MASSACHUSETTS
watershed·based plans

WATERSHED-BASED PLAN

Farm Pond
Framingham, MA

June 2020

Prepared By:

City of Framingham
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Prepared For:

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection

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Executive Summary

Introduction: The purpose of a Massachusetts Watershed-Based Plan (WBP) is to organize information about Massachusetts' watersheds, and present it in a format that will enhance the development and implementation of projects that will restore water quality and beneficial uses in the Commonwealth. The Massachusetts WBP follows USEPA's recommended format for "nine-element" watershed plans. This WBP was developed by Geosyntec Consultants (Geosyntec) under the direction of the City of Framingham (City) with funding, input, and collaboration from the Massachusetts Department of Environmental Protection (MassDEP).

Farm Pond is a 140-acre Great Pond located in the City of Framingham, MA. The drainage area of Farm Pond is part of the greater Concord River watershed and is entirely located within the City of Framingham. The pond is located less than a mile from the Framingham center and is used as a scenic and recreational resource by the community. The pond is divided into two parts by a large dike. The larger section is referred to as "Big Farm Pond" and the smaller section is known as "Little Farm Pond". Farm Pond flows into Eames Brook, which discharges to the Sudbury River and into the Concord River.

Impairments and Pollution Sources: Farm Pond (MA82035) is an impaired waterbody listed under Category 5 on the Massachusetts Year 2016 Integrated List of Waters (303(d) list) for non-native aquatic plants, Eurasian Water Milfoil (EWM), excess algal growth, and turbidity. A 2001 Water Quality Assessment Report, which included Farm Pond described low dissolved oxygen at depths great than 3.5 meters, evidence of Total Phosphorus (TP) release from anoxic sediments, and invasive species present in the pond. The pond was treated with herbicides and algaecide between 1996—2001. Suspected sources of the impairments included municipal urban high-density areas, discharge from separate storm sewer systems and internal nutrient recycling (MassDEP, 2001). The Framingham Conservation Commission manages annual vegetation surveys and water quality sampling, which is conducted by Solitude Lake Management (Solitude). Vegetation surveys conducted in 2019 indicated continued dominance of EWM, Robbins pondweed, and curly-leaf pondweed in Big Farm Pond. The densest EWM growth in Big Farm Pond was identified along the eastern shoreline bordering the railroad tracks and the southern-most shoreline. Treatment of Farm Pond is currently not allowable due to concerns raised by the Natural Heritage and Endangered Species Program (NHESP) due to a rare sedge population on Farm Pond, but treatment is recommended by Solitude if NHESP allows it (Solitude, 2019).

Goals, Management Measures, and Funding: The primary goal of this WBP is to reduce Total Suspended Solids (TSS) and TP loading to Farm Pond. It is expected that these pollutant load reductions will result in improvements to the listed impairments of Farm Pond, eventually leading to delisting of Farm Pond from the 303(d) list.

It is expected that goals will be accomplished primarily through installation of green infrastructure BMPs (e.g., bioretention areas, pervious pavement, rain gardens) to reduce sediment and nutrient loading and through watershed education and outreach. Funding for management measures will be obtained from a variety of sources including Section 319 Grant Funding, City capital funds, volunteer efforts, and other sources.

Public Education and Outreach: Outreach and education will build on recent efforts to educate the watershed and general public about nonpoint source pollution and invasive weeds, with the goal of ensuring continued improvements in water quality and environmental stewardship. Recent efforts include but are not limited to: BMP educational signage, green infrastructure workshops, and public meetings regarding the

importance of green infrastructure. Future efforts will include implementation of informational signage on completed structural BMPs and periodic website updates, including posting this completed WBP.

Implementation Schedule and Evaluation Criteria: Project activities will be implemented based on the information outlined in the following elements for monitoring, implementation of structural BMPs, public education and outreach activities, and periodic updates to the WBP. It is expected that the existing water quality monitoring program will enable direct evaluation of improvements over time. Other indirect evaluation metrics are also recommended, included quantification of potential pollutant load reductions from non-structural BMPs (e.g., street sweeping). The long-term goal of this WBP is to de-list Farm Pond from the 303(d) list by 2035. The WBP will be re-evaluated and adjusted, as needed, once every three years.

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 it in a format that will enhance the development and implementation of projects that will restore water quality and beneficial uses in the Commonwealth. The Massachusetts WBP follows 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 watershed-based plans only for selected watersheds. 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 Farm Pond sub-basin in the Concord 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 watershed-based plan (and to achieve any other watershed goals identified in the watershed-based plan), as discussed in item (b) immediately below.

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

c) A **description of the nonpoint source (NPS) management measures** needed to achieve the load reductions estimated under paragraph (b) above (as well as to achieve other watershed goals identified in this watershed-based plan), 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, USDA's Environmental Quality Incentives Program and Conservation Reserve Program, and other relevant Federal, State, local and private funds that may be available to assist in implementing this plan.

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

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

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

h) A set of **criteria to determine if loading reductions are being achieved** over time and substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether this watershed-based plan needs to be revised or, if a NPS Total Maximum Daily Load (TMDL) has been established, whether the TMDL needs to be revised.

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

Project Partners and Stakeholder Input

This WBP was developed by Geosyntec Consultants (Geosyntec) under the direction of the City of Framingham with funding, input, and collaboration from the Massachusetts Department of Environmental Protection (MassDEP). This WBP was developed using funds from the Section 319 program to assist grantees in developing technically robust WBPs using MassDEP's Watershed-Based Planning Tool (WBP Tool). The City of Framingham was a recipient of Section 319 funding in Fiscal Year 2017 to implement BMPs in the Farm Pond Watershed.

Core project stakeholders included:

- Kerry Reed – City of Framingham
- Matthew Reardon – MassDEP

This WBP was developed as part of an iterative process. The Geosyntec project team collected and reviewed existing data from the City of Framingham. This information was then used to develop a preliminary WBP for review by core project stakeholders. A stakeholder conference call was then held to solicit input and gain consensus on elements included in the plan (e.g., water quality goals, public outreach activities, etc.). The WBP was finalized once stakeholder consensus was obtained for all elements.

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 Nonpoint Source Pollution Grant Program application and final report for "Farm Pond Green Infrastructure BMPs" (City of Framingham, 2016 and 2019). Additional data sources were reviewed and are included in subsequent sections of this WBP.

Summary of Completed Work

The City of Framingham continues to invest significant effort and public funds and has undertaken a methodical, step-by-step approach to improving the health and water quality of Farm Pond, in order to preserve this unique scenic and recreational resource within walking distance of downtown Framingham. The City's strategy includes integrating water quality improvements into new and redevelopment projects, both private and public. The City has also been working diligently to increase public awareness and educate the community on the importance of preserving and improving the City's natural resources. The following project descriptions highlight water quality improvement projects that have been completed within the Farm Pond watershed (City of Framingham, 2016). Project locations are depicted in Appendix C.

Stormwater Master Plan

The City began comprehensive town-wide stormwater master planning in 2004 as part of an overall strategy to develop a maintenance and improvement program for the City's stormwater infrastructure and to improve water quality. The City was subdivided into 22 sub-basins and planning is being conducted in five phases focusing on two to five sub-basins per phase. Because the Farm Pond sub-basin was identified as a priority sub-basin, it was included in Phase I. Phase I of the Stormwater Master Plan, which included both Farm Pond and Beaver Dam Brook sub-basins, was completed in 2008. Recommendations from Phase I – III have been incorporated in the Town's Capital Improvement Plan.

Franklin Street Roadway and Bridge Improvements

The Franklin Street Roadway and Bridge Improvements project included roadway re-construction, bridge repair work, sidewalk construction, traffic signal and lighting improvements, landscaping, and drainage improvements. The project was designed by Framingham but the construction was managed by the Massachusetts Department of Transportation (MassDOT) under the Transportation Improvement Program (TIP). The design enhanced the existing drainage to improve stormwater management. Specifically, Stormceptors®, infiltration basins, and deep sump catch basins were incorporated into the project. The work was completed in 2008.

CSXT Pearl Street Yard Stormwater Improvements

The CSXT Framingham Yard is located at 60 Pearl Street on the eastern shores of Farm Pond. The rail yard consists of approximately 36 acres, ninety percent of which is covered by railroad ballast and tracks, with another one percent consisting of enclosed buildings and pavement, and the remaining nine percent consisting of grasses or other vegetation. In 2012-2013, CSX installed a large infiltration basin along the northern portion of the yard to improve stormwater management and water quality entering the pond. Prior to installation of the infiltration basin, most of the precipitation that fell on the facility either sheet flowed to Farm Pond or infiltrated into the ballast. The basin was designed to capture up to one inch of rainfall over the entire drainage area. Not only does the new infiltration basin reduce on-site flooding and improve water quality, it provides additional protection in the event of a spill.

Learned Beach Smart Sponge Vault

Learned Pond is a recreational waterbody located north of downtown Framingham within the Farm Pond watershed. During the early 2000s, the beach was closed due to bacteria more often than it was open. Stormwater runoff from the surrounding residential neighborhood was identified as a major pollutant source. In 2007, Framingham replaced the open swale at the outfall with an in-series BMP that consisted of a Downstream Defender® hydrodynamic separator water quality structure and an AbTech Smart Sponge® vault to improve water quality. Although bacteria was the primary pollutant of concern, this BMP also removed sediment, nutrients, and hydrocarbons. This project cost $96,500 (design and construction) and was funded through a Capital appropriation from the General Fund at a City Meeting. Post-construction sampling identified water quality improvements including an average of 72% reduction of bacteria pre- and post-treatment. The Framingham Department of Public Works (DPW) inspects and maintains the BMP annually.

DPW Facility Improvements

Framingham's Henry Street property located on the eastern side of Farm Pond was constructed with a Public Works' maintenance garage and salt shed in 1950. In the early 2000s, DPW maintenance operations moved to a new facility located at 100 Western Avenue (outside the Farm Pond watershed). In 2006, the City of Framingham demolished the outdated salt storage shed and constructed a replacement shed in approximately the same location. The new shed allows delivery and loading of salt to be conducted inside and reduces potential for stormwater impacts.

Additionally, the DPW operates a recycling drop-off center (RDC) at 225 Mount Wayte Avenue, which is located northwest of Farm Pond adjacent to Eames Brook, which hydraulically connects Farm Pond to the Sudbury River. The property was previously used for solid waste management and included an incinerator which has since been decommissioned. A Downstream Defender® hydronamic separator was installed at the RDC to improve water quality from stormwater runoff from the property which discharges to Eames Brook.

Street Sweeping Program

Street sweeping is conducted at least twice a year in the Farm Pond watershed. The main downtown area, which is partly in the Farm Pond watershed, gets swept almost daily. Street sweeping is conducted by the Town of Framingham DPW's Highway Division with its own personnel and equipment.

Cushing Memorial Park Master Plan

Cushing Memorial Park is a 67.5-acre City-owned property located to the west of Farm Pond dedicated to passive recreational pursuits. The Cushing Memorial Park Master Plan was established in 2001 and updated in 2013. The grounds are unique as the property continues to evolve from its historical roots as an expansive state hospital with massive infrastructure (that included roadways, parking lots, utility systems and more than 100 buildings) into a major public park and open space asset. Today, defining park features include the grand pedestrian promenades (renovated former hospital roads), expansive open lawns and meadows (former hospital building footprints), and mature shade trees. The Town of Framingham through the Parks and Recreation Department has completed improvements in excess of $2,000,000 at Cushing Memorial Park. Improvements have been undertaken through a variety of means, including through the securing of grant funds offered through the Massachusetts Division of Conservation Services Parkland Acquisitions and Renovations for Communities (PARC) Program. Significant removal of impervious surfaces and installation of stormwater management improvements were completed throughout the park as part of the redevelopment. Future plans for Cushing Memorial Park included in the master plan include land acquisition for park expansion, removal of surplus paved areas, improved parking areas, landscaping, and streetscape enhancements. The future of Cushing Memorial Park provides additional opportunities for conservation and water quality improvements.

Aquatic Management Program

The Town's long-standing, comprehensive Aquatic Management Program managed by the Framingham Conservation Commission has preserved and enhanced overall ecological and recreational value of the Town's ponds. Like many of the ponds in the City, Farm Pond has suffered from native and non-native invasive growth of aquatic weeds which impact the quality and recreational use of the pond. The Plan provides strategies to reduce weeds and improve the enjoyment of the ponds. Annual water quality monitoring has been conducted as part of the Aquatic Management Program since 2000.

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

Farm Pond is a 140-acre Great Pond located in the City of Framingham, MA. The drainage area of Farm Pond is part of the greater Concord River watershed and is entirely located within the City of Framingham. The pond is located less than a mile from the Framingham downtown and is used as a scenic and recreation resource by the community. The pond is divided into two parts by a large dike. The larger section is referred to as "Big Farm Pond" and the smaller section is known as "Little Farm Pond". Farm Pond flows into Eames Brook, which discharges to the Sudbury River and into the Concord River. **Table A-1** presents the general watershed information for the Farm Pond watershed and **Figure A-1** includes a map of the watershed boundary[1].

Table A-1: General Watershed Information

Watershed Name (Assessment Unit ID):	Farm Pond (MA82035)
Major Basin:	Concord (SuAsCo)
Watershed Area (within MA):	556 acres
Water Body Size:	140 acres

[1] For this WBP, the watershed was delineated utilizing the WBP Tool and varies from the watershed delineation presented by the City of Framingham (Framingham, 2016).

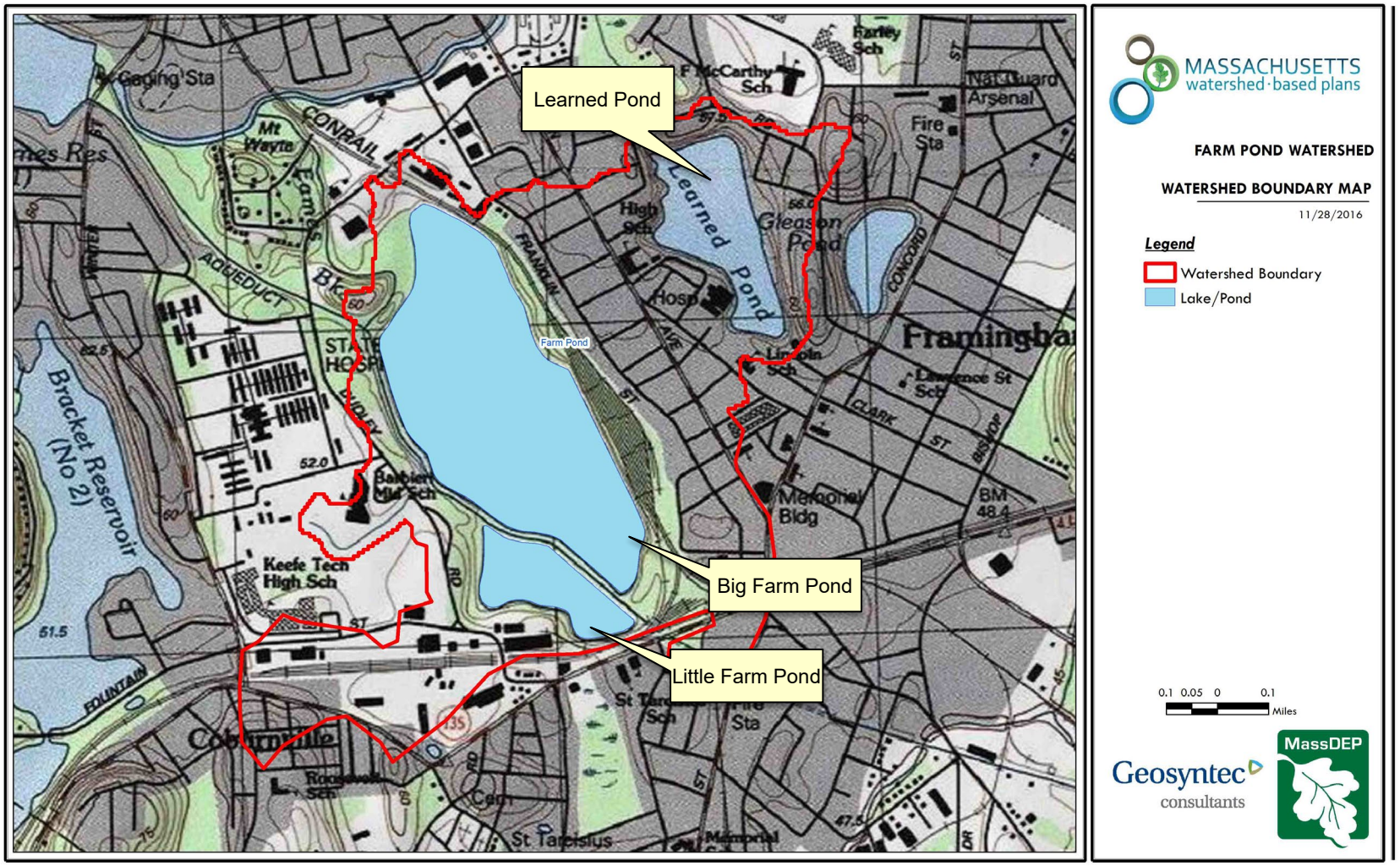

Figure A-1: Watershed Boundary Map

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

Note: For this WBP, the watershed was delineated utilizing the [WBP Tool] and varies from the watershed delineation presented by the City of Framingham (Framingham, 2016).

MassDEP Water Quality Assessment Report and TMDL Review

The following water quality assessment was reviewed for this study:

- SuAsCo Watershed 2001 Water Quality Assessment Report, SUASCO WATERSHED LAKE ASSESSMENTS

Select excerpts from this document relating to the water quality in Farm Pond (MA82035) are included in Appendix B. The report describes low dissolved oxygen at depths greater than 3.5 meters, as well as evidence of TP release from anoxic sediments in Farm Pond. This report details the presence of invasive species present in Farm Pond and assessed it as impaired for non-native aquatic macrophytes and excess algal growth. Suspected sources of these impairments included municipal urban high-density areas, discharge from separate storm sewer systems and internal nutrient recycling. The pond was treated with herbicides and algaecide between 1996 and 2001.

Additional Water Quality Data

2019 Aquatic Management Report (Solitude, 2015)

Under the direction of the Framingham Conservation Commission, Solitude manages and monitors seven of Framingham's ponds including Farm Pond (Big Farm Pond and Little Farm Pond). According to the 2019 annual summary (Solitude, 2019), Big Farm Pond is the only Framingham pond that has supported the growth of non-native EWM. As a result, the annual vegetation management over the years has primarily focused on the selective control of EWM and control of nuisance level native plant growth (water lily and pondweeds). Big Farm Pond cannot currently be treated due to a population of rare Sedge along the shoreline. Little Farm Pond has a dense canopy of native species dominating the plant assemblage. No EWM was observed in Little Farm Pond. Due to concerns raised by NHESP, no herbicide treatment was performed in Little Farm Pond. Results of the 2019 early season and late season vegetation surveys of Big Farm Pond and Little Farm Pond are listed below:

- Big Farm Pond Early Season Vegetation Surveys:
  - The submersed vegetation growth was dominated by EWM, Robbins pondweed, and curly-leaf pondweed (CLP).
  - The densest EWM growth has been located at on the eastern shoreline bordering the railroad tracks and the southern-most shoreline.
  - The CLP growth is located primarily around the boat ramp and the shoreline to the southwest.
  - Other plant species observed at lesser densities were Richardson's pondweed, clasping-leaf pondweed, and white-water lily.
- Big Farm Pond Late Season Vegetation Survey:
  - During the late season survey, EWM continued to be the most dominant species along with Robbin's pondweed.
  - No CLP was observed at the time of inspection.
- Little Farm Pond Early Season Survey:
  - At the time of the survey the submersed vegetation growth was dominated by common waterweed and coontail along the entire shoreline. White water lilies and watershield were scattered along the shoreline.
- Little Farm Pond Late Season Survey:
  - Plant cover in Little Farm Pond remained consistent through the season with little to no change in plant density or observed plant species as past years.
  - Small scattered patches of filamentous algae were observed along the shoreline.

Solitude also collected a single round of water quality samples at Big Farm Pond and Little Farm Pond in conjunction with the 2019 early season surveys. A surface grab sample was collected approximately one-foot below the water's surface in the middle of the pond. The results of this sampling event are provided in **Table A-2**. According to the 2019 report, the turbidity, TN, TP, and *E. coli* measured at the surface of Farm Pond were all below their respective "desirable" limits, as presented in the Solitude (2019) report, of 5 NTU, 0.3 mg/L, 30 ug/L, and 235 colonies/100 mL, respectively; the TP concentration was also below the water quality goal of this WBP (25 ug/L).

Table A-2: Water Quality Data (Solitude, 2019)

Pond	Turbidity (NTU)	Nitrate Nitrogen (mg/L)	Total Phosphorus (ug/L)	*E. coli* (colonies/100 mL)
Big Farm Pond (Mid-Pond)	1.4	Not Detected	12	2.02
Little Farm Pond (Mid-Pond)	1.4	Not Detected	18	14.64

Recommendations from the 2019 survey season (Solitude, 2019) included:

- Continuing to monitor and report to NHESP about Sedge population at Farm Pond and perform treatment if NHESP allows it.
- Continuing to fund the management program so that more long-term management strategies can be identified and implemented in the future.

Mean Annual Water Quality Data for Big Farm Pond (Solitude, 2015)

The mean annual water quality data from 2000 to 2015 for Big Farm Pond is presented in **Figure A-2** and indicates the turbidity, phosphorus, and *E. coli* have remained below their respective desirable limits identified by Solitude (2019) (as described above). The nitrogen concentrations at Big Farm Pond have occasionally been detected above the desirable limit of 0.3 mg/L, at concentrations up to approximately 1 mg/L in 2015.

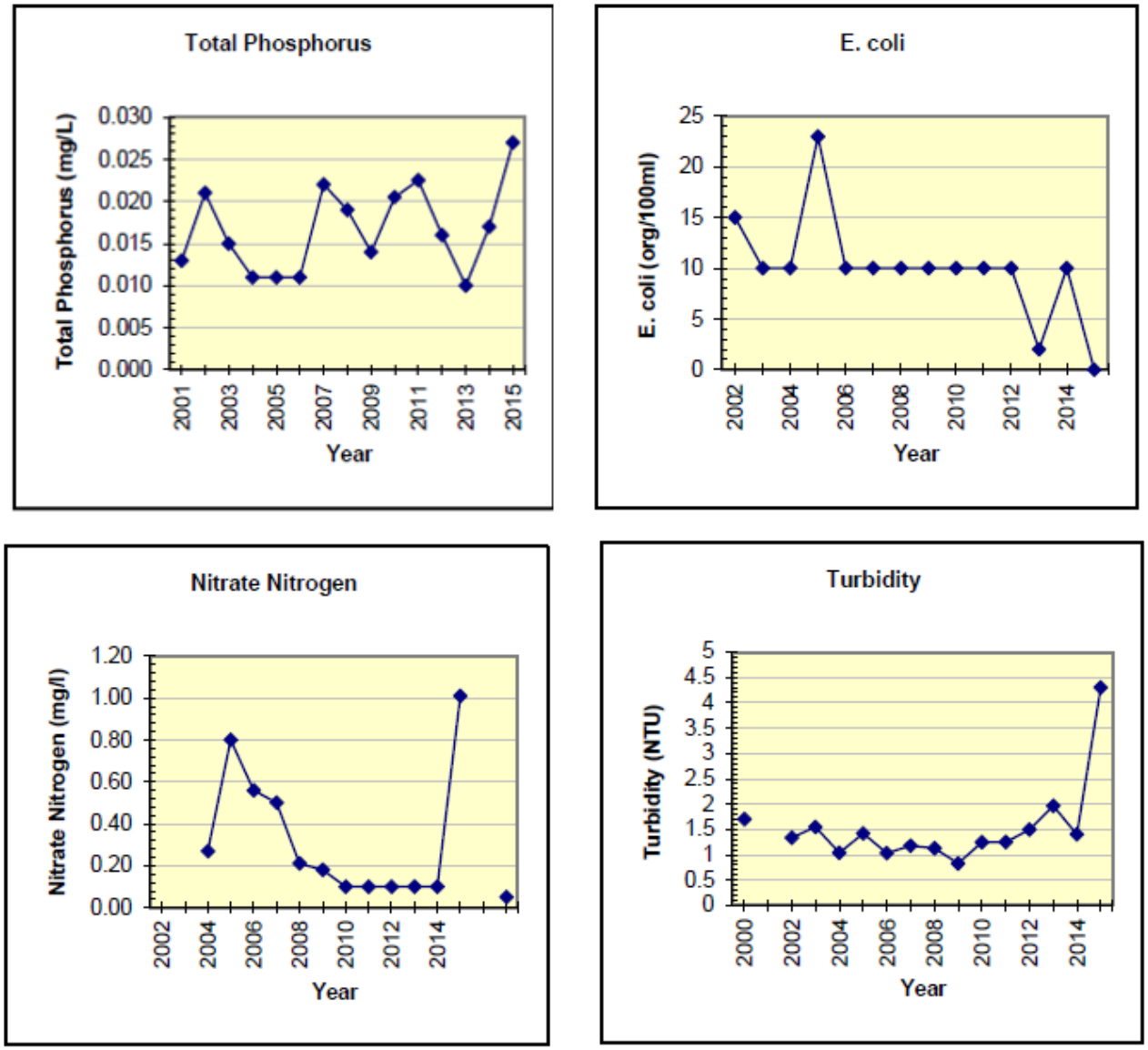

Figure A-2: Mean Annual Water Quality Data in Big Farm Pond (2000—2015)

Water Quality Impairments

Farm Pond is an impaired water body listed under category 5 on the Massachusetts List of Integrated Waters due to excess algal growth, turbidity, EWM, and non-native aquatic plants. The transition around Farm Pond from a rural watershed to a highly urbanized watershed over the past century is apparent. With this transition came water quality impacts to Farm Pond. Much of the development within the watershed predated the regulations that restrict development around resource areas and require stormwater management to address water quality and quantity issues (City of Framingham, 2016).

Known water quality impairments, as documented in the Massachusetts Year 2016 Integrated List of Waters (303(d) list), are listed below in **Table A-4** for Farm Pond. Impairment categories from the Integrated List are included in **Table A-3**.

Table A-3: 2016 MA Integrated List of Waters Categories

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

Table A-4: Water Quality Impairments

Assessment Unit ID	Waterbody	Integrated List Category	Designated Use	Impairment Cause	Impairment Source
MA82035	**Farm Pond**	**5**	Aesthetic	Excess Algal Growth	Source Unknown
MA82035	**Farm Pond**	**5**	Aesthetic	Turbidity	Source Unknown
MA82035	**Farm Pond**	**5**	Fish, other Aquatic Life and Wildlife	Eurasian Water Milfoil, Myriophyllum spicatum	Introduction of Non-native Organisms (Accidental or Intentional)
MA82035	**Farm Pond**	**5**	Fish, other Aquatic Life and Wildlife	Non-Native Aquatic Plants	Introduction of Non-native Organisms (Accidental or Intentional)
MA82035	**Farm Pond**	**5**	Primary Contact Recreation	Excess Algal Growth	Source Unknown
MA82035	**Farm Pond**	**5**	Primary Contact Recreation	Turbidity	Source Unknown
MA82035	**Farm Pond**	**5**	Secondary Contact Recreation	Excess Algal Growth	Source Unknown
MA82035	**Farm Pond**	**5**	Secondary Contact Recreation	Turbidity	Source Unknown

Water Quality Goals

Refer to **Table A-6** for a list of water quality goals. Water quality goals may be established for a variety of purposes, including the following:

a.) For **water bodies with known impairments**, a Total Maximum Daily Load (TMDL) is established by MassDEP and the United States Environmental Protection Agency (USEPA) as the maximum amount of the target pollutant that the waterbody can receive and still safely meet water quality standards. If the waterbody

has a TMDL for total phosphorus (TP) or total nitrogen (TN), or total suspended solids (TSS), that information is provided below and included as a water quality goal.

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

c.) Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2013) prescribe the minimum water quality criteria required to sustain a waterbody's designated uses. Farm Pond is a Class 'B' waterbody as listed in **Table A-5**. The water quality goal for fecal coliform bacteria is based on the Massachusetts Surface Water Quality Standards.

Table A-5: Surface Water Quality Classification by Assessment Unit ID

Assessment Unit ID	Waterbody	Class
MA82035	Farm Pond	B

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

Table A-6: Water Quality Goals

Pollutant	Goal	Source
Total Phosphorus (TP)	Total phosphorus should not exceed: --25 ug/L within any lake or reservoir	Quality Criteria for Water (USEPA, 1986)
Bacteria	**Class B Standards** • Other Waters and Non-bathing Season at Bathing Beaches: For *E. coli*, geometric mean of samples from most recent 6 months shall not exceed 126 colonies/100 ml (typically based on min. 5 samples) and no single sample shall exceed 235 colonies/100 ml. For enterococci, geometric mean of samples from most recent 6 months shall not exceed 33 colonies/100 ml, and no single sample shall exceed 61 colonies/100 ml.	Massachusetts Surface Water Quality Standards (314 CMR 4.00, 2013)
Non-native Aquatic Plants	An aquatic vegetation survey of Farm Pond indicated continued presence of non-native aquatic plants. The goal is therefore to consistently reduce the assessed biomass of non-native aquatic plants, eventually leading to de-listing of the impairment from the 303(d) list.	Solitude (2019)

Land Use 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

As summarized by **Table A-7**, land use in the Farm Pond watershed is mostly surface water (approximately 31 percent); approximately 27 percent of the watershed is commercial or industrial; approximately 16 percent of the watershed is residential; approximately 15 percent of the watershed is forested; approximately 7 percent is devoted to highways; and approximately 3 percent is open land.

Table A-7: Watershed Land Uses

Land Use	Area (acres)	% of Watershed
Water	174.47	31.4
Commercial	115.82	20.8
High Density Residential	89.3	16.1
Forest	82.68	14.9
Highway	40.77	7.3
Industrial	32.3	5.8
Open Land	18.7	3.4
Medium Density Residential	1.65	0.3
Low Density Residential	0.24	0
Agriculture	0	0

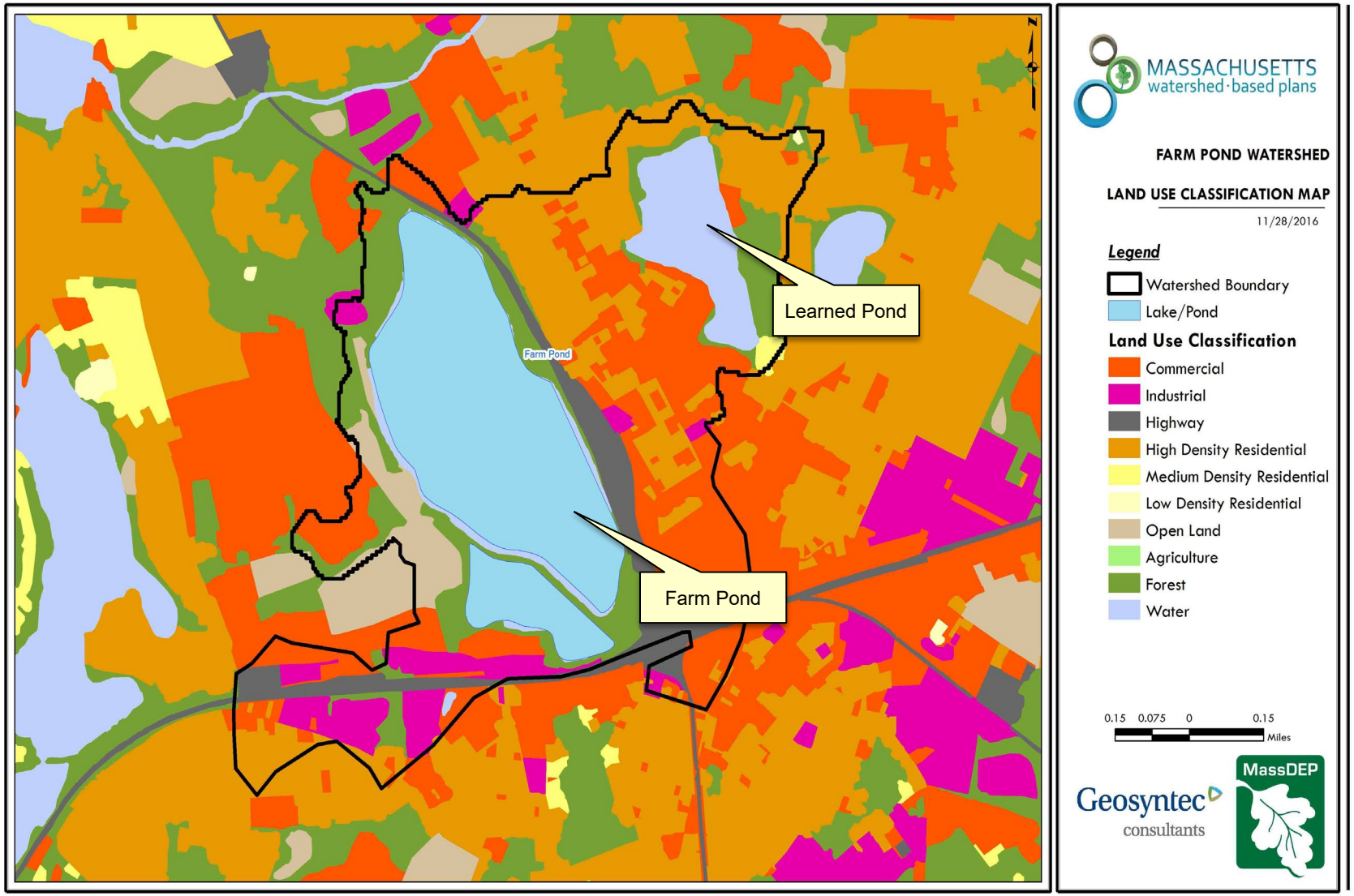

Figure A-2: Watershed Land Use Map

(MassGIS, 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

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 within the Farm Pond watershed is most concentrated east of the pond in the eastern portion of the watershed, as illustrated in **Figure A-8** below.

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. Within each subwatershed, the total area of each land use were summed and used to calculate the percent TIA (**Table A-8**).

Table A-8: TIA and DCIA values for the Watershed

	Estimated TIA (%)	Estimated DCIA (%)
Farm Pond Watershed	46.4	43

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 46.4%; therefore, the surrounding streams are expected to show fair to poor water quality.

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

% Watershed Impervious Cover	Stream Water Quality
0-10%	Typically high quality, and typified by stable channels, excellent habitat structure, good to excellent water quality, and diverse communities of both fish and aquatic insects.
11-25%	These streams show clear signs of degradation. Elevated storm flows begin to alter stream geometry, with evident erosion and channel widening. Streams banks become unstable, and physical stream habitat is degraded. Stream water quality shifts into the fair/good category during both storms and dry weather periods. Stream biodiversity declines to fair levels, with most sensitive fish and aquatic insects disappearing from the stream.
26-60%	These streams typically no longer support a diverse stream community. The stream channel becomes highly unstable, and many stream reaches experience severe widening, downcutting, and streambank erosion. Pool and riffle structure needed to sustain fish is diminished or eliminated and the substrate can no longer provide habitat for aquatic insects, or spawning areas for fish. Biological quality is typically poor, dominated by pollution tolerant insects and fish. Water quality is consistently rated as fair to poor, and water recreation is often no longer possible due to the presence of high bacteria levels.
>60%	These streams are typical of “urban drainage”, with most ecological functions greatly impaired or absent, and the stream channel primarily functioning as a conveyance for stormwater flows.

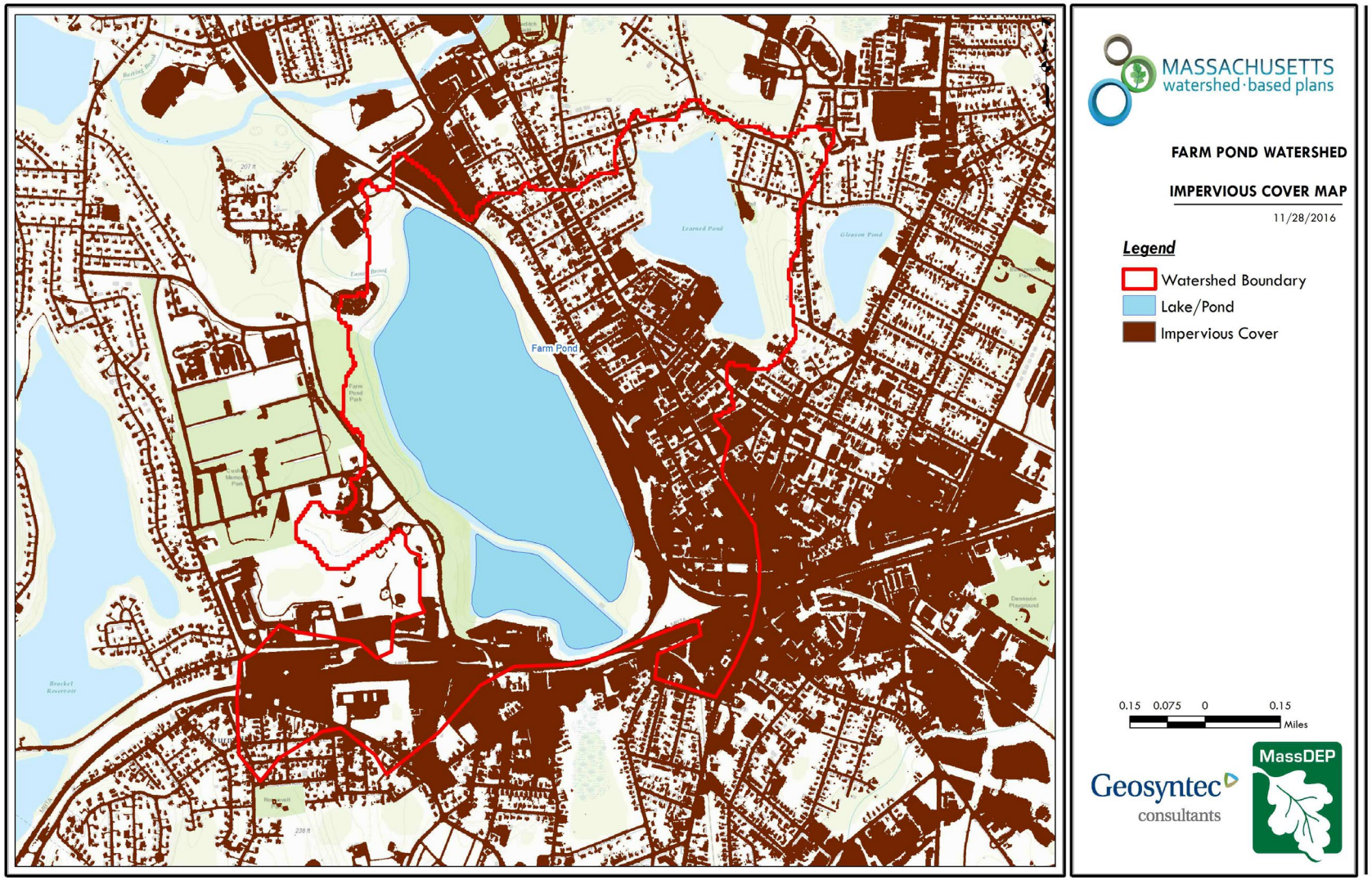

Figure A-3: Watershed Impervious Surface Map

(MassGIS 2009b; MassGIS, 1999; MassGIS, 2001; USGS, 2016)

Pollutant Loading

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). The PLERs are an estimate of the annual total pollutant load exported via stormwater from a given unit area of a particular land cover type. The PLER values for TN, TP and TSS were obtained from USEPA (Voorhees, 2016b) (see documentation provided in Appendix A) as follows:

$$L_n = A_n * P_n$$

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

The estimated land use-based TP, TN, and TSS to receiving waters within the watershed is 367 lbs/yr, 2,863 lbs/yr, and 60 tons/yr, respectively, as presented by **Table A-10**. The largest contributor of the land use-based TP and TN load originates from areas designated as commercial. The second largest contributors of the land use-based TP and TN load in the watershed are high-density residential areas. The largest contributor of the land use-based TSS load in the watershed are expected to be roads and highways. Commercial areas, high-density residential areas, and roadways may provide excellent opportunities for nutrient load reductions through stormwater BMPs.

Table A-10: Estimated Pollutant Loading for Key Nonpoint Source Pollutants

Land Use Type	Pollutant Loading[1]		
	Total Phosphorus (TP) (lbs/yr)	Total Nitrogen (TN) (lbs/yr)	Total Suspended Solids (TSS) (tons/yr)
Commercial	164	1,394	17.44
High Density Residential	90	574	8.75
Highway	45	348	23.96
Industrial	45	386	4.82
Forest	16	93	3.65
Open Land	6	61	1.25
Medium Density Residential	1	7	0.11
Low Density Residential	0	1	0.01
Agriculture	0	0	0.00
TOTAL	367	2,863	60.00

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

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 pollutant loads for TP (367 lbs/yr), TN (2,863 lb/yr), and TSS (60 tons/yr (120,000 lbs/yr)) were previously presented in Element A of this WBP. *E. coli* loading has not been estimated for this WBP, because there are no known PLERs for *E. coli*.

Recommended Load Reduction

Farm Pond is impaired for non-native aquatic plants, turbidity, excess algal growth, and EWM. A water quality goal was established under Element A to consistently reduce the assessed biomass of non-native aquatic plants, eventually leading to de-listing of the impairment from the 303(d) list. Framingham's Stormwater Master Plan has identified stormwater runoff as the main contributor of pollutant loading to the pond (City of Framingham, 2019). Stormwater runoff pollutes the pond with sediment, leading to shallower and warmer waters, and thereby making it easier for plants to grow. Sediment particles also readily transport other pollutants such as metals, nutrients, and pathogens.

Management measures will primarily focus on reducing TP and TSS loading to the lake, which is expected to help decrease non-native aquatic plant biomass, turbidity and excess algal growth. The following adaptive sequence is proposed to establish and track quantitative load reduction goals:

1. Establish an **interim goal** to reduce land-use based TSS loading by 10,000 lbs/yr and land-use based TP loading by 25 lbs/yr over the next 3 years (by 2023).
2. Continue the baseline water quality and vegetation monitoring program in accordance with **Element I**. Use results from the monitoring program to calculate annual TSS and TP budgets and obtain a better understanding of other water quality parameters such as dissolved oxygen. Annual budgets will provide more fine-tuned predictions of loading including other potential sources such as internal phosphorus loading from sediments.
3. Establish realistic **long-term** load reduction goals with the goal of de-listing Farm Pond from the 303(d) list for non-native aquatic plants (and its other impairments) and approaching or exceeding oligotrophic conditions within the next 15 years (by 2035).

Table B-1: Pollutant Load Reductions Needed

Pollutant	Existing Estimated Total Load	Water Quality Goal	Required Load Reduction
Total Phosphorus	367 lbs/yr	(*See above recommendation)	(*See above recommendation)
Total Suspended Solids	60 ton/yr (120,000 lbs/yr)	(*See above recommendation)	(*See above recommendation)
Bacteria	*MSWQS for bacteria are concentration standards (e.g., colonies of fecal coliform bacteria per 100 ml), which are difficult to predict based on estimated annual loading. Available Data collected between 2000—2015 and 2019 indicated E. Coli concentrations below 25 colonies/100 ml.*	Class B. **Class B Standards** • Public Bathing Beaches: For *E. coli*, geometric mean of 5 most recent samples shall not exceed 126 colonies/ 100 ml and no single sample during the bathing season shall exceed 235 colonies/100 ml. For enterococci, geometric mean of 5 most recent samples shall not exceed 33 colonies/100 ml and no single sample during bathing season shall exceed 61 colonies/100 ml; • Other Waters and Non-bathing Season at Bathing Beaches: For *E. coli*, geometric mean of samples from most recent 6 months shall not exceed 126 colonies/100 ml (typically based on min. 5 samples) and no single sample shall exceed 235 colonies/100 ml. For enterococci, geometric mean of samples from most recent 6 months shall not exceed 33 colonies/100 ml, and no single sample shall exceed 61 colonies/100 ml.	Concentration Based (2000—2015 and 2019 data indicates achievement of water quality goal)

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.

The City of Framingham continues to invest significant effort and public funds and has undertaken a methodical, step-by-step approach to improving the health and water quality of Farm Pond, in order to preserve this unique scenic and recreational resource within walking distance of downtown. The City's strategy is to integrate water quality improvements into new and redevelopment projects, both private and public. The City has also been working diligently to increase public awareness and educate the community on the importance of preserving and improving our natural resources.

Existing Management Measures

An extensive list of completed management measures in the Farm Pond watershed is included in the introduction of this WBP. The completed project locations for these projects are depicted in Appendix C. Additionally, the City of Framingham was awarded funding through the Fiscal Year 2017 Section 319 Nonpoint Source Pollution Grant Program to install the proposed green infrastructure BMPs at Fountain Street and Farm Pond Park. **Figures C-1** and **C-2** illustrate the implemented BMP locations at Fountain Street and Farm Pond Park, respectively. The implemented BMPs included:

- Fountain Street: retrofitted existing drainage along Fountain Street and included the installation of two Stormceptor units to provide water quality improvement; and
- Farm Pond Park: retrofitted existing outfall and drainage swale into bioretention areas and incorporated a rain garden into the landscaping of the newly constructed skatepark.

It was estimated that the implemented BMPs at Fountain Street and Farm Pond Park resulted in a combined load reduction of sediment, phosphorus, and nitrogen loading of 6,725 lb/year, 9 lb/year, and 40 lb/year, respectively, as shown **Table C-1** (City of Framingham, 2019).

Table C-1: Estimated Pollutant Load Reductions

Location	TSS (lb/year)	TP (lb/year)	TN (lb/year)
Fountain Street	5,400	6.8	29
Farm Pond Park	1,325	2.5	11
Total	**6,725**	**9.3**	**40**

Figure C-1: Completed BMPs at Fountain Street (City of Framingham, 2019)

Figure C-2: Completed BMPs at Farm Pond Park (City of Framingham, 2019)

Future Management Measures

The following project descriptions highlight water quality improvement projects that are ongoing or planned within the Farm Pond watershed.

"The Buckley at Framingham" redevelopment

A private developer is currently redeveloping the property at 444-480 Franklin Street located on the northeastern shores of Farm Pond. Currently the property contains a vacant shopping plaza, associated parking lot, and a former gas station originally developed in the 1970s. The developer has obtained permits from the City of Framingham's

Planning Board to redevelop the property into a mixed use (condominiums and commercial) property, "The Buckley at Framingham". The proposed project will reduce the net impervious surface. Water quality treatment was designed in accordance with MassDEP's Stormwater Management Standards, including requirements for Land Uses with Higher Potential Pollutant Loads (LUHPPL). A combination of Stormceptors and infiltration basins is expected to result in 85 – 90% reduction in TSS. A Stormwater Pollution Prevention Plan was developed and is being adhered to in order to mitigate potential impacts during construction activities. The project is expected to be completed in late 2020/early 2021.

Fountain Street/Dudley Road Intersection Improvements Project (Stantec, 2019)

The City of Framingham retained Stantec to prepare design plans for the reconstruction of the intersection of Fountain Street at Dudley Road. The Project includes Fountain Street roadway reconstruction, green infrastructure improvements along Fountain Street and the Farm Pond Outfall replacement. The project is currently at 100% design but construction of the proposed green infrastructure improvements and outfall replacement will require the filing of a Notice of Intent (NOI) with the Framingham Conservation Commission to obtain an Order of Conditions for the work, with a copy of the NOI provided to the NHESP for review. The project is currently on hold but is still planned to be implemented.

Union Avenue Utility and Roadway Improvements

The Union Avenue Utility and Roadway Improvement project includes water, sewer, and drainage improvements along with roadway re-construction. Similar to the Franklin Street project, the project is being designed by the City but will be partially managed and funded by the MassDOT under the Transportation Improvement Program (TIP). The project is currently at approximately 60 percent design and is slated for construction in 2022. The stormwater system on Union Avenue between Beech Street and Lexington Street is proposed to be upgraded as part of the improvements project. The existing system currently discharges to Farm Pond through a 24"x36" culvert (assumed size) residing underneath an active CSX rail yard proximate to the DPW's Henry Street garage. In May 2017, BETA and the City attempted to CCTV inspect the culvert to confirm size, existing condition, and determine its ability to accept additional flow from an upgraded stormwater system upstream, designed to convey a 10-year storm event. The inspection was largely unsuccessful due to significant amounts of debris present within the culvert and it was determined that substantial cleaning would be required to perform a suitable CCTV inspection. In March 2019, the City authorized BETA to proceed with cleaning the culvert to facilitate CCTV inspection. The culvert was cleaned between August 12—19, 2019. Only 140 linear feet (LF) of the culvert was able to be inspected as part of the effort. The portion of the culvert that was inspected appeared to be in stable condition. Prior to recommending a long-term solution, BETA recommended that the entire length should be inspected to ensure that the culvert is in stable condition. Based on the amount of debris removed from the culvert, it was evident that the culvert had not been cleaned in a long time (previous cleaning efforts were unknown). A significant amount of debris was removed, but additional debris remained within the culvert. BETA noted that debris within the culvert decreases its stormwater carrying capacity, which will become more critical upon construction of the upgraded stormwater system upstream. Drainage improvements proposed for the upstream stormwater system include off-line catch basins with hoods and sumps for capture of debris and floatables) as well as an off-line water quality unit. Once constructed, the amount of debris discharged to the culvert should decrease significantly. In the interim, it was recommended that the culvert be cleaned and inspected on an annual basis. After construction of the upstream improvements, the required cleaning frequency should be reevaluated (BETA, 2020).

Additional BMP Opportunities

The City of Framingham may also consider additional investigation with the following recommended general sequence to identify and implement future structural BMPs within the Farm Pond watershed:

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 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 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. Additional analysis can also be performed to fine-tune locations to maximize pollutant removals such as performing loading analysis on specifically delineated subwatersheds draining to single outfalls and selecting those subwatersheds with the highest loading rates per acre.
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 BMP-selector tool of 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 TP and TSS loading to Farm Pond, as summarized in **Element B**.

Non-Structural BMPs

Planned BMPs can also be non-structural and can include practices such as street sweeping and catch basin cleaning to reduce TSS, TP, and TN loading; as well as Illicit Discharge Detection and Elimination (IDDE) to reduce TP, TSS, and TN loading and *E. Coli* concentrations. As noted above, street sweeping in the Farm Pond watershed occurs at least twice per year. The City of Framingham currently performs street sweeping and catch basin cleaning, in addition to other non-structural BMPs, as documented in the City's Stormwater Management Plan (SWMP) (City of Framingham, 2019b). The City of Framingham also has multiple programs in place to address water quality, including erosion and sediment control regulations for construction projects and post-construction water quality requirements (City of Framingham, 2019b). Implementation of non-structural BMPs may also results in cost savings. It is recommended that these municipal programs be further evaluated and potentially further optimized. First, it is recommended that potential removals from ongoing activities be calculated in accordance with Elements H&I. Next, it is recommended that ongoing activities be evaluated to see if potential improvements can be implemented to achieve higher pollutant load reductions such as increased frequency or improved technology.

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 and Ongoing Management Measures

Table D-1 presents the funding needed to implement the Section 319 grant funded management measures presented in this WBP (i.e., the Fountain Street and Farm Pond Park BMPs). The table includes costs for BMP design, construction, operation and maintenance plan, and materials and supplies (City of Framingham, 2019). Additionally, annual operation and maintenance costs were estimated, based on best professional judgment, to be two percent of the BMP construction cost (i.e., approximately $6,900/year).

Table D-1: Completed Project Budget for Fountain Street and Farm Pond Park BMPs

Expense Item	s.319 Amount	Non-Federal Match and Source	Total Amount
Salary and Wages	$0	$18,533	$18,533
Subcontractual Services			
BMP Design	$0	$44,541	$44,541
BMP Construction	$185,000	$160,440	$345,440
Operations and Maintenance Plan	$0	$3,000	$3,000
Materials and Supplies	$0	$176	$176
Totals	**$185,000** **45%**	**$226,690** **55%**	**$411,690** **100%**

Future Management Measures

Funding for future BMP installations to further reduce loads within the watershed may be provided by a variety of sources, such as the Section 319 Nonpoint Source Pollution Grant Program, City capital funds, or other grant programs such as hazard mitigation funding. The City of Framingham 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[2].

[2] 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.

Step 1: Goals and Objectives

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

1. Increase public awareness of the benefits of green infrastructure.
2. Provide information about proposed stormwater improvements and their anticipated water quality benefits.
3. Provide information to promote watershed stewardship.

Step 2: Target Audience

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

1. All watershed residents.
2. Businesses within the watershed.
3. Schools within the watershed.
4. Watershed organizations and other user groups
5. Elected officials

Step 3: Outreach Products and Distribution

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

1. As part of the Fountain Street and Farm Pond Park BMP projects, Framingham conducted the following:
   a. The BMP at Farm Pond Park was a highlight of the grand opening of the skatepark on June 21, 2018. The grand opening was widely advertised by the City on social media and the City's website. Hundreds of residents and skateboarding enthusiasts attended. The Mayor and MassDEP's Deputy Regional Director gave speeches. Access Framingham, the local cable access channel, covered the event. Translation services were provided.
   b. The DPW reached out to the New England Wildlife Society (NEWS), based at the Garden in the Woods in Framingham, MA. The City purchased native plants from the NEWS for the raingarden and bioretention areas. The City hopes to partner with NEWS and the Ecological Landscape Alliance to teach more residents about the benefits of rain gardens and use our facilities for tours and examples.
   c. An educational sign was designed (based on an example from Garden in the Woods) and placed at Farm Pond Park during the grand opening. The City intends to translate the sign into Portuguese and Spanish before permanently installing a sign at the park.

d. The City has partnered with Mass Audubon for a series of workshops as part of their Shaping Your Future: Greening Your Community program. The first workshop "Put a LID on it: Managing Your Community's Stormwater in a Changing Climate" was held on March 11, 2019 in Framingham. The second workshop, "A walking tour of Framingham's spaces that manage stormwater with nature", which included a site visit to the skatepark, was held on May 8, 2019.

e. The DPW held a neighborhood meeting on March 8, 2017 about the construction projects in the neighborhood.

f. The DPW coordinated with the Keefe Technical High School's landscape architecture department. The DPW was able to talk to the program educators about the importance of green infrastructures and how the BMPs will improve the water quality at Farm Pond. The DPW sponsored the annual Arbor Day celebration on May 3, 2019, which brings together the Keefe Tech landscaping students, Public Works staff, Parks and Recreation staff, as well as local tree and landscaping companies. The City continues to engage regularly with the students and staff at Keefe Regional Technical School to provide learning opportunities

2. Framingham is also a member and active participant in the Massachusetts Statewide Municipal Stormwater Coalition, which runs the award-winning "Think Blue Massachusetts" campaign. Think Blue Massachusetts is made up of ten regional stormwater groups who joined forces in 2016 to help towns and cities meet their stormwater permit requirements. The group represents 130 communities across the state. The mission of Think Blue Massachusetts is to help residents and businesses take steps to reduce runoff and keep the State's lakes, rivers, and streams clean and healthy. Think Blue Massachusetts won a 2019 "Stormy" Award at the June 2019 meeting of the New England Water Environment Association (NEWEA) in New Hampshire. The award recognized the campaign's accomplishments for stormwater management. More information is available at https://www.thinkbluemassachusetts.org/.

Step 4: Evaluate Information/Education Program

Information and education efforts and how they will be evaluated.
The Outreach Products conducted by the City of Framingham can be evaluated by:

1. Tracking the attendance at public presentations and workshops
2. Tracking social media and website visits

Additional outreach products 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 re-evaluated in 2023 in accordance with Element F&G.

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.

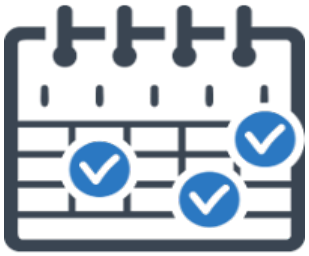

Table FG-1 provides a preliminary schedule for implementation of recommendations provided by this WBP. It is expected that the WBP will be re-evaluated and updated in 2023, or as needed, based on ongoing monitoring results and other ongoing efforts. New projects will be identified through future data analysis and stakeholder engagement and will be included in updates to the implementation schedule.

Table FG-1: Implementation Schedule and Interim Measurable Milestones

Category	Action	Estimated Cost	Year(s)
Monitoring	Continue to perform annual vegetation surveys and water quality sampling per Element H&I monitoring guidance conducted by Solitude and managed by the Framingham Conservation Commission		Annual
Structural BMPs	Uptown Redevelopment Project (combination of Stormceptors and infiltration basins	(by private developer)	TBD
	Fountain Street/Dudley Road Intersection Improvements Project		TBD
	Union Avenue Utility and Roadway Improvements – stormwater BMPs		TBD
Nonstructural BMPs	Document potential pollutant removals from ongoing non-structural BMP practices (i.e., street sweeping, catch basin cleaning)		2021
	Evaluate ongoing non-structural BMP practices and determine if modifications can be made to optimize pollutant removals (e.g., increase frequency).		2022
	Routinely implement optimized non-structural BMP practices		Annual
Public Education and Outreach *(See Element E)*	Periodically post project updates to websites, social media, and blog profiles	$5,000	Annual
	Develop and post informational signs at proposed BMP locations	$5,000	
	Develop and distribute educational mailings	$5,000	Annual
Adaptive Management and Plan Updates	Establish working group comprised of stakeholders and other interested parties to implement recommendations and track progress. Meet at least twice per year.	--	2021
	Re-evaluate Watershed Based Plan at least once every three (3) years and adjust, as needed, based on ongoing efforts (e.g., based on monitoring results, 319 funding, etc.). – Next update, June 2023	--	2023
	Reach interim goal to reduce land-use based TP and TSS	**--**	**2023**
	Reach long-term goal to de-list Farm Pond from the 303(d) list		**2035**

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 interim loading reduction goal of 25 lb/yr of TP and 10,000 lb/yr for TSS is presented in Element B of this WBP. Element C of this plan describes various management measures that will be implemented to help achieve this targeted load reduction. The evaluation criteria and monitoring program described below will be used to measure the effectiveness of the proposed management measures (described in Element C) in improving the water quality of Farm Pond.

Indirect Indicators of Load Reduction

Non-Structural BMPs:

Potential load reductions from non-structural BMPs (e.g., street sweeping and catch basin cleaning) can be estimated from indirect indicators, such as the number of miles of streets swept or the number of catch basins cleaned. Appendix F of the 2016 Massachusetts Small MS4 General Permit provides specific guidance for calculating phosphorus removal from these practices as summarized by Figure HI-1 and HI-2. As indicated by **Element C**, it is recommended that potential phosphorus removal from these ongoing activities be estimated. Next, it is recommended that ongoing activities be evaluated to see if potential improvements can be implemented to achieve higher pollutant load reductions such as increased frequency or improved technology.

The City of Framingham currently performs street sweeping and catch basin cleaning, in addition to other non-structural BMPs, as documented in the City's Stormwater Management Plan (SWMP) (City of Framingham, 2019b). The City of Framingham also has multiple programs in place to address water quality, including erosion and sediment control regulations for construction projects and post-construction water quality requirements (City of Framingham, 2019b).

$$Credit_{sweeping} = IA_{swept} \times PLE_{IC\text{-}land\ use} \times PRF_{sweeping} \times AF \qquad \textbf{(Equation 2-1)}$$

Where:

$Credit_{sweeping}$	=	Amount of phosphorus load removed by enhanced sweeping program (lb/year)
IA_{swept}	=	Area of impervious surface that is swept under the enhanced sweeping program (acres)
$PLE_{IC\text{-}land\ use}$	=	Phosphorus Load Export Rate for impervious cover and specified land use (lb/acre/yr) (see Table 2-1)
$PRF_{sweeping}$	=	Phosphorus Reduction Factor for sweeping based on sweeper type and frequency (see Table 2-3).
AF	=	Annual Frequency of sweeping. For example, if sweeping does not occur in Dec/Jan/Feb, the AF would be 9 mo./12 mo. = 0.75. For year-round sweeping, AF=1.0[1]

As an alternative, the permittee may apply a credible sweeping model of the Watershed and perform continuous simulations reflecting build-up and wash-off of phosphorus using long-term local rainfall data.

Table 2-3: Phosphorus reduction efficiency factors ($PRF_{sweeping}$) for sweeping impervious areas

Frequency[1]	Sweeper Technology	$PRF_{sweeping}$
2/year (spring and fall)[2]	Mechanical Broom	0.01
2/year (spring and fall)[2]	Vacuum Assisted	0.02
2/year (spring and fall)[2]	High-Efficiency Regenerative Air-Vacuum	0.02
Monthly	Mechanical Broom	0.03
Monthly	Vacuum Assisted	0.04
Monthly	High Efficiency Regenerative Air-Vacuum	0.08
Weekly	Mechanical Broom	0.05
Weekly	Vacuum Assisted	0.08
Weekly	High Efficiency Regenerative Air-Vacuum	0.10

Figure HI-1. Street Sweeping Calculation Methodology

$$Credit_{CB} = IA_{CB} \times PLE_{IC\text{-}land\ use} \times PRF_{CB} \qquad \textbf{(Equation 2-2)}$$

Where:

$Credit_{CB}$	=	Amount of phosphorus load removed by catch basin cleaning (lb/year)
IA_{CB}	=	Impervious drainage area to catch basins (acres)
$PLE_{IC\text{-}and\ use}$	=	Phosphorus Load Export Rate for impervious cover and specified land use (lb/acre/yr) (see Table 2-1)
PRF_{CB}	=	Phosphorus Reduction Factor for catch basin cleaning (see Table 2-4)

Table 2-4: Phosphorus reduction efficiency factor (PRF_{CB}) for semi-annual catch basin cleaning

Frequency	Practice	PRF_{CB}
Semi-annual	Catch Basin Cleaning	0.02

Figure HI-2. Catch Basin Cleaning Calculation Methodology

Vegetation Monitoring:

As previously discussed, the aquatic vegetation of Farm Pond is monitored annually by Solitude and managed by the Framingham Conservation Commission. Future annual assessments will be performed using stations and methods consistent with past assessments (i.e., Solitude, 2019). 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 implementation of measures recommended as part of this WBP. It is also recommended that annual vegetation assessments continue to include recommendations as feasible for control measures.

Project-Specific Indicators

Number of BMPs Installed and Pollutant Reduction Estimates:

Anticipated pollutant load reductions from existing, ongoing (i.e., under construction), and future BMPs will be tracked as BMPs are installed. For example, it was estimated that the TSS and TP load reduction for the Farm Pond Park and Fountain Street BMPs is 6,725 lbs/yr and 9.3 lbs/yr, respectively. It is recommended that anticipated pollutant removals of BMPs that are implemented be tracked and documented as designs are finalized.

Direct Measurements

Direct measurements are generally expected to be performed in accordance with the existing monitoring activities managed by the City of Framingham Conservation Commission and conducted by Solitude, as summarized below, along with additional recommendations to supplement sampling.

In-Lake Phosphorus and Water Quality Monitoring

The existing sampling program for Farm Pond may be enhanced to more closely track the progress of water quality improvements towards water quality goals. Monitoring locations should at minimum include the outlet of the pond, tributaries, and the deepest "in-lake" location[3]. It is recommended that sampling programs include analysis of *E. coli*, secchi disk transparency, phosphorus, chlorophyll-a, turbidity, temperature/oxygen profiles, and aquatic vegetation. These parameters will also enable tracking relative to Carlson's state trophic index to evaluate improvements over time.

Adaptive Management

As discussed by Element B, the existing baseline monitoring program will be used to establish a long-term i.e., 15 year) TSS 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 (e.g., invasive aquatic plant biomass) do not show improvement in water quality, the management measures and loading reduction analysis (Elements A through D) will be revisited and modified accordingly.

[3] Additional guidance is provided at: https://www.epa.gov/sites/production/files/2015-06/documents/lakevolman.pdf

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Appendices

Appendix A – Pollutant Load Export Rates (PLERs)

Land Use & Cover[1]	PLERs (lb/acre/year)		
	(TP)	(TSS)	(TN)
AGRICULTURE, HSG A	0.45	7.14	2.59
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 B – Water Quality Assessment Report

Select excerpts from SuAsCo Watershed 2001 Water Quality Assessment Report, SUASCO WATERSHED LAKE ASSESSMENTS relating to the water quality in Farm Pond (MA82035) are included below (note: relevant information is included directly from these documents for informational purposes and has not been modified).

SuAsCo Watershed 2001 Water Quality Assessment Report, SUASCO WATERSHED LAKE ASSESSMENTS (MA82035 - Farm Pond)

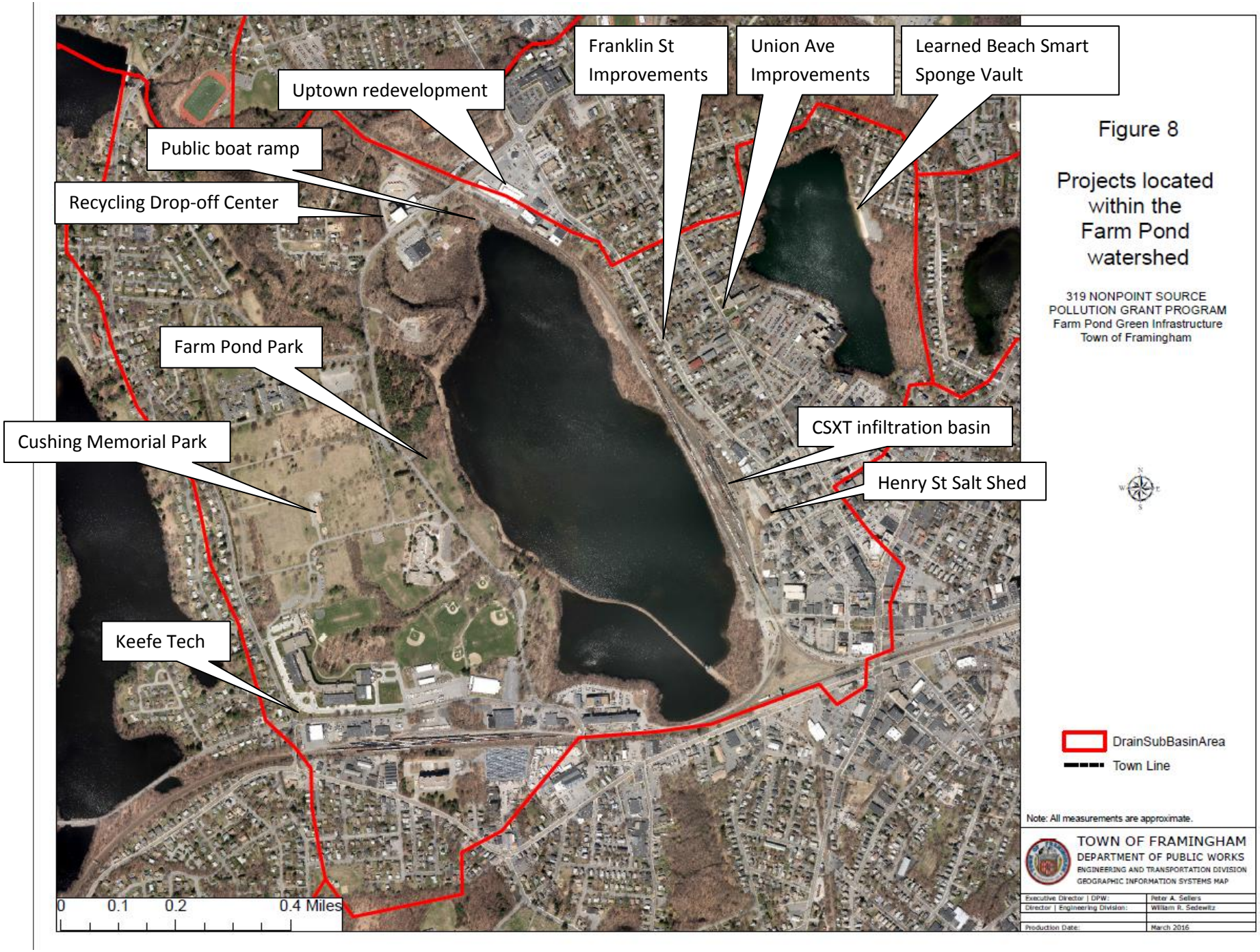
There is cartop boat access site, which is presently being reconstructed, on Farm Pond that is maintained by the Town of Framingham (PAB 2003). Non-native aquatic macrophyte species (M. spicatum, P. crispus and C. caroliniana) have been reported in the pond (Decesare 2004). During the 1996 synoptic survey a species of Myriophyllum was identified but could not be confirmed as M. heterophyllum. The pond has been treated with several herbicides and algaecide between 1996 and 2001. In 2001 MDFW surveyed the lake for MA DEP for the purpose of TMDL development. Low DO/saturation occurred at depths greater than 3.5 m during the August 2001 survey. Data from the other two surveys in the summer of 2001 were either censored or were not collected at the deep hole. In-lake total phosphorus concentrations were not high, but there was evidence of phosphorus release from anoxic sediments. None of the Secchi disk depth measurements violated the bathing beach guidance of four feet. Since the pond is infested with non-native aquatic macrophyte species the Aquatic Life Use is assessed as impaired. The limited current data are not inconsistent with previous studies, which indicated that Farm Pond is an enriched waterbody so it is best professional judgment that the Aquatic Life Use is also impaired as a result of excess algal growth. Suspected sources include municipal urban high density areas (84), discharge from separate storm sewer systems (MS4)(34) and internal nutrient recycling (65). Sampling was also conducted by DWM in 2003 as part of a nutrient criteria development project but these data are not yet available. Farm Pond is on the 2002 Integrated List of Waters in Category 5 because of noxious aquatic plants, turbidity, and exotic species (MA DEP 2003a). MDFW conducted fish population sampling in Farm Pond in May 2001 (Richards 2003a and Hartley 2003).

Report **Recommendations:**
WATERSHED WIDE LAKE RECOMMENDATIONS

Coordinate with MA DCR and/or other groups that conduct lake surveys to generate quality-assured lake data. Conduct more intensive lake surveys to better determine the lake trophic and use support status and identify causes and sources of impairment. As sources are identified within lake watersheds they should be eliminated or, at least, minimized through the application of appropriate point or non-point source control techniques.
Work with MDPH and local municipalities to collect quality-assured data under the "Beaches Bill," which requires water quality testing (bacteria sampling) at all formal bathing beaches. When available, review data and beach closure information to assess the status of the recreational uses.
Review the MA DEP Drinking Water Program SWAP evaluations when they are completed to develop and implement recommendations for the protection of Class A lakes in the SuAsCo Watershed.
Work with the MA DCR Weed Watchers Program to monitor ponds in the SuAsCo Watershed for the presence of exotic invasive species and to develop a removal plan if an infestation is found. Additional information may be obtained from the MA DEM website: http://www.mass.gov/dcr/waterSupply/lakepond/lakepond.htm
Quick action is necessary to manage non-native aquatic or wetland plant species that are isolated in one or a few location(s) in order to alleviate the need for costly and potentially fruitless efforts to do so in the future. Two courses of action should be pursued concurrently. More extensive surveys need to be conducted, particularly downstream from recorded locations to determine the extent of the infestation. And, "spot" treatments [refer to the Generic Environmental Impact Report (GEIR) for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson et al. 2004) for advantages and disadvantages of each] should be undertaken to control populations at these sites. These treatments may include careful hand-pulling of individual plants in small areas. In larger areas other techniques, such as selective herbicide application, may be necessary. In either case, the treatments should be undertaken prior to fruit formation and with a minimum of fragmentation of the individual plants. These actions will minimize the spreading of the populations. This GEIR (Mattson et al. 2004) should be consulted prior to the development of any lake management plan to control non-native aquatic or wetland plant species.
Where non-native plant infestations are more extensive conduct additional monitoring to determine the extent of the problem. The Generic Environmental Impact Report for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson et al 2004) should be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (i.e., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result

in fragmentation (such as cutting or raking) should be discouraged because of the propensity for some invasive species to reproduce and spread vegetatively (from cuttings).
Prevent spreading of non-native plants. Once the extent of the problem is determined and control practices are exercised vigilant monitoring needs to be practiced to guard against infestations in unaffected areas and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the transport mechanisms and their ability/responsibility to reduce the spread of these species.
Implement recommendations identified in TMDLs and lake diagnostic/feasibility studies, including lake watershed surveys, to identify sources of impairment. The single draft TMDL report for total phosphorus, which is being developed for the eight lakes sampled by DWM in 2001 has been delayed (Mattson 2004).

Appendix C – Completed Projects in the Farm Pond Watershed


Franklin St Improvements
Union Ave Improvements
Learned Beach Smart Sponge Vault
Uptown redevelopment
Public boat ramp
Recycling Drop-off Center
Farm Pond Park
Cushing Memorial Park
CSXT infiltration basin
Henry St Salt Shed
Keefe Tech
0 0.1 0.2 0.4 Miles
Figure 8
Projects located within the Farm Pond watershed
319 NONPOINT SOURCE POLLUTION GRANT PROGRAM
Farm Pond Green Infrastructure
Town of Framingham
DrainSubBasinArea
Town Line
Note: All measurements are approximate.
TOWN OF FRAMINGHAM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING AND TRANSPORTATION DIVISION
GEOGRAPHIC INFORMATION SYSTEMS MAP
Executive Director | DPW: Peter A. Sellers
Director | Engineering Division: William R. Sedewitz
Production Date: March 2016