MASSACHUSETTS
watershed·based plans

WATERSHED-BASED PLAN

Great Brook (MA32-25)

July 2024

Prepared By:

Massachusetts Association of Conservation Districts
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Prepared For:

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection

This project has been financed with Federal Funds from the Environmental Protection Agency (USEPA) to the Massachusetts Department of Environmental Protection (the Department) under a s. 319 competitive grant. The contents do not necessarily reflect the views and policies of USEPA or of the Department, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

Contents

Executive Summary

Introduction: 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 (USEPA's) recommended format for "nine-element" watershed plans. This WBP was developed by Geosyntec Consultants, Inc. (Geosyntec) under the direction of the Massachusetts Association of Conservation Districts (MACD) with funding, input, and collaboration from the Massachusetts Department of Environmental Protection (MassDEP).

This WBP was prepared for the Great Brook watershed, which is in the Town of Southwick and City of Westfield, Massachusetts; a portion of the watershed (approximately 1.7 square miles east of the Congamond Lakes) is also within Suffield, Connecticut; for the purposes of this WBP, the watershed delineation does not include the Connecticut portion. Great Brook is within the Westfield River watershed, which flows into the Connecticut River. The headwaters of Great Brook (MA32-25) are the Congamond Lakes in Southwick. The Congamond Lakes (also referred to as Lake Congamond) are comprised of three basins ("north basin", "middle basin", and "south basin" also referred to as "north pond", "middle pond", and "south pond") connected by waterways which are navigable by boat. Great Brook begins at twin culverts located at the western side of middle basin (in a cove adjacent to the "South Boat Ramp"). The culverts are underneath Berkshire Avenue.

For this WBP, the watershed was delineated to approximately 900 feet upstream of the confluence with the Westfield River (at Little River Road). The total area of the Great Brook watershed (within Massachusetts) is approximately 14,128 acres (approximately 22.1 square miles). Major tributaries in the Great Brook watershed include Kellog Brook (MA32-55), Slab Brook, Tuttle Brook, Johnson Brook, and Pearl Brook.

The Great Brook Aquifer contains municipal supply wells for the City of West Springfield, City of Westfield, and the Town of Southwick. The aquifer trends north-south across the Town of Southwick and underlies the valley of Great Brook (PVPC 2005). Areas of the watershed adjacent to the Congamond Lakes, Great Brook, and Kellogg Brook include municipal separate storm sewer system (MS4). The Town of Southwick and the City of Westfield are therefore both permitted under the 2016 Massachusetts Small MS4 General Permit.

Impairments and Pollution Sources: Great Brook (MA32-25) is a category 5 water body on the 2022 Massachusetts Integrated List of Waters (303(d) list) due to *Escherichia coli* (*E. coli*) from municipal separate storm sewer system (MS4) and unknown sources; and due to temperature from unknown sources. There is limited water quality data for Great Brook but data available from 2006 and 2012 indicated elevated levels of *E. coli* (above the Massachusetts Water Quality Standards) and elevated levels of Total Phosphorus (TP).

The Congamond Lakes (MA32021, MA32022, MA32023) are identified as category 5 waterbodies due to Eurasian Water Milfoil (*Myriophyllum spicatum*), non-native fish/shellfish, dissolved oxygen (DO), harmful algal blooms, and nutrient/eutrophication biological indicators from MS4 discharges, accidental or intentional introduction of non-native organisms, internal nutrient recycling, and unknown sources. Data available for the Congamond Lakes (2009, 2013, 2015, 2016, and 2023) indicated elevated levels of *E. coli* and elevated levels of TP.

In addition to the identified pollution sources on the 303(d) list, stormwater runoff from agricultural parcels is also a potential nonpoint source pollution source in the watershed.

Goals, Management Measures, and Funding: The long-term goal of this WBP is to reduce *E. coli* and Total Phosphorus (TP) loading to Great Brook and the Congamond Lakes, eventually leading to delisting of impaired waterbodies in the study area from the 303(d) list. It is expected that these pollutant load reductions will result in improvements to other water quality parameters throughout the watershed as well.

It is expected that these goals will be accomplished through implementation of structural, non-structural and agricultural Best Management Practices (BMPs) to capture runoff and reduce *E. coli* loading as well as implementation of watershed education and outreach to achieve additional pollutant load reductions. MACD was a recipient of Section 319 funding in Fiscal Year 2022 for its Agricultural Nonpoint Source Regional Coordinators for Franklin, Hampshire, Hampden Counties program. Under this program, MACD is supporting the Massachusetts Nonpoint Source Program through regional agricultural coordinators. The coordinators focus their efforts to restore impaired waters and protect unimpaired/high quality and threatened waters within Western Massachusetts watersheds including the Great Brook watershed.

It is expected that future funding for management measures will be obtained from a variety of sources including Section 319 Grant Funding, Climate Smart Agricultural Program (CSAP), Massachusetts Environmental Trust (MET) grants, Massachusetts Department of Agricultural Resources (MDAR), , the Agricultural Produce Safety Improvement Program (APSIP), Town capital funds, volunteer efforts, and United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) grants including the Environmental Quality Incentives Program (EQIP) and the Agricultural Management Assistance (AMA) program.

Public Education and Outreach: Goals of public education and outreach are to provide information and incentives to farmers on funding resources for BMP implementation; provide information about farm conservation plans and agricultural BMPs and their anticipated benefit to farm operations as well as water quality benefits; provide information to all residents within the watershed to promote watershed stewardship; provide information to all residents in the watershed about proposed stormwater improvements and their anticipated water quality benefits; and to meet Massachusetts Small MS4 Permit Requirements.

An initial stakeholder meeting was held on March 8, 2024, which included core stakeholders in the Great Brook watershed. The purpose of the meeting was to introduce stakeholders to one another and gain consensus on elements of this WBP.

Implementation Schedule and Evaluation Criteria: The implementation schedule includes milestones for monitoring, farmer outreach for implementation of structural and non-structural BMPs, public education and outreach, and plan updates.

This WBP recommends establishing a Great Brook watershed water quality monitoring program that includes sampling at key locations along Great Brook, its tributaries, and the Congamond Lakes. This would help achieve a better understanding of water quality trends in Great Book including determining sources of pollution, evaluating the effectiveness of implemented BMPs, and tracking compliance with the water quality goals identified in this WBP.

This WBP is meant to be a living document, re-evaluated at least once every three years and adjusted as needed based on ongoing efforts (e.g., based on monitoring results, funding, etc.). It is recommended that a working group of watershed stakeholders be established to meet at least biannually to implement and update this WBP, and track progress. A stakeholder should also be designated for maintaining this plan and coordinating periodic plan evaluations and updates.

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 (USEPA'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.

USEPA 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 for the Great Brook watershed includes nine elements (a through i) in accordance with USEPA 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 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 (EQIP) 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 nonpoint source management measures that will be implemented.

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

g) A description of **interim, measurable milestones** for determining whether nonpoint source 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 towards attaining water quality standards and, if not, the criteria for determining whether this WBP needs to be revised or, if a nonpoint source 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.

Project Partners and Stakeholder Input

This WBP was developed by Geosyntec under the direction of the Massachusetts Association of Conservation Districts (MACD) with funding, input, and collaboration from MassDEP, with funding from the Section 319 program. MACD was a recipient of Section 319 funding in Fiscal Year 2022 for its Agricultural Nonpoint Source Regional Coordinators for Franklin, Hampshire, Hampden Counties program. Under this program, MACD is supporting the Massachusetts Nonpoint Source Program through regional agricultural coordinators. The coordinators focus their efforts to restore impaired waters and protect unimpaired/high quality and threatened waters within Western Massachusetts watersheds including the Great Brook watershed.

The following are core Great Brook WBP stakeholders:

- Michael Leff – MACD
- Judith Rondeau – MassDEP
- Meghan Selby – MassDEP
- Malcolm Harper – MassDEP
- Therese Boudoin -- MassDEP
- Ryan O'Donnell – Connecticut River Conservancy
- Patty Gambarini – Pioneer Valley Planning Commission (PVPC)
- Sabrina Pooler – Southwick Conservation Commission
- Randal Brown – Southwick Department of Public Works (Southwick DPW)
- Dick Grannells – Southwick DPW and Southwick Lake Management Committee
- Catherine Magee – Natural Resources Conservation Service (NRCS)
- Christopher Pratt – Southwick Conservation Commission
- Michelle Pratt – Citizens Restoring Congamond
- Jay Vinskey – City of Westfield Planning Department
- Matthew Karas—Hampden Hampshire Conservation District (HHCD)

This WBP was developed as part of an iterative process as outlined below:

- The Geosyntec project team first collected and reviewed existing data from MACD and other available sources.
- Subsequently, a stakeholder meeting was held on March 8, 2024, to solicit additional input and gain consensus on elements included in the plan (identifying problem areas, BMP projects, water quality goals, public outreach activities, etc.). The meeting minutes from the stakeholder conference call are included in **Appendix A**.
- Next, a WBP was drafted and reviewed by MACD.
- The WBP was updated and finalized based on MACD input and submitted to MassDEP for review.

This WBP is meant to be a living document. It should be reevaluated at least once every three years and adjusted as needed based on ongoing efforts (e.g., based on monitoring results, 319 funding, etc.). It is strongly recommended that a working group including the stakeholders listed above and possibly additional stakeholders be established to meet at least biannually to implement and update this WBP, and track progress.

Data Sources

This WBP was developed using the framework and data sources provided by MassDEP's WBP Tool and supplemented by information provided in the Section 319 grant application for "Agricultural Nonpoint Source Regional Coordinators for Franklin, Hampshire, Hampden Counties" (MACD, 2021). Additional data sources were reviewed and are included in subsequent sections of this WBP.

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

This WBP was prepared for the Great Brook watershed, which is in the towns of Southwick and Westfield, Massachusetts; a portion of the watershed (approximately 1.7 square miles east of the Congamond Lakes) is also within Suffield, Connecticut; for the purposes of this WBP, the watershed delineation does not include the Connecticut portion. Great Brook is within the Westfield River watershed, which flows into the Connecticut River.

The headwaters of Great Brook (MA32-25) are the Congamond Lakes in Southwick. The Congamond Lakes (also referred to as Lake Congamond) are comprised of three basins ("north basin", "middle basin", and "south basin" also referred to as "north pond", "middle pond", and "south pond") connected by waterways which are navigable by boat. The north basin (MA32022) is 47 acres, has an average depth of 21 feet, and a maximum depth of 46 feet. The middle basin (MA32021) is 284 acres, has an average depth of 22 feet, and a maximum depth of 42 feet. The south basin (MA32023) is 146 acres, has an average of 16 feet, and a maximum depth of 27 feet (MassWildlife 2016). A bathymetry map of the Congamond Lakes is included in **Appendix B.** Great Brook begins at twin culverts located at the western side of middle basin (in a cove adjacent to the "South Boat Ramp"). The culverts are underneath Berkshire Avenue. Due to sedimentation that has occurred in this cove, Great Brook periodically reverse flows into the middle basin. Efforts are currently underway to restore the flow from Lake Congamond middle basin to Great Brook (see **Element C**) (Town of Southwick 2024a). The Congamond Lakes have one additional outlet, Canal Brook, which is a former canal that flows south through Connecticut into the Farmington River.

For this WBP, the watershed was delineated to approximately 900 feet upstream of the confluence with the Westfield River (at Little River Road). The total area of the Great Brook watershed (within Massachusetts) is approximately 14,128 acres (approximately 22.1 square miles). Major tributaries in the Great Brook watershed include Kellog Brook (MA32-55), Slab Brook, Tuttle Brook, Johnson Brook, and Pearl Brook.

The Great Brook Aquifer contains municipal supply wells for the City of West Springfield, City of Westfield, and the Town of Southwick. The aquifer trends north-south across the Town of Southwick and underlies the valley of Great Brook (PVPC 2005).

Areas of the watershed adjacent to the Congamond Lakes, Great Brook, and Kellogg Brook include municipal separate storm sewer systems (MS4). The Town of Southwick and the City of Westfield are therefore both permitted under the 2016 Massachusetts Small MS4 General Permit[1]. **Appendix C** includes the MS4 area within Southwick and Westfield.

[1] https://www.epa.gov/npdes-permits/massachusetts-small-ms4-general-permit

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

Table A-1: Great Brook General Watershed Information

Waterbody Name (Assessment Unit ID):	Great Brook (MA32-25) Kellog Brook (MA32-55) Slab Brook Tuttle Brook Johnson Brook Pearl Brook Congamond Lakes – Middle Basin (MA32021) Congamond Lakes – North Basin (MA32022) Congamond Lakes – South Basin (MA32023)
Major Basin:	Westfield
Watershed Area (within MA):	14,128 acres (22.1 square miles)

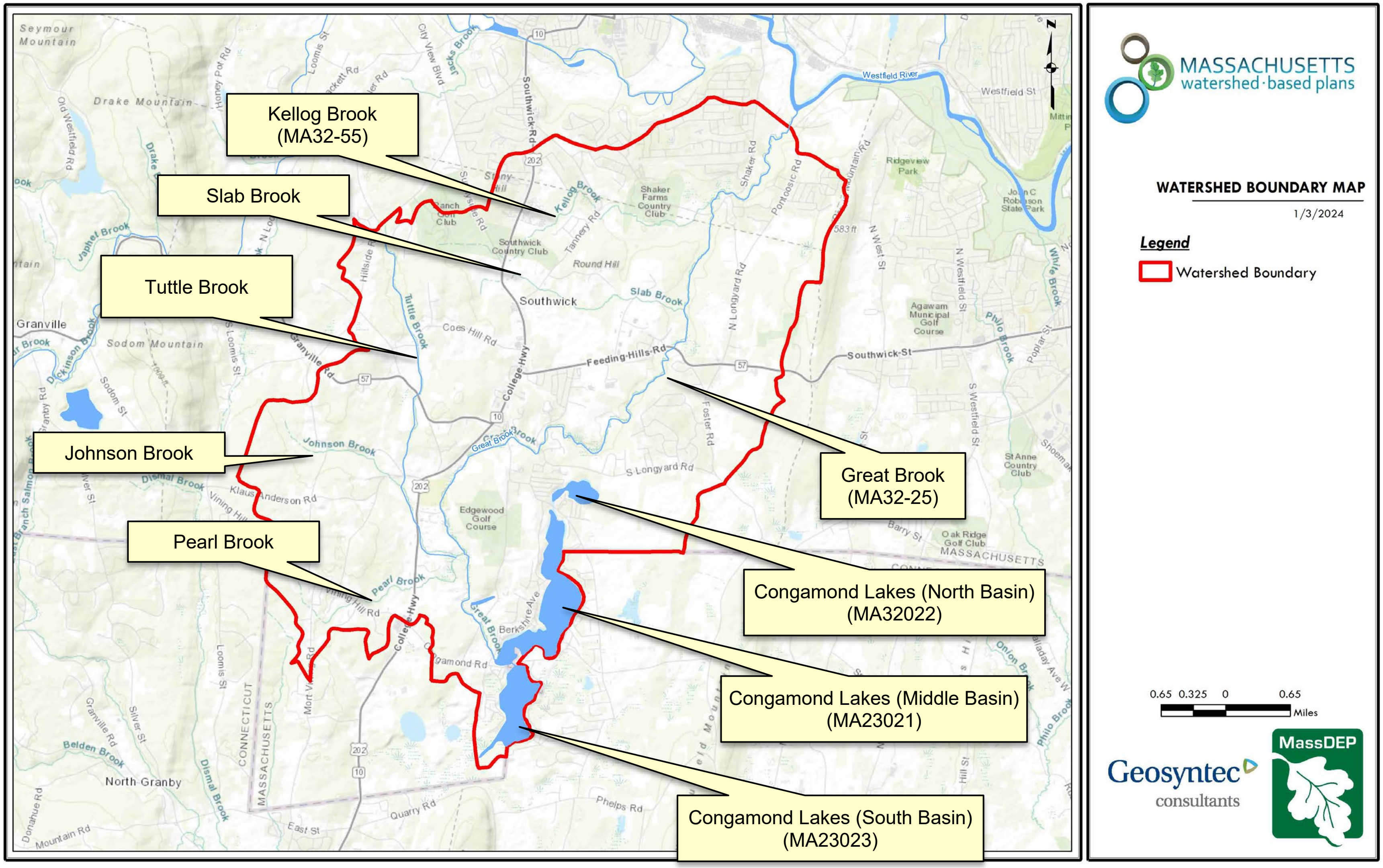

Figure A-1: Great Brook Watershed Boundary Map

(MassGIS, 2007; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

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

MassDEP Water Quality Assessment Report and TMDL Review

The section below summarizes the findings of the available Water Quality Assessment Reports and/or TMDLs that relate to water quality and water quality impairments.

The following water quality assessment report is available:

- *Westfield River Watershed 2001 Water Quality Assessment Report* (MassDEP, 2005)

The Great Brook watershed does not have a TMDL[2]. Select excerpts from the water quality assessment report relating to the water quality in the Great Brook watershed are included in **Appendix D** (note: relevant information is included directly from this document for informational purposes and has not been modified).

Water Quality 303 (d) List Impairments

Impairment categories from the MassDEP 2022 Massachusetts Integrated List of Waters (303(d) List) (MassDEP, 2023) are listed in **Table A-2**. Known water quality impairments, as documented in the 2022 303(d) List are illustrated in **Figure A-2** and listed in **Table A-3,** which indicates that Great Brook (MA32-25) is identified as a category 5 waterbody due to *Escherichia coli* (*E. coli*) from municipal separate storm sewer system (MS4) and unknown sources and due to temperature from unknown sources. The Congamond Lakes (MA32021, MA32022, MA32023) are identified as category 5 waterbodies due to Eurasian Water Milfoil, non-native fish/shellfish, dissolved oxygen (DO), harmful algal blooms, and nutrient/eutrophication biological indicators from MS4 discharges, accidental or intentional introduction of non-native organisms, internal nutrient recycling, and unknown sources. In addition to the listed impairments, it was mentioned during the March 8, 2024 stakeholder meeting (meeting minutes included in **Appendix A**) that Curly Pondweed and Hydrilla were recently found in at least two coves of the Congamond Lakes. *E. coli* is not currently a listed impairment for the Congamond Lakes, but available water quality monitoring data indicates elevated concentrations of *E. coli* in the Congamond Lakes (more information provided below).

Table A-2: 2022 Massachusetts 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.

[2] Great Brook is part of the Connecticut River watershed; the Connecticut River flows into the Long Island Sound. The Long Island Sound has a TMDL: "A Total Maximum Daily Load Analysis to Achieve Water Quality Standards for Dissolved Oxygen in Long Island Sound".

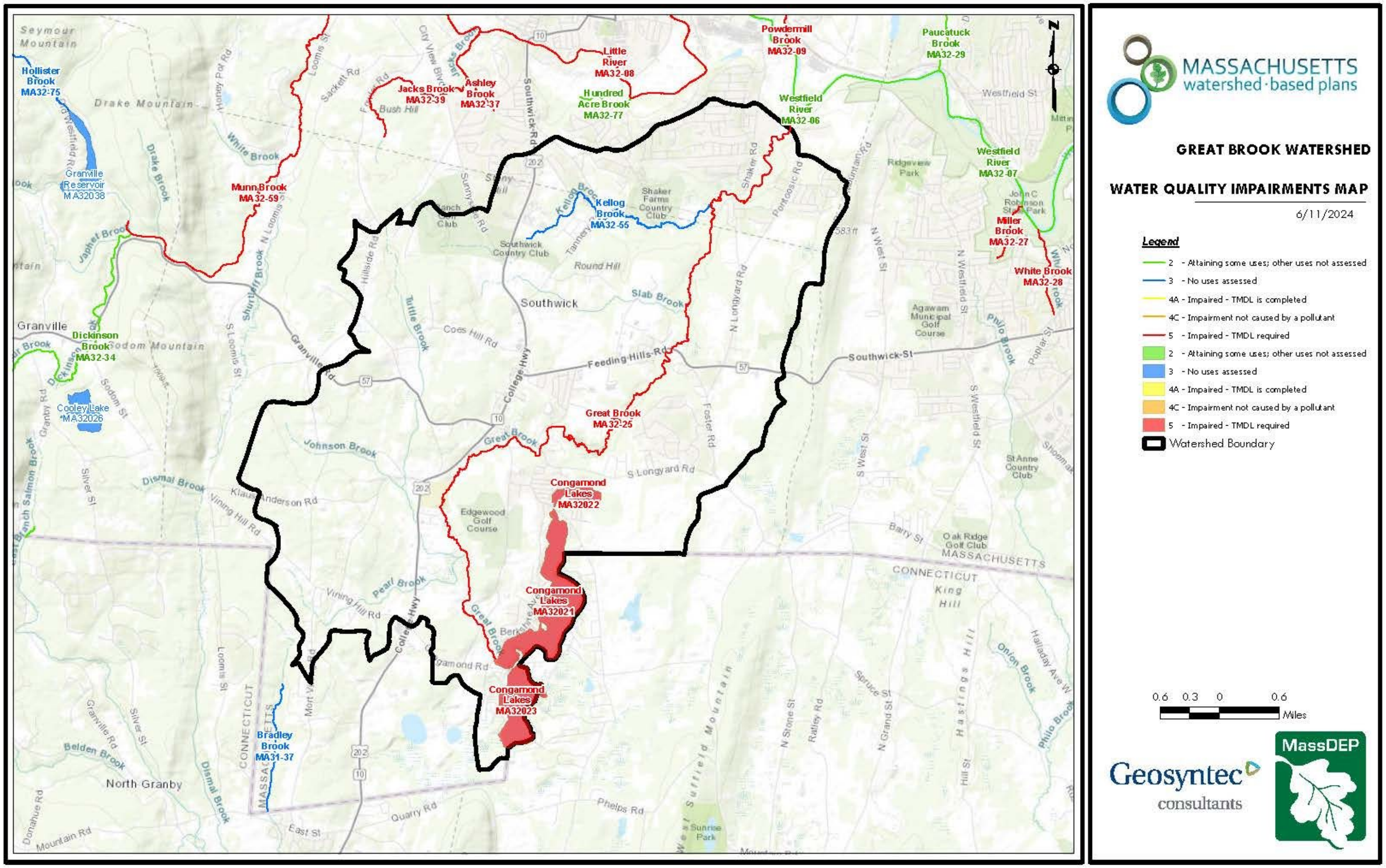

Figure A-2: Great Brook Watershed Water Quality Impairments Map
(MassGIS, 2022a; MassGIS, 2022b; ESRI et al., 2023)

Table A-3: Water Quality Impairments (MassDEP, 2023)

Assessment Unit ID	Waterbody	Integrated List Category	Designated Use	Impairment Cause	Suspected Impairment Source
MA32-25	Great Brook	5	Fish, other Aquatic Life and Wildlife	Temperature	Source Unknown
		5	Primary Contact Recreation	Escherichia Coli (*E. coli*)	Discharges from Municipal Separate Storm Sewer System (MS4)
		5	Primary Contact Recreation	Escherichia Coli (*E. coli*)	Source Unknown
MA322021	Congamond Lake (Middle Basin)	5	Fish, other Aquatic Life and Wildlife	Eurasian Water Milfoil, Myriophyllum Spicatum	Introduction of non-native organisms (accidental or intentional)
		5	Fish, other Aquatic Life and Wildlife	Non-Native Fish/Shellfish/Zooplankton	Introduction of non-native organisms (accidental or intentional)
		5	Primary Contact Recreation	Harmful Algal Blooms	Discharges from Municipal Separate Storm Sewer System (MS4)
		5	Primary Contact Recreation	Harmful Algal Blooms	Source Unknown
		5	Aesthetic	Harmful Algal Blooms	Discharges from Municipal Separate Storm Sewer System (MS4)
		5	Aesthetic	Harmful Algal Blooms	Source Unknown
		5	Secondary Contact Recreation	Harmful Algal Blooms	Discharges from Municipal Separate Storm Sewer System (MS4)
		5	Secondary Contact Recreation	Harmful Algal Blooms	Source Unknown
		5	Fish, other Aquatic Life and Wildlife	Dissolved Oxygen (DO)	Source Unknown
MA322022	Congamond Lake (North Basin)	5	Fish, other Aquatic Life and Wildlife	Eurasian Water Milfoil, Myriophyllum, Spicatum	Introduction of non-native organisms (accidental or intentional)
		5	Fish, other Aquatic Life and Wildlife	Dissolved Oxygen	Source Unknown
MA322023	Congamond Lake (South Basin)	5	Fish, other Aquatic Life and Wildlife	Eurasian Water Milfoil, Myriophyllum, Spicatum	Introduction of non-native organisms (accidental or intentional)
		5	Fish, other Aquatic Life and Wildlife	Nutrient/Eutrophication Biological Indicators	Internal Nutrient Recycling
		5	Fish, other Aquatic Life and Wildlife	Nutrient/Eutrophication Biological Indicators	Source Unknown
		5	Fish, other Aquatic Life and Wildlife	Dissolved Oxygen	Source Unknown
		5	Fish, other Aquatic Life and Wildlife	Dissolved Oxygen	Internal Nutrient Cycling

March 8, 2024, Stakeholder Meeting Pollutant Sources Identification

The main potential pollution sources to Great Brook that were discussed during the stakeholder meeting on March 8. 2024 included:

- Lack of regulation or oversight on runoff from agricultural properties (agricultural properties in the watershed are mainly tobacco and there are also some vegetable/flower farms, and a few horse farms);
- Boats not properly washed before entering the Congamond Lakes, after being in other waterbodies, thereby introducing invasive non-native species; and
- MS4 discharges.

Water Quality Data

MassDEP Water Quality Monitoring Program Data

Historical and current Technical Memoranda (TM) produced by the MassDEP Watershed Planning Program (WPP) are available here: https://www.mass.gov/guides/water-quality-technical-memoranda 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 primarily to biological information (e.g., benthic macroinvertebrates, periphyton, fish populations) contain biological data and metrics that are currently not reported elsewhere. The data contained in the water quality TMs are also provided on the "Data" page https://www.mass.gov/guides/water-quality-monitoring-program-data. Many of these TMs have helped inform Clean Water Act 305(b) assessment and 303(d) listing decisions.

WPP *E. coli* water quality monitoring data is available for the Great Brook watershed from the years 2006, 2012, and 2016 (MassDEP, 2022). Data was taken at a different location in the watershed during each of these years.

The *E. coli* data is presented in **Table A-4**, and all locations in each of the three years (2006, 2012, 2016) exceeded the Massachusetts Surface Water Quality Standards (MSWQS) (MassDEP, 2021) for *E. coli*, which states that *E. coli* concentrations shall not exceed 126 colony-forming units per 100 milliliters (CFU/100mL), calculated as the geometric mean of all samples collected within any 90-day or smaller interval; and no more than 10 percent of all such samples shall exceed 410 CFU/100 mL (a statistical threshold value).

Table A-4: MassDEP Water Quality Monitoring Program *E. coli* Data for Great Brook and Congamond Lakes (MassDEP, 2023)

Unique ID	Sampling Location	Date	*E. coli* (CFU/100 mL or MPN/100 mL)	90-Day Geometric Mean (CFU/100 mL or MPN/100 mL)	Geometric Mean Criterion Exceeded? (126 CFU/100 mL)	STV Criterion Exceeded? (410 CFU/100 mL)	Meets MSWQS/Water Quality Goal?
W1456	Great Brook [Shaker Road bridge nearest Canal Drive, Westfield]	5/9/2006	20	20	No	No	Yes
		6/13/2006	44	30	No	No	Yes
		7/25/2006	160	52	No	No	Yes
		8/29/2006	204	113	No	No	Yes
		10/3/2006	436	242	Yes	Yes	**No**
W2276	Great Brook [approximately 175 feet downstream of the Shaker Road crossing nearest the Kellog Brook confluence (which is approximately 600 feet downstream of station), Westfield]	5/10/2012	1,990	1,990	Yes	Yes	**No**
		5/30/2012	866	1,313	Yes	Yes	**No**
		6/14/2012	114	581	Yes	Yes	**No**
		7/19/2012	36	290	Yes	Yes	**No**
		8/16/2012	1,730	280	Yes	Yes	**No**
		9/20/2012	248	249	Yes	Yes	**No**
W2608	Congamond Lakes [South Basin, beach east of Beach Road, south off Route 168 (Congamond Road), Southwick]	5/9/2016	2	2	No	No	Yes
		6/13/2016	5	3	No	No	Yes
		7/5/2016	3	3	No	No	Yes
		8/8/2016	113	8	No	No	Yes
		9/12/2016	2,420	45	No	Yes	**No**

"*E. coli*" = Escherichia coli
"STV" = statistical threshold value
"MSWQS" = Massachusetts Surface Water Quality Standards
"MPN/100 mL" = most probable number per 100 milliliters
"CFU/100 mL" = colony forming units per 100 milliliters
Samples taken in 2006 were reported in CFU/100 mL and those taken in 2012 and 2016 were reported in MPN/100 mL.

WPP TP water quality monitoring data is available at one location along Great Brook from 2012 and two locations in the Congamond Lakes (South Basin and Middle Basin) from 2016. These data are presented in **Table A-5** and **Table A-6**, respectively. TP concentrations were above the TP USEPA "Gold Book" (USEPA, 1986) standard of 50 micrograms per liter (µg/L) for rivers/streams on two of the sampling events for Great Brook in 2012 (**Table A-5**). TP concentrations in the near bottom of the lakes were also above the TP USEPA "Gold Book" (USEPA, 1986) of 25 µg/L for lakes, but the TP concentrations were below the standard at the surface of the Congamond Lakes in 2016 (**Table A-6**).

Table A-5: MassDEP 2012 Water Quality Monitoring Program TP Data for Great Brook (MassDEP, 2023)

Unique ID	Sampling Location	Date	TP (µg/L)
W2276	Great Brook [approximately 175 feet downstream of the Shaker Road crossing nearest the Kellog Brook confluence (which is approximately 600 feet downstream of station), Westfield	5/10/2012	**100**
		6/14/2012	46
		7/19/2012	16
		8/16/2012	**140**
		9/20/2012	39

"µg/L" = micrograms per Liter

Table A-6: MassDEP 2016 Water Quality Monitoring Program TP Data for Congamond Lakes (South and Middle Basin) (MassDEP, 2023)

Unique ID	Sampling Location	Date	TP (µg/L)	
			Surface	Near Bottom
W0925	Congamond Lakes [deep hole, center of South Basin, Southwick]	6/22/2016	19	**45**
		7/28/2016	13	**62**
		9/14/2016	21	**100**
W0923	Congamond Lakes [deep hole, center of Middle Basin, Southwick]	**6/22/2016**	21	**100**
		7/28/2016	15	**360**
		9/14/2016	11	**720**

"µg/L" = micrograms per Liter

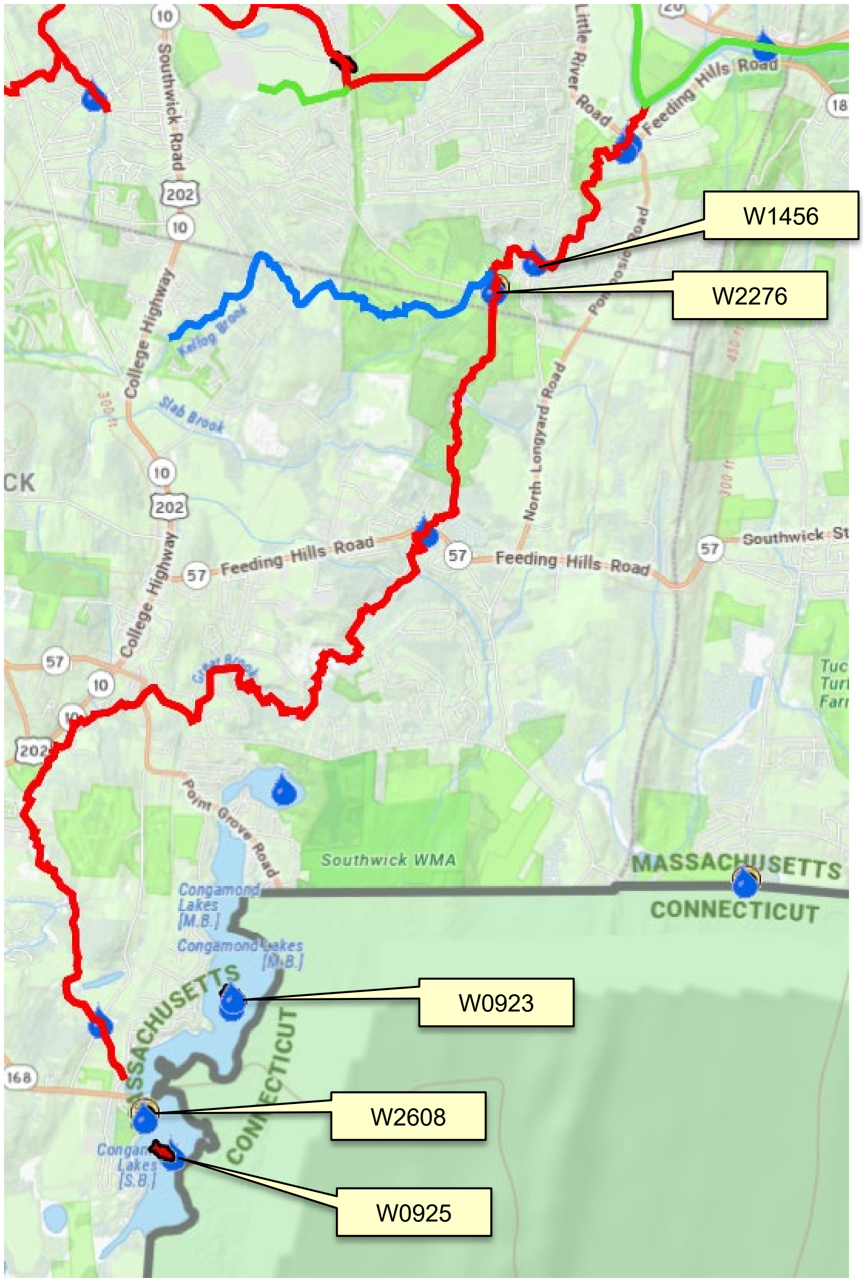

Figure A-3 MassDEP Water Quality Monitoring Program *E. coli* and Total Phosphorus Data Stations for Great Brook Watershed (MassDEP, 2022)

Aquatic Plant Mapping and Water Quality Monitoring at Congamond Lake - 2009

Northeast Aquatic Research conducted an aquatic plant and water quality study in the Congamond Lakes in 2009 (Northeast Aquatic Research, 2010). The objectives of the study were to collect water quality information each of the three Congamond Lakes basins (North, Middle, and South) and to survey the aquatic plants in the Congamond Lakes.

Water quality data was obtained from two visits in September and October of 2009. Three in-lake stations were established, one in each of the three basins. Each station was generally located in the deepest part of the basin. The water quality depths that were sampled ("top", "middle", and "bottom") for each of the basins are listed in **Table A-7**. **Table A-8** presents the TP monitoring results at each of the three locations. TP concentrations were above the TP USEPA "Gold Book" (USEPA, 1986) standard of 25 µg/L on one or both sampling events in all three basins.

Table A-7: 2009 Water Sampling Depths in the Congamond Lakes (Northeast Aquatic Research, 2010)

	South Basin	Middle Basin	North Basin
Top (feet below surface)	3	3	3
Middle (feet below surface)	10	20	16
Bottom (feet below surface)	23	33	36

Table A-8: 2009 Total Phosphorous (µg/L) Results for Congamond Lakes (Northeast Aquatic Research, 2010)

Location	South Basin		Middle Basin		North Basin	
Date	9/14/2009	10/14/2009	9/14/2009	10/14/2009	9/14/2009	10/14/2009
Surface	27	**43**	22	25	13	15
Middle	29	**52**	24	21	22	12
Bottom	**252**	**47**	**26**	**196**	**42**	**43**
Average	**103**	**48**	24	**81**	**26**	23

"µg/L" = micrograms per Liter

Based on these results as well as the additional monitoring that was conducted for various other parameters, the study concluded that Congamond Lakes have a variable trophic condition, with South Basin being eutrophic, North Pond being mesotrophic, and Middle Pond not quite fitting a category, having slightly less TP than South Basin but slightly poorer clarity. The study concluded that South Basin appears to generate a significant amount of TP internally from sediment release, and it is possible that TP released from sediments in South Basin mixes throughout the water column by late summer because the thermocline erodes quickly in that basin causing bottom TP to diffuse into upper waters. Higher TP levels in South Basin may contribute to TP values in Middle Basin (Northeast Aquatic Research, 2010). Since Middle Basin is the headwaters of Great Brook, Middle Basin may also be a source of pollutant loading to Great Brook.

The aquatic plant survey consisted of collecting species presence at GPS waypoints along the entire shoreline of the three basins of the Congamond Lakes. The study concluded that the aquatic plants in the Congamond Lakes were characterized as a tape grass/pondweed association with areas of water lilies. The lake had a high diversity of species (38) but only five occurred at more than 10 percent of the observation sites. Two invasive aquatic plants were found: Eurasian milfoil (*Myriophyllum spicatum*) and Minor Naiad (*Najas minor*). Eurasian milfoil was present at only 5 points (2%), three in South Basin (each near the small bay on the east side of the lake), and two in North Basin. The North Basin sites only had individual milfoil plants scattered along the shoreline and mixed with other native species. The South Basin sites, clustered together near the existing buoys marking the exclusion zone, were more robust than the North Basin plants but still did not reach the surface. No topped-out beds of milfoil were found. Minor naiad was found at 3 points (1.3%), two points were near the northern tunnel in Middle Basin, and one site was in South Basin. There were stretches of shoreline in Middle Basin that had no plants, or only very tiny bottom plants. The study also concluded that the Congamond Lakes have very high number of bluegreen algae in the water in September. The bluegreen algae were dominated by the taxon; Lyngbya and Anabaena. Both these groups have species that are known toxin producers, and the study recommended testing for Microcystin in the future (Northeast Aquatic Research, 2010).

Zebra Mussel Phase II Assessment – 2010

Biodrawversity LLC assessed 26 lakes and reservoirs and four rivers in the Connecticut River watershed to determine presence of zebra mussels (Dreissena polymorpha) and to evaluate the potential for these waterbodies to support zebra mussels based on physical, chemical, and biological parameters. The study included assessment of the Congamond Lakes. Fieldwork was conducted June of 2010 (Biodrawversity LLC, 2010). Based on the results of the analysis (pH higher than 8.0, higher average species richness of aquatic snails, and calcium concentration) the Congamond Lakes were identified as vulnerable and medium risk to zebra mussel invasion. **Figure A-4** includes the "Lake Profile" of Congamond Lakes from the 2010 assessment.

The study also noted that The Congamond Lakes are also very accessible, have multiple launch sites, and receive high visitation including competitive bass tournaments that draw anglers from around the region. Based on information from the Department of Conservation and Recreation (DCR), in 2008, 48 boats reportedly last used in zebra mussel infested waters (Lake George NY, Twin Lakes CT, Lake Ontario NY, and Lake Champlain VT) were launched in the Congamond Lakes, indicating a high prevalence of potential dispersal vectors (Biodrawversity LLC, 2010).

Zebra Mussel Phase II Assessment in the Connecticut River Watershed of Massachusetts

biodrawversity research report

Congamond Lakes
Southwick

- Surveyed: June 18, 2010
- Survey Sites: Five locations in two basins were surveyed, including boat access points and a former public beach were surveyed. Methods included SCUBA (four locations), snorkeling (five locations) and D-net sampling while wading (five locations), three plankton tows, and both laboratory and field measurements of water chemistry parameters.
- Description: The three basins of the Congamond Lakes comprise 465 acres of surface area in the towns of Southwick, MA and West Suffield, CT. Macrophyte abundance was generally high throughout the lake, with a decline in plant densities in deep water. Substrate in shallow areas was primarily sand and gravel with some areas of cobble, while deeper areas contained mostly organic muck or gyttja. Secchi depth ranged from 4.5 to 6 feet. Average dssolved oxygen was 12.7 mg/L at the surface and 0.4 mg/L at 13 feet. Shoreline development and recreation are very high, with multiple boat ramps and many private docks.
- Potential for Zebra Mussels: The Congamond Lakes are considered Medium Risk, with a pH readings ranging from 7.7 to 8.2, calcium between 14-16 mg/L, and alkalinity of 42-46 mg/l. The size, depth, and substrate make it among the more suitable physical habitats among the 2010 survey lakes. High boating activity increases the risk of zebra mussel introduction.

Congamond Lake survey sites.

Figure A-4: Lake Profile – Congamond Lakes (Biodrawversity LLC, 2010)

Development of an Algae Management Plan for the Congamond Lakes - 2016

Water Resources Services assisted the Lake Management Committee with development of a monitoring program with the intent of collecting water quality and supplemental data necessary for a proper review of algae control options in the Congamond Lakes (Water Resource Services, 2016). Key elements of the study included:

- Temperature and oxygen profiles,
- Nutrient concentrations,
- Algae sampling,
- Zooplankton sampling,
- Stormwater first flush sampling,
- Sediment sampling, and
- Lake loading modeling.

Monthly 2015 TP data from the study (as well as 2013 TP data and the 2009 TP data from Northeast Aquatic Research presented above) is presented in **Table A-9** (Water Resource Services, 2016).

Table A-9: 2009, 2013, and 2015 Total Phosphorous (µg/L) Results for Congamond Lakes (Water Resources Services, 2016)

Date		9/14/2009	10/14/2009	7/24/2013	9/3/2013	5/20/2015	6/19/2015	7/16/2015	8/18/2015	9/18/2015	10/14/2015
North Basin	Surface	13	15	10	10	14	14	10	13	10	10
	Bottom	42	43	24	24	32	32	66	79	30	62
	Average	28	**29**	17	17	23	23	**38**	**46**	20	**36**
Middle Basin	Surface	22	25	17	17	21	29	14	19	19	13
	Bottom	26	196	110	110	34	130	390	450	340	220
	Average	**24**	**111**	**64**	**64**	**28**	**80**	**202**	**235**	**180**	**117**
South Basin	Surface	27	43	19	18	22	26	12	13	19	22
	Bottom	252	47	30	320	28	81	36	88	48	23
	Average	**140**	**45**	**25**	**169**	25	**54**	24	**51**	**34**	23

"µg/L" = micrograms per Liter

Additional findings from this study included monthly algal biomass variabilities. Algal biomasses peaked in the fall with minimal presence in the beginning of the summer. Zooplankton biomass peaked in the early summer but dropped during the fall.

Based on stormwater quality data that was obtained during this study, it was concluded that in smaller quantities stormwater runoff does not affect the large water volumes in the lakes, but over time have has a potential impact on the higher internal loading and recycling of TP and TN in the Congamond Lakes. Additional sampling of sediment cores in the South Pond determined that there is a high amount of iron-bound phosphorous that could be contributing to the high nutrient cycling and ultimate anoxic conditions of the lakes, but further testing would be required. Fertilizer was noted to be a major contributor of nitrogen and phosphorous and loads from the atmosphere, birds, and septic systems were concluded to be relatively minor.

Town Beach *E. coli* Monitoring

The Southwick Health Department monitors the Southwick Town Beach (located on the South Basin of Congamond Lakes) weekly for *E. coli* during the summer swimming season each year. Data from 2023 is presented in **Table A-10** (Hibert, 2024). The beach was closed for approximately two weeks in the Summer of 2023 due to elevated levels of *E. coli*. Input from stakeholders during the stakeholder meeting on March 8, 2024, also indicated that beach closures usually occur every summer due to elevated *E. coli*.

Table A-10: 2024 Southwick Town Beach *E. coli* Data (Hibert, 2024)

Date	*E. coli* (CFU/100 mL)	90-Day Geometric Mean (CFU/100 mL)	Geometric Mean Criterion Exceeded? (126 CFU/100 mL)	STV Criterion Exceeded? (410 CFU/100 mL)	Meets MSWQS/Water Quality Goal?	Beach Status
6/12/2023	90	90	No	No	Yes	Open
6/20/2023	277	158	**Yes**	No	**No**	Closed 6/23/23
6/27/2023	294	194	**Yes**	No	**No**	Remains closed
7/5/2023	32	124	No	No	Yes	Beach reopened
7/11/2023	33	95	No	No	Yes	Open
7/17/2023	30	78	No	No	Yes	Open
7/25/2023	6.3	55	No	No	Yes	Open
7/31/2023	36	52	No	No	Yes	Open
8/8/2023	13	45	No	No	Yes	Open
8/16/2023	7.5	34	No	No	Yes	Closed for season 8/20/23

"E. coli" = Escherichia coli
"STV" = statistical threshold value
"MSWQS" = Massachusetts Surface Water Quality Standards
"CFU/100 mL" = colony forming units per 100 milliliters

Water Quality Goals

Based on the impairments and water quality data identified above, the long-term water quality goal in the Great Brook watershed is to reduce bacteria and TP loading to Great Brook and the Congamond Lakes so the Great Brook watershed meets its designated uses for fish, other aquatic life, and wildlife; primary contact recreation; aesthetic; and secondary contact recreation. It is expected that reduction in TP loading in the Congamond Lakes will also result in improvements to DO impairment, harmful algal blooms, and non-native aquatic macrophytes. Excess TP can cause eutrophication which depletes DO. Effective management of TP can limit eutrophication and allow DO to naturally replenish (USEPA, 2024).

As noted above, the Great Brook watershed does not have a TMDL, but it is within the Connecticut River watershed, which flows into the Long Island Sound. The Long Island Sound has a TMDL: "A Total Maximum Daily Load Analysis to Achieve Water Quality Standards for Dissolved Oxygen in Long Island Sound", which has a target to attain a 58.5 percent reduction in nitrogen discharges to Long Island Sound from Connecticut and New York (and a standard of 0.34 mg/L for TN in waters entering the Long Island Sound) and a 10 percent reduction target for discharges to the Connecticut River from Massachusetts (NYSDEC, 2000). It is expected that progress made toward achieving the water quality goals will also result in reductions in nitrogen discharges to the Connecticut River stemming from the Great Brook watershed.

The water quality goals for bacteria, temperature, and DO are based on the MSWQS (MassDEP, 2021), which prescribe the minimum water quality criteria required to sustain a waterbody's designated uses. **Table A-6** includes the Massachusetts surface water classifications by assessment unit within the Great Brook watershed. All the assessment units in the watershed are designated as Class 'B' waterbodies. Class B is assigned to waters designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth, and other critical functions, and for primary and secondary contact recreation. Where designated in 314 CMR 4.06 (of the MSWQS), they shall be suitable as a source of public water supply with appropriate treatment ("Treated Water Supply"). Class B waters shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value (MassDEP, 2021). Kellog Brook (not listed as impaired on the 303 (d) list) is also identified as a Cold Water Fishery, which indicates "waters in which the mean of the maximum daily temperature over a seven day period generally does not exceed 68°F (20°C) and, when other ecological factors are favorable (such as habitat), are capable of supporting a year-round population of cold water stenothermal aquatic life such as trout (Salmonidae)" (MassDEP, 2021).

Table A-6: Surface Water Quality Classification by Assessment Unit

Assessment Unit ID	Waterbody	Class	Qualifier (if applicable)
MA32-25	Great Brook	B	
MA32-55	Kellog Brook	B	Cold Water Fishery
MA322021	Congamond Lakes – middle basin	B	
MA322022	Congamond Lakes – north basin	B	
MA322023	Congamond Lakes – south basin	B	

The water quality goal for TP is based on target concentrations established in the Quality Criteria for Water (EPA, 1986) (also known as the "Gold Book"). The Gold Book states that TP should not exceed 50 µg/L in any stream at the point where it enters any lake or reservoir, nor should TP exceed 25 µg/L within a lake or reservoir. For the purposes of developing WBPs, MassDEP has adopted 50 µg/L as the TP target for all streams (that do not have a TP TMDL) at their downstream discharge point, regardless of which type of water body the stream discharges to.

Refer to **Table A-7** for a list of water quality goals for TP, bacteria, temperature, non-native aquatic macrophytes/harmful algal blooms, DO, and TN. Element C of this WBP includes proposed management measures to address these water quality goals.

Table A-7: Water Quality Goals for Great Brook (MA32-25) and the Congamond Lakes (MA322021, MA322022, MA322023)

Pollutant	Waterbody Name (Assessment Unit ID)	Goal	Source
Total Phosphorus (TP)	Great Brook (MA32-25)	TP should not exceed 50 µg/L	Quality Criteria for Water (USEPA, 1986)
	Congamond Lakes (MA32021, MA32022, MA32023)	TP should not exceed 25 µg/L	Quality Criteria for Water (USEPA, 1986)
Bacteria (*E. coli*)	All Assessment Units within the watershed	**Class B Standards** • E. coli concentrations shall not exceed 126 CFU/100mL, calculated as the geometric mean of all samples collected within any 90-day or smaller interval; and • no more than 10 percent of all such samples shall exceed 410 CFU/100 mL (a statistical threshold value).	Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2021)
Temperature	Great Brook (MA32-25)	Temperature shall not exceed 83°F (28.3°C). The rise in temperature due to a discharge shall not exceed 5°F (2.8°C) (based on the minimum expected flow for the month)	Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2021)
Dissolved Oxygen (DO)	Congamond Lakes (MA32021, MA32022, MA32023)	DO shall not be less than 5.0 mg/L	Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2021)
Non-Native Aquatic Macrophytes and Harmful Algal Blooms	Congamond Lakes (MA32021, MA32022, MA32023)	Consistently reduce the assessed biomass of non-native aquatic macrophytes and harmful algal blooms, eventually leading to de-listing of the impairment from the 303(d) list.	Stakeholder input
Total Nitrogen (TN)	All Assessment Units within the watershed	10% reduction in TN	A Total Maximum Daily Load Analysis to Achieve Water Quality Standards for Dissolved Oxygen in Long Island Sound (NYSDEC, 2000)

"E. coli" = Escherichia coli
"CFU/100 mL" = colony forming units per 100 milliliters
"µg/L" = micrograms per Liter
"mg/L" = milligrams per Liter

Land Use and Impervious Cover Information

Land use information and impervious cover is presented by the below tables and figures. Land use source data is from 2005 and was obtained from MassGIS (2009b).

Watershed Land Uses

Table A-8 and **Figure A-5** present the land uses in the Great Brook watershed. Land use in the Great Brook watershed is mostly forested (approximately 51 percent); approximately 20 percent of the watershed is agricultural; approximately 11 percent of the watershed is low density residential; approximately seven percent of the watershed is medium density residential. The remaining approximately 10 percent includes water, open land, commercial, industrial, high density residential and highway land uses.

Table A-8: Subwatershed Land Uses

Land Use	Area (acres)	% of Watershed
Forest	7,215	51.1
Agriculture	2,760	19.5
Low Density Residential	1,568	11.1
Medium Density Residential	953	6.7
Water	507	3.6
Open Land	494	3.5
Commercial	318	2.3
Industrial	175	1.2
High Density Residential	125	0.9
Highway	12	0.1

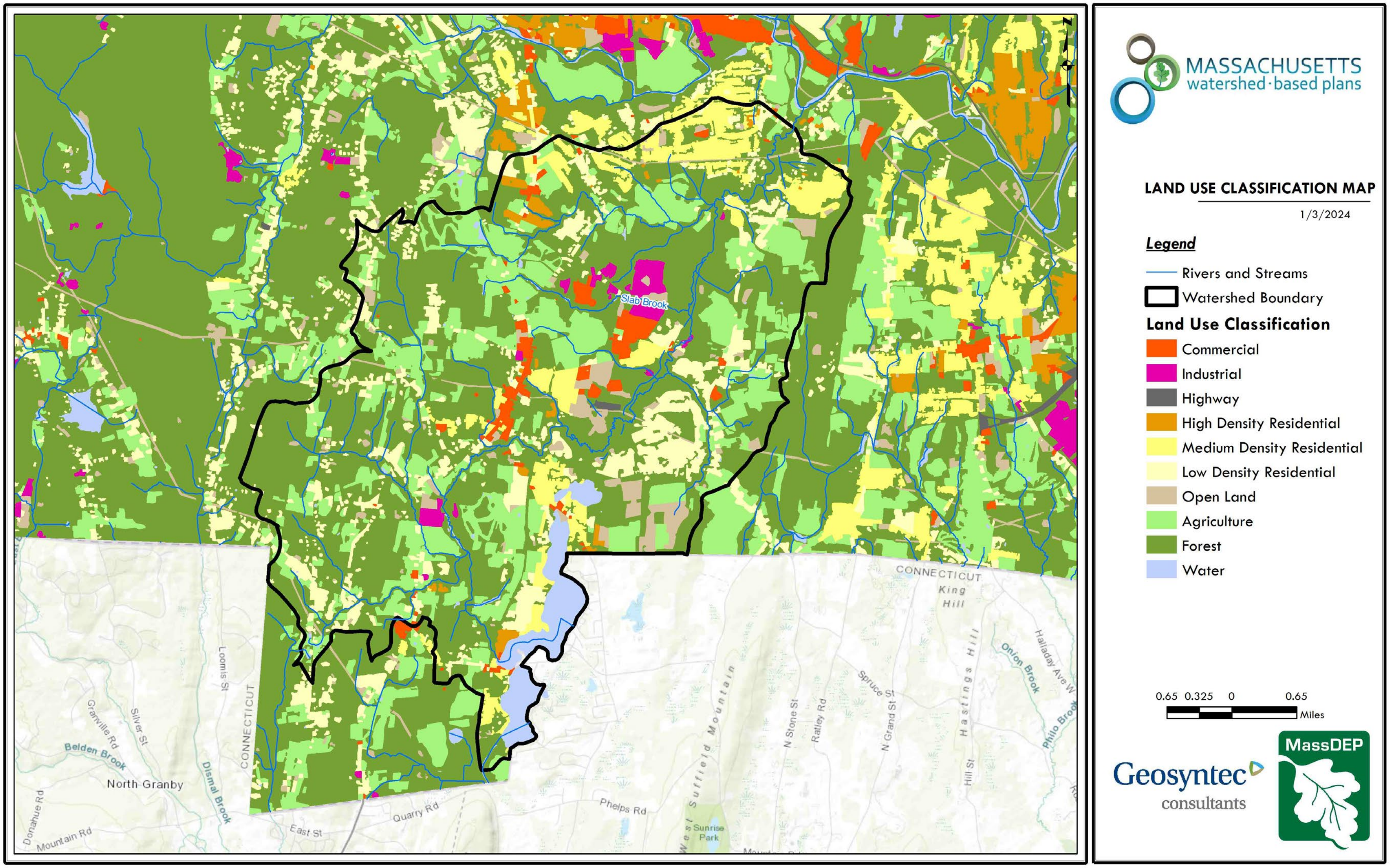

Figure A-5: Great Brook Watershed Land Use Map

(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. Impervious area in the Great Brook watershed is mainly concentrated along United States (U.S.) Route 202, along Massachusetts Route 57, along Hudson Drive, as well as along the downstream Westfield portion of Great Brook. **Figure A-6** is an impervious cover map for Great Brook watershed.

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 estimated TIA and DCIA for the Great Brook watershed is 8.6 percent and 5.7 percent, respectively.

The relationship between TIA and water quality can generally be categorized as listed by **Table A-9** (Schueler et al. 2009). The TIA value for the watershed range is 8.6 percent; therefore, the river and surrounding tributaries would be expected to have high quality. However, Great Brook watershed additionally has a high percentage of agricultural land use as well as the impaired Congamond Lakes forming the headwaters; these are likely additional major sources of water quality stress.

Table A-9: Relationship between Total Impervious Area (TIA) and water quality (Schueler et al. 2009)

% Watershed Impervious Cover	Stream Water Quality
0% to 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% to 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% to 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.

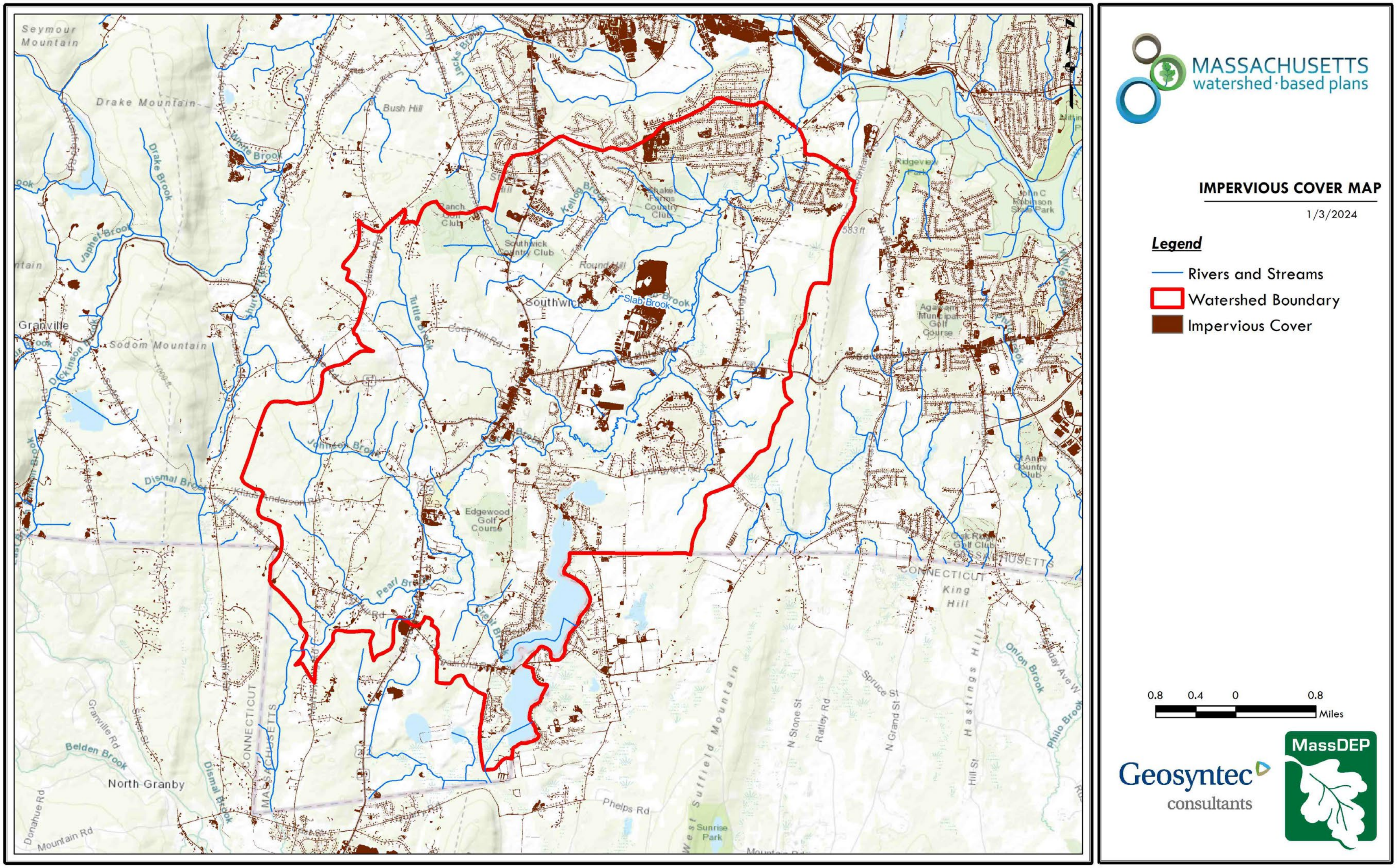

Figure A-6: Great Brook Watershed Impervious Surface Map

(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

Geographic Information Systems (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.

The amount of DCIA was estimated using the Sutherland equations as described above and any reduction in impervious area due to disconnection (i.e., the area difference between TIA and DCIA) was assigned to the pervious D soil category for that land use to simulate that some infiltration will likely occur after runoff from disconnected impervious surfaces passes over pervious surfaces.

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 (pound per year (lb/yr)); A_n = area of land use/cover type n (acres); P_n = pollutant load export rate of land use/cover type n (pound per acre per year (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 and TP were obtained from USEPA (USEPA, 2020; UNHSC, 2018, Tetra Tech, 2015) (see values provided in **Appendix E**).

Table A-10 presents the estimated land-use based TP, TN, and TSS within the Great Brook watershed. The largest contributor of the land use-based TP and TN load originates from areas designated as agriculture. Agricultural areas provide excellent opportunities for nutrient load reductions through agricultural BMPs as described in the Element C. Forest areas are the second largest contributors of land-use based TP and TN load and the largest contributor of TN load in the watershed. TP and TN generated from forested areas is generally a result of natural processes such as decomposition of leaf litter and other organic material; the forested portions of the watershed therefore are unlikely to provide opportunities for nutrient load reductions through best management practices.

Table A-10: Estimated Pollutant Loading in the Great Brook Watershed for Key Nonpoint Source Pollutants

Land Use Type	Pollutant Loading[1]		
	Total Phosphorus (TP) (lb/yr)	Total Nitrogen (TN) (lb/yr)	Total Suspended Solids (TSS) (tons/yr)
Agriculture	1,361	8,198	83.17
Commercial	306	2,631	32.93
Forest	1,230	4,828	177.66
High Density Residential	99	633	9.62
Highway	14	110	7.56
Industrial	195	1,682	21.05
Low Density Residential	374	3,727	51.44
Medium Density Residential	300	2,426	34.98
Open Land	147	1,147	26.07
TOTAL	4,025	25,382	444.49

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

"lb/yr" = pounds per year

It is important to note pollutant loads presented in **Table A-10** do not consider loads from point sources or septic systems or internal loading within the Congamond Lakes. Septic system sources should be separately evaluated to determine whether septic system upgrades or sanitary sewer system conversion would cost-effectively reduce bacteria and nutrient sources in the watershed, especially the septic systems surrounding the Congamond Lakes.

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

Estimated land use-based pollutant loads for TP (4,025 lb/yr), TN (25,382 lb/yr), and TSS (444.5 tons/yr) were previously presented in **Table A-10** of this WBP. *E. coli* land use-based loading has not been estimated for this WBP, as there are not yet established PLERs available for *E. coli*: this may be updated in future revisions to this WBP.

Water Quality Goals and Required Load Reduction

There are many methodologies that can be used to set pollutant load reduction goals for a WBP. Goals can be based on water quality criteria, surface water standards, existing monitoring data, existing TMDL criteria, or other data. As discussed in Element A, the water quality concentration goal for TP is based on the EPA Gold Book and the water quality concentration goal for E. coli is based on the MSWQS (MassDEP 2021).

According to the EPA Gold Book, TP should not exceed 50 µg/L in any stream at the point where it enters any lake or reservoir. The water quality load reduction goal for the entire Great Brook watershed was estimated by multiplying this target maximum TP concentration (50 µg/L) by the estimated annual watershed discharge for the Great Brook watershed. 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. It is important to consider the estimated TP loading as the expected TP loading from stormwater sources, because the estimated existing loading value only accounts for TP due to stormwater runoff. Other sources of TP may be relevant, particularly TP from on-site wastewater treatment (septic systems) within close proximity to receiving waters. TP 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.

Additionally, within the Congamond Lakes, internal TP cycling was identified as a significant source of TP loading, which is not included in this estimation. A 90 percent reduction of internal phosphorous loading in the Congamond Lakes was recommended to limit algal blooms and increase water clarity in the lakes (Water Resources Services, 2016).

As noted in Element A, the *E. coli* water quality goal in the Great Brook watershed is based on the MSWQS (MassDEP, 2021) that apply to the Water Class of the selected water body. All segments in the Great Brook watershed are classified as “Class B” waterbodies. MSWQS for bacteria are concentration standards which are difficult to predict based on estimated annual loading. While *E. coli* loads are not estimated, *E. coli* reductions may be determined by comparing monitored water quality concentrations to the goals for *E. coli* presented in Element A and **Table B-1**.

The TN load reduction goal is based on the 10 percent reduction goal for Massachusetts in the Long Island Sound TMDL (NYSDEC, 2000).

The water quality load reduction goals are included in **Table B-1**. The management measures described in Element C of this WBP are expected to reduce both *E. coli*, TP, and TN loads to Great Brook; however, additional load reductions may be required to meet the water quality goals.

The following adaptive sequence is recommended to sequentially track and meet these load reduction goals:

1. Develop a baseline water quality monitoring program in accordance with **Element I**. Results from the monitoring program should advise if **Element C** management measures have been effective at addressing listed water quality impairments or water quality goals for other indicator parameters established by **Table A-7** of this WBP (e.g., TP and *E. coli*). Results can further be used to periodically inform or adjust load reduction goals.

2. Establish a **long-term reduction goal** to reduce land-use-based TP, TN, and *E. coli* over the next 15 years. Based on monitoring data, establish additional **long-term reduction goal(s)**, if needed, to lead to delisting of Great Brook from the 303(d) list.

Table B-1: Pollutant Load Reductions Needed for Great Brook Watershed

Pollutant	Existing Estimated Total Load	Water Quality Goal	Required Load Reduction
Total Phosphorus (TP)	4,025 lb/yr	3,688 lb/yr	337 lb/yr
Bacteria (*E. coli*)	*MSWQS for bacteria are concentration standards (CFU/100 mL), which are difficult to predict based on estimated annual loading.*	• E. coli concentrations shall not exceed 126 colony-forming units per 100 milliliters (CFU/100mL), calculated as the geometric mean of all samples collected within any 90-day or smaller interval; and • no more than 10 percent of all such samples shall exceed 410 CFU/100 mL (a statistical threshold value).	N/A Concentration-based
Total Nitrogen (TN)	*25,382 lb/yr*	22,844 lb/yr	2,538 lb/yr

"E. coli" = Escherichia coli
"CFU/100 mL" = colony forming units per 100 milliliters
"lb/yr" = pounds per year
"MSWQS" = Massachusetts Surface Water Quality Standards
"N/A" = Not applicable

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.

Management measures, also referred to as stormwater best management practices (BMPs) manage stormwater runoff by reducing peak runoff rates, managing runoff volume, and improving water quality by reducing nutrients and pollutants. There are two main types of BMPs: structural BMPs that are engineered systems such as (but not limited to) rain gardens, water quality swales, and subsurface infiltration units; and non-structural BMPs that are practices such as street sweeping and catch basin cleaning which indirectly reduce the pollutant load to waterbodies. Agricultural BMPs can be structural or non-structural.

Past Management Measures

Congamond Lakes – 2009 -- BaySeparators™ on Middle Pond and North Pond

In 2009, The PVPC, working with the Town of Southwick, selected Geosyntec to design, permit and oversee construction of stormwater BMPs at five sites adjacent to North Pond and Middle Pond of the Congamond Lakes. The five sites were located at Castle Street, Eagle Street, North Lake Avenue and Summer Drive, Veteran Street, and Vicinity of 136 Berkshire Avenue. The BMPs included catch basins and BaySeparators™. These structural BMPs were designed to achieve 80 percent removal of total suspended solids (TSS) loading in stormwater runoff draining through each BMP.

Ongoing and Future Management Measures

Treatment of Invasive Aquatic Plants in Congamond Lakes

Solitude Lake Management has been contracted by the Town of Southwick for decades to treat the non-native invasive species of Eurasian milfoil and curly-leaf pondweed (with applications such as Aluminum Sulfate). Discrete herbicide/algaecide treatment have included the use of fluridone, diquat, and copper (Water Resource Services, 2016). A plan is currently in place to pinpoint where the new recently discovered Hydrilla is originating and then aggressively treat it with diquat to stop the spread (MassLive 2024a).

2023—2025 Town of Southwick Department of Public Works Projects

The Town of Southwick Department of Public Works (DPW) currently has several construction projects aimed at improving stormwater drainage in Southwick within the Great Brook watershed. A list of these projects is included below (Town of Southwick, 2024b)

- Fred Jackson Road (paving and drainage improvements): Drainage and paving completed in Fall 2023.
- Drainage Improvements at Various Locations (Berkshire Avenue near Grandview Street & Point Grove Road near Bungalow Street) – Completed in Fall 2023.

- Drainage Improvements on Feeding Hills Road (Buckingham Drive to Foster Road) – Construction started in June 2024.
- Bungalow Street Reconstruction
  - The Town of Southwick was awarded a total of $616,700 thru two grants from the Community Development Block Grant (CDBG) program for design and construction costs to reconstruct Bungalow Street, including new drainage, new water main, and repaving. Construction bids were opened in May 2024. Construction is expected to start in late 2024 or early 2025.
- North Lake Avenue Reconstruction
  - The Town of Southwick was awarded a grant from the Community Development Block Grant (CDBG) program to initiate design and permitting efforts to reconstruct North Lake Avenue, including new drainage, new water main, and repaving. This design and permitting work will be complete by Spring 2024. Construction schedule is to be determined.
- Granville Road Bridge Crossing at Tuttle Brook
  - The Town of Southwick was awarded $134,500 grant from the Small Bridge Program to initiate design and permitting efforts to replace an aging and deteriorated culvert on Granville Road at Tuttle Brook (just southeast of the Hillside Road intersection). This design and permitting work will be complete by Summer 2024. Construction schedule is to be determined.

Dredging in Congamond Lakes Middle Basin

The Lake Management Committee is applying for a new grant being offered by the Massachusetts Executive Office of Economic Development called the Inland Waters Dredging Program; the funding would be used for dredging in Congamond Lakes Middle Basin adjacent to the South Boat Ramp and adjacent to where a weir connects Great Brook to Middle Basin. There are several water quality reasons the Lake Management Committee is seeking to dredge this area (MassLive 2024b):

- The depth of the water at the South Boat Ramp is approximately two feet, and boats often have to drift out from the boat ramp to where it is deep enough to drop their propellers into the water; boat propellers can stir up the sediment on the pond's bottom, which can release TP trapped in the organic matter and lead to algae blooms
- Great Brook is supposed to be an outlet for the Middle Basin, but because of the shallowness at the mouth of the weir gate, often Great Brook flows into Middle Basin after larger precipitation events, increasing the risk of flooding on the Congamond Lakes.
- Another benefit would be the removal of a patch of the invasive Hydrilla that was recently discovered in this location (see above).

Agricultural Nonpoint Source Regional Coordinators for Franklin, Hampshire, Hampden Counties

MACD was awarded Fiscal Year 2022 Section 319 grant funding for its "Agricultural Nonpoint Source Regional Coordinators for Franklin, Hampshire, Hampden Counties". The MACD agricultural regional coordinators work with the HHCD, the Franklin Conservation District (FCD), the Franklin Regional Council of Governments (FRCOG), and the PVPC to develop a database of prioritized impaired watersheds for restoration. In addition to waterbody impairment, the group used desktop and dashboard surveys as well as informal interviews with farmers to assess the level of agricultural activity in the watersheds. The database of watersheds created from this effort will provide guidance for future efforts focused on agricultural areas in addition to identifying at least three watersheds to advance to watershed-based planning; Great Brook watershed was one of the selected prioritized watersheds (MACD, 2021).

MACD's general strategy is to conduct outreach and education to farmers; support the development of conservation plans outlining BMPs to reduce pollutant runoff; assist landowners in obtaining access to technical and financial resources to implement the BMPs; and ensure farmers follow operation and maintenance practices recommended by MACD and/or NRCS. MACD has applied for additional grant funding to continue this work into the future. Numerous farms in the Great Brook watershed have been identified for outreach and possible implementation of agricultural BMPs. Agricultural BMPs can be structural or non-structural.

Appendix F includes a list of agricultural BMPs, with estimated TN pollutant load reduction numbers, that are included in MACD conceptual projects for agricultural properties in the Great Brook watershed. The estimated pollutant load reduction (TP, TN and/or *E. coli*) that may be achieved from implementing BMPs is site-specific, can be fine-tuned once BMPs are closer to completion, and may be updated in future iterations of this WBP.

A list of typical agricultural BMPs is also included below.

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 to 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[3];
   - 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; and
   - 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% rain drop 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[4]; is a tool that farmers can use to achieve these goals.

7. **Stormwater Runoff Management Practices on Agricultural Properties:** Stormwater runoff management practices on agricultural properties include structural BMPs such as gutters, downspouts, pipes, catch basins, french drains, to divert runoff and prevent it from intermingling with runoff from areas that store manure, chemicals, or other potential pollutants.

[3] See here for more information and recommended footing materials recommended for sacrifice areas: https://ag.umass.edu/sites/ag.umass.edu/files/fact-sheets/pdf/horse_footing_materials_15_05.pdf

[4] See here for ten key components to include in a crop nutrient management plan: megamanual.geosyntec.com/npsmanual/cropnutrient.aspx

MACD references guidance from USDA NRCS when planning and implementing BMPs with farm owners. The Massachusetts "Field Office Technical Guide" provides detailed information on agricultural BMPs that may be implemented at farms in the watershed5. **Appendix G** also includes a list of potential agricultural BMPs that may be implemented in the watershed.

Identification of Priority Locations for Structural BMPs.

Implementing agricultural BMPs, along with incorporating structural BMPs (e.g., low impact development practices) on new and existing development, and investigation and remediation of potential other sources such as failing septic systems will be necessary to achieve a measurable and sustainable improvement in water quality in Great Brook.

The following general sequence is recommended to identify and implement future structural BMPs[6]. Examples of structural BMPs include (but not limited to):

- bioretention areas and rain gardens,
- deep sump catch basins,
- dry wells,
- constructed stormwater wetlands (e.g., gravel wetland),
- porous pavement,
- sand filters,
- vegetated filter strips,
- wet ponds,
- infiltration basins and trenches,
- oil/grit separators, and water quality swales.

Pollutant load reduction estimates for the BMPs listed above (in percent) can be found on the Clean Water Toolkit website accessible here: **https://megamanual.geosyntec.com/npsmanual/bmpfactsheetmenu.aspx**

Note this approach applies largely to non-agricultural BMPs that might be implemented by other watershed stakeholders, as MACD's work focuses on building relationships with the agricultural community to guide agricultural BMP implementation.

1. **Identify Potential Implementation Locations:** Perform a desktop analysis using aerial imagery and GIS data to develop a preliminary list of potentially feasible implementation locations based on land use; soil type (i.e., hydrologic soil groups A and B); available public open space (e.g., lawn area in front of a police station); potential redevelopment sites where additional public-private partnerships may be leveraged; and other factors such as proximity to receiving waters, known problem areas, or publicly owned right of ways or easements. See BMP Hotspot Map analysis below, which helps identify potential implementation locations.

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[5] The Massachusetts "Field Office Technical Guide" can be accessed at: https://efotg.sc.egov.usda.gov/#/state/MA/documents/section=4&folder=-3 ; the list of BMPs, as well as detailed information on each, is found under "Section 4 - Practice Standards and Supporting Documents" > "Conservation Practice Standards & Support Documents".

[6] For detailed information on BMP selection, siting and sizing, refer to the following document: https://prj.geosyntec.com/prjMADEPWBP_Files/Files/BMP%20Selection,%20siting%20and%20sizing%20Guidance_FINAL.pdf.

2. **Visit Potential Implementation Locations:** Perform field reconnaissance, preferably during a period of active runoff-producing rainfall, to evaluate potential implementation locations, gauge feasibility, and identify potential BMP ideas. During field reconnaissance, assess identified locations for space constraints, potential accessibility issues, presence of mature vegetation that may cause conflicts (e.g., roots), potential utility conflicts, site-specific drainage patterns, and other factors that may cause issues during design, construction, or long-term maintenance.

3. **Develop BMP Concepts:** Once potential BMP locations are conceptualized, use the Element C BMP-selector tool on the WBP tool to help develop concepts. Concepts can vary widely. One method is to develop 1-page fact sheets for each concept that includes a site description, including definition of the problem, a description of the proposed BMPs, annotated site photographs with conceptual BMP design details, and a discussion of potential conflicts such as property ownership, O&M requirements, and permitting constraints. The fact sheet can also include information obtained from the BMP-selector tool including cost estimates, load reduction estimates, and sizing information (i.e., BMP footprint, drainage area, etc.).

4. **Rank BMP Concepts:** Once BMP concepts are developed, perform a priority ranking based on site-specific factors to identify the implementation order. Ranking can include many factors including cost, expected pollutant load reductions, implementation complexity, potential outreach opportunities and visibility to public, accessibility, expected operation and maintenance effort, and others. Prioritized BMP concepts should focus on reducing *E. coli* and TP loading to Great Brook as summarized by **Element B.**

BMP Hotspot Map

The following GIS-based analysis[7] was performed within the watershed to identify high priority parcels for 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 Great Brook watershed. **Table C-2** includes hotspot score and address information for parcels that have a score above 70.

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

[7] 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).

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.

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

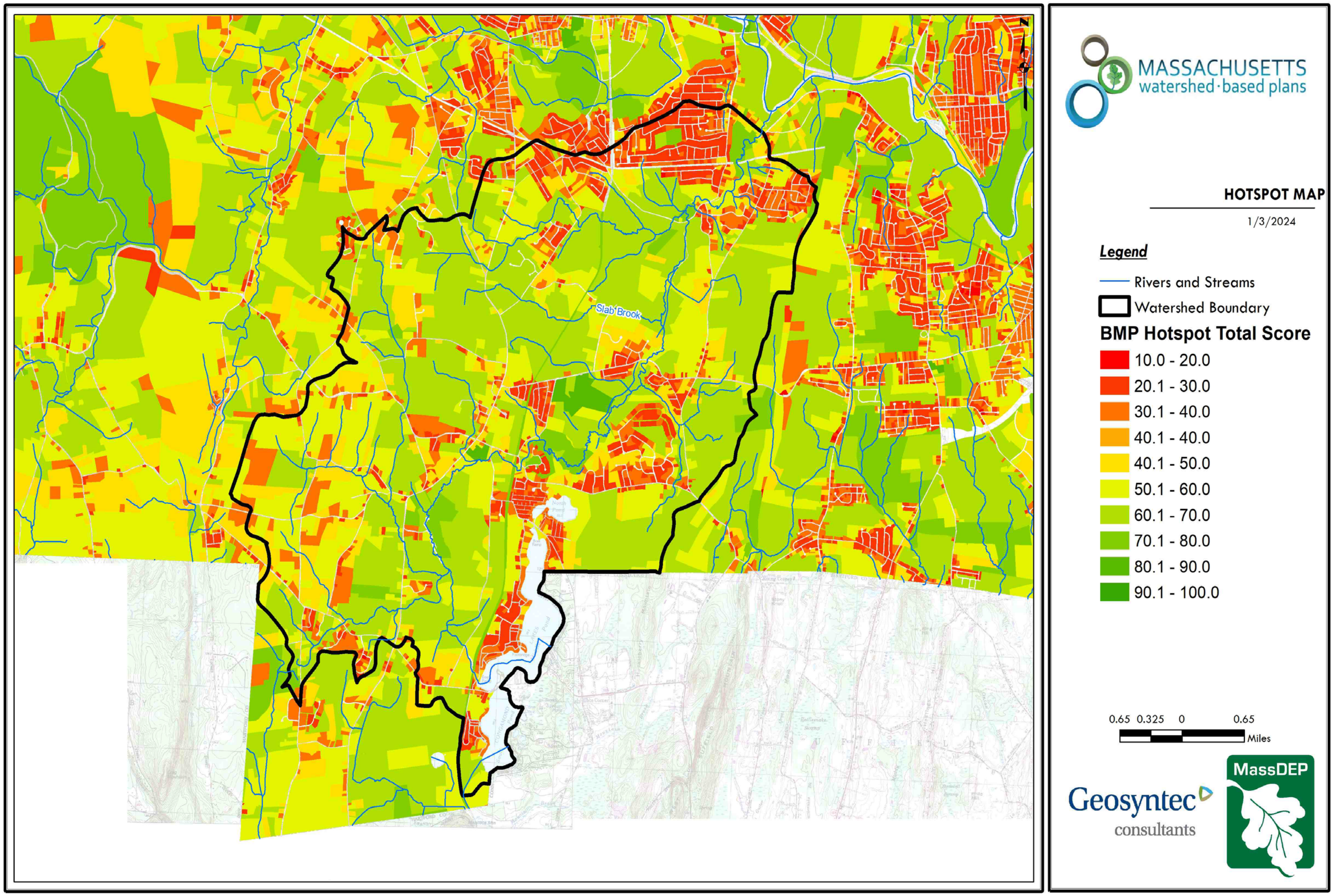

Figure C-1: Great Brook Watershed BMP Hotspot Map (MassGIS (2015a), MassGIS (2015b), MassGIS (2017a), MassGIS (2017b), MassGIS (2020), MA Department of Revenue Division of Local Services (2016), MassGIS (2005), ArcGIS (2020), MassGIS (2009a), MassGIS (2012), ArcGIS (2020b))

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

Table C-2: Hotspot Scores and Address Information for Parcels in Great Brook Watershed with Hotspot Scores above 70

Hotspot Score	Address	City	Parcel ID	Name/Ownership
85	93 FEEDING HILLS RD	SOUTHWICK	067_132_000_000_000	Southwick Regional School
85	94 POWDER MILL RD	SOUTHWICK	075_002_000_000_000	Powder Mill Middle School
85	454 COLLEGE HIGHWAY	SOUTHWICK	088_001_000_000_000	Town of Southwick Municipal Building
78	660 COLLEGE HIGHWAY	SOUTHWICK	065_027_000_000_000	Southwick Community Episcopal Church
78	305 FEEDING HILLS RD	SOUTHWICK	071_006_000_000_000	Mass Highway Department
78	VARIOUS	SOUTHWICK	089_031_000_000_000	Southwick Rail Trail
78	261 COLLEGE HIGHWAY	SOUTHWICK	133_021_000_000_000	Southwick Baptist Church
77	42 POWDER MILL RD	SOUTHWICK	090_014_000_000_000	Whalley Park
77	14 SOUTH LONGYARD RD	SOUTHWICK	099_001_000	Vacant land – Town of Southwick
76	0 MUNGER HILL RD	WESTFIELD	17R-14	Munger Hill Elementary School
76	332 COLLEGE HIGHWAY	SOUTHWICK	111_004_000_000_000	New Southwick Cemetery
76	22 INDUSTRIAL RD	SOUTHWICK	112_002_000_000_000	Town of Southwick Transfer Station
75	180 SOUTH LONGYARD RD	SOUTHWICK	097_057_000_000_000	Vacant land – Town of Southwick
74	155 MORT VINING RD	SOUTHWICK	144_011_000_000_000	Mort Vining Road Conservation Area
71	0 MUNGER HILL RD	WESTFIELD	17R-72	Munger Hill Elementary School
70	267 COLLEGE HIGHWAY	SOUTHWICK	133_022_000_000_000	Living Hope Church

Additional Non-structural BMPs

The City of Westfield and Town of Southwick implement street sweeping and catch basin cleaning (Town of Southwick, 2024; City of Westfield, 2023). Additional nonstructural BMPs that are implemented in the City of Westfield and Town of Southwick include (but not limited to):

- septic system maintenance,
- pet waste management,
- municipal sewer system inspection and maintenance,
- land use regulation revision (e.g., construction erosion and sediment control requirements),
- protection and conservation of open space, riparian buffers, wetlands and stream corridors,
- impervious cover reduction,
- Impervious cover disconnection (e.g., disconnecting roof downspouts from impervious areas),
- Municipal adoption of good housekeeping practices (e.g., yard waste management, leaf litter disposal, fertilizer application best practices), and
- public education and outreach (see Element E).

WBP Implementation

As stated in the introduction, this WBP is meant to be a living document. It should be reevaluated at least once every three years and adjusted as needed based on ongoing efforts (e.g., based on monitoring results, 319 funding, etc.). It is strongly recommended that a working group including additional stakeholders be established to meet at least biannually to implement and update this WBP, and track progress, and that someone is designated to lead the implementation and updates of this plan.

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.

Current Management Measures

MACD Western Massachusetts Agricultural Nonpoint Source Program

The funding needed to implement ongoing and future management measures detailed in Element C is presented in **Table D-1**.

Table D-1: Summary of Ongoing and Planned BMPs Costs

Project	Estimated Cost	Funding Source(s)
Assessment and Treatment of Hydrilla in Congamond Lakes	$250,000	U.S. Fish and Wildlife Service
Fred Jackson Road (paving and drainage improvements)	Portion of appropriated $1,500,000 in Fiscal Year 2023/2024 Town of Southwick funds for paving and infrastructure improvements as well as available Chapter 90 funds	Town of Southwick FY23/24 Funds and Chapter 90 Funds
Drainage Improvements at Various Locations (Berkshire Avenue near Grandview Street & Point Grove Road near Bungalow Street)		Town of Southwick FY23/24 Funds and Chapter 90 Funds
Drainage Improvements on Feeding Hills Road (Buckingham Drive to Foster Road)		Town of Southwick FY23/24 Funds and Chapter 90 Funds
North Lake Avenue Reconstruction		Community Development Block Grant (CDBG) program
Bungalow Street Reconstruction	$616,700	Community Development Block Grant (CDBG) program
Granville Road Bridge Crossing at Tuttle Brook	$134,500	Small Bridge Program
Dredging in Congamond Lakes Middle Basin	$100,000	Community Preservation Committee
	$267,000	Massachusetts Executive Office of Economic Development Inland Waters Dredging Pilot Program

Additional Future Management Measures

Agricultural BMPs

As noted in Element C, MACD will be performing outreach to farms in the watershed for potential implementation of agricultural BMPs. The estimated costs of these projects are currently unknown but can be updated in future iterations of this WBP.

Identification of Additional Management Measures

Funding for future BMP installations to further reduce loads within the watershed may be provided by a variety of sources including Section 319 funding, Climate Smart Agricultural Program (CSAP), Massachusetts Environmental Trust (MET) grants, , the Agricultural Produce Safety Improvement Program (APSIP), Town and City capital funds, volunteer efforts, and NRCS grants including the Environmental Quality Incentives Program (EQIP) and the Agricultural Management Assistance (AMA) program. MACD has previously been successful with and will continue to pursue securing grant funding through various sources. Guidance is available to provide additional information on potential funding sources for nonpoint source pollution reduction efforts[8].

[8] Guidance on funding sources to address nonpoint source pollution:
http://prj.geosyntec.com/prjMADEPWBP_Files/Guide/Element%20D%20-%20Funds%20and%20Resources%20Guide.pdf

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.

Public information and education was a topic discussed during the stakeholder meeting of March 8, 2024 (**Appendix A**). A component of the MACD Agricultural Nonpoint Source Regional Coordinators Program involves outreach to farmers. Farmer outreach through this program includes building relationships with farm owners through phone calls, farm visits, direct mailings, workshops, farm tours, newsletter/newspaper articles, and social media. Additional efforts within the Great Brook watershed that were discussed included educational flyers surrounding dog waste and *E. coli* that were mailed to Congamond Lakefront property owners (Department of Conservation and Recreation, 2020) as well as educational signage at Congamond Lakes when weed treatments are present at the lake.

Additional components of the watershed public information and education program are described below. Additional outreach efforts will be determined when future management measures and activities are planned for implementation in the watershed. This section of the WBP will be updated when the plan is reevaluated in 2027 in accordance with elements F&G of this document.

Step 1: Goals and Objectives

The goals and objectives for the watershed information and education program.

1. Provide information and incentives to farmers on funding resources for BMP implementation.
2. Provide information about farm conservation plans and agricultural BMPs and their anticipated benefit to farm operations as well as water quality benefits.
3. Provide information to promote watershed stewardship.
4. Provide information to all residents in the watershed about proposed stormwater improvements and their anticipated water quality benefits.
5. Meet Massachusetts Small MS4 Permit Requirements.

Step 2: Target Audience

Target audiences that need to be reached to meet the goals and objectives identified above.

1. Farmers in the watershed.
2. Watershed organizations and other user groups.
3. Businesses, schools, and local government within the watershed.

4. Developers (construction) within the watershed.
5. Industrial facilities within the watershed.
6. Boat owners visiting the Congamond Lakes.
7. All watershed residents.

Step 3: Outreach Products and Distribution

The outreach product(s) and distribution form(s) that will be used for each.

1. MACD representatives will conduct one-on-one meetings with farmers and support the development of farm conservation plans.
2. MACD will conduct outreach and education activities, including farm tours highlighting agricultural BMPs.
3. The Lake Management Committee and the Citizens Restoring Congamond provide information about the Congamond Lakes on their websites (https://www.southwickma.org/lake-management-committee; https://www.congamond.org/
4. The Citizens Restoring Congamond hosts monthly meetings that offer news, presentations, and speakers regarding lake health, safety, fish, and wildlife.
5. Informational signs will be developed and posted at implemented BMP locations.
6. Informational signs are recommended at boat launches regarding established decontamination procedures when visiting or leaving the Congamond Lakes.
7. The Stormwater Management Programs (SWMP) for the Town of Southwick and the City of Westfield include additional outreach efforts being conducted within the two municipalities (Town of Southwick, 2024; City of Westfield, 2023).
   Details can be found on the City of Westfield and Town of Southwick stormwater websites (https://www.cityofwestfield.org/233/Stormwater; https://www.southwickma.org/stormwater)

Step 4: Evaluate Information/Education Program

Information and education efforts and how they will be evaluated.

1. Track the number of farm tours and the attendance at each.
2. Track the number of farmers participating in outreach and education efforts, conservation plans, and implementation of BMPs.
3. Track the number of materials and information, such as fact sheets and emails, and the size of the lists receiving these materials.
4. Track the attendance at monthly Citizens Restoring Congamond meetings.

Resources for Additional Outreach Products

The EPA's "Nonpoint Source Outreach Toolbox" (www.epa.gov/nps/toolbox) provides information, tools, and more than 700 outreach materials that can be used or adapted to develop an outreach campaign. The toolbox focuses on six nonpoint source pollution categories:

- stormwater
- household hazardous waste
- septic systems
- lawn care
- pet care
- automotive care

Outreach products in the Toolbox include print ads, public service announcements, and a variety of materials for billboards, signage, kiosks, posters, brochures, fact sheets, and giveaways that help to raise awareness and promote non-polluting behaviors. Permission-to-use information is included for outreach products, which makes it easy to tailor them to local priorities. Evaluations of several outreach campaigns also offer real-world examples of what works best in terms of messages, communication styles, and formats. Other helpful resources include:

- MassDEP's Clean Water Toolkit (https://megamanual.geosyntec.com/npsmanual/default.aspx)
- USEPA's Soak Up the Rain materials (https://www.epa.gov/soakuptherain)
- USEPA's Green Infrastructure Collaborative (https://www.epa.gov/green-infrastructure/green-infrastructure-federal-collaborative#Green%20Infrastructure%20Collaborative%20Resources)

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.

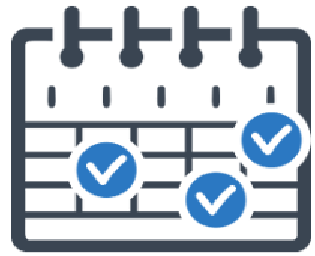

Table FG-1 provides a preliminary schedule for implementation of recommendations provided by this WBP. It is expected that the WBP will be re-evaluated and updated in 2027, or as needed, based on ongoing monitoring results and other ongoing efforts. New projects will be identified through future data analysis and stakeholder engagement and will be included in updates to the implementation schedule.

Table FG-1: Implementation Schedule and Interim Measurable Milestones[9]

Category	Measurable Milestone	Year(s)
Monitoring	Perform water quality sampling at key locations along Great Brook and Congamond Lakes as an expansion of the existing water quality monitoring per Element H&I	2025 and annually
Agricultural Nonpoint Source Regional Coordinators	Conduct outreach to build relationships and scope potential implementation sites for agricultural BMPs.	2021--2024
	Support the development of conservation plans outlining BMPs to reduce pollutant and nutrient runoff. Implement agricultural BMPs at farms in the watershed (contingent on available funding)	2025--2028
Structural BMPs	Town of Southwick DPW projects (see Element C)	2023—2025
	Dredging in Congamond Lakes	To be determined
	Identify locations, develop and rank structural BMP concepts	To be determined
Nonstructural BMPs	Treatment of Invasive Aquatic Plants in Congamond Lakes	To be determined
	Document potential pollutant removals from nonstructural BMPs (i.e., street sweeping, catch basin cleaning). The methodology is included in the 2016 Massachusetts Small MS4 Permit and in Elements H&I of this WBP.	Annually
	Evaluate ongoing nonstructural BMPs and determine if modifications can be made to optimize pollutant removals (e.g., increase frequency).	Annually
	Routinely implement optimized nonstructural BMPs.	Annually
Public Education and Outreach	Conduct outreach and education activities including farm tours highlighting agricultural BMPs.	2021—2027
	Citizens Restoring Congamond Meetings	Monthly
Adaptive Management and Plan Updates	Establish a working group that includes stakeholders and other interested parties to implement recommendations and track progress. Meet at least twice per year.	2024
	Reevaluate WBP at least once every three years and adjust, as needed, based on ongoing efforts (e.g., based on monitoring results, 319 funding, etc.). – Next update, August 2026	2027
	Use monitoring results to reevaluate BMP effectiveness at reducing *E. coli* and TP and/or other indicator parameters in Great Brook and establish additional long-term reduction goal(s), if needed.	**2034**
	Delist Great Brook from the 303(d) list.	**2039**

[9] Note that goals and milestones of this WBP are intended to be adaptable and flexible. Stakeholders will perform tasks contingent on available resources and funding.

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 2016 Water Resources Services study concluded that aside from funding limitations, lack of data is the greatest impediment to ongoing management in the Congamond Lakes (Water Resources Services 2016). There is even less data currently available for Great Brook and its tributaries than for the Congamond Lakes. While more monitoring and study has been completed for the Congamond Lakes, there is limited data available for Great Brook and its tributaries; the data available for locations along Great Brook are from 2006 and 2012 (see Element A).

The water quality goals are presented in Element A of this WBP, and the TP loading reduction goal is presented in Element B of this WBP. Element C of this plan describes management measures that will be implemented to help achieve the water quality goals and the targeted load reduction. The evaluation criteria and monitoring program described below will be used to establish a baseline and measure the effectiveness of the proposed management measures (described in Element C) in improving the water quality of Great Brook and in making progress toward achieving the water quality goals.

Direct Measurements

Congamond Lakes Beach Bacteria Sampling

Sampling at the Southwick Town Beach will continue as summarized in Element A. Bacteria counts will be tracked as they relate to MSWQS. Data will be used to track the percentage of the sampling season that the beaches are closed (i.e., number of days closed / number of days open) and evaluate changes over time.

Great Brook Watershed Monitoring Program

It is recommended that a Great Brook watershed water quality monitoring program be established that includes monitoring for Congamond Lakes, Great Brook and its tributaries. This can be in the form of a volunteer program managed by a municipal department, planning agency, or watershed association[10]. MassDEP also provides support for water quality monitoring efforts through its Water Quality Monitoring Grant Program.

It is recommended that before the start of each season, each volunteer attend a training session with the program coordinator. Training sessions should be held riverside and lakeside so that each volunteer can practice under the supervision of the coordinator before going out into the field. The monitoring should be conducted under an approved Quality Assurance Project Plan (QAPP). Regular sampling should be established to understand the water quality in Great Brook including determining sources of pollution and tracking achievements toward water quality goals. Key features of the water quality monitoring program should include:

- Analytes: The samples collected should primarily be analyzed for *E. coli* and TP (also DO in the Congamond Lakes). TP measurements will provide the most direct means of evaluating the effects of the measures in the plan which have been. Additional parameters such as chlorophyll-a, DO, temperature, conductivity, pH, dissolved phosphorus, and flow rate could provide additional data to better understand the health of the Great Brook watershed.
- Sampling Frequency: It is recommended that, at a minimum, sampling occur at a minimum of five sampling events per Summer (e.g., biweekly from June to September). *E. coli* sampling conducted at this frequency aligns with the MSWQS and will provide the most value.
- Locations: The water quality monitoring program should be focused on at locations downstream of suspected *E. coli* and/or TP sources. If possible, samples should be collected within areas directly downstream of implemented BMPs to determine the impact of BMPs within the watershed (samples at these locations prior to BMP implementation should also be collected to establish a baseline). Monitoring locations should ultimately be selected based on accessibility and representativeness and shall be appropriate to quantify water quality improvements in the watershed. BMP performance monitoring locations will be selected after BMPs have been identified for implementation. Monitoring locations within the Congamond Lakes should be consistent with past monitoring performed (see Element A).
- Planning: As noted above, it is suggested that this be a volunteer water quality monitoring program managed by a municipal department, planning agency, or watershed association and possibly seek support through the MassDEP Water Quality Monitoring Grant Program.

Indirect Indicators of Load Reduction

Vegetation Monitoring in the Congamond Lakes

As previously discussed, aquatic vegetation is continually monitored and managed in the Congamond Lakes. Annual assessments should be performed using stations and methods consistent with past assessments. Results from annual monitoring will be used as a metric for measuring changes in biomass and as a metric for understanding water quality trends in response to management measures. It is also recommended that annual vegetation assessments include recommendations as feasible for future management measures.

Non-Structural BMPs

Potential load reductions from non-structural BMPs (i.e., street sweeping and catch basin cleaning) can be estimated from indirect indicators, such as the number of miles swept, or the number of catch basins cleaned. Appendix F of the 2016 Massachusetts Small MS4 General Permit (USEPA, 2020) provides specific guidance for calculating TP removal from these practices. It is recommended (if not already completed) that potential TP removal from these ongoing actives be estimated. Next, it is recommended that ongoing activities be evaluated

[10] Monitoring may be performed through a volunteer training program or in accordance with established practices for MassDEP's environmental monitoring for volunteers.

to see if potential improvements can be implemented to achieve higher pollutant load reductions such as increased frequency or improved technology.

Project-Specific Indicators

Number of BMPs Installed and Pollutant Reduction Estimates:

Anticipated pollutant load reductions from future BMPs should be estimated and tracked as BMPs are installed; this information should be included in future iterations of this WBP.

Adaptive Management

As discussed by **Element B**, the baseline monitoring program will be used to evaluate and establish a long-term (i.e., 15-year) *E. coli* and TP load reduction goal (or other parameter(s) depending on results). Long-term goals will be re-evaluated at least **once every three years** and adaptively adjusted based on additional monitoring results and other indirect indicators. If monitoring results and indirect indicators do not show improvement to the *E. coli* and TP concentrations and other indicators measured within the watershed, the management measures and loading reduction analysis (Elements A through D) will be revisited and modified accordingly. A watershed stakeholder should be identified for maintaining this plan, coordinating stakeholder coordination, and periodic plan evaluations/updates.

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Appendices

Appendix A – Stakeholder Meeting Minutes

Meeting Minutes

Project Name:	Great Brook Watershed-Based Plan		
Location:	Great Brook Watershed (Southwick, Westfield)		
Meeting Date, #:	March 8, 2024	Meeting Time:	10:00 – 11:30 PM
Prepared By:	Bella D'Ascoli	Meeting Location:	Teams videoconference per Geosyntec invitation
Distribution:	All listed below		

Attendees:

Name	Organization	Contact Information
Bella D'Ascoli	Geosyntec Consultants, Inc	idascoli@Geosyntec.com
Julia Keay	Geosyntec Consultants, Inc	JKeay@Geosyntec.com
Michael Leff	Massachusetts Association of Conservation Districts (MACD)	mleffmacd@gmail.com
Meghan Selby	Massachusetts Department of Environmental Protection (MassDEP)	Meghan.Selby@mass.gov
Judith Rondeau	MassDEP	Judith.Rondeau@mass.gov
Ryan O'Donnell	Connecticut River Conservancy	rodonnell@ctriver.org
Patty Gambarini	Pioneer Valley Planning Commission (PVPC)	Pgambarini@pvpc.org
Sabrina Pooler	Southwick Conservation Commission	spooler@southwickma.gov
Skylar Sweeney	MassDEP	Grace.sweeney@mass.gov
Michelle Pratt	Citizens Restoring Congamond	michelledpratt@icloud.com
Randy Brown	Southwick Department of Public Works	rbrown@southwickma.gov
Jay Vinskey	City of Westfield Planning Department	j.vinskey@cityofwestfield.org
Chris Pratt	Southwick Conservation Commission	prattchris152@gmail.com

Minutes to be considered final unless comments are received within five (5) business days.

Agenda

- Greeting
- 319 Grant Project Spotlight
- Watershed & Goals Overview
- Brief Introductions from All Participants
- Discussion
  - Past, current, or planned stormwater best management practice (BMP) projects in the watershed
  - Pollutant load reduction estimates for BMP projects
  - Water quality monitoring efforts
  - Potential pollution sources or problem areas
  - Public education and outreach
  - Additional grant funding available

Greeting/319 Grant Project Spotlight

Julia Keay. Good morning, thanks for joining. The purpose of this meeting is to get stakeholders together for the Great Brook watershed-based plan (WBP) and get input and additional information to include in the WBP. We will start with a 319 Grant Project Spotlight from MACD, followed by an introduction to the watershed and goals that we have identified. Then we will move into a discussion period for any additional information on best management practices, outreach, problem areas and other activities or plans within the watershed.

Michael Leff. Director of MACD. This project is one of the 319 projects looking for ways to mitigate non-point source pollution to protect water quality. There are many different opportunities to make water quality improvements and ours are specifically focused on agricultural improvements that protect water quality and enhance farming operations. Some of that is meeting with farmers and helping to find ways to direct funding to install best management practices (BMPs) that help the farm and protect water quality as well. In order to do that, you have to have a watershed-based plan completed.

This is one of five, that came out of a particular 319 program that is a collaboration between MACD, our consulting team and the two regional planning agencies in the in this region: FRCOG (Franklin Regional Council of Governments) and PVPC (Pioneer Valley Planning Commission) for Hampden and Hampshire counties. There are five new watersheds that we've identified for having watershed-based plans developed so that opportunities for improvements can be identified. Geosyntec is the consultant who is leading the watershed-based plan process for us on this and many of the others.

Julia Keay: I was just going to highlight as well that once this watershed-based plan is in place and MassDEP has accepted it, it doesn't just have to be used for agricultural projects in the future. If there's opportunities identified in the plan itself for treating stormwater with something like structural BMPs, that would be a bonus for future 319 grant applications.

Michael Leff. I'm glad you mentioned that, because what we will be taking away from it is a focus on the agricultural opportunities. But additionally, just having the watershed-based plan there can be a foundation for any initiative, not just agriculture.

Julia Keay: If Southwick wanted to apply for 319 grant funding, this would be a benefit to have this plan all ready for you.

Michael Leff. Exactly so that's why, whatever if people know of opportunities already in the watershed, then we want to try to include those in the watershed-based plan.

Watershed & Goals Overview

Julia Keay: I just wanted to run through a brief overview of our understanding, currently, of the watershed; probably many of you have a deeper understanding since you're within the watershed and you're a stakeholder, so if there's anything that you want to comment on or add, please let us know.

Presents general watershed information: General area of 22 square miles. Major waterbodies are Great Brook and the Congamond lakes. About 20% of watershed is agriculture. There are three integrated list ID numbers for the different sections of the Congamond Lakes, and they're listed as impaired under the Massachusetts Integrated List. For Great Brook, the impairments listed are *E. coli* and temperature and the sources that are listed are MS4 (municipal separate storm sewer system) discharges and unknown sources. For Congamond lakes, we have a number of different impairments listed. Interestingly, not *E. coli* but some of the MassDEP data we looked at had some exceedances in *E. coli.* We also have sources listed out: accidental or intentional introduction of non-native organisms, MS4 discharges, internal nutrient recycling, and unknown sources.

Presents the breakdown of the watershed land use. There's a high percentage of agriculture; one of the main reasons why MACD is working in this watershed. Our goals that we were planning to present within the watershed-based plan would be based on the Massachusetts surface water quality standards for bacteria and the standard that EPA uses for phosphorus, which is 50 micrograms per liter. We use that as a goal and then compare the monitoring data that's available to that. Anything anyone wanted to add at this point?

Michelle Pratt: Citizens Restoring Congamond. I had a question about the impairments for the lakes of *E coli* not being listed because we've had so many shutdowns of our town beach on the South pond due to *E coli* each year. But in particular last year was really bad year with hot weather and other factors. I'm curious as to how that doesn't make the list.

Julia Keay: Yeah, that's a good question. I don't have the answer to it. I also noticed that because the data that I looked at also had *E. coli* exceedances; Judy and Megan, any thoughts on that?

Meghan Selby: MassDEP. We'd have to take a look at the integrated report and see the age of the data that was used for the ponds. It might just be that the data that MassDEP collected was prior to a lot of these exceedances, and we may not be coming back around in this cycle for a little bit longer. If it's still an issue when we get to that watershed and we sample again, then I think it would probably be picked up and recognized. But I'd have to look at the data and see how old it was for the most recent listing.

Julia Keay: I think for the watershed-based plan, we can still describe that it is an issue based on the data and because of the data is showing it, we would have a goal for that.

Michelle Pratt and **Meghan Selby** agree.

Michelle Pratt: I know it's really important to the residents because it does impair access to the lake and I know our DPH has that data, as does our Lake Management committee.

Julia Keay: Is that something that we could that you could send us or have somebody send us?

Michelle Pratt: I don't have it myself, but I could give you the contact information for the people to get that data for sure.

Sabrina Pooler: Let's just add to the list of impairments for Congamond Lakes. We also have curly pond weed as an invasive and Eurasian water milfoil. We do have treatments that we've been doing for the past years, but this past October hydrilla was found in Congamond. So that's something like brand new.

Julia Keay: Is that in all sections of Congamond?

Sabrina Pooler: Not that we know of. It was just found in a couple coves. I don't know how extensive, the research was for looking around the lakes at the time because it was in the back in October, November time. I think we'll find out more this year how much is actually in there.

Patty Gambarini: Is there an opportunity to address some of the concerns on drinking water and the contamination that was reported? I think by Southwick and West Springfield on the wells or maybe it was just West Springfield.

Julia Keay: I think we can include that in the plan, right, Megan and Judy?

Judy Rondeau: Yeah, the plan is intended to be holistic. Any concerns that are identified should be included.

Julia Keay: I don't have a lot of knowledge on that. Patty do you have any information on that?

Patty Gambarini: There were requests submitted by West Springfield a while ago, and I think that's how Great Brook got into the fold at the start. I don't have data, but conversations with the water folks in West Springfield and maybe Southwick would be helpful because their wells are right in this watershed.

Judy Rondeau: Patty what was the contamination?

Patty Gambarini: It is from tobacco farming.

Randy Brown: Southwick DPW. We didn't note that in any of our wells, but I believe you're right, Patty. It is runoff from farming use tobacco use. It is called ethylene dibromide (EDB).

Julia Keay: Ok we'll be sure to look into that more and include some of that in the plan.

We just have a few maps as well as Google Earth open with the watershed boundary, so I can pin areas if anyone has any specific areas they want us to consider. The Great Brook Land Use map has a lot of agricultural use with most of the higher density residential is in the Westfield area of the watershed. There are a bit of industrial and forest areas around Slab Brook. This additionally shows the impervious cover in the watershed is generally more concentrated in the downstream path of the watershed. We can go back to these figures too.

Brief introductions from all participants
Julia Keay: Geosyntec, Project Manager. I live in Easthampton and so I'm somewhat familiar with the Great Brook Watershed. **Bella D'Ascoli**: Geosyntec. My connection is that I'm working on this plan. I live in Boston but I spent some time out in Western Massachusetts. **Michael Leff**: MACD. I live and work from home up here in Chesterfield. I don't have a direct personal connection to this particular watershed, making my connection is also professionally through this project we're working on now, but I have been involved in many such projects and various 319 and other river restoration projects and things like that in the area. **Patty Gambarini**: Lead Environmental planner for Pioneer Valley Planning Commission. I live in Easthampton and we had some messages from West Springfield about the Great Brook watershed and concern about drinking water and some of the contaminants we're seeing. The other connection I have to Great Brook is that for a bunch of years I've facilitated the Barnes Aquifer Protection Advisory Committee and that aquifer extends down into West Springfield and Southwick. And there's hopes that someday soon we may be able to revive the aquifer group and include West Springfield and Southwick in the conversations. **Judy Rondeau**: Non-point source coordinator of watershed program for MassDEP. We are funding this grant project for MACD. **Sabrina Pooler**: Coordinator for Southwick Conservation Commission. I live on South Pond of Congamond lakes. **Meghan Selby:** MassDEP Non-point source management section. I manage 604b water quality management planning grant program. I help coordinate the watershed-based plans. **Skylar Sweeney**: MassDEP. I am interning under Judy and Meghan. **Jay Vinskey:** City planner for Westfield. Connected through Westfield being included within this watershed area and a lot of sensitivity to drinking water contamination, particularly and wells north of here. **Randy Brown**: DPW Director for Town of Southwick. **Ryan O'Donnell**: Water quality program Manager at the Connecticut River Conservancy. We don't monitor the Great Brook watershed, but I like to learn more about the watersheds that I am not familiar with. **Michelle Pratt**: Lifelong Congamond resident and I live on Middle Pond. Currently the President of Citizens Restoring Congamond that is a non-profit organization that works with the towns of Southwick and Suffield and any other members that want to join to help assist with the care and management of the lakes and safety of the lakes. We have a very active Lake Management Committee in Southwick that have tremendous amounts of water quality data in the lakes over decades and they collect on a regular basis. Reach out to Dick Grannells, Chair of the Lake Management Committee. **Chris Pratt**: Chair of Conservation Commission of Southwick.
Discussion
Randy Brown: Regarding 319 grants, it is my understanding that those are not eligible for MS4 areas? I know the focus here is the agricultural use but just wanted clarification on that.

Judy Rondeau: Not necessarily, 319 cannot be used to fund any activity that is a requirement of MS4 permit. If it is not a requirement of MS4 permit, it is eligible. There is nuance there.

Julia Keay: We have a few topics here to cover during this discussion and starting with number 1, we did find a very good list of past projects that have been done in Southwick from the DPW. Also Geosyntec did do a project I believe with the PVPC back in like 2010 (5 BMPs constructed around Congamond).

Patty Gambarini: Yes, my old colleague worked on it with Dick Grannells.

Julia Keay: We would like to include planned projects as there might be chances to apply for grant funding to fund those projects in the future.

Chris Pratt: There is a dredging project at outflow to Great Brook from Lake Congamond (middle pond) and dredging in Great Brook to improve flow by the south boat ramp. We are looking for funding from grant money and have gone to the Community Preservation Committee for some seed money as well.

Julia Keay: Do you have any information you could send on that project?

Chris Pratt: Dick Grannells would have info.

Michelle Pratt: I can add that they did in preparation for trying to work with Army Corps. There is a broader plan for proposals for flood control in the lake as well as to improve the health and quality of the water of the lakes they conducted bathymetric mapping for looking at muck and management strategies. They are looking at it more globally for the outflow both of Canal Brook and Great Brook. And then the lakes in general for the areas where there's muck build up and the cyanobacteria problems.

Julia Keay: Any additional future potential projects and specific areas where there is a problem or source of poor water quality?

Randy Brown: Was there talk about dredging in northern end of middle pond by cove?

Michelle Pratt: They came up with depth of muck and prioritizing areas of greatest concern. I believe that was a target area

Chris Pratt: Yea that is one of the highest areas of muck and the owner of the Marina is looking at limited dredging project to increase access to the Marina.

Randy Brown: Dick recently located aerial maps and comparing historical lake coverage.

Michelle Pratt: Next Thursday evening at 7pm – Lake Management Committee meeting.

Julia Keay: Asks Sabrina about new invasive species. New potential project to address that issue.

Sabrina Pooler: They did find a source. The Connecticut River by Six Flags, and of a specific bass tournament where boats were going from waterbody to waterbody.

Julia Keay: So public education as a project about washing boats could be important. Asks for additional problem areas or project areas.

Randy Brown: Outfalls on the lakes along Berkshire Avenue that we have targeted. Probably ineligible because within MS4 area.

Julia Keay: Yes, but still important to include as sources are MS4 outfalls and that they are being addressed. Are these listed in your Stormwater Management Plan?

Randy Brown confirms.

Sabrina Pooler: Would land acquisition be a potential project? Kestrel Land Trust contacted me about a portion that the Great Brook goes through for potential protection of water quality.

Julia Keay: Potential for 319 funding?

Judy Rondeau: Land acquisition is fundable. Is not high priority category and need pollutant load reduction associated with plan and protection of land. Want to reiterate that plans are intended to be very holistic and what would protect the watershed and encourage inclusion regardless of funding.

Julia Keay: Next bullet is pollution load reduction estimates. We would like to include and if anyone has the information please forward. Also water quality efforts. We have reviewed MassDEP but is from 2006 and 2012, is there newer data?

Question for Meghan and Judy. Are there plans to monitor Great Brook?

Judy Rondeau: Confirms plans to be out in western Massachusetts next year in 2025/2026. We are on a 7-year rotation.

Meghan Selby: We can check in with monitoring group to strategize sampling locations. I do not know if we are a year or two too soon but at least get it on their radar so they know there is interest and hopefully we can make that part of it.

Julia Keay: Is there water quality data in Congamond?

Michelle Pratt confirms. The Dept of Public Health monitors *E.coli* exceedances. Michelle to send information.

Michelle Pratt: The Lake Management Committee monitors weekly throughout summer. They have decades of different water quality indicators. Southwick completed master plan and has information of lakes and the watershed and value of resilience for future.

Julia Keay: Are there any potential pollution sources and problem areas?

Randy Brown: Nothing known but worried about agricultural runoff.

Julia Keay: Any specific you want us to include?

Randy Brown: More generally. But in the back of my mind there's no regulation or oversight of what's happening in those fields.

Julia Keay: Is it mainly agricultural tobacco? Livestock?

Randy Brown: Yes tobacco. No dairy farms.

Sabrina Pooler: There are a couple horse farms. But also corn farms, but those may spill into Suffield. There is a concern of possible pollutants from the Suffield side. They don't have sewers and are on septic.

Michelle Pratt: They have all been checked recently but is a future concern if there is no upkeep with systems.

Julia Keay: Any other information regarding agriculture? It is a big percentage compared to most watershed-based plans we've done. So, it sounds like an important potential pollution source.

Moving on to public education and outreach. Sounds like there is a good amount going on. Any specific examples we should include?

Michelle Pratt: The town did a great job with master plan and had stakeholder input and looked at a lot of aspects with open/public meetings. Results of that was high importance on water quality and protection of lakes. There can be more done with education.

Julia Keay: Is there signage around lakes?

Michelle Pratt: No not a lot of signage. We post when weed treatments are in lakes. And there are kiosks at the boat ramps. We also have an annual meeting where we present all the water quality results in May. We could probably do more education on social media to get attention.

Sabrina Pooler: We have something called the Local Permitting Program. We issue annual permits for vessels and structures on the lakes. We also send out mailings to all residents—included in mailing is the dog waste pamphlet in regard to the *E. coli* issues last year.

Julia Keay: Does Southwick have MS4 public outreach?

Randy Brown: We have done a lot of that and worked with Patty. We targeted landscapers, property owners and landowners. They are in the stormwater permit online.

Julia Keay: The watershed-based plan has one element for public education and outreach. We would like to include past, and planned outreach.

The last topic to discuss is grant funding which we have discussed throughout. Meghan, can you mention the 604b program?

Meghan Selby: 604b is planning focused while 319 is implementation focused. So 604b does all the identifying solutions for planning. Eligible parties: counties, tribes, municipal planning boards, water quality sampling and efforts to identify projects and solutions and we like to set them up to roll into 319 grants. Once the RFP comes out, we cannot answer specific project questions. We have an email distribution list that we will send the announcement out. It will be posted on the Massachusetts Commbuys website as well as our grant website, the MassDEP grants website.

Judy Rondeau: If you're not on that distribution list, you can drop me a message in the chat with your email address and I can add you in, or you can email. I'll put my email in the chat as well (Judith.Rondeau@mass.gov)

Julia Keay: 319 RFP should be coming out soon?

Judy Rondeau: Hoping for next week.

Julia Keay: Any questions or anything to discuss?

Michael Leff: If anything occurs to you, please stay in touch!

Julia Keay: We will reach out to Dick Grannells.

Michelle Pratt: I will send YouTube link Dr Eric Mueller from Lake Management. He is the one who is kind of in charge of all that data for water quality monitoring.

Julia Keay: Additionally, the watershed-based plan is meant to be a living document and meant to be reevaluated and updated in the future.

Patty Gambarini: Will there be goal setting as part of the process?

Julia Keay: Yes, the plan will be state/EPA goals. Unless people have additional goals they want to achieve? If there are any qualitative goals, you can mention now or email us.

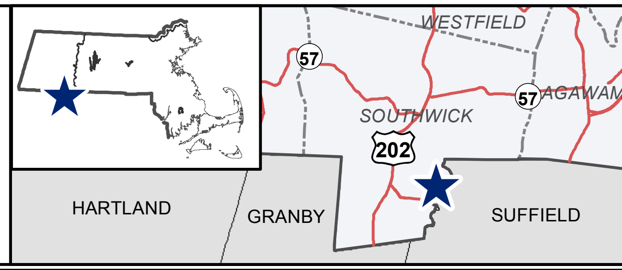
Thank you for your time and for joining and participating, we really appreciate it!

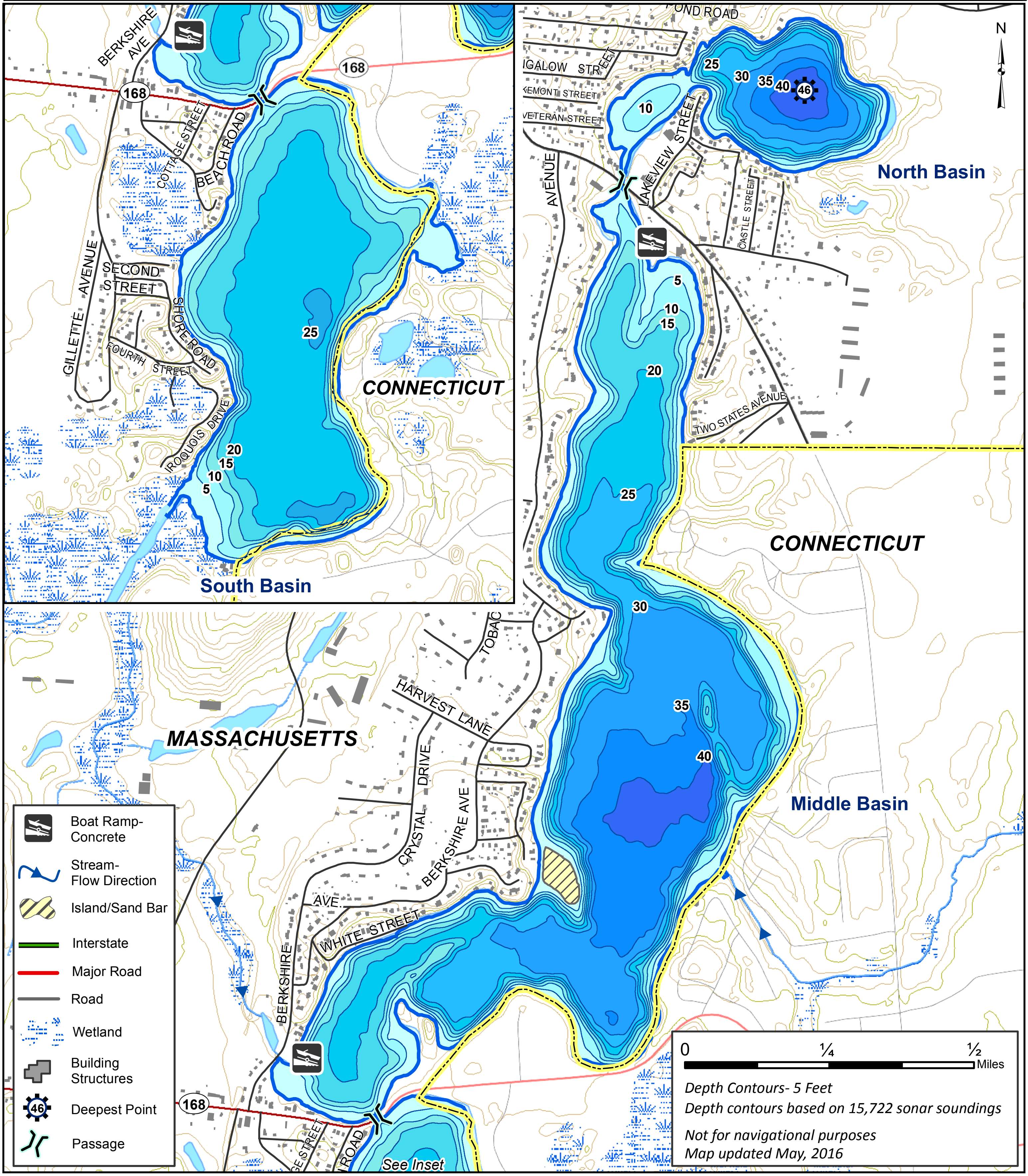
Contact: Julia Keay, JKeay@geosyntec.com
Bella D'Ascoli, IDascoli@geosyntec.com

Appendix B – Congamond Lakes Bathymetry Map (MassWildlife 2016)

Lake Congomond

477 Acres
Southwick
Westfield River Watershed
Coordinates: 72°45'25"W 42°02'29"N
USGS Quad: Southwick





Lake Congamond, Southwick

General Information

Lake Congomond is a 477 acre great pond located off of Route 168 on the Massachusetts-Connecticut border in Southwick. Lake Congomond is comprised of three basins connected by waterways which are navigable to all but the largest of boats. The North basin (47 acres) has an average depth of 21 feet and a maximum of 46 feet, the middle basin (284 acres) has an average depth of 22 feet with a maximum of 42 feet, and the south basin (146 acres) has an average of 16 feet with a maximum of 27 feet. Water clarity varies among basins, and the bottom is generally mud with scattered areas of gravel and cobble. Aquatic vegetation is patchy and generally not abundant due to the application of herbicides. With the exception of the east side of the north basin, the shoreline is heavily developed with year round residences. Congomond Lake hosts multiple competitive bass tournaments each year and receives heavy recreational use during summer.

Recreational Access

The town of Southwick manages two public boat ramps in the middle basin where watercraft may be launched for a fee. The north ramp (72°45'25.90"W 42°2'28.95"N) is located off Point Grove Road on the northern shore of the middle basin and is a double concrete ramp with an adjacent fishing pier, small picnic area, and parking lot suitable for roughly 30 trailers. The south ramp (72°46'7.35"W 42°1'14.55"N) is located off Berkshire Road on the southeastern shore of the middle basin and is a single concrete ramp (with a sharp drop off!) and an adjacent parking area suitable for roughly 18 trailers. Shoreline access is limited to areas adjacent to the ramps. Please contact the offices of the town of Southwick for additional information, fee structure, and/or restrictions pertaining to public access of Lake Congomond.

Fish Populations

The following fish species were found during MassWildlife surveys: Largemouth Bass, Smallmouth Bass, Chain Pickerel, Yellow Perch, White Perch, Black Crappie, Bluegill, Pumpkinseed, Rock Bass, Brown Bullhead, Common Carp, White Sucker, landlocked Alewife, Banded Killifish, and Golden Shiner. The middle basin of Lake Congomond is also stocked with trout every spring and fall.

Fishing

Lake Congomond is renowned for its largemouth bass fishery which commonly produces fish exceeding 5lbs. Fishing for stocked trout is also popular during spring and fall but the scarcity of cold oxygenated water during summer limit the ability of trout to survive multiple seasons and grow to trophy sizes. Lake Congomond is also known for its large Yellow Perch and Black Crappie which can be caught throughout the year. Lake Congomond has produced Largemouth Bass, Smallmouth Bass, Chain Pickerel, sunfish, Black Crappie, Yellow Perch, and Brown Trout that meet minimum sizes for recognition by the Freshwater Sportfishing Awards Program.

Useful Links:

Get your Fishing License

Freshwater Fishing

Trout Stocking Information

Freshwater Sportfishing Awards Program

Learn more:
Mass.gov/MassWildlife

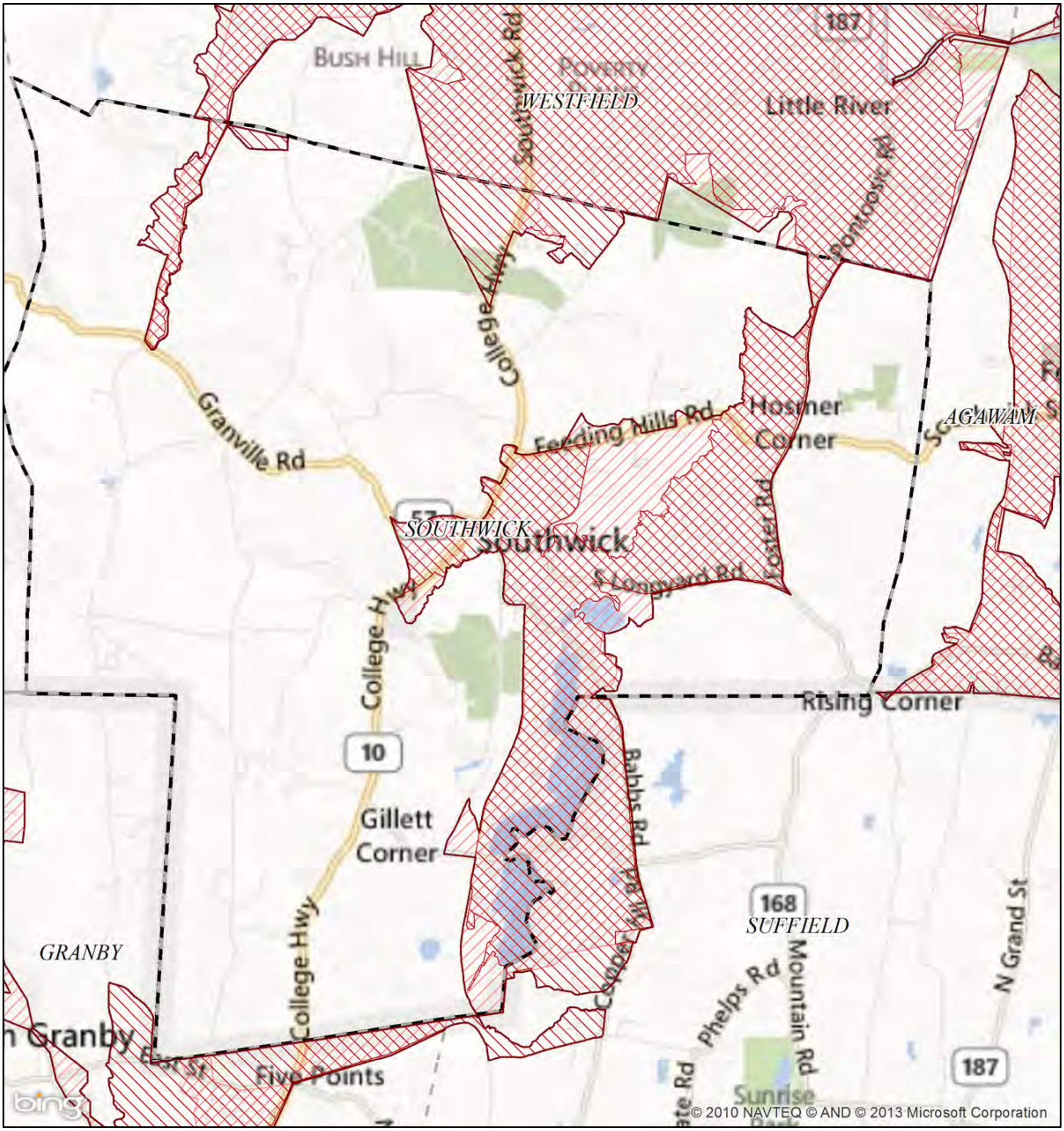
Connect with us:
Facebook.com/MassWildlife

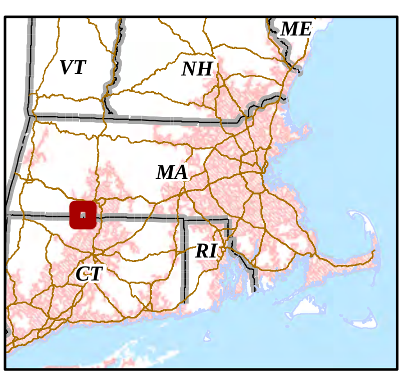
Your local MassWildlife office:
East Street
Belchertown, MA 01007
(413) 323-7632

STOP AQUATIC HITCHIKERS!
Prevent the transport of nuisance species.
Clean all recreational equipment.
ProtectYourWaters.net

Updated: 2016

Appendix C – MS4 Map (USEPA 2020)





NPDES Phase II Stormwater Program
Automatically Designated MS4 Areas

Southwick MA

Regulated Area:

UA Based on 2000 Census | UA Based on 2010 Census

0 1 2 3 4 Kilometers

0 1 2 3 Miles

Town Population: 9502

Regulated Population: 5308

(Populations estimated from 2010 Census)

EPA

Urbanized Areas, Town Boundaries:
US Census (2000, 2010)
Base map © 2013 Microsoft Corporation
and its data suppliers

US EPA Region 1 GIS Center Map #8824, 8/9/2013

Appendix D – Select excerpts from the Westfield River Watershed 2001 Water Quality Assessment Report (MassDEP, 2005) relating to the water quality in the Great Brook watershed (note: relevant information is included directly from these documents for informational purposes and has not been modified).

Westfield River Watershed 2001 Water Quality Assessment Report (MA32-25 - Great Brook)
USE ASSESSMENT AQUATIC LIFE Biology MDFW regularly stocks trout in Great Brook. In July 2001 MDFW conducted backpack electrofishing in two reaches of Great Brook - upstream from the Route 57 Bridge in Southwick (Station 564) and near the Shaker Road Bridge in Westfield (Station 328, Richards 2003). In the upstream reach five fish species collected, in order of abundance, were brown trout, blacknose dace, white sucker, brook trout, and one bluegill. Multiple age classes of brown trout were found. Further downstream eight species collected, in order of abundance, were brown trout, blacknose dace, brook trout, tessellated darter, white sucker, American eel, bluegill, and longnosed dace. Multiple age classes of brown trout and brook trout were found. With the exception of bluegill and American eel these species are all fluvial specialists/dependants. Chemistry – water DWM collected in-situ measurements and water quality samples from one station on Great Brook ~ 250 feet upstream from Route 187 bridge, Westfield (Station GRTB00.3), between 1 August and 3 October 2001 (n=4). In-situ parameters measured included dissolved oxygen, pH, temperature, conductivity, and total dissolved solids (Appendix 2 of Appendix A). Grab samples were collected and analyzed for alkalinity, hardness, chloride, and total suspended solids (Appendix 3 of Appendix A). DO The instream DO measured by DWM in Great Brook (Station GRTB00.3) ranged from 7.5 to 9.0 mg/L (74 to 81% saturation) Temperature Temperatures recorded by DWM ranged from 11.0 to 17.5°C. pH pH measurements recorded by DWM ranged from 7.1 to 7.2 SU. Conductivity Conductivity reported by DWM ranged from 224 to 230 µS/cm. Solids Total suspended solid concentrations reported by DWM ranged from <1.0 to 4.4 mg/L. Alkalinity The alkalinity reported by DWM ranged from 23 to 25 mg/L. Hardness Hardness values reported by DWM ranged from 53 to 55 mg/L. Chloride Chloride concentrations reported by DWM ranged from 73 to 82 mg/L. The Aquatic Life Use for Great Brook is assessed as support based primarily on the fish population information, the water quality data, and best professional judgment. The presence of two intolerant species (brown trout and brook trout) is indicative of excellent water and habitat quality. PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS ESS collected fecal coliform bacteria samples from four locations on Great Brook in 1999. The stations and results can be summarized as follows (ESS 2000). • Outlet of Congamond Lake at Sheep Pasture Road, Southwick (Station SS-23), on 3 November: <10 cfu/100 mls, • South Longyard Road, Southwick (Station SS-22), on 3 November: 1,700 cfu/100 mls, • Feeding Hills Road, Southwick (Station SS-21), on 3 November: 1,800 cfu/100 mls, • Little River Road/Feeding Hills Road bridge in Westfield (Station PS-4), on 28 December: 30 cfu/100 ml DWM collected fecal coliform bacteria samples from Great Brook near the Route 187 bridge, Westfield (Station GRTB00.3) between 1 August and 3 October 2001 (n=4). Sample results for fecal coliform ranged from 33 to 130 cfu/100 ml (Appendix 3 of

Appendix A). No trash, debris or other objectionable deposits were noted by the field survey crews (MA DEP 2001b). Occasional septic odors were noted however.

ESS also collected fecal coliform bacteria samples from three tributaries to Great Brook in 1999. The stations and results can be summarized as follows (ESS 2000).
• Pearl Brook near Route 202/10, Southwick (Station SS-45), on 28 December: 20 cfu/100 ml.
• Johnson Brook at Route 202/10, Southwick (Station SS-44), on 28 December: 30 cfu/100 ml.
• unnamed tributary at Route 202/10 (slightly south of Route 57), Southwick (Station SS-46), on 28 December: 60 cfu/100 ml.

It should also be noted that DWM collected fecal coliform bacteria samples from three stations (as described below) along Great Brook in May and August 1996 as part of the 1996 Westfield River Watershed monitoring survey (Appendix G, Table G4).
• near Sheep Pasture Road in Southwick (Station GRTB08.6)
• near Route 57 in Southwick (Station GRTB03.1)
• Little River Road, Westfield (Station GRTB00.3)

The Primary and Secondary Contact Recreational uses are assessed as support for Great Brook based on the generally low fecal coliform bacteria counts for the brook. The recreational uses are identified with an "Alert Status", however, because of the two high bacteria counts documented in the brook near Longyard Road and Feeding Hills Road in 1999. Although no objectionable deposits were noted, too limited data are available, so the Aesthetics Use is currently not assessed.

MDFW has proposed that Great Brook and its tributary Johnson Brook be listed in the SWQS as cold water fisheries (MDFW 2003).
WMA WATER WITHDRAWAL SUMMARY - See original document for authorized withdrawal (MGD)

Report Recommendations:
• Conduct bacteria monitoring to assess the Primary and Secondary Contact Recreational uses and the effectiveness of the City of Westfield's and the Town of Southwick's Phase II stormwater management permits and programs.
• Conduct additional biological monitoring to assess the status of the Aquatic Life Use.
• Great Brook should be listed in the next revision of the Massachusetts Surface Water Quality Standards as a cold water fishery.
• Review municipalities of Westfield (MAR041236), and Southwick (MAR041022) Phase II Stormwater SWPPPs, extent of compliance, and the effectiveness in minimizing impacts of stormwater runoff from their facilities into the Westfield River and subwatershed tributaries.

Appendix E – Pollutant Load Export Rates (PLERs)

Land Use & Cover[1]	PLERs (lb/acre/year)		
	(TP)	(TSS)	(TN)
AGRICULTURE, HSG A	0.45	7.14	2.59
AGRICULTURE, HSG B	0.45	29.4	2.59
AGRICULTURE, HSG C	0.45	59.8	2.59
AGRICULTURE, HSG D	0.45	91.0	2.59
AGRICULTURE, IMPERVIOUS	1.52	650	11.3
COMMERCIAL, HSG A	0.03	7.14	0.27
COMMERCIAL, HSG B	0.12	29.4	1.16
COMMERCIAL, HSG C	0.21	59.8	2.41
COMMERCIAL, HSG D	0.37	91.0	3.66
COMMERCIAL, IMPERVIOUS	1.78	377	15.1
FOREST, HSG A	0.12	7.14	0.54
FOREST, HSG B	0.12	29.4	0.54
FOREST, HSG C	0.12	59.8	0.54
FOREST, HSG D	0.12	91.0	0.54
FOREST, HSG IMPERVIOUS	1.52	650	11.3
HIGH DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.27
HIGH DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.16
HIGH DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.41
HIGH DENSITY RESIDENTIAL, HSG D	0.37	91.0	3.66
HIGH DENSITY RESIDENTIAL, IMPERVIOUS	2.32	439	14.1
HIGHWAY, HSG A	0.03	7.14	0.27
HIGHWAY, HSG B	0.12	29.4	1.16
HIGHWAY, HSG C	0.21	59.8	2.41
HIGHWAY, HSG D	0.37	91.0	3.66
HIGHWAY, IMPERVIOUS	1.34	1,480	10.2
INDUSTRIAL, HSG A	0.03	7.14	0.27
INDUSTRIAL, HSG B	0.12	29.4	1.16
INDUSTRIAL, HSG C	0.21	59.8	2.41

Land Use & Cover[1]	PLERs (lb/acre/year)		
	(TP)	(TSS)	(TN)
INDUSTRIAL, HSG D	0.37	91.0	3.66
INDUSTRIAL, IMPERVIOUS	1.78	377	15.1
LOW DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.27
LOW DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.16
LOW DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.41
LOW DENSITY RESIDENTIAL, HSG D	0.37	91.0	3.66
LOW DENSITY RESIDENTIAL, IMPERVIOUS	1.52	439	14.1
MEDIUM DENSITY RESIDENTIAL, HSG A	0.03	7.14	0.27
MEDIUM DENSITY RESIDENTIAL, HSG B	0.12	29.4	1.16
MEDIUM DENSITY RESIDENTIAL, HSG C	0.21	59.8	2.41
MEDIUM DENSITY RESIDENTIAL, HSG D	0.37	91.0	3.66
MEDIUM DENSITY RESIDENTIAL, IMPERVIOUS	1.96	439	14.1
OPEN LAND, HSG A	0.12	7.14	0.27
OPEN LAND, HSG B	0.12	29.4	1.16
OPEN LAND, HSG C	0.12	59.8	2.41
OPEN LAND, HSG D	0.12	91.0	3.66
OPEN LAND, IMPERVIOUS	1.52	650	11.3
[1]HSG = Hydrologic Soil Group			

Appendix F – Summary of Agricultural BMPs included in Conceptual Projects and associated Planning-level Nitrogen Load Reductions in the Great Brook Watershed

Great Brook Conceptual Projects and Potential Nitrogen Load Reductions

- **Fence (382)**
  - Definition - A constructed barrier to animals or people.
  - Purpose - This practice facilitates the accomplishment of conservation objectives by providing a means to control movement of animals and people, including vehicles.

    - ➢ This practice is typically paired with heavy use areas and stream crossings.
    - ➢ The estimated nitrogen load reduction for a herd of 50 cattle is approximately 900 lbs/year.

- **Filter Strip (393)**
  - Definition - A strip or area of herbaceous vegetation that removes contaminants from overland flow.
  - Purpose - Reduce suspended solids and associated contaminants in runoff, reduce dissolved contaminant loadings in runoff, reduce suspended solids and associated contaminants in irrigation tailwater.

      - ➢ Typically paired with fencing, waste storage facilities, heavy use areas, and other field-based practices with pollutant load reductions.

- **Stream Crossing (578)**
  - Definition - A stabilized area or structure constructed across a stream to provide controlled access for people, livestock, equipment, or vehicles.
  - Purpose – This practice is used to accomplish one or more of the following purposes:
    - ➢ Improve water quality by reducing sediment, nutrient, or organic loading to a stream
    - ➢ Reduce streambank and streambed erosion

      - ➢ This practice is typically paired with fencing.
      - ➢ The estimated nitrogen for a herd of 50 cattle, is approximately 900 lbs/year.

*Nitrogen reduction estimates are variable based on animal numbers, location, and final design of the practice.

Appendix G – List of Potential Agricultural BMPs with USDA-NRCS Code (Provided to Geosyntec by Franklin Regional Council of Governments [FRCOG]).

The Massachusetts "Field Office Technical Guide" can be accessed at:
https://efotg.sc.egov.usda.gov/#/state/MA/documents/section=4&folder=-3 .Detailed information on each BMP can be found under "Section 4 - Practice Standards and Supporting Documents" > "Conservation Practice Standards & Support Documents"

207-Site Assessment and Soil Testing for Contaminants Activity	656-Constructed Wetland
216-Soil Health Testing	309-Agrichemical Handling Facility
217-Soil and Source Testing for Nutrient Management	311-Alley Cropping
309-Agrichemical Handling Facility	314-Brush Management
311-Alley Cropping	315-Herbaceous Weed Control
313-Waste Storage Facility	338-Prescribed Burning
316-Animal Mortality Facility	350-Sediment Basin
317-Composting Facility	351-Water Well Decommissioning
327-Conservation Cover	356-Dike
328-Conservation Crop Rotation	362-Diversion
329-Residue and Tillage Management, No Till/Strip Till/Direct Seed	367-Roofs and Covers
330-Contour Farming	378-Pond
332-Contour Buffer Strips	380-Windbreak/Shelterbelt Establishment
340-Cover Crop	381-Silvopasture Establishment
342-Critical Area Planting	382-Fence
345-Residue and Tillage Management, Reduced Till	402-Dam
355-Water Well Testing	422-Hedgerow Planting
360-Waste Facility Closure	430-Irrigation Pipeline
366-Anaerobic Digester	441-Irrigation System, Micro irrigation
386-Field Boarder	442-Sprinkler System
390-Riparian Herbaceous Cover	443-Irrigation System, Surface & Subsurface
391-Riparian Forest Buffer	462-Preision Land Forming
393-Filter Strip	464-Irrigation Land Leveling
395-Stream Habitat Improvement and Management	468-Lined Waterway or Outlet
410-Grade Stabilization Structure	484-Mulching
412-Grassed Waterway	511-Forage Harvest Management
436-Irrigation Reservoir	512-Forage and Biomass Planting
449-Irrigation Water Management	516-Livestock Pipeline
472-Access Control	558-Roof Runoff Structure
528-Prescribed Grazing	560-Access Road
561-Heavy Use Area Protection	574-Spring Development
575-Trails and Walkways	578-Stream Crossing
580-Streambank and Shoreline Protection	582-Open Channel
590-Nutrient Management	585-Stripcropping
600-Terrace	587-Structure for Water Control
601-Vegetative Barrier	595-Integrated Pest Management
612-Tree/Shrub Establishment	603-Herbaceous Wind Barriers
629-Waste Treatment	607-Surface Drain, Field Ditch
634-Waste Transfer	608-Surface Drain, Main or Lateral
635-Vegetative Treatment Area	614-Watering Facility
638-Water and Sediment Control Basin	620-Underground Outlet
632-Solid/Liquid Waste Separation Facility	650-Windbreak/Shelterbelt Renovation
642-Water Well	657-Wetland Restoration
643-Restoration and Management of Declining Habitats	658-Wetland Creation
644-Wetland Wildlife Habitat Management	659-Wetland Enhancement