WATERSHED-BASED PLAN

Green River (MA21-23)

August 29, 2025

Prepared By:

Housatonic Valley Association
106 Wendell Ave.
Pittsfield, MA 01201

Prepared For:

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection

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Executive Summary

Introduction: The purpose of a Massachusetts Watershed-Based Plan (WBP) is to organize information about Massachusetts' watersheds and present it in a format that will enhance the development and implementation of projects that will restore water quality and beneficial uses in the Commonwealth. The Massachusetts WBP follows the United States Environmental Protection Agency's (USEPA's) recommended format for "nine-element" watershed plans. This WBP was developed by the Housatonic Valley Association (HVA) in collaboration with the Berkshire Ag Nonpoint Source Partnership with funding from the Massachusetts Department of Environmental Protection (MassDEP).

This WBP was prepared for the Green River (MA21-23), which is in the towns of Alford, Egremont, and Great Barrington, Massachusetts. A tributary of the Housatonic River watershed, the Green River's total area encompasses approximately 17,552 acres (27.4 square miles) and includes streams such as Alford Brook (MA21-44), Long Pond Brook (MA21-14), Scribner Brook (MA21-45); Seekonk Brook (MA21-22), and Tom Ball Brook (unassessed). The Green River originates in Canaan, NY and flows for approximately 18 miles southeast where it meets the Housatonic River in Great Barrington, Massachusetts.

Impairments and Pollution Sources: Long Pond Brook (MA21-14) is a category 4C waterbody on the 2016 Massachusetts Integrated List of Waters (303(d) list) due to dewatering impacts from hydro-structure flow regulation/modification. Three dams situated on the former campus of Bard College at Simon's Rock contribute to this flow modification impairment.

Though not categorized as an impairment by Mass DEP, water quality data collected and assembled by HVA, the town of Great Barrington, MassDEP, and a private landowner between 2020 and 2023 indicated levels of *Escherichia coli (E. coli*) that exceed Massachusetts Surface Water Quality Standards. We suspect these elevated levels of *E. coli* are the result of agricultural nonpoint source pollution.

Goals, Management Measures, and Funding: The goal of this WBP is to reduce agricultural nonpoint source (Ag NPS) pollution and mitigate water quality impacts identified by HVA, the town of Great Barrington, and additional community stakeholders. This will be accomplished by working with agricultural producers to identify and implement Ag NPS pollution Best Management Practices (BMPs) such as riparian buffer restoration, livestock exclusion from waterways, streambank stabilization, improved manure storage and handling systems, cover cropping, and other measures that capture stormwater runoff, reduce nutrient and sediment loading, lower *E. coli* concentrations, and help ensure the Green River continues to meet Massachusetts Surface Water Quality Standards. In addition, the project will engage other landowners, municipal officials, and community stakeholders—including recreational users, land trusts, and institutional property managers—to promote land use practices and restoration actions that further enhance water quality throughout the Green River watershed. It is expected that these pollutant load reductions will result in improvements to other water quality parameters throughout the watershed as well.

Agricultural BMP planning and implementation will initially be performed at select farms in the watershed. In FY23, HVA was awarded MassDEP Section 319 grant funding to build and strengthen agricultural partnerships in

Berkshire County, conduct outreach and education to farmers in the Green River watershed, develop conservation plans outlining BMPs to reduce pollutant runoff, help landowners access funding and technical support, implement Ag NPS reduction BMPs, and follow up with projects with relevant operation and maintenance practices. It is expected that future funding to develop farm-scale conservation plans and implement Ag NPS BMPs will be obtained from a variety of sources including the MassDEP Section 319 Grant Program, the National Fish & Wildlife Foundation, and U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) grants including the Environmental Quality Incentives Program (EQIP) and the Agricultural Management Assistance (AMA) program.

While this WBP will focus on ensuring the Green River meets Class B waterbody use goals by reducing Ag NPS pollution, it should also be noted that three dams on Lond Pond Brook (MA21-14), situated on the campus of Bard College at Simon's Rock in Great Barrington, are under consideration for removal. Stakeholders from the Simon's Rock community, staff from Massachusetts Division of Ecological Restoration, and consultants are working through the necessary permits and design elements to remove the three dams that contribute to the current Category 4C water quality impairment and restore the stream channel with anticipated benefits to water quality and stream processes. Project stakeholders, along with HVA and the Berkshire Environmental Action Team, will also develop plans for invasives species management and vegetative buffers within the stream corridor, in addition to education and outreach targeting the communities and stakeholders in Great Barrington.

Public Education and Outreach: In 2023, the Berkshire Agricultural Nonpoint Source Pollution Partnership was formed to increase the pace and scale of on-farm conservation planning and Ag NPS pollution reduction, which would benefit from more coordinated education and outreach efforts across selected subwatersheds with a particular focus on agricultural producers. A core partners meeting was held on April 1st, 2024, to review a draft education and outreach plan developed by consultants for farm outreach in the Green River. The core partners agreed that HVA and project consultants will research and prioritize farms in the Green River for outreach, engage in dialogue and relationship building with farmers, and share information about funding and technical assistance available through MassDEP, the Massachusetts Department of Agricultural Resources (MDAR) and Natural Resources Conservation Service (NRCS) to implement BMPs to reduce contaminated runoff from agricultural operations. A core goal of public education and outreach centers on developing relationships with farmers and community stakeholders with the goal of engaging in collaborative on-farm conservation planning and implementing Ag NPS BMPs. A

Implementation Schedule and Evaluation Criteria: The implementation schedule includes milestones for outreach and education to agricultural producers, securing agreements from farmers in the Green River watershed to work with HVA and the Berkshire Ag NPS Partnership to develop conservation plans, implementing Ag NPS BMPs, and conducting post-project monitoring, including operation and maintenance plans.

HVA will then continue to conduct targeted water quality monitoring to track the progress of Ag NPS reduction projects in the Green River with the goal of meeting Massachusetts Surface Water Quality Standards. The Berkshire Agricultural Nonpoint Source Pollution Regional Partnership also intends to work with farmers and community stakeholder to re-evaluate and update this WBP plan approximately every 3 years to ensure goals of the plan continue to address both established and emerging water quality threats.

Introduction

What is a Watershed-Based Plan?

Purpose & Need

The purpose of a Massachusetts Watershed-Based Plan (WBP) is to organize information about Massachusetts' watersheds and present the information in a format that will enhance the development and implementation of projects that will restore water quality and beneficial uses in the Commonwealth. The Massachusetts WBP follows the United States Environmental Protection Agency's (EPA's) recommended format for "nine-element" watershed plans, as described below.

All states are required to develop WBPs, but not all states have taken the same approach. Most states develop WBPs only for selected watersheds. Massachusetts Department of Environmental Protection's (MassDEP's) approach has been to develop a tool to support statewide development of WBPs so **that good projects in all areas of the state may be eligible for federal watershed implementation grant funds** under Section 319 of the Clean Water Act.

EPA guidelines promote the use of Section 319 funding for developing and implementing WBPs. WBPs are required for all projects implemented with Section 319 funds and are recommended for all watershed projects, whether they are designed to protect unimpaired waters, restore impaired waters, or both.

Watershed-Based Plan Outline

This WBP includes nine elements (a through i) in accordance with EPA Guidelines:

a) An **identification of the causes and sources** or groups of similar sources that will need to be controlled to achieve the load reductions estimated in this WBP and to achieve any other watershed goals identified in the WBP, as discussed in item (b) immediately below.

b) An **estimate of the load reductions** expected for the management measures described under paragraph (c) below, recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time.

c) A **description of the nonpoint source (NPS) management measures** needed to achieve the load reductions estimated under paragraph (b) above as well as to achieve other watershed goals identified in this WBP and an identification (using a map or a description) of the critical areas in which those measures will be needed to implement this plan.

d) An **estimate of the amounts of technical and financial assistance needed**, associated costs, and/or the sources and authorities that will be relied upon, to implement this plan. As sources of funding, States should consider the use of their Section 319 programs, State Revolving Funds, United States Department of Agriculture's (USDA's) Environmental Quality Incentives Program and Conservation Reserve Program, and other relevant federal, state, local, and private funds that may be available to assist in implementing this plan.

e) An **information/education component** that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the NPS management measures that will be implemented.

f) A **schedule for implementing the NPS management measures** identified in this plan is reasonably expeditious.

g) A description of **interim, measurable milestones** for determining whether NPS management measures or other control actions are being implemented.

h) A set of **criteria to determine if loading reductions are being achieved** over time and substantial progress is being made toward attaining water quality standards and, if not, the criteria for determining whether this WBP needs to be revised or, if a NPS total maximum daily load (TMDL) has been established, whether the TMDL needs to be revised.

i) A **monitoring component** to evaluate the effectiveness of the implementation efforts over time measured against the criteria established under item (h) immediately above.

The purpose of this WBP is to preserve and enhance water quality so that the Green River consistently meets Massachusetts Surface Water Quality Standards (SWQS), remains an asset for community recreation, and supports a diverse array of aquatic life. Water quality sampling programs led by HVA and the town of Great Barrington have shown levels of *E. Coli* that regularly exceed SWQS. To proactively address these impacts to water quality and prevent further degradation that would lead MassDEP to list the Green River as impaired for Class B waterbody use goals, this WBP proposes to advance partnerships with farmers and community stakeholders to plan, develop, and implement Best Management Practices (BMPs) that will reduce nonpoint source pollution and ensure the Green River watershed remains a healthy and vibrant ecosystem.

Project Partners and Stakeholder Input

This WBP was developed by HVA in collaboration with the Berkshire Ag NPS Partnership and with funding and input from MassDEP. This WBP was developed using funds from the Section 319 grant program and using MassDEP's Watershed-Based Planning Tool (WBP Tool). HVA was a recipient of Section 319 funding in FY23 to coordinate a regional Ag NPS planning partnership, identify sub-watersheds for strategic producer outreach, develop inventories of agricultural operations in selected sub-watersheds, develop an outreach strategy that encourages agricultural producers to engage with on-farm conservation planning, and implement BMPs that lead to meaningful reductions in *E. coli* and other pollutants.

As HVA worked to complete the Green River WBP, feedback was solicited during meetings with Berkshire Regional Planning Commission, Berkshire Ag Ventures, Berkshire Grown, Berkshire Conservation District, staff from MassDEP and NRCS, and project consultants.

The following are core project stakeholders:

- Erik Reardon, Housatonic Valley Association
- Mike Jastremski, Housatonic Valley Association
- Alison Dixon, Berkshire Regional Planning Commission

- Ben Crockett, Berkshire Agricultural Ventures
- Margaret Moulton, Berkshire Grown
- Ambrose Clausen, Berkshire Conservation District
- Cynthia Grippaldi, Berkshire Conservation District
- Ben Fellows, NRCS
- Malcolm Harper, MassDEP

Data Sources

This WBP was developed using the framework and data sources provided by MassDEP's WBP Tool. Additional data sources were reviewed and are included in subsequent sections of this WBP.

Summary of Completed Work

In 2017, the Housatonic Valley Association (HVA) completed a comprehensive stream assessment of the mainstem of the Green River, from the headwaters in Canaan, New York to the confluence with the Housatonic River in Great Barrington, Massachusetts. HVA organized the Green River "Stream Team" composed of local community volunteers trained to collect visual data within defined stream reaches. The Green River Stream team observed and recorded information related to the condition of the river, banks, and adjacent riparian area, while documenting resource concerns and recommending actions to address the source of those impacts. This work culminated with HVA's "Green River Assessment: Report & Action Plan." In addition, HVA has inventoried and assessed all road-stream crossings in the towns of Alford, Egremont, and Great Barrington and developed Road-Stream Crossing Management Plans designed to assist municipal efforts to replace culverts with structures that meet Massachusetts Stream Crossing Standards. Lastly, in 2019, Berkshire Conservation District purchased a new Esch 5512 12-footfoot No-Till seeder drill through grant funding from the Massachusetts Office of Energy and Environmental Affairs and the Massachusetts Department of Agricultural Resources. Designed to increase crop yield, use less seed, reduce labor cost, conserve water and improve soil structure and carbon sequestration, the no-till seeding approach to planting avoids disturbing the soil structure like traditional tilling practices do. In 2020, 2021, and 2022, it was utilized to plant approximately 750 acres in and around Berkshire County.

Element A: Identify Causes of Impairment & Pollution Sources

Element A: Identify the causes and sources or groups of similar sources that need to be controlled to achieve the necessary pollutant load reductions estimated in the watershed based plan (WBP).

General Watershed Information

The Green River originates in Canaan, New York north of Fog Hill Road, and terminates at the confluence of the Housatonic River in Great Barrington. The river is approximately 18 miles long and flows through several towns; Canaan, Austerlitz & Hillsdale, New York and Alford, Egremont, and Great Barrington, Massachusetts. In New York, the river is classified by the New York Department of Environmental Conservation as having “non-impacted water quality conditions” and is approximately 8.2 miles long. The headwaters of the Green River originate in Beebe Hill State Forest (2,018 acres) and Harvey Mountain State Forest (2,007 acres), two large, protected landscapes that help safeguard water quality and habitat in the watershed. It is managed by the New York Department of Environmental Conservation for multiple uses including timber production, watershed protection, wildlife habitat, and recreation.

In Massachusetts, the Green River is classified as a Class B, Cold Water Fish Resource (CFR) by the Massachusetts Department of Environmental Protection (MassDEP) and is approximately 10.1 miles long. Class B waters are designated as habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other critical functions, but also for primary (for example, swimming) and secondary (for example, boating) contact recreation. It is among the best trout streams in Massachusetts. Massachusetts Division of Fisheries and Wildlife’s (MassWildlife) Natural Heritage & Endangered Species Program identifies much of the Green River watershed as “Core Aquatic Habitat” and a “Priority Habitat of Rare Species.” Tributary streams include Alford Brook, Long Pond Brook, Scribner Brook, Seekonk Brook, and Tom Ball Brook. Long Pond and Prospect Lake, also located within the watershed, are both impaired for “Fish, other Aquatic Life and Wildlife” due to “Introduction of Non-Native Organisms” specifically Curly Leaf Pondweed in the case of Prospect Lake and Eurasian Water Milfoil in Long Pond.

The towns of Alford, Egremont, and Great Barrington are "Right-to-Farm" communities, the core of which states: "It is now determined that whatever impact may be caused to others through the normal practice of agriculture is more than offset by the benefits of farming to the neighborhood, community, and society in general." Of Egremont's 12,039 acres, 2,355, or nearly 20%, are presently used for agriculture. Of those agricultural acres, 266 are part of the Commonwealth's Agricultural Preservation Restriction (APR) program, which limits development and ensures the land's future use for farming purposes.

Table A-1 presents the general watershed information for the Green River watershed and **Figure A-1** includes a map of the watershed boundary.

Table A-1: General Watershed Information

Watershed Name (Assessment Unit ID):	Alford Brook (MA21-44); Green River (MA21-23); Long Pond Brook (MA21-14); Scribner Brook (MA21-45); Seekonk Brook (MA21-22); Tom Ball Brook
Major Basin:	Housatonic River
Watershed Area (within MA):	17552.7 (ac)

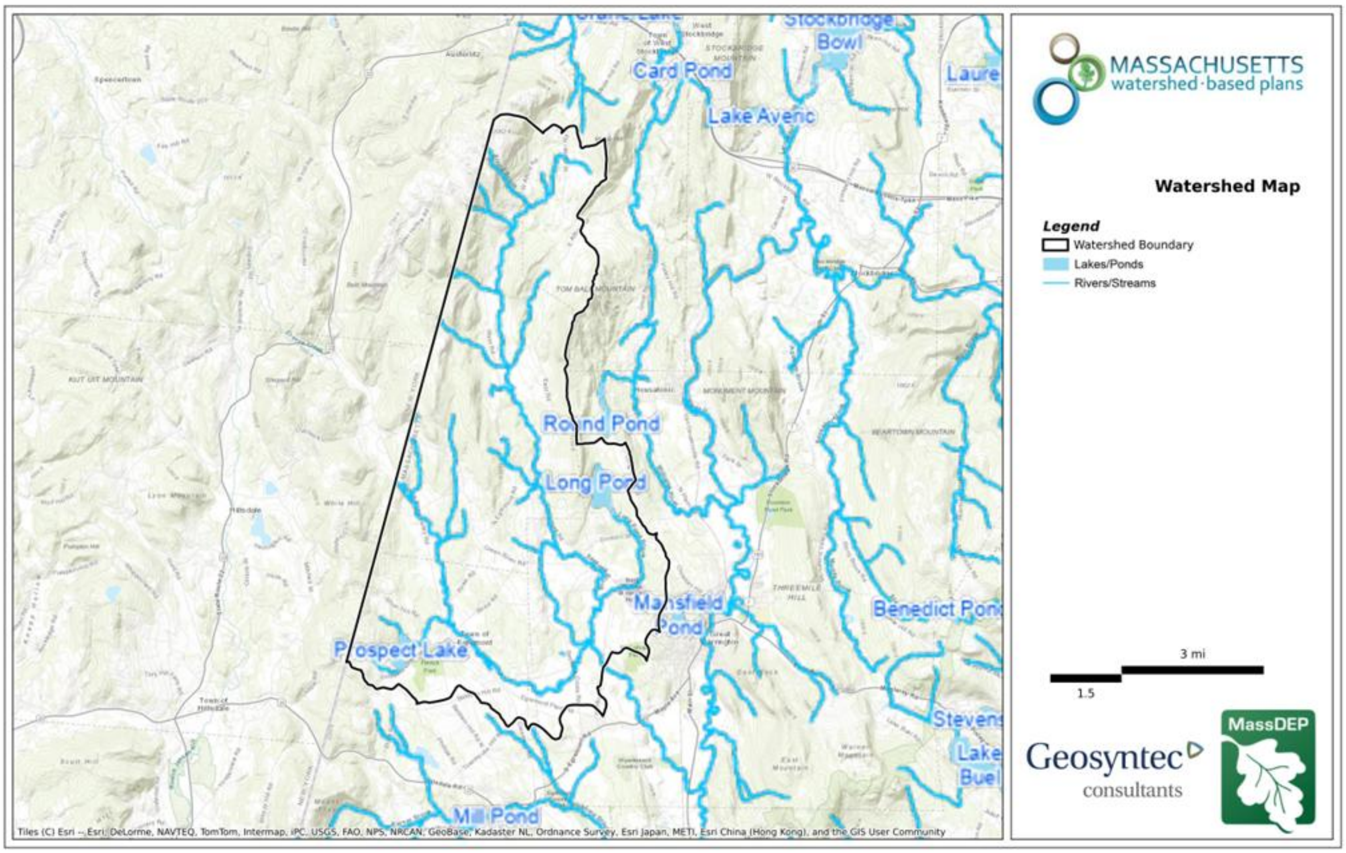


Figure A-1: Watershed Boundary in Massachusetts (MassGIS, 2007; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

MassDEP Water Quality Assessment Report and TMDL Review

The section below summarizes the findings of any available Water Quality Assessment Report and/or TMDL that relate to water quality and water quality impairments. Select excerpts from these documents relating to the water quality in the watershed are included below (note: relevant information is included directly from these documents for informational purposes and has not been modified).

The following reports are available:

- Housatonic River Watershed 2002 Water Quality Assessment Report

Housatonic River Watershed 2002 Water Quality Assessment Report (MA21-23 - GREEN RIVER)
AQUATIC LIFE USE Habitat and Flow Stage height and some limited streamflow data have been collected for the Green River at Hurlburt Street in Great Barrington between March and August 2006 by HVA volunteers partnering with the Massachusetts Riverways Programs pilot River Instream Flow Stewards (RIFLS) project (MA DFG 2006b). DWM performed a habitat assessment at Station GR23A (B0497), downstream from Route 23/41 in Great Barrington, MA. The total habitat score for Station WR01 was 130 out of 200 because of "poor quality of in-stream features, not riparian features" (Appendix C). Habitat such as in-stream cover for fish was poor, and there was a large amount of sediment deposition. DWM biologists collected periphyton samples at Station GR23A in September of 2002 (Appendix G). Canopy cover at this station was reported as 10%, algal cover was 90%, and the dominant algal genera were Zygnema sp., Mougeeotia sp., and Cocconeis sp. Biology DWM sampled the benthic macroinvertebrate community at Station GR23A (see above) in 2002. RBP III analysis indicated this station was non-impacted when compared to the regional reference station on the East Branch Housatonic River (Station EB01B). MA DFG sampled two sites on the Green River. Site 649 was located downstream from Cross Road near West Plain Road in Great Barrington. One hundred twenty-two fish were collected, representing seven species, including: 69 brown trout (62-370 mm long), 30 slimy sculpin, nine brook trout (70-175 mm long), seven bluegill, three green sunfish, three pumpkinseed, and one blacknose dace. Site 669 was located between the Boston and Maine Railroad and Route 7 in Great Barrington (Richards 2006). A total of 162 fish were collected, representing 13 species, including: 89 white sucker, 26 brown trout (51-475 mm in length), 14 blacknose dace, nine slimy sculpin, eight tesselated darter, five bluntnose minnow, three green sunfish, two bluegill, two common shiner, one creek chub, one fallfish, one largemouth bass, and one rock bass. The fish community at station 649 was dominated by pollution intolerant fluvial specialist species. Station 669 displayed a diverse fish community, with 13 species present, and included multiple age classes of brown trout, a pollution intolerant species. Chemistry-water DWM sampled the water quality of the Green River at Station 23A, downstream from Rte. 23/41 in Great Barrington between May and September 2002 (Appendix B). In-situ sampling was conducted to measure dissolved oxygen, temperature, pH, and conductivity during pre-dawn hours. Grab samples were collected and analyzed for total suspended solids, ammonia-nitrogen, and total phosphorus (low-level). All in-situ measurements met water quality criteria. The Aquatic Life use is assessed as support based upon the RBP III analysis of the macroinvertebrate community as non-impacted, the cold-water fish communities, and the good water quality. Sedimentation issues are a concern (Appendix C). PRIMARY CONTACT RECREATION, SECONDARY CONTACT RECREATION AND AESTHETICS DWM collected fecal coliform bacteria and *E. coli* samples from the Green River at Station 23A between May and September 2002 (Appendix B). None of the fecal coliform counts exceeded 180 cfu/100mL.

The Town of Great Barrington conducted weekly *E. coli* bacteria testing at a bathing beach on the Green River in 2003 and 2004. Despite nine of the 23 counts exceeding the bathing beach single sample criteria of 235 cfu/100mL, there were no postings at this beach in 2003 or 2004 (MA DPH 2004, 2005a). Currently, there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no Primary Contact Recreational Use assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

DWM biologists made field observations at Station GR23A on September 9, 2002. No sediment odors, deposits or oils were noted, and the water was noted to be clear with no odors or oils (MassDEP 2002b). DWM personnel also made field observations at Station 23A during the surveys conducted between May and September 2002. No objectionable deposits, scums or water odors were noted, and water clarity was generally noted as clear (MassDEP 2002a).

The Primary Contact Recreation, Secondary Contact Recreation and Aesthetics uses are assessed as support, based on the low fecal coliform bacteria counts and the lack of any objectionable conditions.

Report Recommendations:
Investigate the sediment contributions from the upstream agricultural activities. Monitoring of the biota has not yet shown an impact, but the sediment contributions are significant enough to warrant concern for negative impacts in the future.

Continue to monitor elevated bacteria levels around the beach area, and, if possible, use bacteria source tracking methods to identify sources.

Housatonic River Watershed 2002 Water Quality Assessment Report (MA21-22 - SEEKONK BROOK)

No recent quality assured data are available; thus, all uses are not assessed.

Report Recommendations:
Conduct water quality monitoring to evaluate designated uses.

Housatonic River Watershed 2002 Water Quality Assessment Report (MA21-14 - LONG POND BROOK)

No recent quality assured data are available; thus, all uses are not assessed. Housatonic Water Works Company (WMA registration 10211306) withdraws from Long Pond.

Report Recommendations:
Conduct water quality monitoring to evaluate designated uses.

Historical and current Technical Memoranda (TM) produced by the MassDEP Watershed Planning Program are available here: Water Quality Technical Memoranda | Mass.gov and are organized by major watersheds in Massachusetts. Most of these TMs present the water chemistry and biological sampling results of WPP monitoring surveys. The TMs pertaining mainly to biological information (e.g., benthic macroinvertebrates, periphyton, fish populations) contain biological data and metrics not reported elsewhere. The data contained in the water quality TMs are also provided on the “Data” page (Water Quality Monitoring Program Data |

Mass.gov). Many of these TMs have helped inform Clean Water Act 305(b) assessment and 303(d) listing decisions.

Additional reports and studies that helped inform this watershed-based plan are summarized in **Table A-3**. Links are provided where available. For information about the other reports, please contact HVA.

Table A-3: Additional Reports related to the Green River

Year	Title	Prepared by	Description	Link
2013	Enhanced Implementation Plan: Preliminary Evaluation of Current Stormwater and Nonpoint Source Control Efforts in Massachusetts	Mass DEP, Division of Watershed Management	The purpose of this report...is to qualitatively assess existing federal, state, and local NPS programs and available data that could be used to track NPS remediation measures that reduce nitrogen exports to LIS... Massachusetts Department of Environmental Protection (MassDEP) decided to use this report to quantify NPS load reductions that have occurred during the last few years... to properly determine where data gaps exist and, more importantly, will provide guidance regarding data and information that could be used by all of the LIS watershed states to determine if the LIS TMDL NPS reduction goals are being achieved.	https://neiwpcc.org/wp-content/uploads/2020/08/LIS-TMDL_MA-State-Section.pdf
2013	Town of Great Barrington Master Plan	Town of Great Barrington with BRPC support	Describes a vision for the Town of Great Barrington (Two volumes)	https://www.townofgb.org/sites/g/files/vyhlif636/f/uploads/master_plan_volume_1.pdf
2013	Town of Great Barrington Open Space and Recreation Plan	Town of Great Barrington with BRPC support	Updates the 2007 OSRP. Provides an inventory of Great Barrington's land assets and recreational opportunities, and it establishes a plan to meet future recreation, and conservation needs and the town community's vision. Great Barrington is currently seeking funding to update this plan.	https://www.townofgb.org/sites/g/files/vyhlif636/f/uploads/open_space_and_recreation_plan_2013.pdf
2017	Green River Assessment Report & Action Plan	HVA	Conducted by HVA, this assessment provides a summary of observations and recommendations for the Green River.	https://hvatoday.org/wp-content/uploads/2018/02/Green-River-Assessment-Report_Final_2017.pdf
2020	Great Barrington Hazard Mitigation and Climate Adaptation Plan	Town of Great Barrington with BRPC support	Provides background information and an action plan for improving the climate resilience of the town and reducing the impact of weather and other hazards.	https://www.townofgb.org/sites/g/files/vyhlif636/f/uploads/great_barrington_hazard_mitigation_and_climate_adaptation_plan_mvp_sof_-_11192020.pdf
2020	Bacteria Monitoring in the Upper Housatonic Watershed	HVA	Annual report of HVA's water quality monitoring program including protocols, results and recommendations	HVA could provide a link (File is in the year's folder in the Berkshire Water Quality Data folder)
2021	Bacteria Monitoring in the Upper Housatonic Watershed	HVA	Annual report of HVA's water quality monitoring program including protocols, results and recommendations	HVA could provide a link (File is in the year's folder in the Berkshire Water Quality Data folder)

Year	Title	Prepared by	Description	Link
2022	Berkshire County Water Quality Monitoring Coalition Summary Report	HVA	Annual report of HVA and Hoosic River Watershed Association's water quality monitoring program including protocols, results and recommendations. Parameters sampled included: temperature, conductivity, surfactants, ammonia, salinity and chlorine.	HVA could provide a link (File is in the year's folder in the Berkshire Water Quality Data folder)
2022	THE DEVELOPER (Part Six): A different Prospect Lake campground is coming into view. Does it matter whom it's for?	Berkshire Edge News Source	Includes historical information about Prospect Lake and what the new owner proposes for the Prospect Lake Campground bought in 2022. The owner of this property also owns Prospect Lake dam which needs repair.	https://theberkshireedge.com/the-developer-part-six-a-different-prospect-lake-campground-is-coming-into-view-does-it-matter-who-its-for/
2022	Town of Egremont Municipal Vulnerability Preparedness (MVP) - Hazard Mitigation Plan (HMP)	Town of Egremont and Weston & Sampson	Provides background information and an action plan for improving the climate resilience of the town and reducing the impact of weather and other hazards.	https://egremont-ma.gov/DocumentCenter/View/930/Town-of-Egremont-2022-Municipal-Vulnerability-Preparedness-MVP-Hazard-Mitigation-Plan-HMP-Final-PDF?bidId=
2022	Egremont Road-Stream Crossing Management Plan	HVA	Provides an inventory and prioritization of replacement of the public and private road-stream crossings in the Town of Egremont. Culvert prioritization is based on flood risk, aquatic connectivity, and condition.	Contact HVA at (413) 344-9401 for a digital copy
2022	Great Barrington Road Stream Crossing Management Plan	HVA	Provides an inventory and prioritization of replacement of the public and private road-stream crossings in the Town of Great Barrington. Culvert prioritization is based on flood risk, aquatic connectivity, and condition. The Plan was adopted by the town.	Contact HVA at (413) 344-9401 for a digital copy
2023	Egremont Open Space and Recreation Plan (DRAFT-2023)	Town of Egremont and BRPC	Updates the town OSRP, this is still in draft form	https://egremont-ma.gov/DocumentCenter/View/1314/Draft-Open-Space-and-Recreation-Plan-2023-2030-Submitted-August-2023-PDF?bidId=
2022	Alford Road Stream Crossing Management Plan	HVA	Provides an inventory and prioritization of replacement of the public and private road-stream crossings in the Town of Alford. Culvert prioritization is based on flood risk, aquatic connectivity, and condition.	Contact HVA at (413) 344-9401 for a digital copy
2024	Draft Massachusetts Statewide Total Maximum Daily Load for Pathogen-Impaired Waterbodies	Watershed Planning Program Division of Watershed Management, Bureau of Water Resources MassDEP	Provides a framework to address bacterial and other pathogenic pollutants in the impaired waterbodies of Massachusetts including the Housatonic watershed	https://www.mass.gov/lists/total-maximum-daily-loads-by-watershed

Additional Water Quality Data

Water quality monitoring, primarily for E. coli has been conducted in the Green River watershed by the Housatonic Valley Association, Great Barrington Board of Health and the owner of the Prospect Lake Park. Table A-4 provides a summary of the programs conducted in 2007 and between 2020-2023; Table A-5 identifies sampling locations; and Table A-6 summarizes sampling results.

The *E. coli* data is summarized in **Table A-4** exceeded the Massachusetts Surface Water Quality Standards (MSWQS) (314 CMR 4.05(5)(f)3, 2022) for *E. coli*, which states that the geometric mean of all samples collected within any 90-day or smaller interval (typically based on a minimum of 5 samples) or no more than 10% of all such samples shall exceed 410 cfu per 100mL.

Table A-4

WATER QUALITY MONITORING PROGRAMS				
Year	**Program Description**	**Site Locations**	**Program Coordinator**	**Funding / Protocols**
2023	**E. coli* surface water sampling at two swimming locations on the Green River	Site 1: "Green River at Maple Ave" located downstream of the Route23/41 bridge. Site 2: "Green River Beach: located downstream of the Seekonk Cross Road Bridge.	Great Barrington BOH	Funded by the municipality/Sampling completed by the contractor, *Housatonic Basin Sampling & Testing* (https://www.housatonicbasin.com) Samples are collected weekly during June - August, in accordance with the Massachusetts Department of Public Health regulations related to public and semi-private bathing beaches. Analysis is completed by Microbac in Lee using the SM-9223B QT Method that quantifies a Most Probable Number (MPN). MPN results of greater than or equal to 235 MPN/100mL-MCL trigger beach closures until further testing is conducted to verify adequate water quality for bathing under the MCL. Nonconformance issues with respect to Sample Identification are recorded.
2023	**E. coli* surface water sampling in the Upper Housatonic Watershed	Alford Brook was monitored downstream of the East Road bridge (Site ID ALF110) which is downstream of agricultural operations	Housatonic Valley Association	Partially funded by a MassDEP Water Quality Grant/From June through September, sites were sampled every other week eight times in wet and dry weather.

WATER QUALITY MONITORING PROGRAMS				
Year	**Program Description**	**Site Locations**	**Program Coordinator**	**Funding / Protocols**
2022	*Surface water sampling in the Upper Housatonic Watershed	***Alford Brook*** was monitored at two sites, downstream of East Road bridge (Site ID ALF110) downstream of agricultural operations and downstream of Willson Road (ALF90). ALF90 was the only location available to sample the above agricultural operations but is not ideal as the water ponds below the culvert and the beavers are active in the area. ***Green River*** was monitored at one site (GNR400) located downstream of the Rte23/41 bridge and upstream of a swimming hole.	Housatonic Valley Association	MassDEP Water Quality Grant/Sites sampled from June through September, every other week 8 times in wet and dry weather. In addition to *E. coli,* sites were sampled for temperature, conductivity, surfactants, ammonia, salinity and chlorine.
2022	**E. coli* surface water sampling at two swimming locations on the Green River	Site 1: "Green River at Maple Ave" located downstream of the Route23/41 bridge; Site 2: "Green River Beach: located downstream of the Seekonk Cross Road Bridge.	Great Barrington BOH	Funded by the municipality/Sampling completed by the contractor, *Housatonic Basin Sampling & Testing* (https://www.housatonicbasin.com) Samples are collected weekly during June - August, in accordance with the Massachusetts Department of Public Health regulations related to public and semi-private bathing beaches. Analysis is completed by Microbac in Lee using the SM-9223B QT Method that quantifies a Most Probable Number (MPN). MPN results of greater than or equal to 235 MPN/100mL-MCL trigger beach closures until further testing is conducted to verify adequate water quality for bathing under the MCL. Nonconformance issues with respect to Sample Identification are recorded.

WATER QUALITY MONITORING PROGRAMS				
Year	**Program Description**	**Site Locations**	**Program Coordinator**	**Funding / Protocols**
2021	**E. coli* surface water sampling in the Upper Housatonic Watershed	***Alford Brook*** was monitored at two sites, upstream of East Road bridge (Site ID ALF100) downstream of agricultural operations and downstream of Willson Road (ALF90). ALF90 was the only location available to sample the above agricultural operations but is not ideal as the water ponds below the culvert and the beavers are active in the area. ***Green River*** was monitored at one site (GNR400) located downstream of the Rte23/41 bridge and upstream of a swimming hole.	Housatonic Valley Association	Partially funded by a MassDEP Water Quality Grant/From June through September, sites were sampled every other week seven times on Alford Brook and 5 times on Green River in wet and dry weather
2021	**E. coli* surface water sampling at Prospect Lake Park, Egremont	Beach at the campground	Private Owner	Private funding. Sampled weekly during the bathing season, 15 times

WATER QUALITY MONITORING PROGRAMS				
Year	**Program Description**	**Site Locations**	**Program Coordinator**	**Funding / Protocols**
2020	**E. coli* Surface Water Sampling in the Upper Housatonic River.	***Green River*** was monitored at three sites (***GNR400, GNR300 and GNR200***). ***Seekonk Brook*** was monitored at two sites (SKR300 and SKR400). Two sites on Alford Brook were added after *E coli results* were elevated on Seekonk Brook. **(Site ID ALF90 and ALF100).**	Housatonic Valley Association	Partially funded by a MassDEP Water Quality Grant/From June through September, sites were sampled every other week seven times on Alford Brook and 8 times on the Green River and Seekonk Brooks in wet and dry weather
2007	*Surface Water Sampling in the Housatonic River watershed	Green River was monitored at the Rte23/41 bridge (State ID W1112) for multiple parameters.	Mass DEP	MassDEP program/From May through September the Green River was sampled once a month for *E coli,* TSS, TN, and Ammonia.

Table A-5

Sampling Location Information							
STATE ID	**Site ID**	**Waterbody**	**Description**	**Municipality**	**Latitude**	**Longitude**	**NOTES**
	GNR200	Green River	Upstream of Rowe Road bridge	Egremont	42.20610196	-73.438995	Upstream of recreational swimming hole. Sampled by HVA for *E. coli* in 2020. Egremont BOH does not conduct *E. coli* sampling on the Green River.
	GNR300	Green River	Downstream of Seekonk Cross Road bridge described as **Green River Beach** in the Great Barrington Board of Health data.	Great Barrington	42.19113121	-73.3990689	Upstream of recreational swimming hole. During the summer season, this site is tested regularly by the Great Barrington Board of Health. Sampled by HVA for E coli in 2020.
W1112	GNR400	Green River	Upstream of the Rte 23/41 bridge and the swimming hole described as ***Green River at Maple Ave Bridge*** in the Great Barrington Board of Health data.	Great Barrington	42.17962898	-73.3793878	Upstream of recreational swimming hole. Sampled by HVA for E coli in 2020, 2021 and 2022. During the summer season, this site is tested regularly by the Great Barrington Board of Health.
	ALF 90	Alford Brook	Downstream of Willson Road Bridge	West Stockbridge	42.297736	-73.408268	Sample site added in 2020 season due to high *E. Coli* readings in Alford Brook at ALF100. Sampled by HVA for *E. coli* in 2020, 2021 and 2023.

Sampling Location Information							
STATE ID	**Site ID**	**Waterbody**	**Description**	**Municipality**	**Latitude**	**Longitude**	**NOTES**
	ALF100	Alford Brook	Upstream of the East Road Bridge	Alford	42.23842	-73.41156	Sampling site added 6/25/2020 due to high *E. coli* readings in Seekonk Brook. Sampled by HVA for *E. coli* in 2020 and 2021.
	ALF110	Alford Brook	Downstream of the East Road Bridge	Alford	42.2382544	-73.4117821	This sampling site replaced ALF100 in 2022 due to easier access. Sampled by HVA *for E. coli* in 2022 and 2023.
	SKR300	Seekonk Brook	Downstream of the Alford Road bridge	Alford	42.225278	-73.407552	Sampling conducted in 2020. Sample site originally upstream of the bridge but was moved to downstream of the bridge due to easier access.
	SKR400	Seekonk Brook	Upstream of the Division Street bridge	Great Barrington	42.21674765	-73.3980932	Sampled by HVA for *E. coli* in 2020.

Table A-6

Water Quality Results Analysis Summary		
Year	**Program Description**	**Results Summary**
2023	**E. coli* surface water sampling at two swimming locations on the Green River	***Green River at Maple Ave:*** Of the data received from the GB BOH (10 sampling events), the highest *E. coli* results were all wet weather samples (greater than 0.1" in 24 hours prior to sampling). On 6/13/23, 0.22" of rain were recorded with an *E. coli* result of 110.6 MPN; on 7/3/23, 1.31" of rain were recorded with an *E. coli* result of 233.3 MPN; on 7/10/23, 1.6" rain with an *E. coli* result of 193.5 MPN. Remaining samples ranged from 6.3 MPN - 93.3 MPN. ***Green River Beach:*** The highest *E. coli* results also occurred on the two wet weather sampling days (7/3/2023 - 223.7 MPN and 7/10/2023 - 344.1 MPN). The July 10th results exceeded the Mass. Dept. Of Public Health 235 MPN/100 ml threshold triggering beach closures. On 8/14/23, the *E. coli* results were 129 MPN in dry weather. However, a localized storm could have occurred.
2023	**E. coli* surface water sampling in the Upper Housatonic Watershed	***Alford Brook (ALF110***) was monitored downstream of the East Road bridge which is downstream of agricultural operations. 5/8 samples met the state SWQS of 126 cfu/100 ml as a geometric mean of all samples collected within a 90-day period. Two samples were slightly elevated (146.7 cfu/100 ml on 7/6/23 and 127.4 on 7/13/23) The highest reading occurred on 7/27/23, 365.4 cfu/100ml. For 7/27/23, conditions had been dry for 48 hours, 0.04 inches of rain fell 3 days prior to sampling. The season geomean was 85.44.
2022	*Surface water sampling in the Upper Housatonic Watershed	***Alford Brook (ALF110)*** met state standards 5/8 sampling events. Two samples were moderately elevated: On 6/28 the results were 224.7 cfu/100ml after 0.49 inches of rain in the previous 24 hours and on 9/20 the results were again 224.7 cfu/100 ml after about 0.6 inches of rain in the previous 48 hours. The highest *E. coli* result occurred on 9/6/2022. The results were >2419.6 cfu/100ml after a heavy rain the night before (about 2 inches in the prior 48 hours). It was raining at the time of sampling. The geomean of the season was 5.63. ***Green River (GNR400)*** met MA SWQS 6/8 sampling events. The results were recorded at 2419.6 cfu/100ml on 9/6 after heavy rain (about 2" in 48 hours) and were elevated on 9/20 at 204.6 cfu/100 ml The geomean of the with a rainfall of 0.60 inches. Additional parameters sampled indicated no issues. All results were within state standards, and no further sampling or investigation was deemed necessary. The season geomean was 3.88.

Water Quality Results Analysis Summary		
Year	**Program Description**	**Results Summary**
2022	**E. coli* surface water sampling at two swimming locations on the Green River	***Green River at Maple Ave:*** Of the data received from the GB BOH (13 sampling events) the highest *E. coli* results were 866.4 MPN on 7/19/22 and 579.4 MPN on 9/7/22. The remaining samples ranged from 23.8 MPN - 228.2 MPN with a geomean of 85.3 MPN. ***Green River Beach:*** The highest *E. coli* result 248.9 MPN also occurred on 9/7/22. The remaining samples ranged from 7.4 MPN to 127.2 MPN with a geomean of 48 MPN. According to Pittsfield Municipal Airport weather history, less than 0.1" of precipitation was recorded in the 24 hours prior to sampling on 7/19 and 9/7/22. However localized storms may have occurred. The weather history at Bradley International Airport indicates precipitation amounts of 0.61" on 7/19 and 1.27" on 9/7 during the 24 hours prior to the sampling date.
2021	**E. coli* surface water sampling at Prospect Lake Park, Egremont	Property owner sampled weekly 15 times during the bathing season. No exceedances reported. *Source: https://www.mass.gov/doc/2021-freshwater-beach-data-0/download*
2021	**E. coli* surface water sampling in the Upper Housatonic Watershed	Both Alford Brook sites ***(ALF100 and ALF90)*** met the state SWQS 4/7 sampling events. At ALF100 three samples were elevated: 6/17 results were 920.8 cfu/100ml with 0" of rain 24 hours prior to sampling and 0.16" of rain 72 hours prior to sampling; 7/1 results were 816.4 cfu/100 ml with 1.5" of rain 24 hours prior to sampling; 9/16 results were 461.1 cfu/100 ml with 0.37" of rain 24 hours prior to sampling and 1.04" of rain 48 hours prior to sampling. At ALF90 the three samples that were elevated occurred on 7/1 (547.5 cfu/100ml); 8/11 (238.2 cfu/100ml) and 9/16 (410.6 cfu/100ml). The geomean of the season for ALF100 was 157.78 and for ALF90 it was 140.99, the geomean of both AFL100 and ALF90 was 149.15. ***GNR400*** met the state standards 4/5 sampling events. On 7/1 with 1.5" of rain 24 hours prior the results were greater than 2419.6. The geomean of the results, without the 7/1 results, was 82.3 cfu/100ml.

Water Quality Results Analysis Summary		
Year	**Program Description**	**Results Summary**
2020	**E. coli* Surface Water Sampling in the Upper Housatonic River.	The results from the Alford Brook sites remained elevated until late August and September. ***ALF90 and ALF100*** met the state geometric mean standard of 126 cfu/100ml for 2/7 sampling events. The 4 samples collected from June – early August had results that ranged from about 300 – 1700 cfu/100ml. The bacteria levels lessened to <126 cfu/100ml in late Aug and September. ***GNR200*** met the state standards for 6/8 sampling events. Slightly elevated readings occurred on 7/14/20 (235.9) and 8/11 (160.7 cfu/100ml). The geomean for the season was 65.87. ***GNR300*** met the state standards for all 8 sampling events. The geomean for the season was 49.80. ***GNR400*** met the state standards for 50% of the sampling events with elevated readings on 6/25 (190.4 cfu/100ml), 7/14 (410.6 cfu/100ml) 7/28 (365.4 cfu/100ml) and 8/11 (>2419.6 cfu/100ml). On 8/11 the water quality monitors reported localized heavy thunderstorms. The geomean of the season was 209.95 cfu/100ml. Seekonk Brook sample sites ***SKR300 and SKR400*** met the state standards 3/8 sampling events. The highest reading occurred on 6/25 with 0.84 inches of rain within 48 hours (SKR300, 1553 cfu/100ml; SKR400, 920.8 cfu/100ml). The geomean of the season for SKR300 was 228.51 cfu/100ml and for SKR400 was 157.24 cfu/100ml. The geomean of the season for both SKR300 and SKR400 was 189.56 cfu/100ml.
2007	*Surface Water Sampling in the Housatonic River watershed	Green River was monitored at the Rte23/41 bridge by MassDEP *(State ID W1112) E. coli* results exceeded state geometric mean standard of 126 cfu/100ml for 1/5 sampling events. On 7/17, results were 810 cfu/100ml. All the other results were unremarkable.

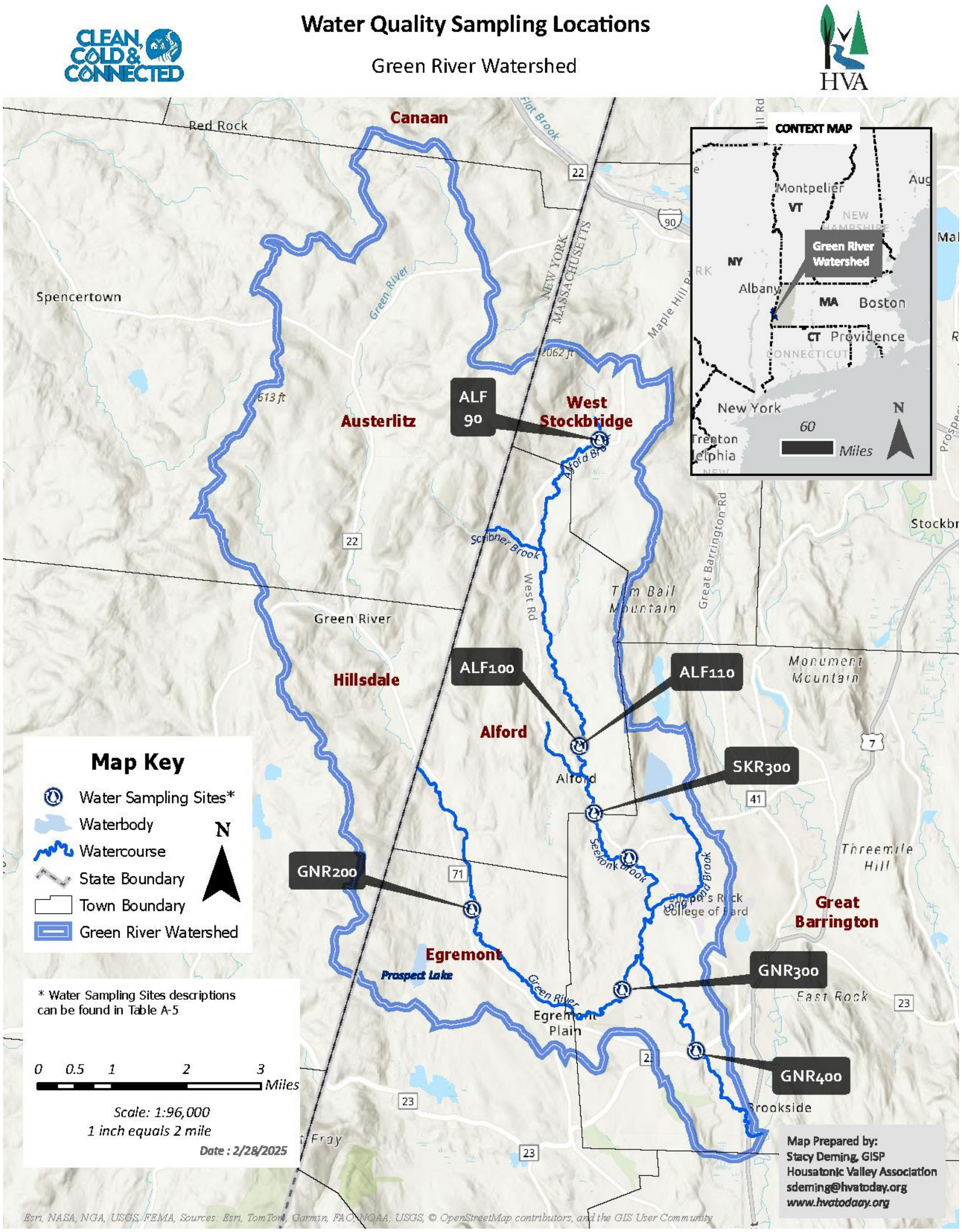


Figure A-2: HVA's Water Quality Sampling Site Locations

Water Quality Impairments

Known water quality impairments, as documented in the Massachusetts Department of Environmental Protection (MassDEP) 2018/2020 Massachusetts Integrated List of Waters (MassDEP, 2021), are listed below. Impairment categories from the Integrated List are as follows:

Table A-7: 2022 MA Integrated List of Waters Categories

Integrated List Category	Description
1	Unimpaired and not threatened for all designated uses.
2	Unimpaired for some uses and not assessed for others.
3	Insufficient information to make assessments for any uses.
4	Impaired or threatened for one or more uses, but not requiring calculation of a Total Maximum Daily Load (TMDL), including: 4a: TMDL is completed 4b: Impairment controlled by alternative pollution control requirements 4c: Impairment not caused by a pollutant - TMDL not required
5	Impaired or threatened for one or more uses and requiring preparation of a TMDL.

Table A-8: Water Quality Impairments (MassDEP)

Assessment Unit ID	Waterbody	Integrated List Category	Designated Use	Impairment Cause	Impairment Source
MA21062	**Long Pond**	**4C**	Fish, other Aquatic Life and Wildlife	EURASIAN WATER MILFOIL, MYRIOPHYLLUM SPICATUM	INTRODUCTION OF NON-NATIVE ORGANISMS (ACCIDENTAL OR INTENTIONAL)
MA21084	**Prospect Lake**	**4C**	Fish, other Aquatic Life and Wildlife	CURLY-LEAF PONDWEED	INTRODUCTION OF NON-NATIVE ORGANISMS (ACCIDENTAL OR INTENTIONAL)
MA21084	**Prospect Lake**	**4C**	Fish, other Aquatic Life and Wildlife	NON-NATIVE AQUATIC PLANTS	INTRODUCTION OF NON-NATIVE ORGANISMS (ACCIDENTAL OR INTENTIONAL)
MA21-14	**Long Pond Brook**	**4C**	Fish, other Aquatic Life and Wildlife	DEWATERING	IMPACTS FROM HYDROSTRUCTURE FLOW REGULATION/MODIFICATION

The impaired waterbodies listed in **Table A-8** are identified in **Figure A-1**.

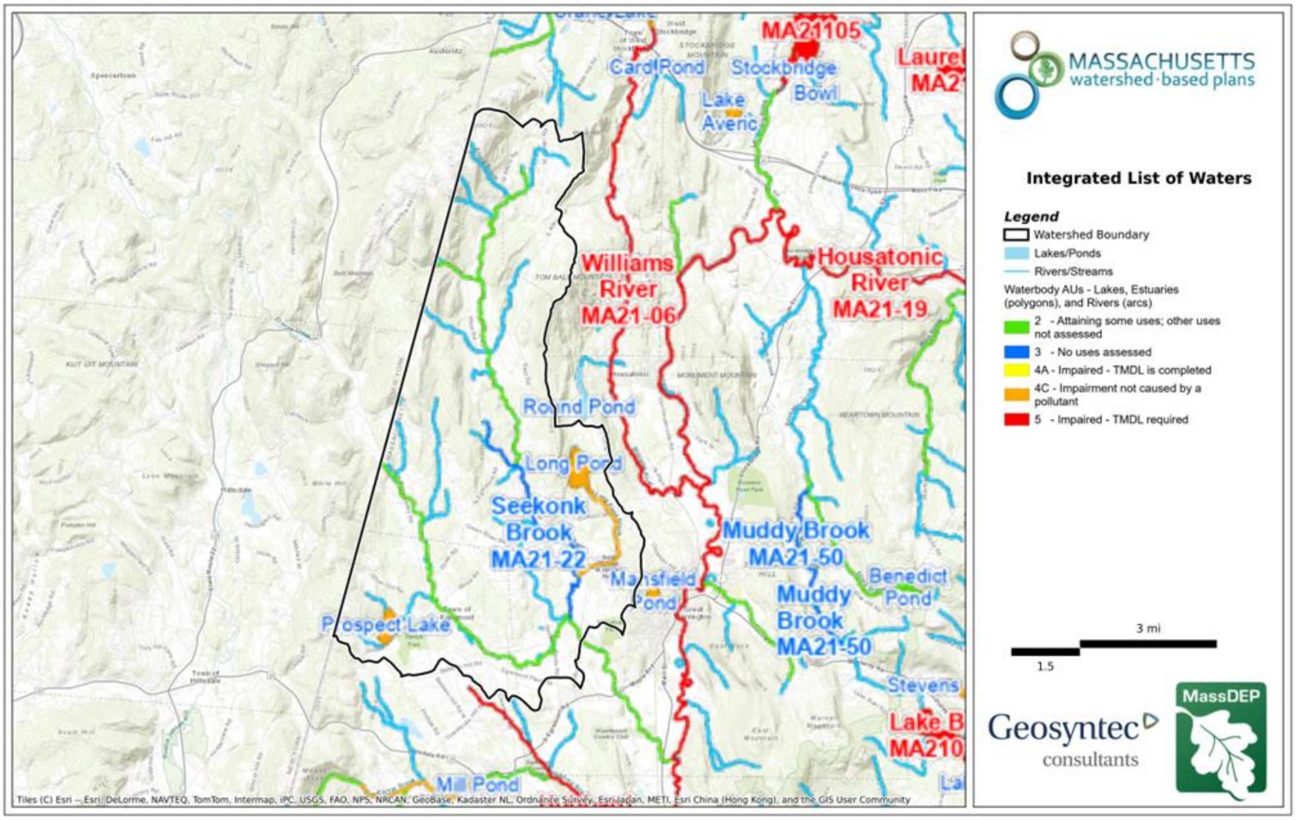


Figure A-3: Watershed Water Quality Impairments Map (MassGIS, 2007; MassGIS, 1999; MassGIS, 2001; USGS, 2016; MassGIS, 2023)

Water Quality Goals

Water quality goals may be established for a variety of purposes, including the following:

a.) For **water bodies with known impairments**, a Total Maximum Daily Load (TMDL) is established by MassDEP and the United States Environmental Protection Agency (USEPA) as the maximum amount of the target pollutant that the waterbody can receive and still safely meet water quality standards. If the waterbody has a TMDL for total phosphorus (TP) or total nitrogen (TN), or total suspended solids (TSS), that information is provided below and included as a water quality goal.

b.) For **water bodies without a TMDL for total phosphorus** (TP), a default water quality goal for TP is based on target concentrations established in the Quality Criteria for Water (USEPA, 1986) (also known as the "Gold Book"). The Gold Book states that TP should not exceed 50 ug/L in any stream at the point where it enters any lake or reservoir, nor 25 ug/L within a lake or reservoir. For the purposes of developing WBPs, MassDEP has adopted 50 ug/L as the TP target for all streams at their downstream discharge point, regardless of which type of water body the stream discharges to.

c.) Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2022) prescribe the minimum water quality criteria required to sustain a waterbody's designated uses. This watershed is a Class 'B' waterbody. The water quality goal for fecal coliform bacteria is based on the Massachusetts Surface Water Quality Standards.

Table A-9: Surface Water Quality Classification by Assessment Unit

Assessment Unit ID	Waterbody	Class
MA21-14	Long Pond Brook	B
MA21-22	Seekonk Brook	B
MA21-23	Green River	B
MA21-44	Alford Brook	B
MA21-45	Scribner Brook	B

d.) **Other water quality goals set by the community** (e.g., protection of high quality waters, in-lake phosphorus concentration goal to reduce recurrence of cyanobacteria blooms, etc.).

Table A-10: Water Quality Goals

Pollutant	Goal	Source
Total Phosphorus (TP)	Total phosphorus should not exceed: --50 ug/L in any stream --25 ug/L within any lake or reservoir	Quality Criteria for Water (USEPA, 1986)
Bacteria	**Class A Standards** • Water supply intakes in unfiltered public water supplies: For fecal coliform, fecal coliform shall not exceed 20 organisms per 100 mL in all samples taken in any six-month period. For total coliform, total coliform shall not exceed 100 organisms per 100 mL in 90% of samples taken in any six-month period. If both fecal coliform and total coliform are measured, then only the fecal coliform criterion must be met. • Primary contact recreation: For *E. coli*, geometric mean of samples collected within any 90-day or smaller period shall not exceed 126 cfu/100 mL, and no more than 10% of all such samples shall exceed 410 cfu/100 mL. For enterococci,	Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2022)

	geometric mean of all samples collected within any 90-day or smaller period shall not exceed 35 cfu/100 mL, and no more than 10% of all such samples shall exceed 130 cfu/100 mL. o Waters adjacent to any public or semi-public beach, at a location used for bathing and swimming purposes: For *E. coli*, geometric mean of samples collected within any 30-day or smaller period shall not exceed 126 cfu/100 mL, and no more than 10% of all such samples shall exceed 410 cfu/100 mL. For enterococci, geometric mean of all samples collected within any 30-day or smaller period shall not exceed 35 cfu/100 mL, and no more than 10% of all such samples shall exceed 130 cfu/100 mL.	
Bacteria	**Class B Standards** • Primary contact recreation: For *E. coli*, geometric mean of samples collected within any 90-day or smaller period shall not exceed 126 cfu/100 mL, and no more than 10% of all such samples shall exceed 410 cfu/100 mL. For enterococci, geometric mean of all samples collected within any 90-day or smaller period shall not exceed 35 cfu/100 mL, and no more than 10% of all such samples shall exceed 130 cfu/100 mL. o Waters adjacent to any public or semi-public beach, at a location used for bathing and swimming purposes or waters impacted by combined sewer overflows (CSO) or publicly owned treatment works (POTW) discharges: For *E. coli*, geometric mean of samples collected within any 30-day or smaller period shall not exceed 126 cfu/100 mL, and no more than 10% of all such samples shall exceed 410 cfu/100 mL. For enterococci, geometric mean of all samples collected within any 30-day or smaller period shall not exceed 35 cfu/100 mL, and no more than 10% of all such samples shall exceed 130 cfu/100 mL.	Massachusetts Surface Water Quality Standards (MassDEP, 2022)

Note: *There may be more than one water quality goal for bacteria due to different Massachusetts Surface Water Quality Standards Classes for different Assessment Units within the watershed.*

Land Use and Impervious Cover Information

Land use information and impervious cover is presented in the tables and figures below. Land use source data is from 2016 and was obtained from MassGIS (2019). The land use and land cover categories were matched with the associated land use category using the methodology identified in the MassDEP guidance document "2016 Massachusetts Small MS4 Permit Pollutant Loading Export Rates applied to the 2016 Massachusetts Land Use/Land Cover GIS Dataset" (MassDEP, 2023b). **Table A-11** includes the area and percent of watershed of each of these land use categories.

Watershed Land Uses

Table A-11: Watershed Land Uses

Land Use	Area (acres)	% of Watershed
Agriculture	2687.14	15.3
Commercial	271.31	1.5
Forest	11792.65	67.2
High Density Residential	339.14	1.9
Highway	217.14	1.2
Industrial	0.52	0
Medium Density Residential	1263.83	7.2
Open Land	722.97	4.1
Water	258.71	1.5
High Density Residential	6.46	0

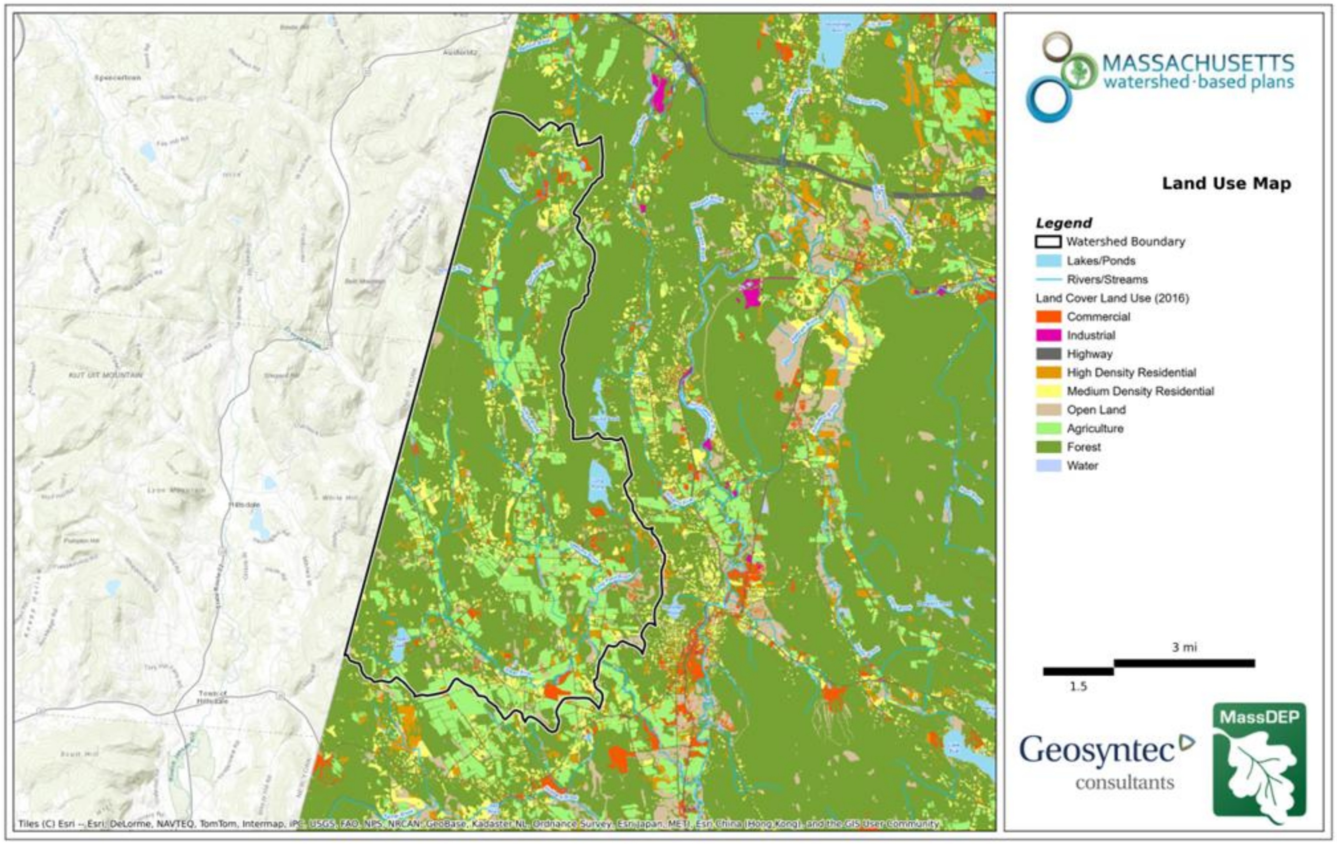


Figure A-4: Watershed Land Use Map (MassGIS, 2007; MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

Ctrl + Click on the map to view a full sized image in your web browser.

Watershed Impervious Cover

There is a strong link between impervious land cover and stream water quality. Impervious cover includes land surfaces that prevent the infiltration of water into the ground, such as paved roads and parking lots, roofs, basketball courts, etc. The total impervious area was estimated for the watershed based on the land use and impervious cover source data from 2016 (MassGIS, 2019). The total impervious area for the watershed is presented in **Table A-7**.

Impervious areas that are directly connected (DCIA) to receiving waters (via storm sewers, gutters, or other impervious drainage pathways) produce higher runoff volumes and transport stormwater pollutants with greater efficiency than disconnected impervious cover areas which are surrounded by vegetated, pervious land. Runoff volumes from disconnected impervious cover areas are reduced as stormwater infiltrates when it flows across adjacent pervious surfaces.

An estimate of DCIA for the watershed was calculated based on the Sutherland equations. USEPA provides guidance (USEPA, 2010) on the use of the Sutherland equations to predict relative levels of connection and disconnection based on the type of stormwater infrastructure within the **total impervious area (TIA)** of a watershed. The Sutherland equations are a set of empirical equations used to calculate the percentage of directly connected impervious areas (DCIA) in urban watersheds. The equations were developed by R.C. Sutherland in 1995 and are based on USGS data. EPA uses the equations to estimate DCIA based on land use types. Within each subwatershed, the total area of each land use was summed and used to calculate the percent TIA.

Table A-12: TIA and DCIA Values for the Watershed

	Estimated TIA (%)	Estimated DCIA (%)
Watershed	2.5	2

The relationship between TIA and water quality can generally be categorized as shown in **Table A-8** (Schueler et al. 2009):

Table A-13: Relationship between Total Impervious Area (TIA) and water quality (Schueler et al. 2009)

% Watershed Impervious Cover	Stream Water Quality
0-10%	Typically high quality, and typified by stable channels, excellent habitat structure, good to excellent water quality, and diverse communities of both fish and aquatic insects.
11-25%	These streams show clear signs of degradation. Elevated storm flows begin to alter stream geometry, with evident erosion and channel widening. Streams banks become unstable, and physical stream habitat is degraded. Stream water quality shifts into the fair/good category during both storms and dry weather periods. Stream biodiversity declines to fair levels, with most sensitive fish and aquatic insects disappearing from the stream.

26-60%	These streams typically no longer support a diverse stream community. The stream channel becomes highly unstable, and many stream reaches experience severe widening, downcutting, and streambank erosion. Pool and riffle structure needed to sustain fish is diminished or eliminated and the substrate can no longer provide habitat for aquatic insects, or spawning areas for fish. Biological quality is typically poor, dominated by pollution tolerant insects and fish. Water quality is consistently rated as fair to poor, and water recreation is often no longer possible due to the presence of high bacteria levels.
>60%	These streams are typical of “urban drainage”, with most ecological functions greatly impaired or absent, and the stream channel primarily functioning as a conveyance for stormwater flows.

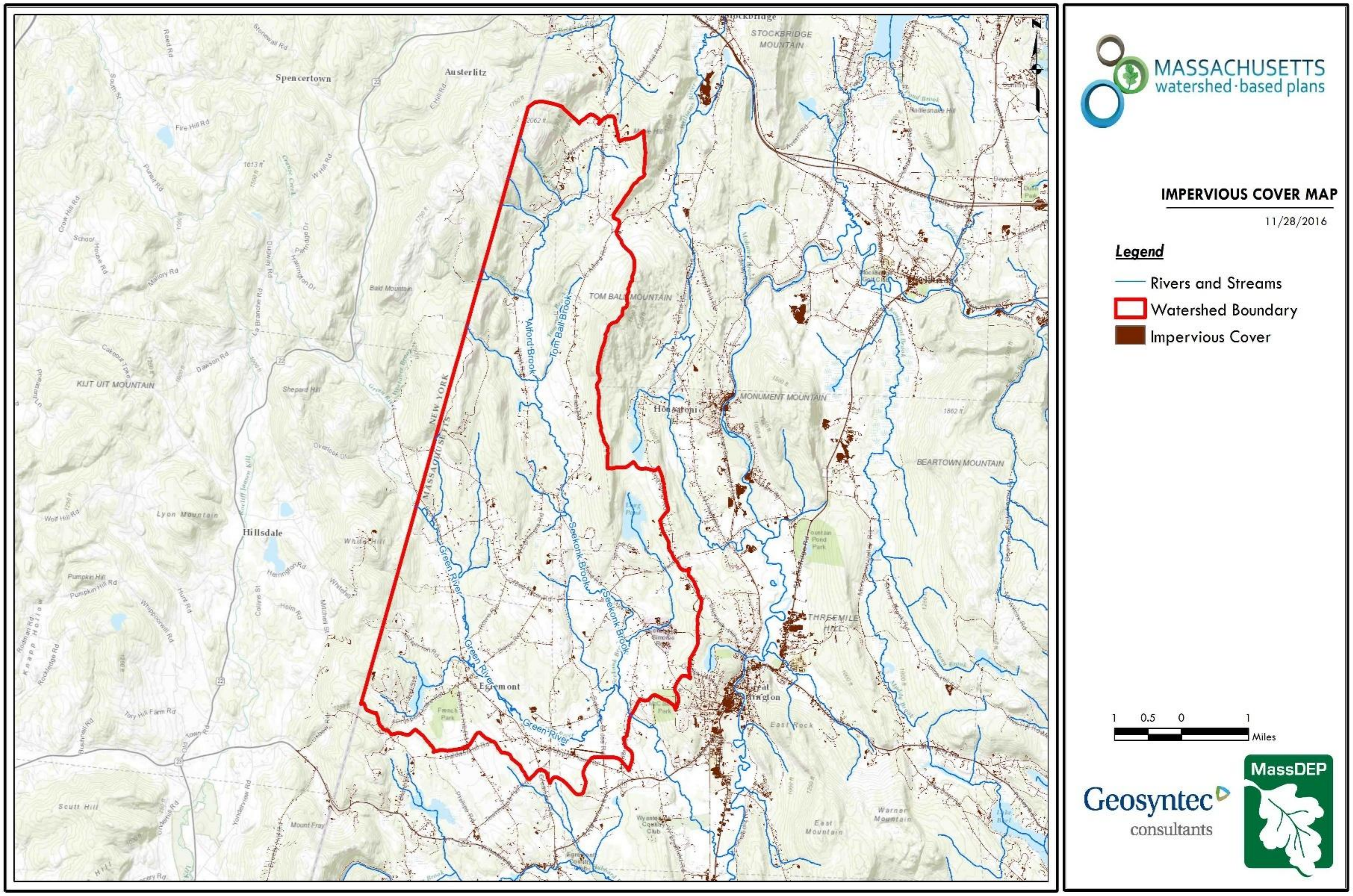


Figure A-5: Watershed Impervious Surface Map (MassGIS, 2007; MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

Ctrl + Click on the map to view a full sized image in your web browser.

Pollutant Loading

A Geographic Information System (GIS) was used for the pollutant loading analysis. The land use data (MassGIS, 2009b) was intersected with impervious cover data (MassGIS, 2009a) and United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soils data (USDA NRCS and MassGIS, 2012) to create a combined land use/land cover grid. The grid was used to sum the total area of each unique land use/land cover type.

Pollutant loading for key nonpoint source pollutants in the watershed was estimated by multiplying each land use/cover type area by its pollutant load export rate (PLER) as follows:

$$L_n = A_n * P_n$$

Where L_n = Loading of land use/cover type n (lb/yr); A_n = area of land use/cover type n (acres); P_n = pollutant load export rate of land use/cover type n (lb/acre/yr)

The PLERs are an estimate of the annual total pollutant load exported via stormwater from a given unit area of a particular land cover type. The PLER values for TN, TP and TSS were obtained from USEPA (USEPA, 2020; UNHSC, 2018, Tetra Tech, 2015) (see values provided in Appendix A). **Table A-14** presents the estimated land-use based TN, TP and TSS pollutant loading in the watershed.

Table A-14: Estimated Pollutant Loading for Key Nonpoint Source Pollutants

Land Use Type	Pollutant Loading		
	Total Phosphorus (TP) (lbs/yr)	Total Nitrogen (TN) (lbs/yr)	Total Suspended Solids (TSS) (tons/yr)
Agriculture	1,206	7,012	41.66
Commercial	122	1,096	13.78
Forest	1,579	6,317	173.72
High Density Residential	152	1,160	16.35
Highway	338	2,426	125.02
Industrial	0	1	0.01
Medium Density Residential	512	4,363	61.21
Open Land	150	1,505	22.25
TOTAL	4,059	23,880	454.01

These estimates do not consider loads from point sources or septic systems.

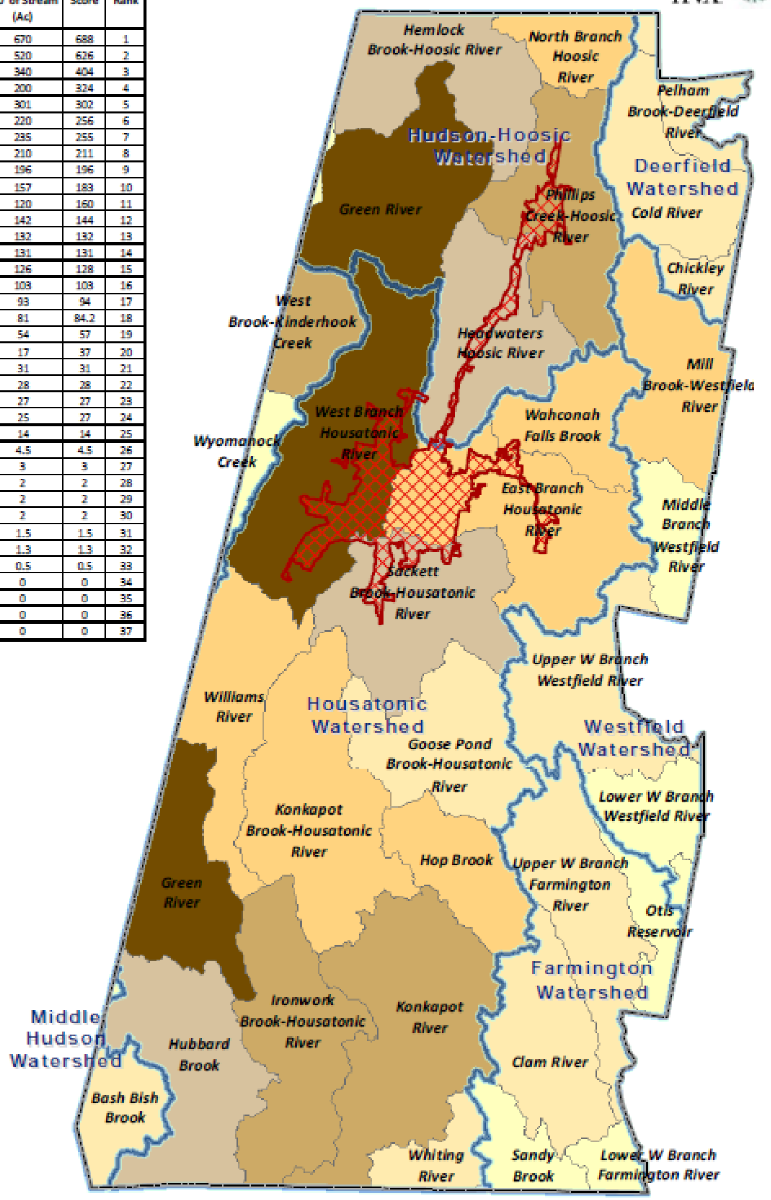
Pollutant loading information:

HVA has conducted a GIS analysis to understand which subwatersheds of the Housatonic River are most likely experiencing stream health impacts from agriculture, and contributing to downstream impairments, and evaluated that against our water quality data and data collected by our partners under an approved QAPP by MassDEP and EPA. We first analyzed the intersection of cultivated crops and pasture within a 300-foot buffer of all streams. The area (acres) of cultivated crops within the buffer were multiplied by a weight of 2 and the area of pasture within the buffer by 1. The sum of these two weighted values equals the score depicted and used to rank each subwatershed. This analysis identified the Green River watershed in Berkshire County as an area where on-farm conservation planning and Ag NPS pollution BMP implementation could have a significant positive impact (Figure A-4). Agricultural BMPs that we expect to implement in partnership with farmers in the Green River are outlined in Element C of this Watershed Based Plan.

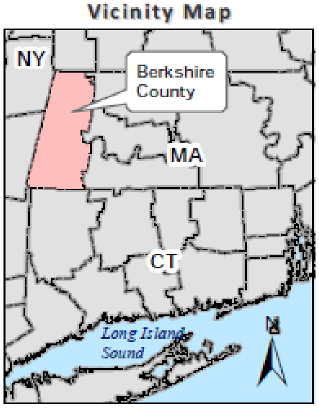
Designated MS4 Areas & Potential Agricultural Impacts

Berkshire County, Massachusetts

Subwatershed (HUC12)	Watershed (HUC8)	Cultivated Crops within 300' of Stream (Ac)	Pasture within 300' of Stream (Ac)	Score	Rank
West Branch Housatonic River	Housatonic	9	670	688	1
Green River	Hoosic	53	520	626	2
Green River	Housatonic	31	340	404	3
Ironwork Brook-Housatonic River	Housatonic	62	200	324	4
Phillips Creek-Hoosic River	Hoosic	0.5	301	302	5
Konkapot River	Housatonic	18	220	256	6
West Brook-Kinderhook Creek	Middle Hudson	10	235	255	7
Headwaters Hoosic River	Hoosic	0.5	210	211	8
Sackett Brook-Housatonic River	Housatonic	0	196	196	9
Hemlock Brook-Hoosic River	Hoosic	13	157	183	10
Hubbard Brook	Housatonic	20	120	160	11
Williams River	Housatonic	1	142	144	12
Wahconah Falls Brook	Housatonic	0	132	132	13
Hop Brook	Housatonic	0	131	131	14
East Branch Housatonic River	Housatonic	1	126	128	15
Mill Brook-Westfield River	Westfield	0	103	103	16
North Branch Hoosic River	Hoosic	0.5	93	94	17
Konkapot Brook-Housatonic River	Housatonic	1.6	81	84.2	18
Goose Pond Brook-Housatonic River	Housatonic	1.5	54	57	19
Whiting River	Housatonic	10	17	37	20
Upper West Branch Westfield River	Westfield	0	31	31	21
Cold River	Deerfield	0	28	28	22
Clam River	Farmington	0	27	27	23
Upper West Branch Farmington River	Farmington	1	25	27	24
Bash Bish Brook	Middle Hudson	0	14	14	25
Pelham Brook-Deerfield River	Deerfield	0	4.5	4.5	26
Chickley River	Deerfield	0	3	3	27
Lower West Branch Westfield River	Westfield	0	2	2	28
Wyomanock Creek	Middle Hudson	0	2	2	29
Lower West Branch Farmington River	Farmington	0	2	2	30
Sandy Brook	Farmington	0	1.5	1.5	31
Otis Reservoir	Farmington	0	1.3	1.3	32
Middle Branch Westfield River	Westfield	0	0.5	0.5	33
Headwaters Little Hoosic River	Hoosic	0	0	0	34
Stony Kill	Middle Hudson	0	0	0	35
Cobble Mountain Reservoir	Westfield	0	0	0	36
Headwaters Roeliff Jansen Kill	Middle Hudson	0	0	0	37



Vicinity Map



Legend

Regulated Area (Based on 2010 Census)

Watersheds of Berkshire County

Watersheds of Berkshire County

Subwatersheds (HUC12)

Score

- 0-2
- 2.1-57
- 57.1- 144
- 144.1 - 211
- 211.1 - 324
- 324.1 - 976

N

Data Sources:
Landcover-Land Use: NLCD (2016)
Boundaries: Northeast Political Boundaries
Integrated waters: Mass GIS (2014)
Regulated Area: Mass GIS/US EPA Region 1
GIS Center Map #8824, 11/19/2012

0 12.5 25 50 75 100 Miles

Subwatersheds were ranked for potential agricultural impact by identifying the intersection of cultivated crops and pasture within a 300 foot buffer of all streams. The area (acres) of cultivated crops within the buffer was multiplied by a weight of 2 and the area of pasture within the buffer by 1. The sum of these two weighted values equals the score depicted, and used to rank each subwatershed

Date: 6/2/2020

Figure A-6: Designated MS4 Areas & Potential Agricultural Impacts in Berkshire County

Element B: Determine Pollutant Load Reductions Needed to Achieve Water Quality Goals

Element B of your WBP should:

Determine the pollutant load reductions needed to achieve the water quality goals established in Element A. The water quality goals should incorporate Total Maximum Daily Load (TMDL) goals, when applicable. For impaired water bodies, a TMDL establishes pollutant loading limits as needed to attain water quality standards.

Estimated Pollutant Loads

Table B-1 lists estimated pollutant loads for the following primary nonpoint source (NPS) pollutants: total phosphorus (TP), total nitrogen (TN), total suspended solids (TSS). These estimated loads are based on the pollutant loading analysis presented in Section 4 of Element A. *E. coli* and bacteria loading information and reduction estimates are not calculated in this element as no reliable pollutant load export rates exist for these parameters. Should that change, this WBP will be updated to reflect new systems for calculating pollution load reductions.

Water Quality Goals

Water quality goals for primary NPS pollutants are listed in **Table B-1** based on the following:

- TMDL water quality goals (if a TMDL exists for the water body);
- For all water bodies, including impaired waters that have a pathogen TMDL, the water quality goal for bacteria is based on the Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2022) that apply to the Water Class of the selected water body.
- If the water body does not have a TMDL for TP, a default target TP concentrations is provided which is based on guidance provided by the USEPA in Quality Criteria for Water (1986), also known as the "Gold Book". Because there are no similar default water quality goals for TN and TSS, goals for these pollutants are provided in **Table B-1** only if a TMDL exists or alternate goal(s) have been optionally established by the WBP author.
- According to the USEPA Gold Book, total phosphorus should not exceed 50 ug/L in any stream at the point where it enters any lake or reservoir. The water quality loading goal was estimated by multiplying this target maximum phosphorus concentration (50 ug/L) by the estimated annual watershed discharge for the selected water body. To estimate the annual watershed discharge, the mean flow was used, which was estimated based on United States Geological Survey (USGS) "Runoff Depth" estimates for Massachusetts (Cohen and Randall, 1998). Cohen and Randall (1998) provide statewide estimates of annual Precipitation (P), Evapotranspiration (ET), and Runoff (R) depths for

the northeastern U.S. According to their method, Runoff Depth (R) is defined as all water reaching a discharge point (including surface and groundwater), and is calculated by:

$$P - ET = R$$

A mean Runoff Depth R was determined for the watershed by calculating the average value of R within the watershed boundary. This method includes the following assumptions/limitations:

a. For lakes and ponds, the estimate of annual TP loading is averaged across the entire watershed. However, a given lake or reservoir may have multiple tributary streams, and each stream may drain land with vastly different characteristics. For example, one tributary may drain a highly developed residential area, while a second tributary may drain primarily forested and undeveloped land. In this case, one tributary may exhibit much higher phosphorus concentrations than the average of all streams in the selected watershed.

b. The estimated existing loading value only accounts for phosphorus due to stormwater runoff. Other sources of phosphorus may be relevant, particularly phosphorus from on-site wastewater treatment (septic systems) within close proximity to receiving waters. Phosphorus does not typically travel far within an aquifer, but in watersheds that are primarily unsewered, septic systems and other similar groundwater-related sources may contribute a significant load of phosphorus that is not captured in this analysis. As such, it is important to consider the estimated TP loading as "the expected TP loading from stormwater sources."

c. If the calculated water quality goal is higher than the existing estimated total load; the water quality goal is automatically set equal to the existing estimated total load.

Table B-1: Pollutant Load Reductions Needed

Pollutant	Existing Estimated Total Load	Water Quality Goal	Required Load Reduction
Total Phosphorus	3632 lbs/yr	3632 lbs/yr	0 lbs/yr
Total Nitrogen	21577 lbs/yr		
Total Suspended Solids	567 ton/yr		
Bacteria	*MSWQS for bacteria are concentration standards (e.g., colonies of fecal coliform bacteria per 100 ml), which are difficult to predict based on estimated annual loading.*	**Class B Standards** • Primary contact recreation: For *E. coli*, geometric mean of samples collected within any 90-day or smaller period shall not exceed 126 cfu/100 mL, and no more than 10% of all such samples shall exceed 410 cfu/100 mL. For	

		enterococci, geometric mean of all samples collected within any 90-day or smaller period shall not exceed 35 cfu/100 mL, and no more than 10% of all such samples shall exceed 130 cfu/100 mL. o Waters adjacent to any public or semi-public beach, at a location used for bathing and swimming purposes or waters impacted by combined sewer overflows (CSO) or publicly owned treatment works (POTW) discharges: For *E. coli*, geometric mean of samples collected within any 30-day or smaller period shall not exceed 126 cfu/100 mL, and no more than 10% of all such samples shall exceed 410 cfu/100 mL. For enterococci, geometric mean of all samples collected within any 30-day or smaller period shall not exceed 35 cfu/100 mL, and no more than 10% of all such samples shall exceed 130 cfu/100 mL.	

Water Quality Recommendations for the Green River

Absent a categorized impairment for nutrients, bacteria, or total suspended solids, this WBP does not outline specific quantities required for load reductions to meet SWQS. Though the Green River currently meets SWQS, to maintain and enhance water quality that supports Class B use goals, HVA and project partners will plan and implement pollution reduction BMPs described in Element C. The town of Great Barrington and HVA have collected water quality data which demonstrate periodic exceedances of *E. coli* which often require the closure of public swimming areas and negatively affect native aquatic organisms. This WBP represents an effort to proactively address these impacts before they rise to the level of a MassDEP categorized impairment.

Element C: Describe management measures that will be implemented to achieve water quality goals

Element C: A description of the nonpoint source management measures needed to achieve the pollutant load reductions presented in Element B, and a description of the critical areas where those measures will be needed to implement this plan.

Ongoing and Future Management Measures

As presented in Element A **Table A-11**, agriculture accounts for 15.3% of the total land use (approximately 2687.14 acres) within the Green River watershed according to data from 2016 obtained from MassGIS. Next to forest cover, farms constitute the second largest category of land use within the Green River and a likely source of *E. coli* contamination identified through water quality testing programs enumerated in **Table A-4**.
While agriculture is a vital part of the landscape, culture and economy of this region, on-farm management of nutrients, stream corridor modifications, and other elements of agricultural production may contribute to water quality impairments for recreation and aquatic life, both locally and in downstream waters. Agriculture can be a significant source of nutrients, pathogens, sediment, pesticides and salts to surface water, but impacts from individual farms vary considerably. Local water quality impairments in the region are primarily related to pathogens—primarily *E. coli*—from livestock manure; phosphorus from livestock manure, synthetic fertilizers and Total Suspended Solids/sediment from tilled area erosion and stream instability. Further downstream, phosphorus from Upper Housatonic agricultural operations contribute to seasonal Hazardous Algae Blooms in Housatonic River impoundments in Connecticut (Lake Lillinonah, Lake Zoar). Nitrogen from Upper Housatonic agricultural operations contribute to seasonal hypoxia in Long Island Sound, and pathogens, pesticides and salts also impact the productivity and safety of shellfish beds.

This WBP recommends a suite of both structural and non-structural Best Management Practices (BMPs) to manage stormwater runoff and mitigate impacts from nonpoint source pollution. Structural BMPs typically involve engineered systems that retain, divert, filter or otherwise manage stormwater to prevent or mitigate runoff of pollutants into nearby freshwater ecosystems. Non-structural BMPs focus on preventative measures and land management practices which can include proactive site planning, street sweeping, catch basin maintenance, road salt management, spill prevention, or education and outreach that promotes stormwater management on municipal or private property. Ag NPS BMPs range from structural practices—such as riparian buffers, manure storage improvements, and livestock exclusion fencing—to non-structural measures like cover cropping, nutrient management, and rotational grazing, all designed to reduce nutrient, sediment, and bacteria runoff to waterways. Though the management measures outlined in this section are largely focused on Ag NPS pollution reduction, we also include some baseline BMP strategies that would apply to both municipal officials and private landowners.

Completed Assessment, Planning, and Management Measures

In FY23, HVA was awarded MassDEP Section 319 funding for a program dedicated to "Increasing the Pace of On-Farm Watershed Restoration in Berkshire County," which includes building relationships with local partners and agricultural producers with the goal of implementing Ag NPS pollution reduction BMPs in target subwatersheds. The Green River was selected by the Berkshire Ag NPS Pollution Partnership—which include the Berkshire

Conservation District, Berkshire Ag Ventures, Berkshire Grown, NRCS, Berkshire Regional Planning Commission, project consultants, and HVA—as a priority sub watershed for producer outreach, conservation planning, and implementation of Ag NPS BMPs.

HVA staff, with support from partners and consultants, pursued initial field reconnaissance to identify potential Ag NPS pollution reduction projects on participating farms, using protocols based on the Center for Watershed Protection's Unified Stream Assessment (USA) and the NRCS Conservation Planning process. Both of these protocols provide frameworks for documenting potential Ag NPS reduction projects that minimize subjectivity and facilitate project prioritization based on natural resource conservation and long-term sustainability of agricultural operations.

HVA staff identified three farm properties with fields cleared to the river's edge and calculated a combined 2 acres of riparian buffer that could be restored with native trees, shrubs, and grasses. This calculation is based on a prospective buffer width of 30 feet. A combination of desktop analysis and farm site visits also revealed extensive stream bank instability, erosion, and deposition of sediment all of which contribute to water quality impacts that this WBP intends to address. At one project location, staff observed a failing stream bank approximately 20 feet tall and 604 linear feet along the stream edge. Based on a revegetated 30-foot-wide buffer adjacent to the eroding streambank, this stabilization and restoration project would encompass approximately .42 acres. HVA intends to partner with NRCS to develop Conservation Plans tailored to these specific resource concerns while also working with consultants to engage additional farmer with conservation planning related to manure storage and management. Since stream bank instability is present across much of the watershed, HVA will also work with a fluvial geomorphologist to conduct a Phase 1 geomorphic assessment to determine potential land use practices and channel modifications that contribute to erosion. We anticipate that this assessment will assist with project prioritization with the goal of maximizing system-wide conservation benefit.

HVA and Berkshire Ag partners will continue to identify both simpler projects that will result in meaningful Ag NPS pollution reduction (e.g. livestock exclusion from streams, riparian forest buffer restoration on stable streams, changes in management practices), as well as more complicated projects that will require engineering design and permitting (e.g. covered barnyards/manure storage, stream channel reconstruction, floodplain reconnection, stream bank stabilization). As planning and design work continues, projects will be categorized by standard NRCS Conservation Practices.

Non-Structural BMPs:

1. Education and Outreach: Education and Outreach focused on reducing nonpoint source pollution aims to engage a variety of stakeholders through tailored messages and strategies. For municipal officials, the plan may emphasize the importance of policies and infrastructure improvements that manage stormwater runoff. For private landowners, the plan focuses on promoting BMPs like proper lawn care, waste disposal, and erosion control to reduce pollution from residential areas. For farmers, the plan provides guidance on implementing conservation practices such as nutrient management, cover cropping, and buffer zones to minimize agricultural runoff. The plan may employ a mix of workshops, informational materials, community events, and one-on-one technical assistance to raise awareness, foster collaboration, and promote actions that protect water quality and reduce nonpoint source pollution.

2. Conservation Planning: The Conservation Planning process by the Natural Resources Conservation Service (NRCS) is a structured approach to help landowners and managers develop and implement effective conservation practices. It begins with an assessment of the land's current condition to identify issues like soil erosion or water quality. Next, goals are set in collaboration with NRCS specialists, followed by the creation of a detailed plan outlining conservation practices. Implementation involves carrying out the plan with support from NRCS, which may include technical assistance and funding. Finally, the plan's effectiveness is evaluated and adjusted as necessary to ensure the goals are met, focusing on long-term sustainability of natural resources. HVA and Berkshire Ag NPS partners will work to support conservation planning processes by bringing funding and technical assistance to support land stewardship practices that enhance the long-term resilience of the Green River watershed while supporting local agricultural operations.

2. Comprehensive Nutrient Management Plan: The Comprehensive Nutrient Management Plan (CNMP), developed by the NRCS, is a practice designed to help farmers and landowners manage the use of nutrients on their land in an environmentally responsible way. The process involves assessing the current nutrient levels, soil conditions, and farming practices. Based on this assessment, the CNMP outlines strategies for efficiently applying fertilizers, managing manure, and improving soil health while protecting water quality and reducing nutrient runoff. These practices are implemented with consideration of local conditions, economic feasibility, and regulatory compliance to promote sustainable agriculture and water quality protection. Implementation is supported by NRCS technical assistance and may include regular monitoring to ensure the plan's effectiveness. Some options that could be included in the nutrient management plan might be:

- Soil analysis – Regular soil testing to tailor fertilizer applications and prevent excess nutrient buildup.
- Nutrient-efficient fertilizers – Selecting fertilizers that are readily available to plants while minimizing runoff risk.
- Split application – Distributing fertilizers in multiple stages during the growing season to match crop uptake and reduce leaching.
- Crop rotation – Alternating crops to improve soil fertility, enhance nutrient cycling, and reduce pest pressure.
- Cover cropping – Planting cover crops during fallow periods to prevent erosion, improve soil structure, and capture excess nutrients.
- Manure management – Storing and applying manure properly to minimize nutrient loss through runoff and volatilization.

Structural BMPs:

The following Ag NPS pollution structural BMP descriptions (#1-6) were developed by the Massachusetts Association of Conservation Districts and included in their MassDEP-approved ***Hinsdale Brook Watershed Based Plan***. This list is not exhaustive, and other practices may be included based on potential Ag NPS pollution reduction.

1. Livestock Exclusion: This practice involves the fencing of an area not intended for grazing to exclude livestock from accessing that area. Livestock exclusion may improve water quality by preventing livestock from being in the water, preventing access to steep or highly erodible banks, and by preventing animal waste deposition in surface waters. This practice prevents compaction of the soil by livestock and prevents losses of vegetation and undergrowth. This may maintain or increase evapotranspiration. Increased soil permeability may reduce erosion and decrease the transport of sediment and other pollutants to surface waters. By protecting existing vegetation, this practice also promotes shading along streams and may reduce surface water temperature.

2. Riparian Buffers: A riparian buffer is the area of trees, shrubs and grasses adjacent to a river that can intercept pollutants from both surface and shallow groundwater before reaching a river or stream. This practice involves the protection, maintenance, and restoration of riparian forest areas. The ability of a riparian buffer to remove pollutants is dependent on the width of the buffer, the type of vegetation, the manner in which runoff traverses the vegetated areas, the slope and the soil composition within the riparian area. Riparian buffers also provide habitat for wildlife and enhance fish habitat by reducing water temperature.

3. Alternative Livestock Water Supply: An alternate livestock drinking water supply located away from surface waters can reduce stream bank erosion, prevent the deposition of animal waste within water bodies, protect riparian vegetation, and provide a dependable, clean source of water for livestock. In some locations, artificial shade may also be constructed to encourage use of upland sites for shading and loafing. Alternative livestock water can be provided through the following practices:

- Pond: A water impoundment made by constructing a dam or an embankment or by excavation of a pit or dugout.
- Trough or Tank: By the installation of troughs or tanks, livestock may be better distributed over the pasture, grazing can be better controlled, and surface runoff reduced, thus reducing erosion.
- Well: A drinking water supply well can be constructed or improved to provide water for livestock.
- Spring Development: This practice includes improving springs and seeps by excavating, cleaning, capping, or providing collection and storage facilities. Temporary erosion and sedimentation may occur from any disturbed areas during and immediately following any related construction activities.
- Pipeline/Pump System: A gravity pipeline or pump system can be developed in combination with the practices described above to increase the distance between a water source (e.g., well, spring) and targeted water supply areas within the pasture.

4. **Rotational Grazing Systems and Improved Pasture Management**: Rotational grazing systems and improved pasture management are recommended in conjunction with livestock exclusion and alternative livestock water supply projects. Grazing systems and improved pasture management allow farmers to better use grazing land and includes:

- Managing livestock rotation to maintain minimum grazing height recommendations and sufficient rest periods for plant recovery.
- locating feeding and watering facilities away from sensitive areas (see alternative livestock water supply above).
- Designating a sacrifice lot/paddock (that does not drain directly into ponds, creeks, etc.) to locate livestock during the rainy season or when pastures are not growing actively to prevent overgrazing and trampling.
- Using compost-bedded pack barns (large, open resting area, under covered housing, usually bedded with sawdust or dry, fine wood shavings and manure composted into place and mechanically stirred on a regular basis) for dairy cows.
- Chain harrowing pastures (at least twice a year) to break up manure piles and uniformly spread manure, after livestock are removed.

5. **Afforestation of Hay and Pastureland**: Using a small portion of hay and pastureland for tree planting. This converts pasture that is not well suited for grazing due to slope and other characteristics, optimizes the use of suitable pastureland in the watershed, and prevents runoff and soil loss from marginal pastures.

6. **Cropland Management Practices**: Cropland management practices include, among others, continuous no till, cover crops, and fertilizer management.

- Continuous no till is used to encourage procedures to convert fields under some degree of tillage to a system of minimal soil disturbance that will maintain a minimum a 60% raindrop intercepting residue cover.

• Cover crops keep cover on fields during times of year when they would otherwise be left barren in order to minimize runoff and erosion from the soil surface and also decrease leaching of nitrogen through the soil.
• Farmers can implement fertilizer management practices to help maintain high yields and save money on fertilizers while reducing nonpoint source pollution. A Crop Nutrient Management Plan is a tool that farmers can use to achieve these goals.

7. **Runoff Management from Barns and Farm Buildings:** A BMP designed to prevent pollution from runoff generated by livestock facilities, barns, and other farm buildings. Runoff from these structures can carry pollutants from manure and fertilizers, sediment, oils, and pathogens into nearby water bodies, potentially degrading water quality and harming aquatic ecosystems. Effective runoff management includes strategies like creating diversion ditches or berms around barns to direct water away from buildings and prevent it from picking up contaminants. Roof gutters and downspouts can be installed to capture rainwater from barn roofs, diverting it into a rainwater harvesting system or a controlled stormwater detention pond. The captured water can be reused for irrigation or livestock watering, reducing runoff, and conserving water.

8. Bedded Pack Management: Manages the bedding material used in livestock facilities, such as barns or animal housing areas, to reduce the environmental impact of manure and bedding runoff. This practice is commonly used in dairy and beef operations where animals are housed on deep bedding packs made of materials like straw, wood shavings, or sawdust. Proper management of the bedded pack involves regularly turning or replenishing the bedding to prevent it from becoming saturated, which helps control odors, minimize nutrient leaching, and reduce the potential for water contamination. Roofing over animal housing areas or using covered storage areas for manure collection prevents rainwater from saturating the bedding and causing nutrient runoff. Proper storage and handling of the material, including seasonal removal and spreading according to nutrient management plans, further ensures that water quality is protected while benefiting farm productivity.

9. On-farm manure management: Designed to reduce the environmental impact of manure from livestock operations. It involves proper storage of manure in systems like covered lagoons or compost piles to prevent runoff and leaching, along with a nutrient management plan to ensure the right amount of manure is applied to crops based on soil needs. Buffer zones and vegetated filters around storage areas help trap nutrients and prevent runoff into water bodies. Composting manure can reduce pathogens and odors, while record keeping and monitoring water quality ensure practices are effective and compliant with regulations. These practices help maintain soil health, prevent water pollution, and improve overall farm sustainability.

9. **Streambank Stabilization**: As much of the Green River and its tributaries suffer from extensive stream bank instability, erosion, and associated channel sedimentation, we anticipate that in many locations restoration of riparian vegetative buffers will be insufficient to arrest further bank erosion and by extension, loss of farmland. HVA and partners will leverage nature-based processes (also known as bioengineering) to grade and stabilize failing banks by utilizing large woody debris—logs, stumps, root wads—boulders, and plants with deep root systems to anchor soil in place. According to NRCS conservation practices associated with Streambank and Shoreline Protection (Code 580) causes of stream bank instability include, but are not limited to:

- Livestock access
- Watershed alterations resulting in significant modifications or sediment production
- In-channel modifications
- Head cutting
- Water level fluctuations

HVA plans to conduct a thorough geomorphic assessment of the Green River watershed to identify locations where significant stream modifications may be contributing to this instability and erosion throughout the system and determine where bank stabilization projects will result in the most benefit for the entire ecosystem.

Additional BMPs:

The following description of non-agricultural BMPs is tailored to a largely rural watershed like the Green River.

1. Bioretention Basin - Rain Gardens: Bioiretention basins and rain gardens are both effective non-structural BMPs designed to reduce nonpoint source pollution by managing stormwater runoff. A bioretention basin is a landscaped area designed to capture and treat stormwater. It typically consists of a shallow depression filled with a mix of soil, sand, and vegetation that allows water to infiltrate the ground, reducing runoff and filtering pollutants such as sediments, nutrients, and heavy metals before they enter waterways. A rain garden is a planted, shallow depression designed to capture runoff from impervious surfaces like roofs and driveways. It features native plants and special soil mixes that allow rainwater to soak into the ground, while the vegetation helps filter pollutants and provides habitat for wildlife. Rain gardens are effective in reducing the volume of stormwater runoff, preventing erosion, and improving water quality.

2. Wetland Restoration: Restoring or creating wetlands in rural areas helps manage stormwater by absorbing excess water, reducing flooding, and filtering pollutants. Wetlands act as natural filters for nutrients and sediments, improving water quality and providing critical ecosystem services, such as wildlife habitat.

3. Forest and Tree Planting: In rural watersheds, afforestation and reforestation efforts can enhance water quality by promoting infiltration and reducing surface runoff. Trees help absorb rainfall, reduce soil erosion, and improve groundwater recharge, especially in areas with upland watersheds or along water courses.

4. Unpaved Road Management: Many rural areas have gravel or dirt roads that can contribute significantly to runoff and erosion. Gravel road maintenance, including proper grading, the installation of water diversion structures (like culverts and cross drains), and vegetation on road shoulders, can reduce erosion and prevent pollutants from entering streams and rivers.

5. LID (Low Impact Development) Practices: LID practices focus on managing stormwater in a way that mimics natural hydrology by promoting infiltration, evapotranspiration, and water harvesting. Examples include bioretention cells, vegetated roofs, and stormwater gardens. These practices are designed to minimize runoff and reduce the environmental impact of urban development.

6. Water Quality Monitoring: This BMP involves regularly assessing the quality of water in nearby streams, rivers, ponds, or other water bodies to track the health of the water and identify pollution sources. This practice typically includes sampling water at various points in a watershed or on a property, analyzing it for key indicators such as nutrients, sediment levels, bacteria, dissolved oxygen, temperature, and presence of harmful chemicals or pathogens. By regularly monitoring water quality, landowners, watershed managers, and communities can identify trends, pinpoint areas where pollution may be entering the water and evaluate the effectiveness of conservation efforts and implemented BMPs. Water quality monitoring also provides valuable data that can inform future management decisions and guide actions to reduce contamination, such as adjusting land use practices, improving stormwater management, or implementing further pollution-reduction measures.

BMP Hotspot Map:

The following GIS-based analysis was performed within the watershed to identify high priority parcels for best management practice (BMP) (also referred to as management measure) implementation:

- Each parcel within the watershed was evaluated based on ten different criteria accounting for the parcel ownership, social value, and implementation feasibility (See **Table C-1** for more detail below);
- Each criterion was then given a score from 0 to 5 to represent the priority for BMP implementation based on a metric corresponding to the criterion (e.g., a score of 0 would represent lowest priority for BMP implementation whereas a score of 5 would represent highest priority for BMP implementation);
- A multiplier was also assigned to each criterion, which reflected the weighted importance of the criterion (e.g., a criterion with a multiplier of 3 had greater weight on the overall prioritization of the parcel than a criterion with a multiplier of 1); and
- The weighted scores for all the criteria were then summed for each parcel to calculate a total BMP priority score.

Table C-1 presents the criteria, indicator type, metrics, scores, and multipliers that were used for this analysis. Parcels with total scores above 60 are recommended for further investigation for BMP implementation suitability. **Figure C-1** presents the resulting BMP Hotspot Map for the watershed. The following link includes a Microsoft Excel file with information for all parcels that have a score above 60: hotspot spreadsheet.

This analysis solely evaluated individual parcels for BMP implementation suitability and likelihood for the measures to perform effectively within the parcel's features. **This analysis does not quantify the pollutant loading to these parcels from the parcel's upstream catchment**. When further evaluating a parcel's BMP implementation suitability and cost-effectiveness of BMP implementation, the existing pollutant loading from the parcel's upstream catchment and potential pollutant load reduction from BMP implementation should be evaluated.

GIS data used for the BMP Hotspot Map analysis included:

- MassGIS (2015a);
- MassGIS (2015b);
- MassGIS (2017a);
- MassGIS (2017b);
- MassGIS (2020);
- MA Department of Revenue Division of Local Services (2016);
- MassGIS (2005);
- ArcGIS (2020);
- MassGIS (2009b);
- MassGIS (2012); and
- ArcGIS (2020b).

Table C-1: Matrix for BMP Hotspot Map GIS-based Analysis

Criteria	Indicator Type	METRICS																											Multiplier	Maximum Potential Score
		Yes or No?		Hydrologic Soil Group				Land Use Type									Water Table Depth				Parcel Area			Parcel Average Slope						
		Yes	No	A or A/D	B or B/D	C or C/D	D	Low and Medium Density Residential	High Density Residential	Commercial	Industrial	Highway	Agriculture	Forest	Open Land	Water	101-200 cm	62-100 cm	31-61 cm	0-30 cm	Greater than 2 acres	Between 1-2 acres	Less than 1 acre	Less than 2%	Between 2% and 15%	Greater than 15%	Less than 50%	Between 51% and 100%		
Is the parcel a school, fire station, police station, town hall or library?	**Ownership**	5	0																										2	10
Is the parcel's use code in the 900 series (i.e. public property or university)?	**Ownership**	5	0																										2	10
Is parcel fully or partially in an Environmental Justice Area?	**Social**	5	0																										2	10
Most favorable Hydrologic Soil Group within Parcel	**Implementation Feasibility**			5	3	0	0																						2	10
Most favorable Land Use in Parcel	**Implementation Feasibility**							1	2	4	2	4	5	1	4	**X**[1]													3	15
Most favorable Water Table Depth (deepest in Parcel)	**Implementation Feasibility**																5	4	3	0									2	10
Parcel Area	**Implementation Feasibility**																				5	4	1						3	15
Parcel Average Slope	**Implementation Feasibility**																							3	5	1			1	5
Percent Impervious Area in Parcel	**Implementation Feasibility**																										5	2.5	1	5
Within 100 ft buffer of receiving water (stream or lake/pond)?	**Implementation Feasibility**	5	2																										2	10

Note 1: **X** denotes that parcel is excluded

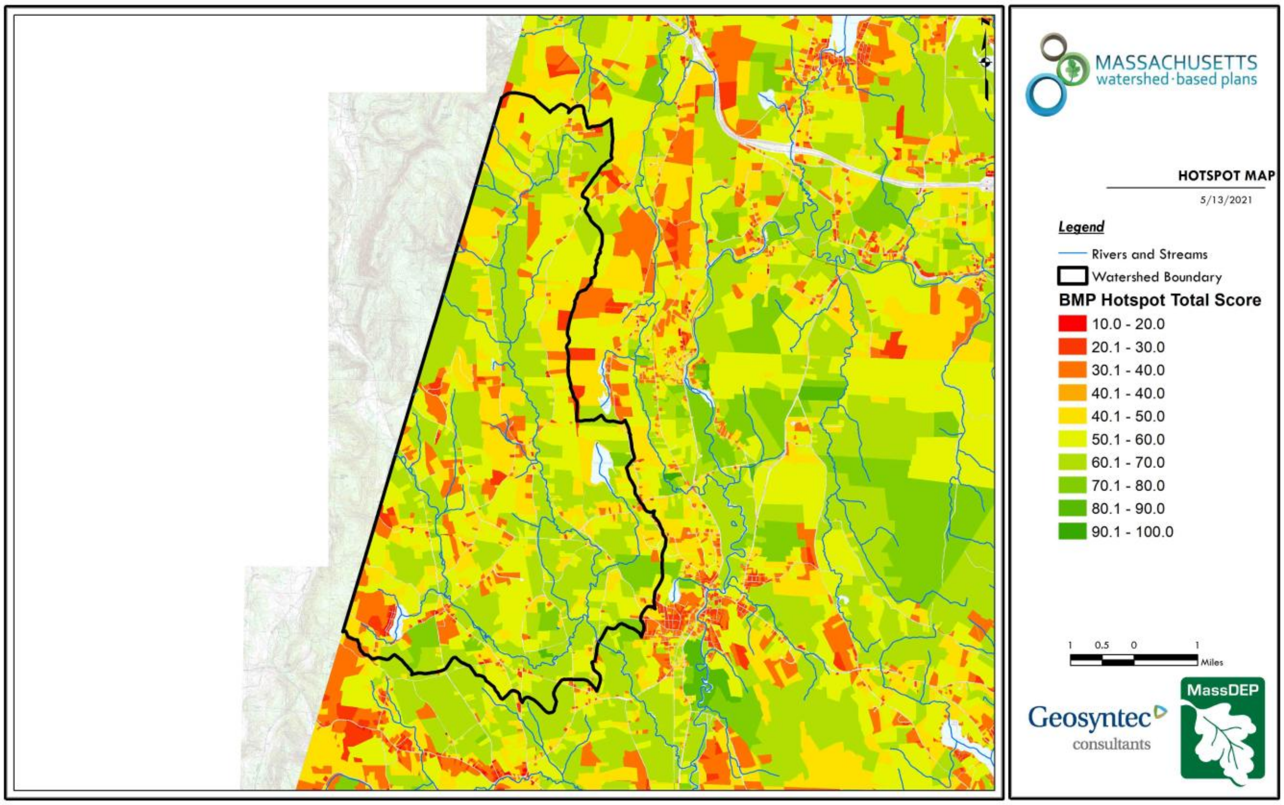


Figure C-1: BMP Hotspot Map (MassGIS (2015a), MassGIS (2015b), MassGIS (2017a), MassGIS (2017b), MassGIS (2020), MA Department of Revenue Division of Local Services (2016), MassGIS (2005), ArcGIS (2020), MassGIS (2009b), MassGIS (2012), ArcGIS (2020b))

Ctrl + Click on the map to view a full sized image in your web browser.

Proposed Management Measures:

Table C-2 presents proposed management measures informed by site assessments and GIS analysis conducted by HVA staff and project consultants in addition to anticipated BMP types that this WBP might support. Pollutant load reductions for the riparian vegetative buffer were estimated using the EPA Region 5 Pollutant Load Estimation Model and informed by NRCS practice standards 393 (Filter Strip), 390 (Riparian Herbaceous Cover), and 391 (Riparian Forest Buffer). This BMP was modeled as a 30-foot-wide buffer along 480 feet of streambank adjacent to cropland, with load reductions based on default cropland pollutant loading rates and estimated buffer removal efficiencies. Combined removal rates of 50% for total nitrogen (TN), 55% for total phosphorus (TP), and 80% for Total Suspended Solids (TSS) reflect the expected performance of well-vegetated riparian buffers, consistent with NRCS guidance associated with these specific conservation practices.

Pollutant load reductions for the streambank stabilization project were also estimated using the EPA Region 5 Pollutant Load Estimation Model and associated methodology for estimating the average annual rate of streambank erosion. The project involves stabilizing 604 linear feet of a 20-foot-high eroding bank adjacent to cropland, using grading, large wood and boulder toe revetment, along with coir matting and live staking native vegetation. Load estimates were calculated based on an assumed bank recession rate of 0.3 feet/year, a contributing bank height of 14 feet, and a bulk density of 0.0481 tons/ft³. These inputs yielded annual reductions of 123.5 lbs TN, 74.1 lbs TP, and 164,628 lbs. TSS, assuming an 85% pollutant removal efficiency following stabilization. Design and implementation align with NRCS Practice Code 395 (Stream Habitat Improvement and Management).

Pollutant load reductions for the livestock exclusion BMP were estimated using the EPA Region 5 Pollutant Load Estimation Model and guidance from NRCS Practice Standards 472 (Access Control), 382 (Fence), and E472A (Managed Livestock Access to Waterbodies). The proposed practice would restrict 50 cows from accessing 125 linear feet of a tributary stream through fencing and riparian buffer restoration. Nutrient reductions were calculated using EPA Region 5 default values for direct deposition of livestock waste into surface waters, which attribute 0.85 lbs. of total nitrogen (TN) and 0.36 lbs. of total phosphorus (TP) per cow per day. For 50 cows, these values yield annual TN reductions of 7,735 to 15,512.5 lbs/year and TP reductions of 3,276 to 6,570 lbs/year, depending on whether access is seasonal (182 days) or year-round (365 days). Additional reductions in total suspended solids (TSS) were estimated by modeling streambank erosion due to livestock trampling across 250 feet of bank (both sides), assuming 0.3 feet/year recession, a 5-foot contributing bank height, and a soil bulk density of 0.0481 tons/ft³, with an 85% reduction achieved through fencing and revegetation. This yields a range of approximately 5,097 to 10,221 lbs/year of TSS reduced depending on seasonal or year-round access.

Table C-2: Proposed Best Management Practices and Pollution Load Reduction Estimates

BMP Type	Drainage Area (acres)	BMP Area (square feet)	Pollution Load Reductions (lbs./year)
Riparian Buffer Restoration	9.2 (Cropland)	14,400	• Total Nitrogen: 92 • Total Phosphorus: 15.18 • Total Suspended Solids: 2,576
Streambank Stabilization	6.4 (Cropland)	17,860	• Total Nitrogen: 123.5 • Total Phosphorus: 74.1 • Total Suspended Solids: 164,628
Livestock Exclusion, Fencing, and riparian buffer restoration	6.1 acres (Pasture) Approx. 50 cows	7,500 of riparian buffer (both sides of the stream) 250 linear feet of fence	• Total Nitrogen: 15,512.5 • Total Phosphorus: 6,570 • Total Suspended Solids: 10,221.3

Element D: Identify Technical and Financial Assistance Needed to Implement Plan

Element D: Estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan.

Table D-1 presents the funding needed to develop Conservation Plans, Comprehensive Nutrient Management Plans, and select Ag NPS pollution reduction BMPs within the Green River watershed. The table includes estimated project costs which are calculated according NRCS Conservation Practice Standard payment schedules associated with Ag NPS pollution planning and BMP implementation. Project descriptions and costs were taken from USDA – NRCS Regional Conservation Partnership Program payment schedules for Berkshire County in FY25: fy25-ma-rcpp-2325.pdf. BMP scope and dimensions enumerated in the tables below are based on conditions observed by HVA and project partners during the previous MassDEP 319 grant, “Increasing the Pace of On-Farm Watershed Restoration in Berkshire County.” Site observations included a farm property with fields cleared to the river’s edge and an estimated 2 acres of riparian buffer that could be restored with native trees, shrubs, and grasses; based on a prospective buffer width of 30 feet. HVA also observed a failing stream bank approximately 20 feet tall and 604 linear feet along the stream edge. Based on a 30-foot-wide buffer, this stream bank stabilization project would encompass approximately 0.42 acres.

NRCS advises that these payment schedules “consider the current costs for material and labor within the state and the fair marketplace compensation for opportunity costs that may arise (e.g. conversion of productive land). If necessary, the amount of financial assistance is adjusted to keep pace with actual costs.”[i] In addition to labor and material costs, we also include estimated costs associated with project management, permitting, engineering and design, and project consultants. We anticipate engaging with engineers to develop stormwater management BMPs, NRCS to develop farm-scale Conservation Plans and Comprehensive Nutrient Management Plans, Soil and Water Conservation Districts to assist with planning and implementing vegetative swales and buffers to direct and infiltrate nutrient runoff.

Table D-1: Summary of Funding Needed to Implement the Watershed Plan

Riparian Buffer Restoration (From Element C)						
County	**Code**	**Practice**	**Component**	**Units**	**Unit Cost**	Est. Cost Per 2 Acres
Berkshire	420	Wildlife Habitat Planting	High Species Diversity on Fallow or Non-Cropland, no Foregone Income	Ac	$549.22	$1,098.44
Berkshire	390	Riparian Herbaceous Cover	Native Perennial Grasses, Low Density	Ac	$1,474.05	$2,948.10
Berkshire	390	Riparian Herbaceous Cover	Plugging and Seeding	Ac	$18,925.66	$37,851.32
Berkshire	390	Riparian Herbaceous Cover	Pollinator Habitat	Ac	$1,162.22	$2,324.44
Berkshire	391	Riparian Forest Buffer	Bare Root, No Shelters	Ac	$2,164.71	$4,329.42
Berkshire	391	Riparian Forest Buffer	Small area hand planting with container or bare root stock	Ac	$2,633.08	$5,266.16
Berkshire	E391A	Increase riparian forest buffer width for sediment and nutrient reduction	Riparian Forest Buffer Expansion	Ac	$2,860.90	$5,721.80
			Construction Labor Cost	Per Project		$10,000.00
			Project Mangagement Cost	Per Project		$4,000.00
			Permitting and Survey	Per Project		$3,000.00
			Riparian Buffer Restoration	**Total**		**$76,539.68**
Stream Bank Restoration (From Element C)						
County	**Code**	**Practice**	**Component**	**Unit Cost**	**Project Management, Technical Assistance, Additional Consultants**	Est. Cost Per 0.58 acres
Berkshire	395	Stream Habitat Improvement and Management	Stream Restoration	Ac	$456,953.24	$265,032.88
Berkshire	395	Stream Habitat Improvement and Management	Wood Structure, Root Wads, Instream Manual	Ac	$6,580.66	$3,816.78
Berkshire	395	Stream Habitat Improvement and Management	Wood Structure, Root Wads, Instream Mechanical	Ac	$18,834.24	$10,923.86
			Project Management and Consultants	Per Project		$8,000.00
			Survey and Permitting	Per Project		$40,000.00
			Engineering and Design	Per Project		$80,000.00
			Stream Bank Restoration	**Total**		**$610,368.14**
Agriculcutal Non-Point Source Pollution Planning and Reduction (From Element E)						
County	**Code**	**Practice**	**Component**	**Unit Cost**	**Project Management, Technical Assistance, Additional Consultants**	**Total**
Berkshire	199	Conservation Plan	One Land Use, 200 to 1,000 Acres	$4,836.79	$8,000.00	**$12,836.79**
Berkshire	199	Conservation Plan	Small Farm	$2,590.37	$8,000.00	**$10,590.37**
Berkshire	199	Conservation Plan	Two Land Uses, 200 to 1,000 Acres	$6,437.34	$8,000.00	**$14,437.34**
Berkshire	102	Comprehensive Nutrient Management Plan	Dairy Operations, 301 to 700 Animal Units	$5,324.77	$8,000.00	**$13,324.77**
Berkshire	102	Comprehensive Nutrient Management Plan	Dairy Operations, Less Than or Equal to 300 Animal Units	$4,327.89	$8,000.00	**$12,327.89**
Berkshire	102	Comprehensive Nutrient Management Plan	Non-Dairy Livestock Operations, 301 to 700 Animal Units	$4,663.07	$8,000.00	**$12,663.07**
Berkshire	102	Comprehensive Nutrient Management Plan	Non-Dairy Livestock Operations, Less Than or Equal to 300 Animal Units	$3,531.08	$8,000.00	**$11,531.08**

Livestock Fencing and Alternate Water Supply (From Element E)						
County	**Code**	**Practice**	**Component**	**Unit Cost**	**Project Management, Technical Assistance, Additional Consultants**	**Total**
Berkshire	382	Fence	Exclusion, 96 Inch	Ft	$11.34	
Berkshire	642	Water Well	Deep Well	No	$17,601.71	
Berkshire	642	Water Well	Dug Well	No	$10,947.87	
Berkshire	642	Water Well	High Volume Typical Well	No	$13,568.00	
Berkshire	642	Water Well	Typical Well	No	$9,632.06	
			Consultants	Per Project		$6,000.00
			Permitting	Per Project		$8,000.00
			Contractor	Per Project		TBD
			Well Cost Dependent on Site Conditions	**Total**		**$9000-$18000**

Monitoring and Evaluation (see Element H/I)						
County	**Code**	**Practice**	**Component**	**Units**	**Unit Cost**	**Cost Per 2 Acres**
Berkshire	E449F	Intermediate IWM - Year 1, Equipment with Soil or Water Level monitoring	Year One, Equipment, Intermediate Soil Moisture or Water Monitoring	Ac	$52.37	$104.74
Berkshire	E449G	Intermediate IWM - Years 2-5, Soil or Water Level monitoring	Years Two-Five, Data Collection	Ac	$12.53	$25.06
Berkshire	E449H	Intermediate IWM - Years 2 -5, using soil moisture or water level monitoring	Years Two-Five, Interpretation of Data Log	Ac	$59.77	$119.54
Berkshire	E580A	Stream corridor bank stability improvement	Vegetation for Bank Stability	Ac	$2,782.59	$5,565.18
Berkshire	E580B	Stream corridor bank vegetation improvement	Vegetation for Wildlife	Ac	$2,782.59	$5,565.18
			Project Management	Per Project		$8,000.00
			General Consultants	Per Project		$6,000.00
			Monitoring Supplies Year Two-Five	Per Project		$2,000.00
			Monitoring Costs Dependent on Site Conditions	**Total**		**$27,379.70**

Element E: Public Information and Education

Element E: Information and Education (I/E) component of the watershed plan used to:

1. Enhance public understanding of the project; and
2. Encourage early and continued public participation in selecting, designing, and implementing the NPS management measures that will be implemented.

Step 1: Goals and Objectives

The primary goal of this Watershed-Based Plan is to expand efforts to reduce Ag NPS pollution with a focus on the Green River in Alford, Egremont, and Great Barrington. While agricultural landowners and operators remain the core audience for technical assistance and implementation support, the success of this plan also depends on meaningful engagement with a wider network of watershed stakeholders — including homeowners, municipal departments, land trusts, recreational users, and institutional landowners — whose land use decisions directly influence water quality outcomes.

HVA has assembled a group of partners who are building on existing collaborations to deliver education, outreach, and implementation across these diverse audiences. The project aims to engage farms and non-agricultural landowners alike, prioritizing those where meaningful and sustained reductions in nonpoint source pollution are feasible. Key objectives include:

Regional Strategy Development: Partner with USDA-NRCS, Soil and Water Conservation Districts, watershed conservation groups, and non-profit organizations to develop a framework that identifies and prioritizes farms and other properties with the greatest potential for water quality improvement through targeted engagement.

Proactive Outreach and Capacity Building: Build relationships with priority farms through phone calls and in-person outreach, encouraging producers to participate in Conservation Planning and implementation efforts. Extend outreach efforts to other key stakeholder groups through briefings, educational materials, and collaborative programming with local institutions such as the golf course in Great Barrington, land trusts, and municipal departments.

Implementation and Expansion: Facilitate the application of existing Conservation Plans and create new ones to incorporate practices tailored to individual farm needs and landscapes. We will combine increased capacity for on-farm Conservation Planning and implementation with a regional analysis to compile a farm inventory for the watershed. This will identify priority farms based on livestock presence, proximity to rivers/tributaries, and referrals from agricultural partners. The initiative will focus on the most positive impacts for local and downstream waters, conduct proactive producer outreach/engagement in those areas, and work those areas to both implement existing Conservation Plans and write new ones.

Step 2: Target Audience

The target audience for this Watershed Based Plan includes both agricultural producers and a broader community of landowners, land managers, and water users whose decisions influence the health of the Green River. This includes everyone from small, diversified farms and large dairy operations to homeowners, municipal staff, recreational users, land trusts, and institutional landowners such as the golf course in Great Barrington.

A primary focus remains the wide range of farms within the Green River watershed, from small mixed-livestock and produce operations to larger dairy farms. Effective outreach to farmers requires:

Tailored Engagement: Outreach and engagement strategies must be tailored to specific farms and farmers, which requires fine-grained relationship building that acknowledges the unique challenges that each operation faces. These relationships are essential to developing Ag NPS pollution reduction practices that are cost-effective, suited to the farm operation and the landscape, bolster the bottom line of farm businesses, and are eligible for funding through state and federal programs.

Land Stewardship Focus: Most producers are deeply committed to the long-term health of their land. Outreach efforts will build upon this ethic to connect water quality conservation with a shared goal of sustaining productive, resilient farmland.

Overcoming Barriers: Our partnership is committed to finding ways for farmers to overcome financial and logistical barriers to incorporating watershed restoration into their land management through technical support, grant seeking and management, and identification of bottom-line benefits possible from conservation planning and Ag NPS BMPs.

Beyond the agricultural sector, outreach efforts may include:

- Homeowners, particularly those living near the river or tributaries, can be empowered to reduce nutrient and sediment pollution through septic maintenance, riparian planting, and fertilizer reduction.
- Municipal staff and departments, including public works, conservation commissions, and stormwater managers, are critical partners in reducing sediment and pollutant loading from road runoff, culvert infrastructure, and town maintenance practices.
- Recreational users such as anglers, hikers, and paddlers, can support long-term river protection and behavior changes that reduce bank erosion and prevent the spread of invasive species.
- Land trusts and conservation groups that own or manage riparian lands and can integrate water quality goals into easement enforcement, habitat restoration, and open space and recreation planning.
- Institutional landowners, such as the golf course in Great Barrington, represent a unique opportunity to adopt land management practices that reduce runoff and protect stream buffers.

Together, these groups form a place-based stewardship network committed to protecting and restoring the Green River. Education and outreach will be scaled appropriately for each audience and designed to support the collective goal of improving water quality and stream health across the watershed.

Step 3: Outreach Products

Producer Outreach Guidance Document: Our Berkshire Ag NPS partnership has benefitted from the expertise and experience of farm-facing organizations, technical service providers, and project consultants that worked with HVA to develop a collaborative outreach strategy that will guide our targeted outreach program to farmers in the Green River. We are happy to share this approach with organizations invested in similar Ag NPS pollution reduction initiatives across the commonwealth. A draft of our Producer Outreach Guidance Document is included below. This approach will evolve as partners learn from each engagement with producers in the Green River.

Outreach Strategy

- Research farms in the watershed to compile a farm inventory
- Identify priority farms for outreach
  - Insights and referrals from agricultural partners (BCD, BAV, BG).
  - Livestock present.
  - Land along river and/or tributary.
- Call farmers (verbal communication is more effective than written communication)
  - Use online resources or personal connections to find the phone number for the farm.
  - Make an introduction and let the farmer know that work is being conducted in the area to help farms identify best management practices, and that there are technical and financial resources available to help implement projects. Leave a voicemail if nobody answers.
  - Ask questions and learn about the farm. Build rapport.
  - If no answer, call again in 2-4 weeks. Generally, it is best to call twice and visit on the third.
- Visit farms
  - Schedule the visit if a phone connection has been made.
  - Drop in if no phone connection has been made.
    - If the farm's general operational schedule is known, try to stop by at a convenient time (i.e. not during milking for a dairy farm).
  - Make an introduction and let them know that work is being done in the area to help farms identify best management practices, and that there are technical and financial resources available to help implement projects.
  - Ask questions and learn about the farm. Build rapport.
    - If their concerns are relevant to the project or programs offered by agricultural partners, feel free to ask if they have heard of those programs/organizations [see resources below]
    - If they seem interested, talk through the opportunities.
    - If they do not seem interested, let them know who to contact if they have any questions in the future
  - Call or visit the farm to check in after a few weeks if there was a thread
- Confer with Agricultural Partners
  - Describe the farm's resource concern and discuss options for implementation

        - There may be a desire to consider all programs that might be relevant or useful for the farm. Try to stick to the farmers' top resource concerns first.
    - Visit the farm to make introductions and talk through options to address their concern in some depth.
        - It may be helpful to align their goals/interests with the goals of the conservation practice, which can often be the same thing, just using different words.
        - Set expectations in terms of timing, involvement, funding, and reporting
    - Continue to check in with the farmer and the agricultural partners throughout the planning and implementation process.

Inventories of Agricultural Resources: HVA and project consultants researched and compiled an inventory of agricultural operations in the Green River and will continue to refine this document as conditions on the ground change as additional insights and referrals from Berkshire Ag NPS partners increase our understanding of the Green River's agricultural landscape. This inventory will function as an internal prioritization tool that will help inform future outreach with variables including the presence of livestock and land in cultivation near the river or tributary waters.

Berkshire Conservation District No-Till Drill Program Promotional Materials: The Berkshire Conservation District (BCD) has identified a lack of awareness among Berkshire County farmers regarding state nutrient management regulations. This often leads to over-application of fertilizers. Not only does this increase nutrient loading to waterways, but it also results in increased costs for farmers. HVA and the Berkshire Ag NPS Partnership are eager to promote and advertise the Berkshire Conservation District's No-Till Drill Program which according to their website helps farmers "reduce soil erosion and promote soil health and crop yield, a win-win for water quality and the cost-effectiveness of farming operations- especially if the necessary equipment is available without cost to the farmer." HVA and partners will take advantage of these kinds of existing programs that Core Partners are already implementing by broadcasting their availability to farmers in the Green River. We are interested in hosting demonstration days at participating farms and inviting neighboring producers to learn more about how this program can benefit their operations while reducing erosion and mitigating water quality impacts. Partners will consider additional demonstrations at Berkshire County fairs and agriculturally focused events.

Building Case Studies: HVA and partners will work with participating producers to document elements of Conservation Planning and Conservation Practice implementation expected to lead to measurable economic benefits to farm businesses. This information will be used to begin developing region-specific case studies that we can incorporate into future producer outreach/engagement activities. Building data for case studies while projects are implemented and performance is measured, the framework for collecting the data and anecdotes will be built to tell compelling stories in the future, which will be essential to sustaining the increased pace of on-farm watershed restoration that we'll develop with this work.

Expanded Outreach Products for Broader Stakeholder Engagement: To complement the targeted farm outreach described above, HVA and partners will develop educational products and engagement opportunities for a broader group of watershed stakeholders. These materials will help build awareness of local stream conditions, land use impacts, and restoration opportunities.

1. Green River Geomorphic Assessment Outreach Materials
HVA is working with a consultant to complete a Phase 1 Geomorphic Assessment of the Green River, which will identify major erosion hazards, sediment transport dynamics, and current constraints on stream stability. To share these findings with landowners, municipal staff, and recreational users, we will develop public-friendly materials — such as summary fact sheets, GIS-based story maps, and presentations for community meetings. These will explain geomorphic processes in accessible terms and highlight recommendations for floodplain protection, streamside vegetation, and infrastructure planning.

2. Riparian Buffer Fact Sheet and Property Owner Guide
HVA has created a general-audience educational handout focused on the role of riparian buffers in protecting water quality and stream habitat. This document offers guidance on buffer widths, plant selection, and maintenance, tailored to residential landowners. HVA can distribute this document at all public-facing events that accompany the execution of the education and outreach goals outlined in this section of the Green River WBP.

3. Targeted Briefings and Custom Presentations
HVA will develop additional materials for key non-farming stakeholders, including conservation commissions and DPW staff on practices to minimize road runoff and support culvert and streambank resilience; land trusts on integrating stream protection goals into land stewardship and easement planning; golf course or recreational property managers on land care practices that minimize nutrient and sediment runoff.

Step 4: Evaluate Information/Education Program

Quantifying Impacts: HVA and partners will record and retain information related to number of farm contacts and farm visits, outreach programming, the results of relationships building including collaborative agreements to engage in conservation planning and Ag NPS BMP implementation.

From Peer-to-Peer to Community & Stakeholder Engagement: Though this WBP proposes a focused peer-to-peer outreach strategy—rooted in building trust between project partners and farmers—we recognize the importance of broader watershed engagement. As the program evolves, HVA and partners will evaluate opportunities to expand education and outreach to include additional stakeholders such as:

- Residential landowners near the Green River, whose landscaping or drainage practices may affect water quality.
- Recreational users, whose engagement with the river can foster public stewardship and awareness.
- Municipal officials and staff, who play a critical role in decisions related to land use, stormwater, and infrastructure.
- Land trusts and institutional landowners, who manage large tracts of land along the river and can serve as demonstration partners for best practices.

Evaluation methods may include participation counts at public events and briefings, feedback surveys following community presentations, and tracking distribution of educational products such as riparian buffer guides or geomorphic assessment summaries. These insights will inform ongoing adjustments to outreach approaches and help strengthen the place-based stewardship network emerging around the Green River.

Elements F & G: Implementation Schedule and Measurable Milestones

Element F: Schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious.

Element G: A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented.

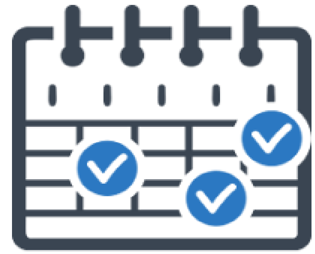


Table FG-1 provides a timeline for Ag NPS pollution reduction planning, project prioritization, BMP implementation, and project monitoring and evaluation. The Berkshire Ag NPS Pollution Reduction partnership intends to revisit, revise, and update this implementation schedule as circumstances require. As new project opportunities materialize, partners and community stakeholders can recommend revisions to include in future iterations of the Green River Watershed Based Plan.

Table FG-1: Implementation Schedule and Interim Measurable Milestones

Project Phase	Description	Cost Estimate	Year(s)
Berkshire County Ag NPS Pollution Partnership – Partner Coordination	• Maintain and expand the network of farm-facing partner organizations in Berkshire County. • Identify and apply for funding and technical assistance available for farms engaged in conservation planning and Ag NPS pollution reduction. • Engage partners to expand regional capacity to support farm sustainability and address water quality threats.	To be determined	• 2025 • 2025-2026 • 2027
Producer Outreach	• Utilize the draft Outreach Strategy developed by project consultants and the Berkshire County Ag NPS Pollution Partnership. • Foster existing relationships with farmers in Berkshire County while expanding the network of farmers willing to collaborate with HVA and project partners.	$30,000	• 2025 • 2025-2026 • 2025-2027

	• Connect farmers with funding and technical assistance through state and federal programs.		
Green River Geomorphic Assessment	• Conduct a desktop analysis with project consultants to identify causes and locations of stream bank instability in the Green River watershed. • Collect field data to assess potential project locations identified in the analysis. • Develop stream bank stabilization project proposals addressing sediment and nutrient loading while improving aquatic habitat. • Work with partners to identify funding sources to support the implementation of bank stabilization projects.	>$60,000	• 2025 • 2026 • 2026 • 2026-2027
Project Development: Conservation Plans – Comprehensive Nutrient Management Plans	• Collaborate with farmers, NRCS, and consultants to develop or update Conservation Plans and Comprehensive Nutrient Management Plans. • Identify resource concerns impacting water quality and support sustainable land management practices. • Engage engineers and additional consultants, if needed, to design Ag NPS BMPs identified in the conservation planning process.	$80,000	• 2025-2026 • 2026 • 2026-2027
Ag NPS BMP Implementation	• Work with priority farms to address resource concerns identified in the conservation planning process. • Engage with NRCS, MDAR, MassDEP, and other state and federal agencies to apply for BMP implementation funding. • Work with 2-4 farms in the Green River watershed on Ag NPS pollution BMP implementation over the next five years.	~$1,000,000	• 2026 • 2026-2030 • 2026-2030

<table>
<tr><td>Community
Outreach</td><td>Organize education and outreach events to highlight Ag NPS pollution BMPs.
Host farm tours to showcase project achievements and educate the public on Ag NPS pollution reduction.</td><td>To be determined</td><td>2026-2030</td></tr>
<tr><td>Adaptive Management-Plan Updates</td><td colspan="2">Work with Berkshire Ag NPS Pollution Reduction Partnership and other stakeholders and community groups to evaluate progress towards plan milestones and review and revise the plan’s pollution reduction goals as circumstances within the Green River watershed may require.</td><td>Every three years</td></tr>
</table>

Elements H & I: Progress Evaluation Criteria and Monitoring

Element H: A set of criteria used to determine (1) if loading reductions are being achieved over time and (2) if progress is being made toward attaining water quality goals. Element H asks "**how will you know if you are making progress towards water quality goals?**" The criteria established to track progress can be direct measurements (e.g., E. coli bacteria concentrations) or indirect indicators of load reduction (e.g., number of beach closings related to bacteria).

Element I: A monitoring component to evaluate the effectiveness of implementation efforts over time, as measured against the Element H criteria. Element I asks "**how, when, and where will you conduct monitoring?**"

The water quality target concentration(s) is presented under Element A of this plan. To achieve this target concentration, the annual loading must be reduced to the amount described in Element B. Element C of this plan describes the various management measures that will be implemented to achieve this targeted load reduction. The evaluation criteria and monitoring program described below will be used to measure the effectiveness of the proposed management measures (described in Element C) in improving the water quality across the Green River watershed.

Direct Measurements

Bacteria (*E. coli)* Sampling: HVA and project partners will conduct targeted water quality sampling adjacent to, and downstream of, Ag NPS BMPs locations to measure reductions in *E. Coli* relative to HVA's Green River water quality database and Massachusetts Surface Water Quality Standards.

In addition, there are 2 semi-public beaches located on Green River in Great Barrington which are monitored weekly for *E. Coli* during the bathing season by the town Board of Health. Should partners advance Ag NPS BMPs upstream of those public swimming locations, HVA will work with the Board of Health to assess post-project water quality results. Prospect Lake Park, a campground on Prospect Lake, had been monitored weekly during the bathing season up until 2021. The property has changed ownership. HVA will work with the new owners should the property be re-opened to the public **(Table HI-1).**

Table HI-1: Public Swimming Beaches monitored for *E. coli*

Site Description	Monitoring Authority
Green River Beach	Board of Health, Town of Great Barrington

Green River at Maple Ave Bridge	Board of Health, Town of Great Barrington
Prospect Lake Park	Private Owner/Currently closed

Riparian Buffer Restoration Monitoring: Monitoring riparian buffers within a watershed plan will focus on vegetation health and erosion control. Vegetation monitoring will include regular visual assessments to evaluate the density, diversity, and health of native plants within the buffer zone. Observers can document invasive species presence, areas with sparse vegetation, or evidence of plant stress, all of which may indicate challenges such as improper establishment, erosion or encroachment. Incorporating fixed-point photographic documentation enhances the monitoring process by providing a visual record to track changes over time. Minimal intervention will take place, allowing more of a natural process helping support native vegetation's ability to thrive.

Erosion monitoring complements vegetation assessments by providing a clear picture of streambank stability. Using vegetation monitoring and bank stabilization protocols, described in the next section, will provide an understanding of riparian buffer effectiveness throughout monitoring. Invasive species management will focus more on manual removal techniques such as hand-pulling or digging out invasive plants. These techniques will target invasive species before seed production as much as possible to help prevent further spread. Additionally, using smothering techniques like mulching with biodegradable materials can suppress invasive plant growth while allowing native species to establish and thrive.

Bank Stabilization Evaluation Protocols: Monitoring streambank stability is a key indicator of riparian health and its influence on channel morphology, flow velocity, and water quality. To evaluate and monitor streambank stability within designated project areas, a combination of visual assessments and erosion pins will be installed at identified locations along the streambank. These pins will serve as fixed reference points to measure bank movement over time. Installed in pre-determined locations, the pins will enable precise measurements of streambank erosion or deposition, recorded as the length of pin exposed beyond the datum mark. They will continue to be monitored in the same year as the project completion and in years 2, 3, 5, and 10, post-restoration.

If this monitoring method combined with visual assessment indicates that the streambank is unstable or could be at risk, then appropriate remediation work will be identified and implemented. These measures may include bank stabilization techniques, such as revegetation with native plants, installation of erosion control structures, or modifications to access vulnerable areas. If necessary, cross-section analysis can be conducted to provide a more detailed assessment of streambank morphology and stability. This method offers additional data on bank slopes, profile changes, and sediment dynamics, which can further guide the selection of effective remediation strategies. These combined approaches aim to enhance streambank stability, protect riparian zones, and maintain water quality in the affected areas.

Livestock Exclusion Boundary Monitoring: Monitoring the effectiveness of livestock exclusion techniques, such as fencing, is crucial to ensuring the long-term success of the project. Sites where livestock exclusion fencing has been implemented will be regularly monitored and maintained in alignment with the project proposal and goals.

Fenced areas will be observed periodically to ensure they remain intact and functional, with attention given to signs of wear, damage, or livestock intrusion. Maintenance efforts, such as minor repairs or adjustments, will be carried out as needed to uphold the fencing's role in protecting the streambank and riparian vegetation. Vegetation monitoring will also be conducted using simple visual assessments to help determine whether the exclusion measures are effective. The monitoring and maintenance approach will remain practical and efficient, appropriate to the scale of the project.

Potential Indirect Measurements

Public Bathing Beach Closures: The frequency and duration of public beach closures due to elevated *E. coli* levels serve as an indirect metric of water quality. A reduction in closures can indicate improved water quality conditions following implementation of Ag NPS BMPs upstream.

Aquatic Macroinvertebrate Community Assessments: The diversity and abundance of macroinvertebrate species (mayflies, caddisflies, stoneflies, etc.) are widely recognized as biological indicators of water quality. A shift toward these pollution-sensitive species may suggest improved stream health from BMPs that reduce sediment and nutrient loading.

Fish Presence and Coldwater Habitat Suitability: The persistence or return of coldwater fish species such as Eastern Brook Trout can signal improved stream temperature, reduced sedimentation, and enhanced habitat complexity, all of which are key outcomes of riparian buffer shading, streambank stabilization, and nutrient load reductions. Observations of trout populations or angler reports may serve as qualitative indicators of restoration success.

Community Engagement and Awareness: Broader community awareness of watershed issues, as reflected in participation in outreach events, riparian planting days, or reporting of pollution concerns, provides indirect evidence of cultural and behavioral shifts that support long-term water quality improvement. Metrics such as event attendance or community-initiated stewardship actions help gauge the reach of the broad-based education program outlined in Element E.

Adaptive Management

Implementation of this Watershed-Based Plan will be led by the Housatonic Valley Association (HVA) in partnership with the Berkshire Agricultural Nonpoint Source Pollution Partnership and technical consultants. This core team will coordinate outreach, project planning, and BMP implementation activities, with additional input from local stakeholders and agricultural partners. The Partnership will meet at least twice annually to review progress, assess data from direct and indirect monitoring, and evaluate implementation priorities. These meetings will provide a forum to adjust strategies based on new information, landowner participation, and evolving watershed conditions. Progress will be documented through internal reports and shared with MassDEP and other stakeholders. This plan will be updated every five years or as needed to incorporate new water quality data, project outcomes, and new priorities.

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Water Quality Assessment Reports

"*Housatonic River Watershed 2002 Water Quality Assessment Report*"

Appendices

Appendix A – Pollutant Load Export Rates (PLERs)

Land Use & Cover[1]	PLERs (lb/acre/year)		
	(TP)	(TSS)	(TN)
AGRICULTURE, HSG A	0.45	7.14	2.6
AGRICULTURE, HSG B	0.45	29.4	2.6
AGRICULTURE, HSG C	0.45	59.8	2.6
AGRICULTURE, HSG D	0.45	91	2.6
AGRICULTURE, IMPERVIOUS	1.52	650	11.3
COMMERCIAL, HSG A	0.03	7.14	0.3
COMMERCIAL, HSG B	0.12	29.4	1.2
COMMERCIAL, HSG C	0.21	59.8	2.4
COMMERCIAL, HSG D	0.37	91	3.7
COMMERCIAL, IMPERVIOUS	1.78	377	15.1
FOREST, HSG A	0.12	7.14	0.5
FOREST, HSG B	0.12	29.4	0.5
FOREST, HSG C	0.12	59.8	0.5
FOREST, HSG D	0.12	91	0.5
FOREST, HSG IMPERVIOUS	1.52	650	11.3
HIGH DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.3
HIGH DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.2
HIGH DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.4
HIGH DENSITY RESIDENTIAL, HSG D	0.37	91	3.7
HIGH DENSITY RESIDENTIAL, IMPERVIOUS	2.32	439	14.1
HIGHWAY, HSG A	0.03	7.14	0.3
HIGHWAY, HSG B	0.12	29.4	1.2
HIGHWAY, HSG C	0.21	59.8	2.4
HIGHWAY, HSG D	0.37	91	3.7
HIGHWAY, IMPERVIOUS	1.34	1,480	10.5
INDUSTRIAL, HSG A	0.03	7.14	0.3
INDUSTRIAL, HSG B	0.12	29.4	1.2

INDUSTRIAL, HSG C	0.21	59.8	2.4
INDUSTRIAL, HSG D	0.37	91	3.7
INDUSTRIAL, IMPERVIOUS	1.78	377	15.1
LOW DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.3
LOW DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.2
LOW DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.4
LOW DENSITY RESIDENTIAL, HSG D	0.37	91	3.7
LOW DENSITY RESIDENTIAL, IMPERVIOUS	1.52	439	14.1
MEDIUM DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.3
MEDIUM DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.2
MEDIUM DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.4
MEDIUM DENSITY RESIDENTIAL, HSG D	0.37	91	3.7
MEDIUM DENSITY RESIDENTIAL, IMPERVIOUS	1.96	439	14.1
OPEN LAND, HSG A	0.03	7.14	0.3
OPEN LAND, HSG B	0.12	29.4	1.2
OPEN LAND, HSG C	0.21	59.8	2.4
OPEN LAND, HSG D	0.37	91	3.7
OPEN LAND, IMPERVIOUS	1.52	650	11.3
[1]HSG = Hydrologic Soil Group			

[i] Payment Schedules | Natural Resources Conservation Service: https://www.nrcs.usda.gov/getting-assistance/payment-schedules