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

Appendix A: Hoosic River Basin

Commonwealth of Massachusetts
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Massachusetts Department of Environmental Protection

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

Watershed Planning Program

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

Acknowledgements

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

Disclaimer

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

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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 three pathogen-impaired river segments in the Hoosic 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 Hoosic River Watershed Overview section.

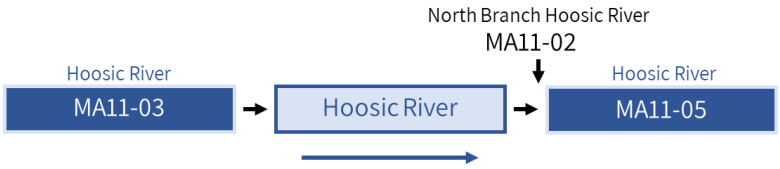


Figure 1-1. Conceptual diagram of water flow routing through the Hoosic River watershed for the three pathogen-impaired river segments. The mainstem of the Hoosic River is shown as three segments beginning with the impaired segment MA11-03, which flows into an unimpaired (light blue) segment of the Hoosic River, then into the impaired Hoosic River segment MA11-05 at the confluence of the impaired North Branch Hoosic River segment, MA11-02. 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 Hoosic 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)					
North Branch Hoosic River		R	126	316	60%	WLA (5%)	0.2	1.7	16.6	166.4	1,664.3	16,642.6
MA11-02	B (CW, HQW)			(90 day)		LA (95%)	2.9	29.2	291.6	2,916.3	29,162.5	291,625.4
Hoosic River		R	126	414	70%	WLA (4%)	0.1	1.2	11.8	117.7	1,176.9	11,769.1
MA11-03	B (CW, HQW)			(90 day)		LA (96%)	3.0	29.6	296.5	2,965.0	29,649.9	296,499.0
Hoosic River		R	126	2,200	94%	WLA (5%)	0.1	1.4	14.5	144.7	1,447.2	14,471.9
MA11-05	B (WW)			(30 day)		LA (95%)	2.9	29.4	293.8	2,938.0	29,379.6	293,796.1

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 Hoosic 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)					
North Branch Hoosic River		P	35	NA	-	WLA (5%)	-	0.5	4.6	46.2	462.3	4,623.0
MA11-02	B (CW, HQW)					LA (95%)	0.8	8.1	81.0	810.1	8,100.7	81,007.1
Hoosic River		P	35	NA	-	WLA (4%)	-	0.3	3.3	32.7	326.9	3,269.2
MA11-03	B (CW, HQW)					LA (96%)	0.8	8.2	82.4	823.6	8,236.1	82,360.8
Hoosic River		P	35	NA	-	WLA (5%)	-	0.4	4.0	40.2	402.0	4,020.0
MA11-05	B (WW)					LA (95%)	0.8	8.2	81.6	816.1	8,161.0	81,610.0

Class *defined in the Massachusetts Surface Water Quality Standards (SWQS) at 314 CMR 4.02.*
Qualifiers *that identify segments with special characteristics are defined at 314 CMR 4.06(1)(d).*
CW *= Cold Water; waters that meet the cold water fisheries (CWF) definition at 314 CMR 4.02 and are subject to CWF dissolved oxygen and temperature criteria*
HQW *= High Quality Water; waters designated for protection under 314 CMR 4.04(2)*
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. Hoosic River Watershed Overview

In Massachusetts, the Hudson River watershed encompasses 202 square miles and is divided into three subwatersheds: the Hoosic River Basin, the Kinderhook River Basin, and the Bashbish River Basin. The Massachusetts portion of the Hoosic River Basin covers an area of approximately 164 square miles (mi^2) in northwestern Massachusetts along the Vermont and New York state borders (Figure 2-1). The watershed includes the Hoosic River, North Branch River, and Green River. Overall, there are 47 named rivers (MassDEP, 2006) and many smaller unnamed rivers; about 133 named river miles (USGS, 2019); and 20 lakes, ponds, or impoundments in the watershed (MassDEP, 2006).

The Hoosic River Basin comprises areas of high elevation, including Mount Greylock (the highest peak in Massachusetts at 3,487 feet above sea level). As a result, many headwater tributaries have steep gradients, and there are few naturally occurring lakes and ponds within the watershed. Water powered mills historically lined the river and tributaries. Due to the flood vulnerability of the watershed, the Army Corps of Engineers created three flood control installations along the Hoosic River and North Branch Hoosic River in the 1950's, which involved rip rapping and hardening the edges of both rivers in some locations and paving sections of both rivers (two vertical cement walls and a cement bed) to form a chute. These severe habitat alterations have contributed to many of the rivers' impairments within the watershed (MassDEP, 2006).

The Hoosic River (locally known as the South Branch Hoosic River) begins in Cheshire at the outlet of the Cheshire Reservoir and flows generally north for about 24 miles in Massachusetts, then flows northwest through Vermont to its confluence with the Hudson River in New York (MassDEP, 2006). The river course has been altered in Adams and North Adams for flood control purposes. Additional flow alterations include the Cheshire Reservoir, industrial water uses and large groundwater withdrawals, and wastewater treatment facility discharges (MassDEP, 2006). There are three pathogen-impaired river segments in the Hoosic River watershed, two of which are along the Hoosic River (MassDEP, 2019).

The North Branch Hoosic River begins at the Massachusetts state boundary in Clarksburg and flows generally south then west for a total of 5.8 miles to its confluence with the Hoosic River in North Adams. The river course has been completely channelized into an open concrete culvert in North Adams for flood control purposes (MassDEP, 2006). There is one pathogen-impaired river segment in the North Branch Hoosic River watershed (MassDEP, 2019).

The Green River begins in New Ashford and flows generally north. The Green River's source waters are from the east and west branches of the Green River. The Green River flows about 12.5 miles to its confluence with the Hoosic River in Williamstown (MassDEP, 2006). There are no pathogen-impaired river segments in the Green River watershed.

A total of 29 miles of the Hoosic River have been classified as state-designated Local Scenic Rivers, and Hopper and Money Brooks have been classified as state-designated Natural Scenic Rivers (HooRWA, n.d., a).

The Hoosic River Basin overlaps at least partially with 13 municipalities in Massachusetts. Of these, five were identified as being direct sources of pathogen loading to the 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 North Adams for the North Branch Hoosic River segment MA11-02), 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 is one Regional Planning Agency (RPA) in the Hoosic 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.

- Berkshire Regional Planning Commission (BRPC), http://www.berkshireplanning.org/ (BRPC, 2020)

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.

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 (Think Blue Massachusetts, 2019).

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

The **Hoosic River Watershed Association (HooRWA)** is working to restore the Hoosic River by promoting conservation, education, and research. Volunteers collect water samples and in-field water quality measurements for an array of parameters, www.hoorwa.org (HooRWA n.d., b).

The **Berkshire Regional Planning Commission** is partially responsible for environmental management and has received MassDEP grants for the Hoosic River Watershed http://www.berkshireplanning.org/ (BRPC, 2020).

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 Metropolitan Area Planning Council (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.

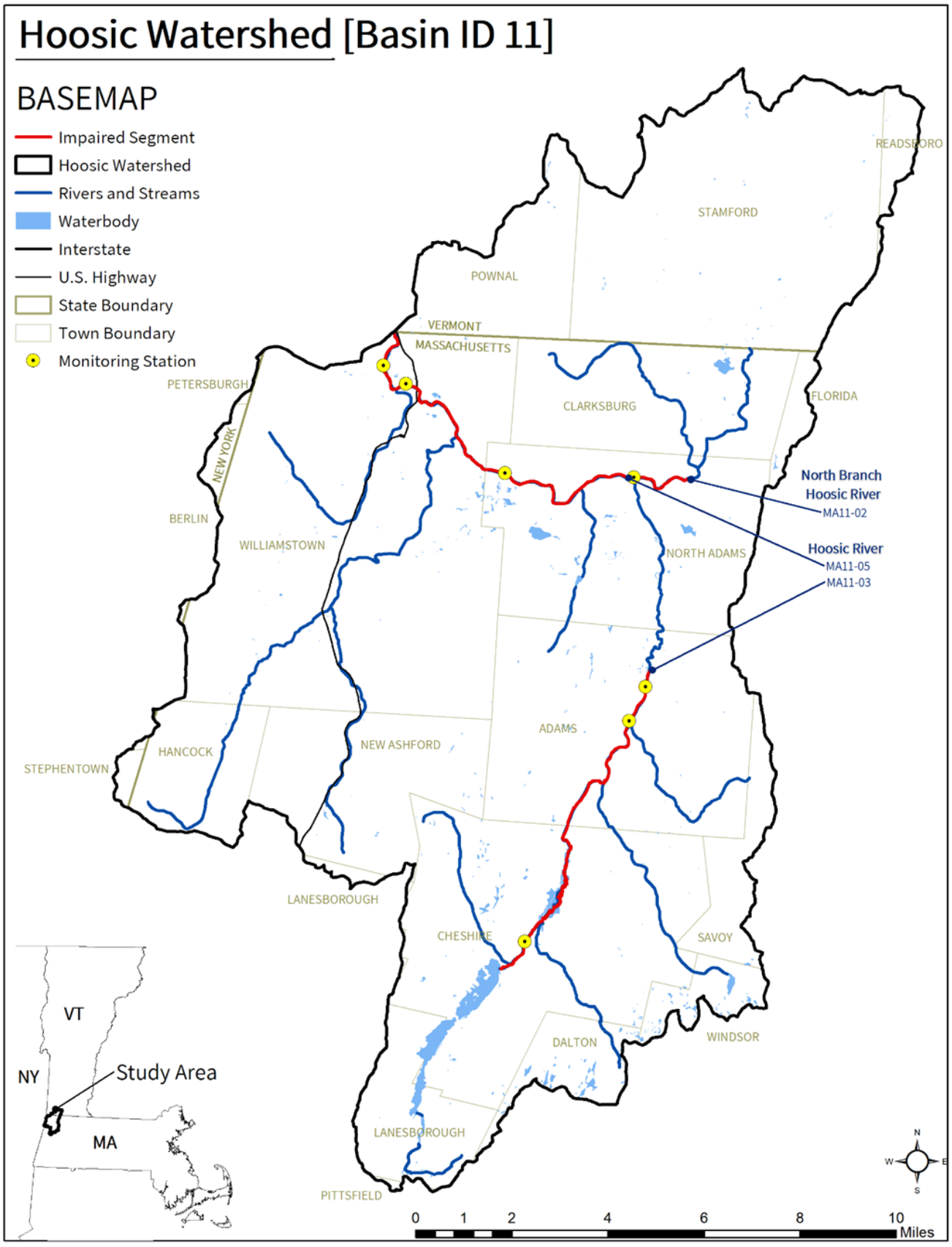


Figure 2-1: Map of all pathogen-impaired river segments, water quality monitoring stations, municipal borders, waterbodies, and roads in the Hoosic River watershed.

3. MA11-02 North Branch Hoosic River

3.1. Waterbody Overview

The North Branch Hoosic River segment MA11-02 is 1.5 miles long and begins at the USGS Gage (#01332000), east of the intersection of Mohawk Trail/MA-2 and Beaver Street/MA-8 in North Adams, MA. The segment flows west before ending at its confluence with the Hoosic River in North Adams, MA.

Tributaries include Hudson Brook, Hunterfield Brook, and other unnamed streams. Named lakes and ponds in the watershed include Mauserts Pond and Choquettes Pond. Key landmarks in the MA portion of the segment watershed include Bald Mountain, the Clarksburg and North Adams town centers, and the North Adams Regional Hospital. The segment is crossed by Union Street/MA-2/MA-8, Eagle Street, Holden Street, and Marshall Street in North Adams.

The North Branch Hoosic River (MA11-02) watershed drains a total area of 44 square miles, of which 2.4 mi^2 (5%) is impervious and 1.3 mi^2 (3%) is directly connected impervious area (DCIA). The watershed extends beyond MA into VT. Out of the total watershed area, 14 mi^2 (32%) are within MA.

The watershed is partially[1] served by public sewer and 5% of the watershed (17% of the area within MA) 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 no combined sewer overflows, one landfill, and no unpermitted land disposal dumping grounds within the MA portion of the segment watershed. See Figure 3-1.

The watershed is predominantly forested (88%), with developed (3%) and agricultural (4%) land uses making up only a small portion of the overall watershed. However, the developed areas are concentrated around the segment in the North Adams town center. Development consists of medium to high density mixed residential,

Reduction from Highest Calculated Geomean: 60%

Watershed Area (Acres): 27,928

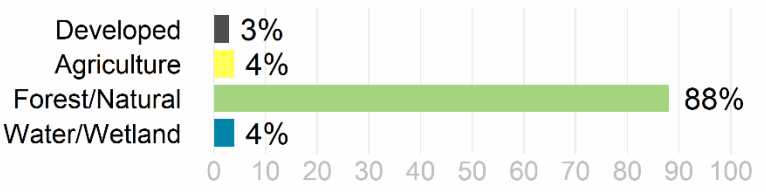
Segment Length (Miles): 1.5

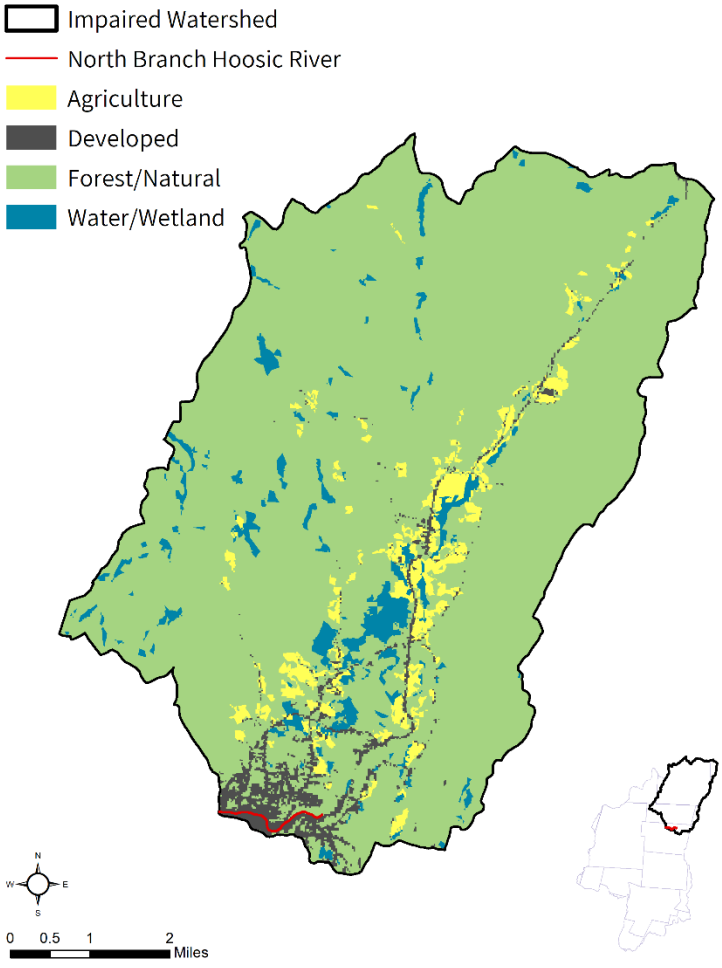
Impairment(s): *E. coli*, fecal coliform (Primary Contact Recreation)

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

Impervious Area (Acres, %): 1,508 (5%)

DCIA Area (Acres, %): 822 (3%)





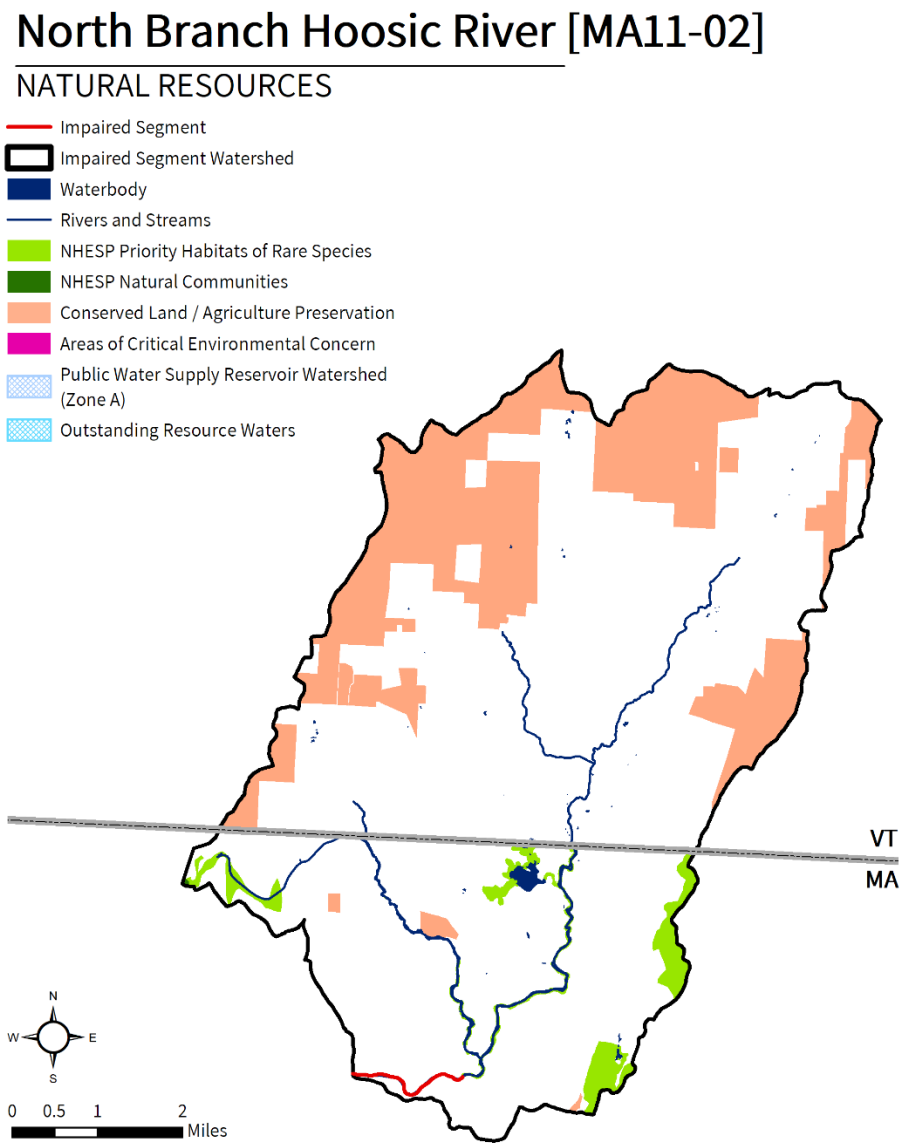
[1] Estimated percentage of developed areas with wastewater infrastructure in the watershed was based on available information: MWRA service areas, MassDEP's Water Utility Infrastructure Mapping Project https://www.mass.gov/guides/water-utility-resilience-program (MassDEP, 2020), MS4 reports, and local knowledge.

commercial, and industrial uses. The river is channelized within vertical cement walls and a cement bed through most of North Adams to its confluence with the Hoosic River and closely flanked by buildings, large parking lots, and small areas of lawns mowed to the channel's edge. Similarly, the agricultural lands are concentrated in the river valleys of upstream tributaries and are mostly hayfields and row crops.

In the North Branch Hoosic River (MA11-02) watershed, under the Natural Heritage and Endangered Species Program, there are 773 acres (3%) of Priority Habitats of Rare Species and three acres (<1%) of 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 6,042 acres (22%) of land protected in perpetuity[2] exist within the segment watershed, which is part of a total of 8,560 acres (31%) of Protected and Recreational Open Space[3]. See Figure 3-1.

[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).



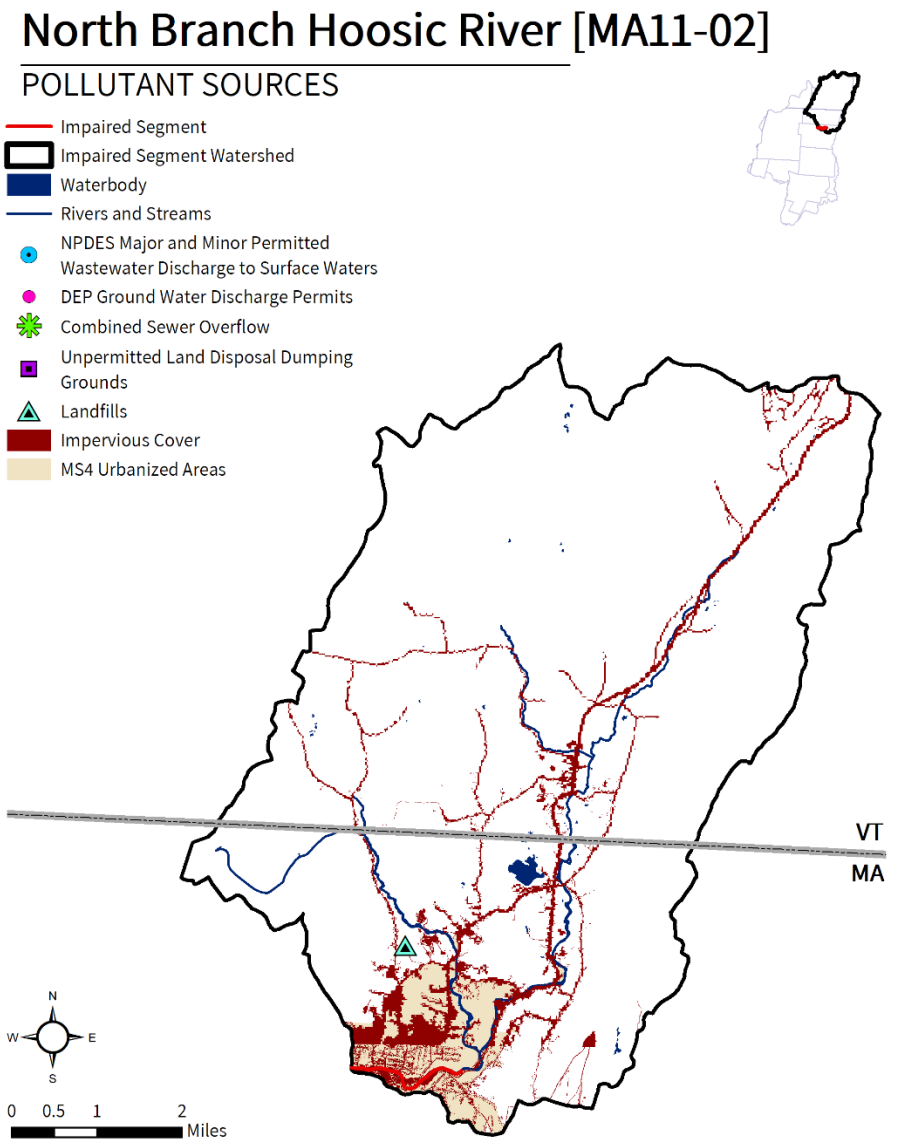


Figure 3-1. Natural resources and potential pollution sources draining to the North Branch Hoosic River segment MA11-02. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollution sources, including impervious cover, MS4 areas, and permitted facilities.

3.2. Waterbody Impairment Characterization

The North Branch Hoosic River (MA11-02) is a Class B, Cold Water and High Quality Water (MassDEP, 2021).

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 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.

- In 2007, five samples were collected at W1597, resulting in four 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.

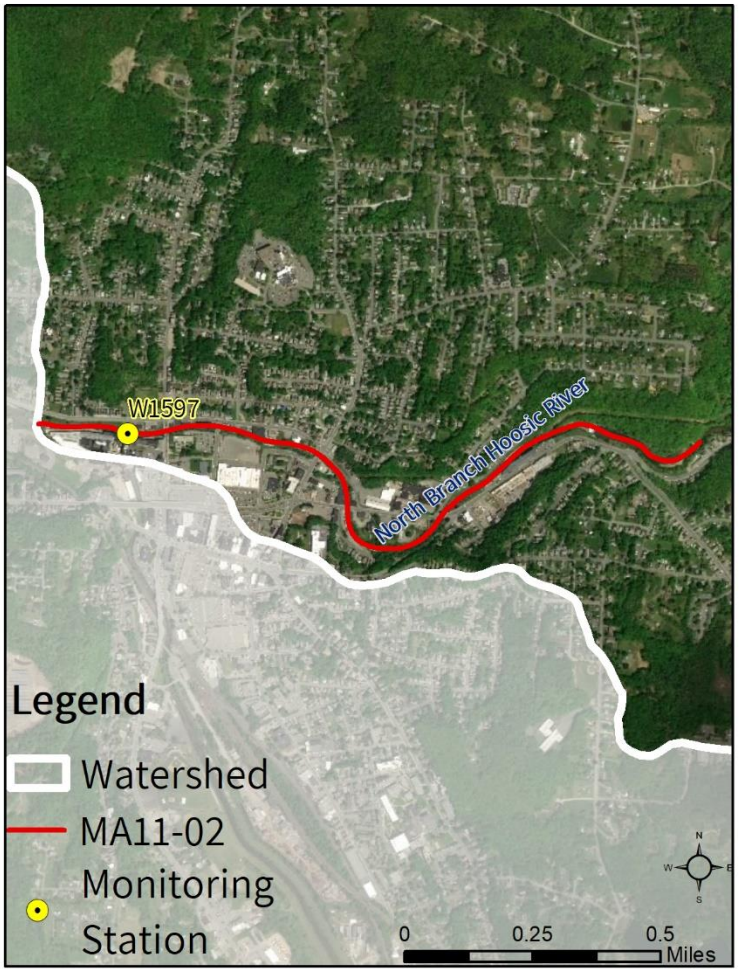


Figure 3-2. Location of monitoring station(s) along the impaired river segment.

Table 3-1. Summary of indicator bacteria sampling results by station for the North Branch Hoosic River (MA11-02). 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
W1597	5/29/2007	9/27/2007	5	316	4	0

Table 3-2. Indicator bacteria data by station, indicator, and date for the North Branch Hoosic River (MA11-02). 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)
W1597	*E. coli*	5/29/2007	WET	118	118	
W1597	*E. coli*	6/26/2007	DRY	316	193	
W1597	*E. coli*	8/7/2007	DRY	380	242	
W1597	*E. coli*	8/21/2007	DRY	260	246	
W1597	*E. coli*	9/27/2007	DRY	320	316	

3.3. Potential Pathogen Sources

Each potential pathogen source is described in further detail below.

Urban Stormwater: Portions of the watershed are heavily developed, with 5% of the land area in MS4 and 3% as DCIA. Development within the watershed is concentrated within the southern, downstream end of the watershed near the segment in North Adams. The segment itself is channelized within an open cement culvert for much of its length. Stormwater runoff from urban areas is likely a significant source of pathogens.

Illicit Sewage Discharges: A portion of the watershed, especially near the segment, is 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. Given the channelized nature of the river and the high density and age of the urbanized environment, illicit discharges from wastewater to stormwater cross connections, failing or leaking sewer lines or SSOs, is likely to be a significant source of pathogens to the river.

On-Site Wastewater Disposal Systems: Most development in the upstream portion 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 4% of the total land use area within the watershed (MA and VT). Those visible on recent aerial photos within the MA portion of the watershed include open fields, hayfields, and row crops. 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 segment flows through dense residential development in North Adams. Conservation and recreational lands, parks, ballfields, and residential streets which may be popular for dog-walking, especially where paths are adjacent to rivers, ponds, or wetlands, represent a possible source of pathogens.

Wildlife Waste: There are areas in and around North Adams where lawns are mowed to the river's banks. 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.

3.4. 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 North Adams

A small portion of North Adams falls within the MS4 area, and the town was granted a MS4 General Permit waiver by the EPA on October 31, 2017, https://www3.epa.gov/region1/npdes/stormwater/ma/waivers/north-adams-epa-waiver-response.pdf (Hamjian, 2017).

North Adams has the following relevant ordinances and bylaws:

- North Adams does not have any supplementary regulations beyond the MassDEP regulations for stormwater management or wetland protection.
- Title 5 Supplementary Regulations: None found.
- Stormwater Utility: None found.
- Pet Waste: https://ecode360.com/27081704 (City of North Adams, 2006)

Town website: http://www.northadams-ma.gov/ (City of North Adams, 2020)
Open Space and Recreation Plan: https://ces.williams.edu/files/2009/08/NAOSRP_FinalReport.pdf (Baecher et al, 2012)

Town of Clarksburg

Clarksburg is not within the MS4 area. Clarksburg has no relevant ordinances and bylaws. Clarksburg did not have a Master Plan available. Clarksburg did not have an Open Space and Recreation Plan available.

4. MA11-03 Hoosic River

4.1. Waterbody Overview

The Hoosic River segment MA11-03 is 8.8 miles long and begins at the outlet of the Cheshire Reservoir in Cheshire, MA. The segment flows north into Adams, where the segment ends at the Adams WWTP discharge (NPDES: MA0100315) in Adams, MA.

Tributaries include Kitchen Brook, South Brook, Penniman Brook, Bassett Brook, Dry Brook, Pecks Brook, Tophet Brook, Southwick Brook, and other unnamed streams. Lakes and ponds in the watershed other than those mentioned above include Berkshire Pond and Gore Pond.

Key landmarks in the watershed include the Cheshire and Adams town centers, Mt Greylock State Reservation, and the MA-8/MA-116 junction. The segment is crossed by South State Road/MA-8, Main Street, and Harbor Road in Cheshire; and Grove Street/MA-8, South Willow Street, Commercial Street/MA-8 (twice), River Street, Park Street/MA-8, Pleasant Street, Dean Street, Spring Street, Hoosac Street, Cook Street, and Lime Street in Adams.

The Hoosic River (MA11-03) watershed drains an area of 64 square miles, of which 2.4 mi^2 (4%) is impervious and 1.0 mi^2 (2%) is directly connected impervious area (DCIA). The watershed is partially[4] served by public sewer and 10% is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (USEPA, 2020). There is one NPDES permit on file governing point source discharges of pollutants to surface waters (Table 4-1) and two MassDEP discharge to groundwater permits for on-site wastewater discharge (Table 4-2) in the watershed. There are no combined sewer overflows, three landfills, and no unpermitted land disposal dumping grounds within the segment watershed. See Figure 4-1.

Reduction from Highest Calculated Geomean: 70%

Watershed Area (Acres): 40,915

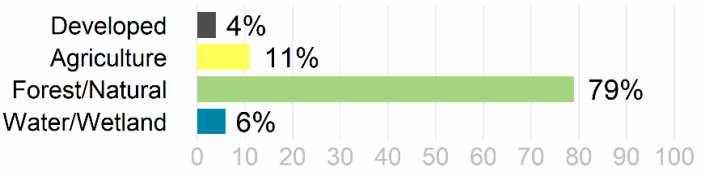
Segment Length (Miles): 8.8

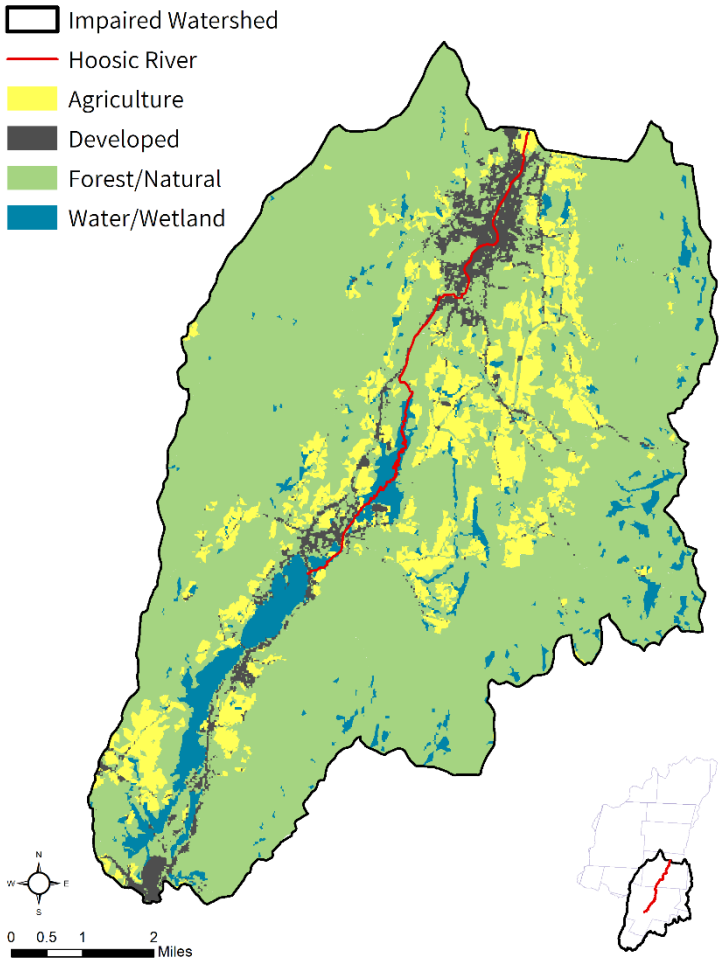
Impairment(s): *E. coli*, fecal coliform (Primary Contact Recreation)

Class (Qualifier): B (Cold Water, High Quality Water)

Impervious Area (Acres, %): 1,562 (4%)

DCIA Area (Acres, %): 630 (2%)





[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, 2020), MS4 reports, and local knowledge.

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
MA0100315	ADAMS WWTP	ADAMS	MUN

Table 4-2. 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).

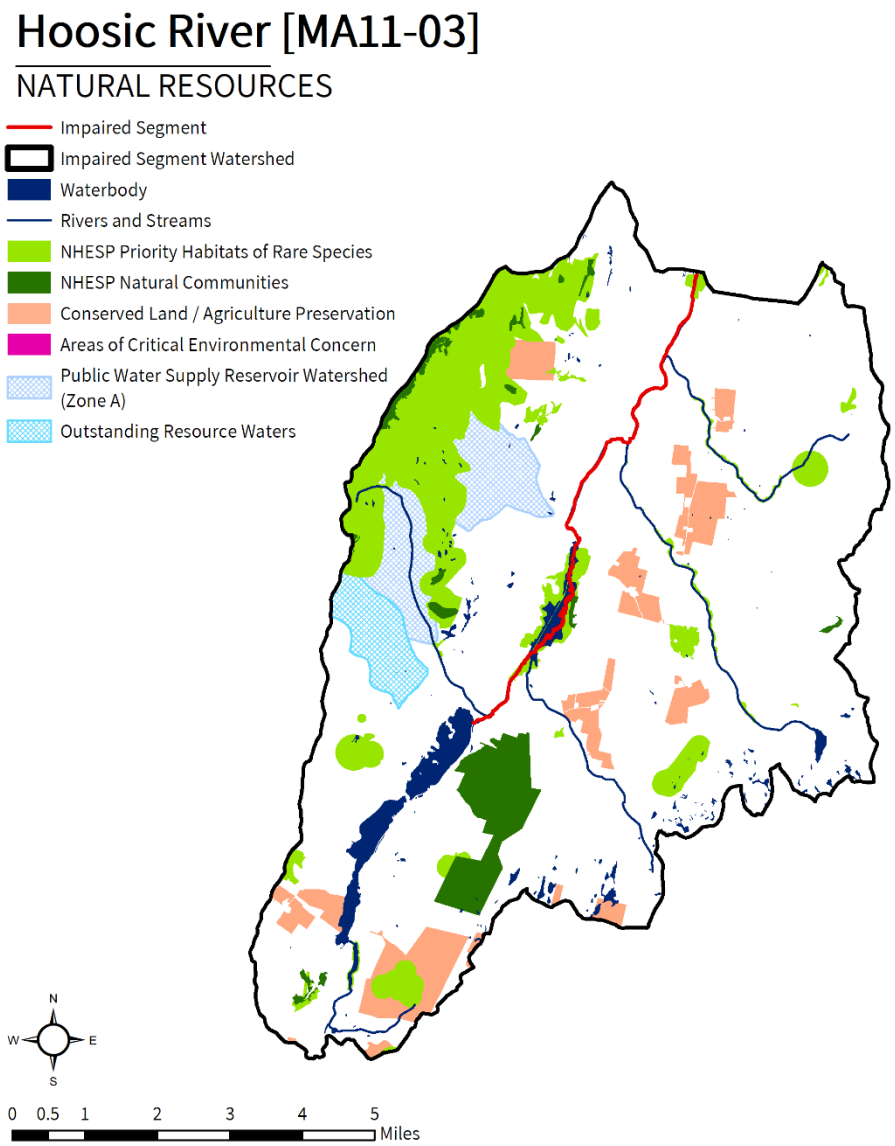
PERR	NAME	TOWN	TYPE	FLOW (GPD)
701-1	PINE VALLEY MOBILE HOME	CHESHIRE	Sanitary Discharge	28,830
350-3	BERKSHIRE MALL WWTF	LANESBORO	Sanitary Discharge	70,000

The watershed is predominantly forested (79%), with developed (4%) and agricultural (11%) land uses making up a small portion of the watershed. However, developed areas are concentrated around the segment, which is channelized through most of Adams town center and is immediately adjacent to commercial, industrial, and residential buildings, parking lots, dense residential neighborhoods, and mowed areas. Agricultural activities are likewise concentrated in the river valleys of upstream tributaries and consist of grazing lands for livestock, hayfields, and row crops.

In the Hoosic River (MA11-03) watershed, under the Natural Heritage and Endangered Species Program, there are 5,454 acres (13%) of Priority Habitats of Rare Species and 1,397 acres (3%) of Priority Natural Vegetation Communities. There are 3,515 acres (9%) under Public Water Supply protection, 780 acres (2%) identified as Outstanding Resource Waters, but no Areas of Critical Environmental Concern. Over 2,485 acres (6%) of land protected in perpetuity[5] exist within the segment watershed, which is part of a total of 18,388 acres (45%) of Protected and Recreational Open Space[6]. See Figure 4-1.

[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).



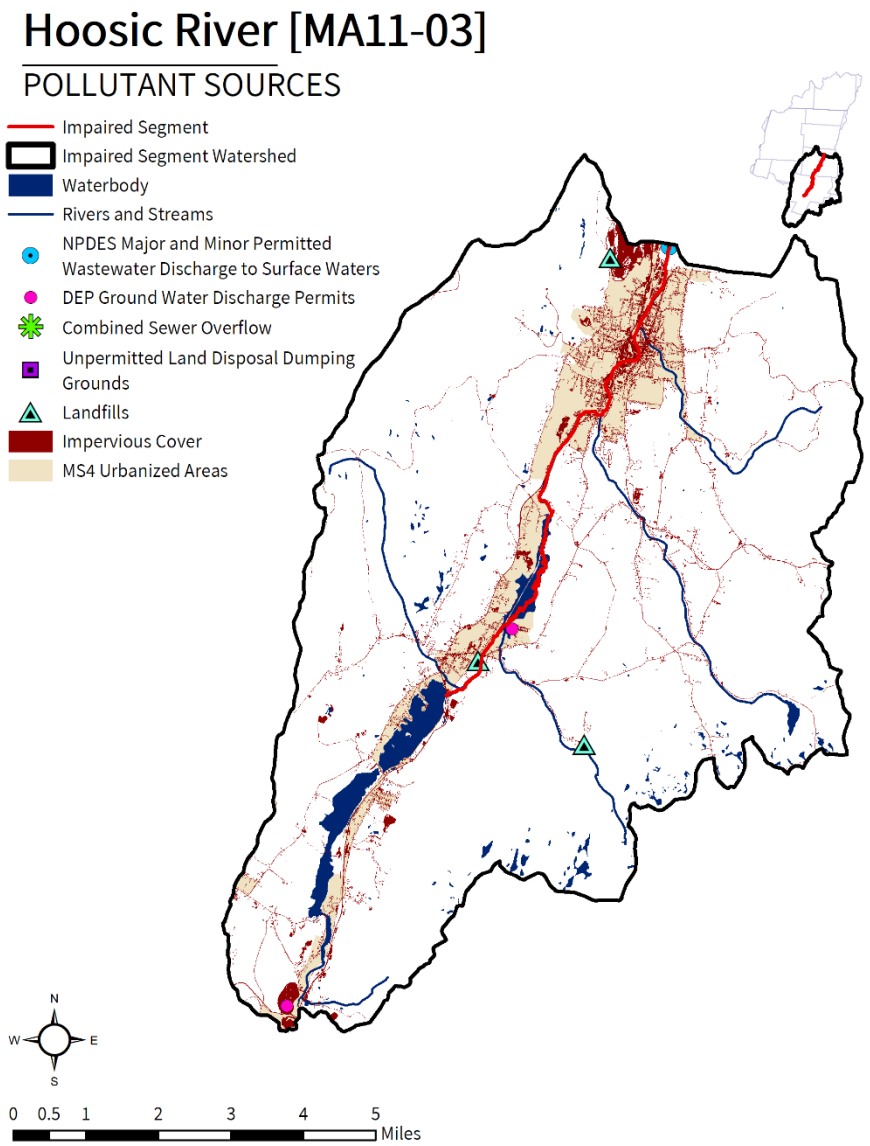


Figure 4-1. Natural resources and potential pollution sources draining to the Hoosic River segment MA11-03. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollution sources, including impervious cover, MS4 areas, and permitted facilities

4.2. Waterbody Impairment Characterization

The Hoosic River (MA11-03) is a Class B, Cold Water, and High Quality Water (MassDEP, 2021).

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 4-3, 4-4; Figure 4-2). Data were evaluated against the SWQS geomean criterion of 126 CFU/100 mL for *E. coli* indicator bacteria and the STV criterion of 410 CFU/100 mL for *E. coli*. The geomean STV criteria for the impaired segment apply to data on a year-round, 90-day rolling basis.

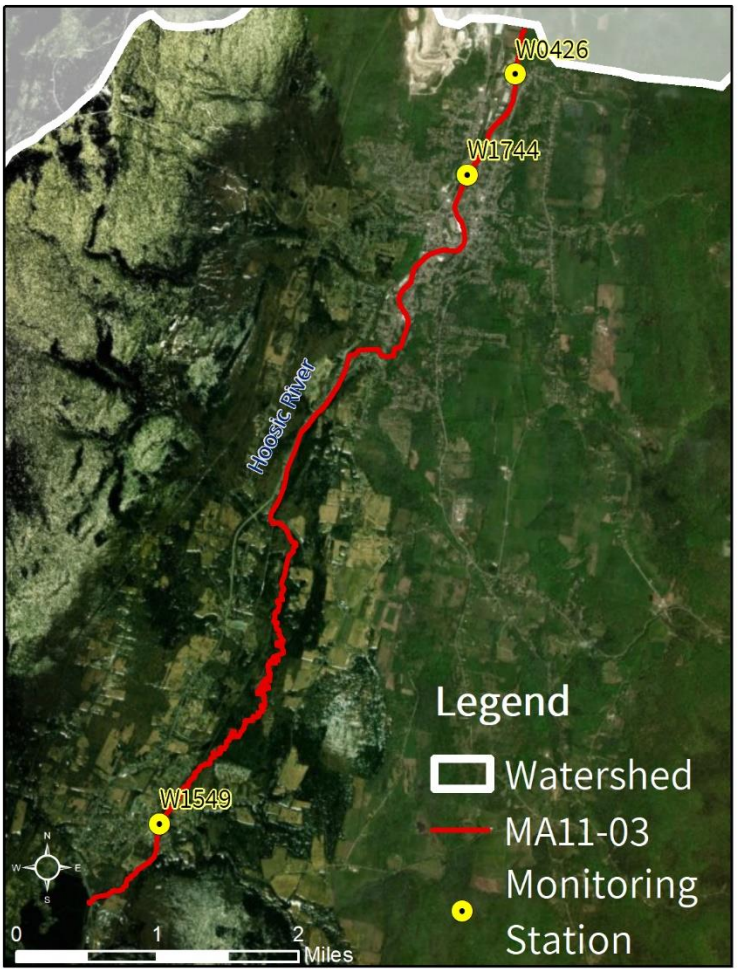


Figure 4-2. Location of monitoring station(s) along the impaired river segment.

- In 2007, five samples were collected at W0426, 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, none exceeded the STV criterion.
- In 2007, five samples were collected at W1549, 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, none exceeded the STV criterion.
- In 2007, five samples were collected at W1744, 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 two samples, one exceeded the STV criterion during dry weather.

Table 4-3. Summary of indicator bacteria sampling results by station for the Hoosic River (MA11-03). 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
W0426	4/24/2007	9/27/2007	5	363	5	0
W1549	4/24/2007	9/27/2007	5	211	2	0
W1744	8/21/2007	9/27/2007	2	414	2	1

Table 4-4. Indicator bacteria data by station, indicator, and date for the Hoosic River (MA11-03). 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 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)
W0426	*E. coli*	4/24/2007	DRY	132	132	
W0426	*E. coli*	5/29/2007	WET	220	170	
W0426	*E. coli*	6/26/2007	DRY	152	164	
W0426	*E. coli*	8/7/2007	DRY	388	235	
W0426	*E. coli*	9/27/2007	DRY	340	363	
W1549	*E. coli*	4/24/2007	DRY	8	8	
W1549	*E. coli*	5/29/2007	WET	94	27	
W1549	*E. coli*	6/26/2007	DRY	344	64	
W1549	*E. coli*	8/7/2007	DRY	292	211	
W1549	*E. coli*	9/27/2007	DRY	100	171	
W1744	*E. coli*	8/21/2007	DRY	260	260	
W1744	*E. coli*	9/27/2007	DRY	660	414	

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 in the Hoosic River (MA11-03) 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 heavily developed, with 10% of the land area in MS4 and 2% as DCIA. Development within the watershed is concentrated along MA-8 which parallels the segment through Adams town center. Here, high density mixed use development is concentrated along the concrete-lined river channel. Stormwater runoff from urban areas is likely a significant source of pathogens.

Illicit Sewage Discharges: A portion of the watershed is served by public sewer, especially near the segment. 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. The highly urbanized character of Adams, the old age of much of the built environment, and the observed elevated dry weather indicator bacteria concentrations all indicate that Illicit discharges like wastewater to storm drain cross connections or failing infrastructure such as leaky sewer lines or SSOs, are likely a significant source of pathogens.

On-Site Wastewater Disposal Systems: There are two groundwater discharge permits for on-site wastewater discharge, which are large-capacity septic systems (non-residential), within the watershed. Most development

in the upstream portion 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 11% of the total land use area within the watershed. Those activities visible on recent aerial photos within the MA portion of the watershed include open fields, hayfields, row crops, and pastureland. Agricultural activities related to manure storage and spreading, if not well managed, are a possible source of pathogens to waterbodies.

Pet Waste: The downstream portion of the segment is surrounded by dense development, including residential neighborhoods. Conservation and recreational lands, parks, ballfields, and residential streets which may be 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 throughout the watershed 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. For a complete view of upstream municipalities and waterbodies, see the map in Figure 2-1.

Town of Adams

Nearly 20% of Adams is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit. Adams (Permit ID #MAR041246) has an EPA approved Notice of Intent (NOI). No information regarding the percentage of mapped MS4 stormwater systems, nor whether it has adopted illicit discharge detection and elimination (IDDE), erosion and sediment control (ESC), and post-construction stormwater regulations could be located. There are nine stormwater outfalls to the Hoosic River (MA11-04) and 101 stormwater outfalls to the pathogen-impaired Hoosic River (MA11-03).

Adams has the following ordinances and bylaws:

- Stormwater management bylaw, 201-13: https://ecode360.com/8903302?highlight=stormwater&searchId=5701520192596889#8903302 (Town of Adams, n.d., a)
- Sewers, Chapter 93 https://ecode360.com/AD2021 (Town of Adams, 2008)
- Animals, Chapter 14, Section 14-5: Removal of animal feces https://ecode360.com/8901363?highlight=animal&searchId=7432376153972093#8901363 (Town of Adams, n.d., b.)

Adams had no available Master Plan or Open Space and Recreation Plan.

Town of Cheshire

Approximately 8% of Cheshire is within the MS4 area. The town does not have a NPDES Phase II permit. Cheshire has no relevant ordinances and bylaws. Cheshire's Master Plan (link below) has a Natural and Cultural Resources chapter (Chapter 9) that contains a summary of the town's water resources. The plan mentions stormwater, impaired streams, sewer/septic infrastructure, and a town beach, but not bacteria.

Cheshire website: https://www.cheshire-ma.gov/ https://www.cheshire-ma.net/ (Town of Cheshire, 2020)

Cheshire Master Plan (with Chapter 10 as the Open Space and Recreation Plan): https://www.cheshire-ma.gov/planning-board (Town of Cheshire and BRPC, 2017)

5. MA11-05 Hoosic River

5.1. Waterbody Overview

The Hoosic River segment MA11-05 is 8.2 miles long and begins at the confluence of the pathogen-impaired North Branch Hoosic River (MA11-02) and the Hoosic River in North Adams, MA. The segment flows west through North Adams before flowing northwest through Williamstown, then ends at the Vermont state line in Williamstown, MA.

Additional tributaries to this segment include, Sherman Brook, Mount Williams Brook, Green River, Hemlock Brook, and Broad Brook. Lakes and ponds exclusive to the immediate drainage area to this segment include Windsor Lake, Witts Pond, Eph Pond, Railroad Pond, Notch Reservoir, and Mount Williams Reservoir.

Key landmarks in the watershed include New Ashford, North Adams, and Williamstown town centers; part of the Mount Greylock State Reservation; Taconic Trail State Park; Clarksburg State Forest; and Williams College. The segment is crossed by Brown Street, State Road/MA-2 (twice), Protection Avenue, Ashton Avenue, and Galvin Road in North Adams; and Cole Avenue, North Street/US-7 in Williamstown.

The Hoosic River (MA11-05) watershed drains a total area of 205 square miles, of which 9.6 mi^2 (5%) is impervious and 4.5 mi^2 (2%) is directly connected impervious area (DCIA). The watershed extends beyond MA into VT and NY. Out of the total watershed area for MA11-05, 164 mi^2 (80%) are within MA.

The watershed is partially[7] served by public sewer and 8% of the watershed (10% of the area within MA) is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (USEPA, 2020). There is one NPDES permit on file governing point source discharges of pollutants to surface waters within the immediate drainage area (Table 5-1) and one additional NPDES permit within the full segment watershed. There is one MassDEP discharge to groundwater permit for on-site wastewater discharge within the immediate drainage area (Table 5-2) and two additional MassDEP discharge to groundwater

Reduction from Highest Calculated Geomean: 94%

Watershed Area (Acres): 131,152

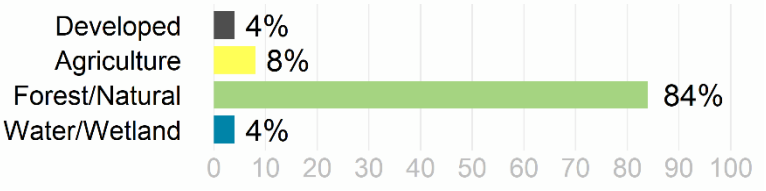
Segment Length (Miles): 8.2

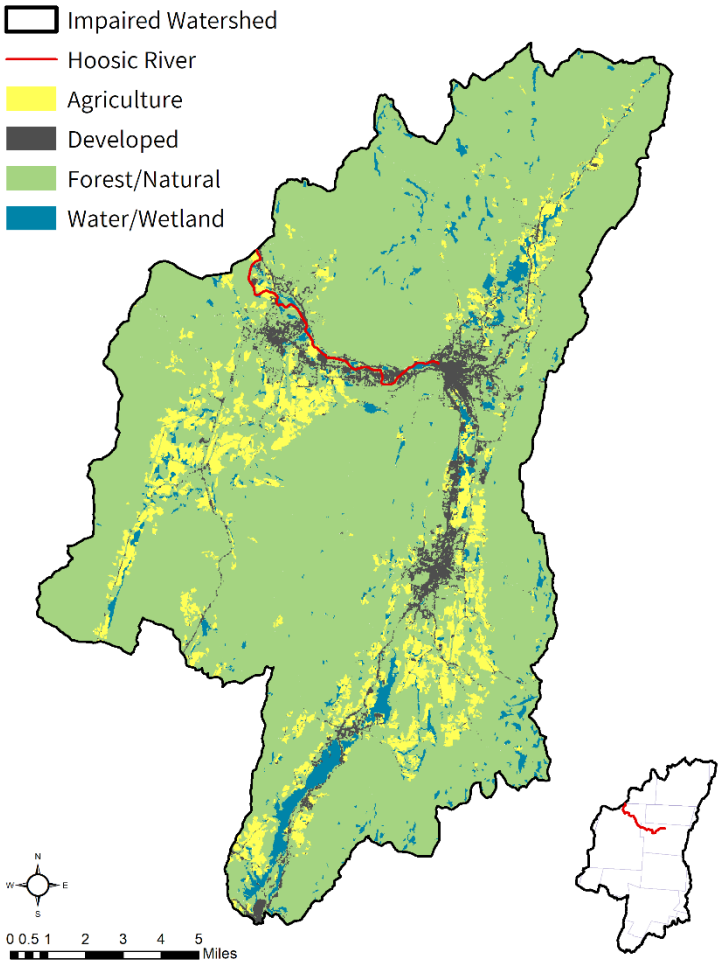
Impairment(s): *E. coli*, fecal coliform (Primary Contact Recreation)

Class (Qualifier): B (Warm Water)

Impervious Area (Acres, %): 6,157 (5%)

DCIA Area (Acres, %): 2,897 (2%)





[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, 2020), MS4 reports, and local knowledge.

permit within the full segment watershed. There are no combined sewer overflows, 19 landfills, and two unpermitted land disposal dumping grounds within the MA portion of the segment watershed. See Figure 5-1.

Table 5-1. 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
MA0100510	HOOSAC WPCF	WILLIAMSTOWN	MUN

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).

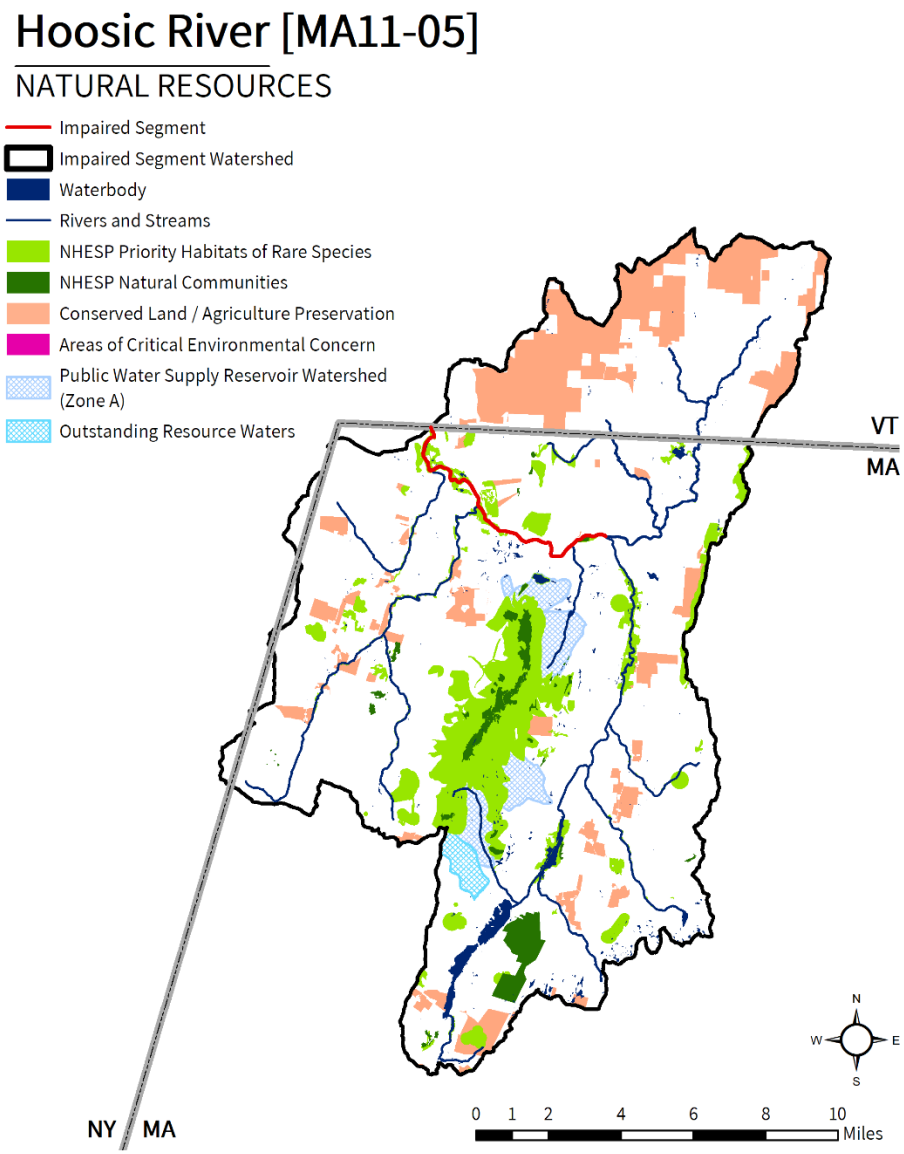
PERR	NAME	TOWN	TYPE	FLOW (GPD)
829-0	STERLING & FRANCINE CLARK ART INSTITUTE	WILLIAMSTOWN	Other	68,282

The watershed is predominantly forested (84%), with developed (4%) and agricultural (8%) land uses making up a small portion of the watershed. However, developed areas are somewhat concentrated around the segment along the MA-2 and US-7 highway corridors in North Adams and Williamstown. Upstream tributaries are channelized and flow through highly urbanized areas. Developed land consists of medium density mixed residential, commercial, and industrial uses. Agricultural land is a mixture of grazing lands for livestock, hayfields, and row crops and is generally concentrated along tributary river valleys. Most of the river segment benefits from a wooded buffer.

In the Hoosic River (MA11-05) watershed, under the Natural Heritage and Endangered Species Program, there are 14,381 acres (11%) of Priority Habitats of Rare Species and 2,314 acres (2%) of Priority Natural Vegetation Communities. There are 5,930 acres (5%) under Public Water Supply protection, 780 acres (1%) identified as Outstanding Resource Waters, but no Areas of Critical Environmental Concern. Over 16,069 acres (12%) of land protected in perpetuity[8] exist within the segment watershed, which is part of a total of 52,574 acres (40%) 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).



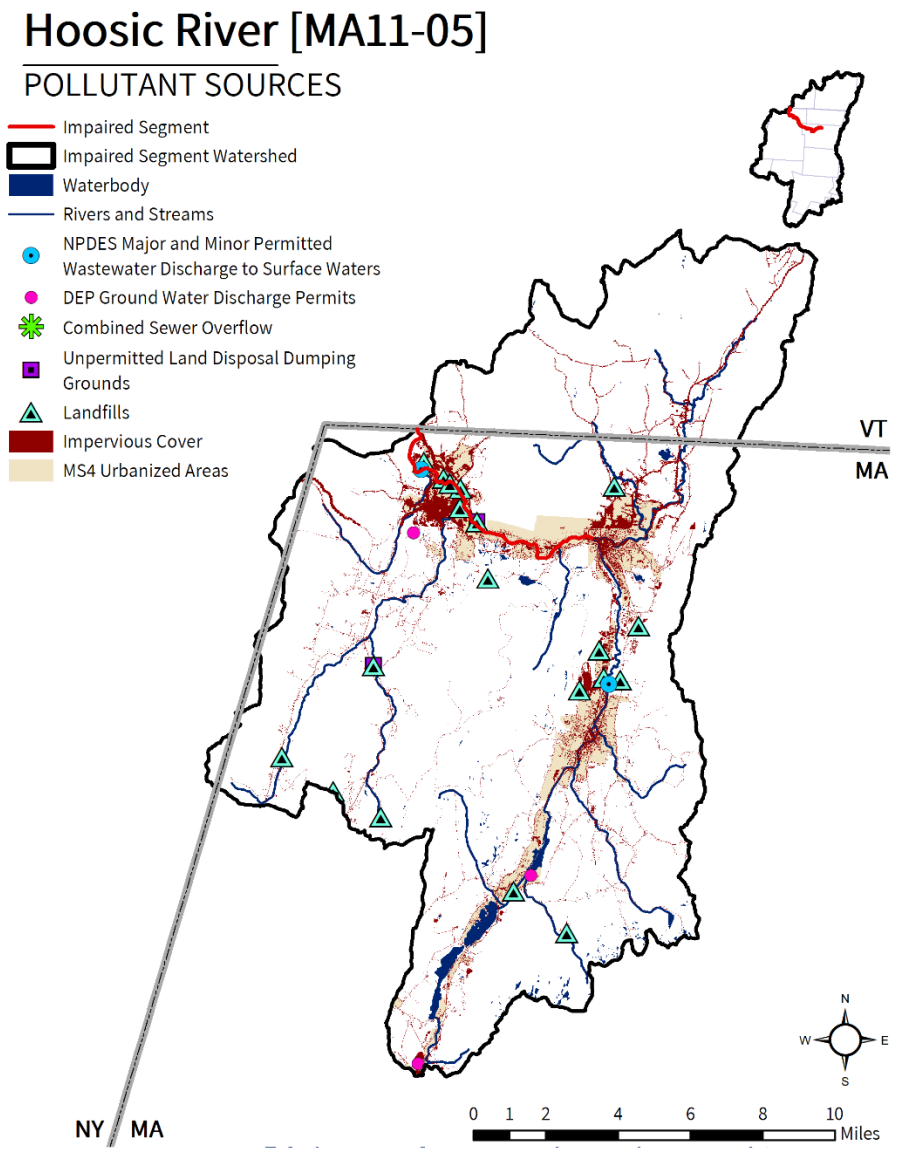


Figure 5-1 Natural resources and potential pollution sources draining to the Hoosic River segment MA11-05. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollution sources, including impervious cover, MS4 areas, and permitted facilities

5.2. Waterbody Impairment Characterization

The Hoosic River (MA11-05) is a Class B, Warm Water (MassDEP, 2021).

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 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.

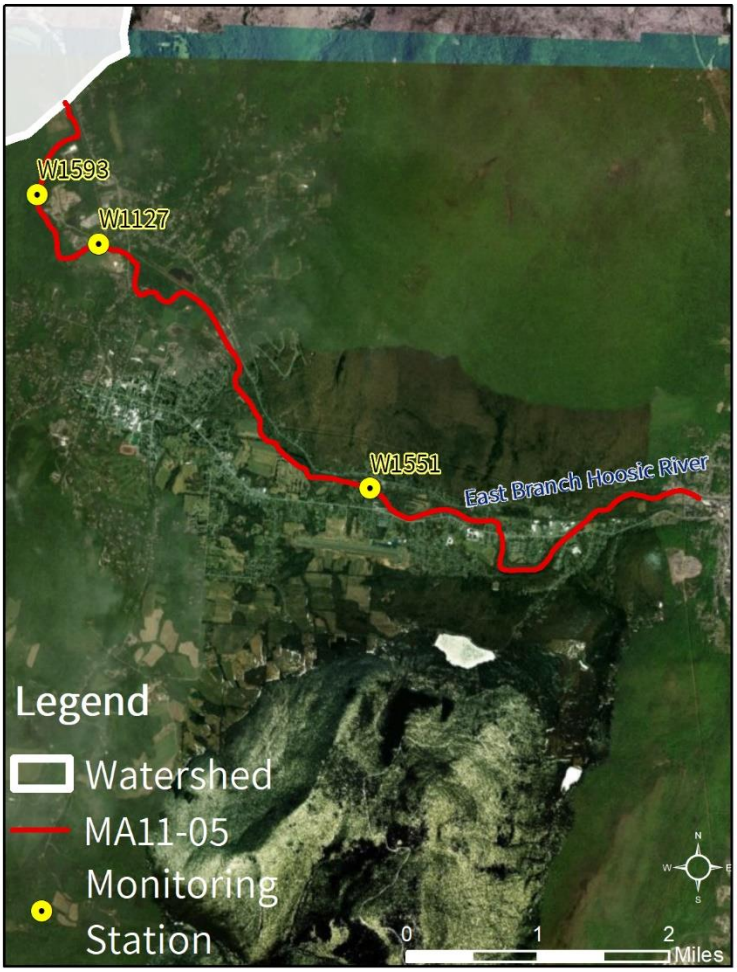


Figure 5-2. Location of monitoring station(s) along the impaired river segment.

- In 2007, five samples were collected at W1127, resulting in two 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 W1551, resulting in two 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 W1593, resulting in 1 day 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, none exceeded the STV criterion.

Table 5-3. Summary of indicator bacteria sampling results by station for the Hoosic River (MA11-05). 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
W1127	4/24/2007	9/27/2007	5	460	2	1
W1551	4/24/2007	9/27/2007	5	2200	2	1
W1593	4/24/2007	9/27/2007	5	280	1	0

Table 5-4. Indicator bacteria data by station, indicator, and date for the Hoosic River (MA11-05). 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 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)
W1127	*E. coli*	4/24/2007	DRY	62	62	
W1127	*E. coli*	5/29/2007	WET	50	50	
W1127	*E. coli*	6/26/2007	DRY	34	41	
W1127	*E. coli*	8/7/2007	DRY	200	200	
W1127	*E. coli*	9/27/2007	DRY	460	460	
W1551	*E. coli*	4/24/2007	DRY	50	50	
W1551	*E. coli*	5/29/2007	WET	60	60	
W1551	*E. coli*	6/26/2007	DRY	152	95	
W1551	*E. coli*	8/7/2007	DRY	280	280	
W1551	*E. coli*	9/27/2007	DRY	2200	2200	
W1593	*E. coli*	4/24/2007	DRY	46	46	
W1593	*E. coli*	5/29/2007	WET	72	72	
W1593	*E. coli*	6/26/2007	DRY	148	103	
W1593	*E. coli*	8/7/2007	DRY	80	80	
W1593	*E. coli*	9/27/2007	DRY	280	280	

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 the Hoosic River (MA11-05) were elevated during dry weather. Note that only one wet weather sample was collected at each station; additional data are needed to better target 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 moderately to heavily developed, especially around the segment itself, with 8% of the land area in MS4 and 2% as DCIA. Development is concentrated around segment where it flows through Williamstown town center and consists of medium density mixed residential and commercial development. Stormwater runoff from urban areas is likely a significant source of pathogens.

Illicit Sewage Discharges: Most of the MA portion of the watershed contains sewer service areas, including areas surrounding the segment. 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. The development patterns and the observed elevated levels of indicator bacterial in dry weather indicate Illicit discharges like wastewater to storm

drain cross connections, or failing infrastructure such as leaky sewer lines or SSOs, are likely a significant source of pathogens.

On-Site Wastewater Disposal Systems: There is one groundwater discharge permit for on-site wastewater discharge within the immediate drainage area (3 within the full watershed). These permits are for large-capacity septic systems (non-residential). A portion 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 8% of the total land use area within the watershed (MA, VT, and NY). Those activities visible on recent aerial photos within the MA portion of the watershed and within the direct drainage area of the segment include open fields, hayfields, row crops, and pastureland. 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, especially in Williamstown. Conservation and recreational lands, parks, ballfields, and residential streets which may be 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 throughout the watershed 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 (excludes upstream impaired segment watersheds). For a complete view of upstream municipalities and waterbodies, see the map in Figure 2-1.

Town of Adams. See Section 4.4

Town of Cheshire. See Section 4.4

City of North Adams. See Section 3.4

Town of Williamstown

Williamstown is not within the MS4 area.

Williamstown has the following relevant ordinances and bylaws:

- Stormwater management, Section 170-4.3: https://ecode360.com/10817484?highlight=wetlands&searchId=5630422306367308#10817484 (Town of Williamstown, n.d., a)
- Sanitary Sewers, Section 113-15: https://ecode360.com/10811165?highlight=sewer,sewers&searchId=6151183827991175#10811165 (Town of Williamstown, n.d., b)
- Pet waste: Removal of Animal Litter, Section 10.6 https://ecode360.com/10632489 (Town of Williamstown, n.d., c)

Williamstown's Master Plan: https://williamstownma.gov/wp-content/uploads/2018/07/Master-Plan-Final-Report-2002-NoGraphics.pdf (Town of Williamstown, 2002)

Williamstown had no available Open Space and Recreation Plan.

6. References

Baecher, C. et al. (2012) [online]. *North Adams Open Space and Recreation. Promoting a Healthier City from the Bottom Up.* Revising the North Adams Open Space and Recreation Plan. Fall 2012. North Adams, Massachusetts. Prepared by Claire Beacher, Vera Cecelski, Taylor Nutting and Helen Song. Williams College Environmental Planning Workshop. Williamstown, Massachusetts. Available at https://ces.williams.edu/files/2009/08/NAOSRP_FinalReport.pdf

BRPC. (2020) [online]. *Berkshire Regional Planning Commission*. Available at http://www.berkshireplanning.org/

City of North Adams. (2006) [online]. *Section 27-9: Removal of Dog Litter.* City of North Adams, MA. Part II: Revised Ordinances. Chapter 27: Dog Regulations. Ordinance of March 14, 2006. Available at https://ecode360.com/27081704

City of North Adams. (2020) [online]. *North Adams.* North Adams, Massachusetts. Available at https://www.northadams-ma.gov/

Hamjian, L. (2017) [online]. Letter from Lynne Hamjian, Acting Director, United States Environmental Protection Agency, Office of Ecosystem Protection to Michael Canales, Administrative Officer, City of North Adams, Massachusetts. October 31, 2017. Available at https://www3.epa.gov/region1/npdes/stormwater/ma/waivers/north-adams-epa-waiver-response.pdf

HooRWA. (n.d., a) [online]. *Meet The Hoosic.* Hoosic River Watershed Association. Available at http://hoorwa.org/the-river/meet-the-hoosic/

HooRWA. (n.d., b) [online]. *Hoosic River Watershed Association*. Available at https://hoorwa.org/

MassDEP. (2006) [online]. *Hudson River Watershed 2002 Water Quality Assessment Report*. Massachusetts Department of Environmental Protection. Worcester, MA. Available at https://www.mass.gov/doc/hudson-river-basin-water-quality-assessment-report-2002/download

MassDEP. (2020) [online]. *Water Utility Resilience Program.* Massachusetts Department of Environmental Protection. Worcester, MA. Available at https://www.mass.gov/guides/water-utility-resilience-program

MassDEP. (2021). *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. (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. Available at https://www.mapc.org/resource-library/stormwater-financing-utility-starter-kit/

MAPC. 2018 [online]. *MS4 Outfall Catchment Calculato*r. Metropolitan Area Planning Council. Available at https://www.mapc.org/resource-library/ms4-outfall-catchment-calculator/

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

Town of Adams. (n.d., a) [online]. *Section 201-13: Stormwater Management.* Town of Adams, MA. The Code. Part II: Rules and Regulations. Subdivision Regulations. Article III: Design Standards. Available at https://ecode360.com/8903302?highlight=stormwater&searchId=5701520192596889

Town of Adams. (n.d., b) [online]. *Section 14-5: Removal of Animal Feces.* Town of Adams, MA. The Code. Part I: Bylaws. Chapter 14: Animals. Available at https://ecode360.com/8901333

Town of Adams. (2008) [online]. *Chapter 93: Sewers*. Town of Adams, MA. The Code. Part I: Bylaws. Adopted June 16, 2008. Available at https://ecode360.com/8901612

Town of Cheshire. (2020) [online]. *Cheshire, Massachusetts.* Available at https://www.cheshire-ma.gov/

Town of Cheshire and BRPC. (2017) [online]. *Master Plan. Town of Cheshire, Massachusetts.* Prepared by Cheshire Master Plan Committee & Berkshire Regional Planning Commission. Approved on May 22, 2017. Available at https://www.cheshire-ma.gov/planning-board

Town of Williamstown. (n.d., a) [online]. *Section 170-4.3: Stormwater Management.* Town of Williamstown, MA. Part IV: Planning Board Regulations. Subdivision Rules and Regulations. Article IV: Design and Construction Requirements. Available at https://ecode360.com/10817484?highlight=wetlands&searchId=5630422306367308

Town of Williamstown. (n.d., b) [online]. *Section 113-15: Sanitary Sewers.* Town of Williamstown, MA. Part II: Board Of Selectmen Regulations. Road Construction Standards. Article III: Utilities. Available at https://ecode360.com/10811165?highlight=sewer,sewers&searchId=6151183827991175%2310811165

Town of Williamstown. (n.d., c) [online]. *Section 10-6: Removal of animal litter.* Town of Williamstown, MA. Part I: Bylaws. Chapter 10: Animals. Available at https://ecode360.com/10632489

Town of Williamstown. (2002) [online]. *Williamstown Master Plan.* Final Report and Recommendations of the Master Plan Steering Committee. Williamstown, Massachusetts. December 2002. Available at https://williamstownma.gov/wp-content/uploads/2018/07/Master-Plan-Final-Report-2002-NoGraphics.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

USGS. (2019) [online] *National Hydrography*. Retrieved from National Hydrography Dataset: United States Geological Survey. Available at http://prd-tnm.s3-website-us-west-2.amazonaws.com/?prefix=StagedProducts/Hydrography/NHD/State/HighResolution/Shape/