [online]. *Open Space & Recreation Plan Working Group.* Meeting Agenda. Monday, February 1, 2021. Seekonk, MA. Available at https://www.seekonk-ma.gov/sites/g/files/vyhlif1191/f/uploads/meeting_agenda.osrp_.2021.02.01_0.pdf

USEPA. (2020) [online]. *General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts.* United States Environmental Protection Agency. Region 1. National Pollutant Discharge Elimination System (NPDES). Issued April 4, 2016. Modified December 7, 2020. Available at: https://www3.epa.gov/region1/npdes/stormwater/ma/2016fpd/final-2016-ma-sms4-gp-mod.pdf