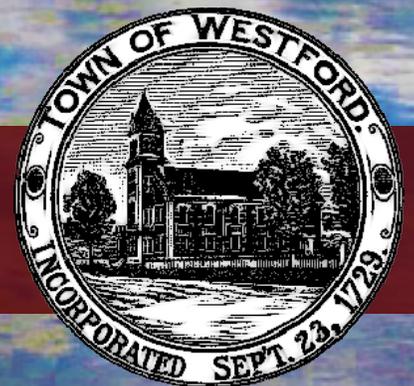


# **STORMWATER MANAGEMENT MASTER PLAN**

## **Volume 1: Stormwater Assessment**

May 2016

**WESTFORD**





# Westford Stormwater Management Master Plan

## Volume 1: Stormwater Assessment

May 2016

Project advisors:

**Tighe & Bond** Tighe & Bond



Raftelis Financial Consultants, Inc.



Regina Villa Associates

*Cover photo by Frank Winters, courtesy of the Westford Conservation Trust.*

*Report Photography: Sources of all report photos are cited unless taken by Tighe & Bond staff.*

*For providing data, other plans and studies, editorial assistance, and guidance to the consulting team, special thanks go to the following Westford town department heads and staff: Paul Starratt, Town Engineer; Jeremy Downs, Assistant Town Engineer; Richard "Chip" Barrett, Highway Superintendent; Chris Coutu, GIS Coordinator; and other staff, members of Town boards, commissions, and committees, residents, and business owners who assisted with this plan.*

## **Acknowledgements**

We gratefully acknowledge the hard work and commitment of the Stormwater Advisory Group, who reviewed draft report documents and met regularly throughout this planning process to provide invaluable input and guidance.

Eric Heideman, Assistant Town Manager

John Mangiaratti, Former Assistant Town Manager

Richard "Chip" Barrett, Highway Superintendent

Stephen Cronin, Water Superintendent

John Cunningham, Conservation Commission & Capital Planning Committee

Jeremy Downs, P.E., Assistant Town Engineer

Mark Kost, Finance Committee

Paul Starratt, P.E., Town Engineer

Jeff Morrissette, Town Planner

Titus Palmer, Westford Real Estate, Inc.

Beverly Woods, Executive Director, Northern Middlesex Council of Governments

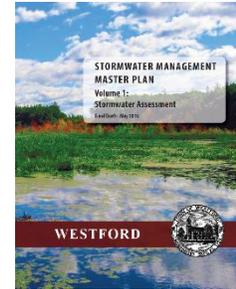
## Stormwater Management Master Plan Contents

The Stormwater Management Master Plan is organized into the following four volumes:

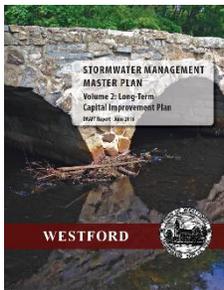
- Volume 1: Stormwater Assessment
- Volume 2: Long-term Capital Improvement Plan (CIP)
- Volume 3: Operation & Maintenance (O&M) Plan
- Volume 4: NPDES Stormwater Program Compliance Plan

The Town has also explored funding and financial alternatives, which are available under a separate cover from the Stormwater Management Master Plan.

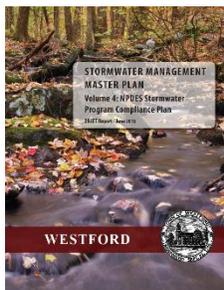
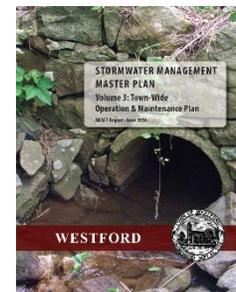
Volume 1, the **Stormwater Assessment**, includes a summary of existing and future conditions (e.g., demographics, land use, water resources), a summary of the current and anticipated future municipal separate storm sewer system (MS4) programs, infrastructure needs, and operations and maintenance. This volume also clarifies drivers for an enhanced stormwater program.



Volume 2, the **Long-Term CIP** includes prioritization of capital projects to address identified drainage and/or water quality needs, recommendations for additional investigation of stormwater infrastructure, and recommendations for the purchase of equipment and hiring of additional staff to meet needs. This plan also incorporates upcoming projects and priorities in Westford that may lend themselves to strategic and cost-effective add-on drainage improvements. For each sub-basin, a menu of appropriate stormwater BMPs that are best to meet that basin's water quality challenges are presented, which can inform future Town projects and also be used to advise local developers during design and permitting for private projects. The Long-term CIP includes an implementation schedule and an opinion of probable costs.



Volume 3, the **Town-wide O&M Plan** includes an inventory of municipal facilities and operations. For the types of activities that the Town routinely conducts, this plan includes town-wide and site specific standard operating procedures (SOPs) for Town staff to follow with the goal of reducing pollutants in stormwater runoff. SOPs are presented in "fact sheets" that can be easily accessed or carried by staff responsible for operations, in some cases at various facilities. The SOPs are consistent with MassDEP's and EPA's most current guidelines.



Volume 4, the **NPDES Stormwater Program Compliance Plan** is equivalent to the written Stormwater Management Program required to satisfy EPA's 2016 Massachusetts Small MS4 General Permit. This Plan documents the best management practices the town will implement to comply with the six minimum control measures (MCMs) within the timeline specified in the reissued General Permit.

| Commonly Used Abbreviations | Definitions  |
|-----------------------------|--|
| AST                         | Aboveground Storage Tank                             |
| BMP                         | Best Management Practice                             |
| CB                          | Catch Basin  |
| CCTV                        | Closed-Circuit Television                            |
| CIP                         | Capital Improvement Plan                             |
| CMR                         | Code of Massachusetts Regulations                    |
| CMRSWC                      | Central Massachusetts Regional Stormwater Coalition  |
| CPA                         | Community Preservation Act                           |
| CWA                         | Clean Water Act                                      |
| DCIA                        | Directly Connected Impervious Area                   |
| DCR                         | Department of Conservation and Recreation            |
| DO                          | Dissolved Oxygen                                     |
| EOEEA, EEA                  | Executive Office of Energy and Environmental Affairs |
| EPA                         | Environmental Protection Agency                      |
| ESS                         | ESS Group, Inc.                                      |
| FEMA                        | Federal Emergency Management Agency                  |
| FY                          | Fiscal Year  |
| GIS                         | Geographic Information System                        |
| GPS                         | Global Positioning System                            |
| HAB                         | Harmful Algal Bloom                                  |
| ICM                         | Impervious Cover Model                               |
| ID                          | Identification                                       |
| IDDE                        | Illicit Discharge Detection and Elimination          |
| MACP                        | Manhole Assessment Certification Program             |
| MassDEP                     | Massachusetts Department of Environmental Protection |
| MassDOT                     | Massachusetts Department of Transportation           |
| MCM                         | Minimum Control Measure                              |
| MESA                        | Massachusetts Endangered Species Act                 |
| MH                          | Manhole  |
| MS4                         | Municipal Separate Storm Sewer System                |
| NHESP                       | National Heritage and Endangered Species Program     |
| NMCOG                       | Northern Middlesex Council of Governments            |
| NOAA                        | National Oceanic and Atmospheric Administration      |
| NOI                         | Notice of Intent                                     |
| NPDES                       | National Pollution Discharge System                  |
| NRCC                        | Northeast Regional Climate Center                    |
| NRCS                        | Natural Resources Conservation Service               |
| O&M                         | Operation and Maintenance                            |
| OSRP                        | Open Space and Recreation Plan                       |

| Commonly Used Abbreviations | Definitions                                |
|-----------------------------|--|
| PACP                        | Pipeline Assessment Certification Program  |
| RVA                         | Regina Villa Associates                    |
| SOP                         | Standard Operating Procedure               |
| SSO                         | Sanitary Sewer Overflow                    |
| SwAG                        | Stormwater Advisory Group                  |
| SWAP                        | Source Water Assessment Report             |
| SWMI                        | Sustainable Water Management Initiative    |
| SWMMP                       | Stormwater Management Master Plan          |
| SWMP                        | Stormwater Management Plan                 |
| SWPPP                       | Stormwater Pollution Prevention Plan       |
| TIP                         | Transportation Improvement Program         |
| TMDL                        | Total Maximum Daily Load                   |
| TP                          | Technical Paper                            |
| TSS                         | Total Suspended Solids                     |
| WCT                         | Westford Conservation Trust                |
| WMA                         | Water Management Act                       |
| WPA                         | Wetland Protection Act                     |
| WRPOD                       | Water Resource Protection Overlay District |

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# Section 1

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# Section 1

## Introduction

The Town of Westford is a desirable place to live and work for a number of reasons. Besides having a highly ranked school system, easy access to Interstate 495 and Route 3, and the charm of “country villages”, the Town has successfully maintained a balance between growth and a high quality of life for its residents. Westford is a beautiful New England town “with rolling hills, lakes, and apple orchards,”<sup>1</sup> as well as regional attractions such as Kimball Farm and the Nashoba Valley Ski Area. Like many other Massachusetts communities, Westford is challenged with maintaining its rural appeal while attracting the right kind of growth that is important to offset the fact that the tax revenue from residential (especially low density residential) areas does not cover the cost of municipal services. The struggle is to attract quality commercial and industrial entities to Town without changing Westford’s beloved character. This approach to growth, known as “Smart Growth”, strives to keep pace with the need for economic development without sacrificing natural resources that enhance the quality of life in Westford.



**Figure 1-1: Stormwater Runoff Discharges to Nearby Waterbodies with Little or No Treatment**

Managing rainwater that runs off land surfaces during storms and from snowmelt is one of the many challenges Westford faces as the Town works to protect public health and safety, preserve its environmental resources, and safeguard its town character. Historically, the primary goals of managing stormwater runoff were to prevent immediate threats to life and property due to flooding and to maintain safe and passable streets. However, it has become clear that to create a sustainable community, Westford’s stormwater runoff must also be managed to address the serious adverse impacts that increased runoff quantity, temperature, and the nutrients, bacteria, sediment, and other pollutants carried by this runoff are having on the Town’s waterbodies. In addition, in the last decade, federal and state regulations have imposed increasingly stringent and onerous requirements on communities to locally manage stormwater runoff. To meet these challenges,



**Figure 1-2: Kayakers on Nabnasset Lake**

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<sup>1</sup> Town of Westford Website, “About Westford”. March 2015. URL: [www.westfordma.gov/pages/about](http://www.westfordma.gov/pages/about)  
Stormwater Management Master Plan

## Section 1 Introduction

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Westford must holistically address multiple stormwater management objectives, including maintaining existing infrastructure to reduce flooding risks, improving water quality and stream ecology, and complying with regulatory requirements.

This Stormwater Management Master Plan (SWMMP) evaluates the current state of stormwater management in the Town of Westford, identifies the long-term capital and operational needs and associated costs, and assesses the Town's ability to provide for these needs and costs. This SWMMP also evaluates funding and financing alternatives, and develops a sensible plan for the Town to deliver comprehensive stormwater management services to meet multiple objectives and preserve the community's character.

### 1.1 Purpose

The purpose of the SWMMP is to present a strategic and sustainable plan that will guide Westford in meeting its long-term water quantity, water quality, and operations and maintenance goals while simultaneously meeting economic and environmental needs. The overall plan approach is to present a compelling case for stormwater management, facilitate local coordination for cost-effective solutions, incorporate emerging local and regional issues, and integrate the overarching tenants of sustainability to:

- Preserve the **water quality** of lakes and streams for **public health, recreation, and wildlife habitat**.
- Provide a sustainable, high-quality **drinking water** source for residents and industry.
- **Operate and maintain Westford's drainage system** to protect public health and property, which includes 52 miles of drain pipes, approximately 5,160 drainage structures (catch basins and manholes), more than 600 outfalls, over 150 miles of publicly maintained roadways plus culverts, dams, and stormwater treatment facilities as well as natural drainage conveyances.
- **Comply with Federal and State environmental regulations** such as the Town's own Stormwater Management and Illicit Discharge bylaws, National Pollutant Discharge Elimination System permits, Massachusetts Stormwater Management Standards, Massachusetts Wetlands Protection Act, Total Maximum Daily Load provisions of the Clean Water Act, and the Safe Drinking Water Act.
- Identify a **sustainable funding strategy** that is **adequate** and **equitable**.

### 1.2 Public Involvement

One of the barriers to implementing a Stormwater Management Master Plan is the fact that achieving stormwater goals often requires a paradigm shift in the way that residents, businesses, and municipal staff conduct day-to-day activities. It can be challenging to convince residents that their lawn care practices are negatively impacting surface water quality or that funding capital projects will bring about a tangible return on the investment. A robust and well-designed public involvement and education program is essential to engage stakeholders from the start. Transparency builds trust and leads to public support of a project that is responsive to the community's concerns and interests. One of the most important functions of the SWMMP is to provide the public with all the data and information that they need in order to truly appreciate the value and wisdom of protecting our natural resources.

## Section 1 Introduction

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Regina Villa Associates (RVA), Tighe & Bond's Project Team member specializing in public affairs, took the lead in developing a public involvement and education program strategic work plan that laid out program elements, a schedule, and key stakeholders and milestones. It prioritized activities to ensure key milestones were supported by the appropriate advance groundwork. The program ensured that residents, businesses, opinion leaders, and elected officials were involved early, had a variety of ways to learn about the issues, and had multiple opportunities to participate. It combined traditional methods such as public meetings, printed materials, and press outreach, and newer techniques such as website materials and social media.

A Stormwater Advisory Group (SwAG) was created to select an engineering firm to complete the SWMMP and to provide oversight of the project from a wide variety of perspectives. The group initially met to review and comment on the project scope and convened at additional meetings at project milestones to discuss project progress, review work products, and provide guidance in advance of presenting information to the Board of Selectmen or general public. The SwAG also provided comments and clarification as needed in draft documents. RVA developed a logo for the SWMMP and for use on other stormwater outreach materials to unify the Town's stormwater message. The SwAG provided input during this process, which resulted in a straightforward message that connects with Westford residents. Westford's stormwater logo is shown in Figure 1-3 to the right.



**Figure 1-3: Westford's Stormwater Logo**

The following people participated in the SwAG, the majority of whom are residents of Westford (*indicated in parentheses*) and/or professional staff. All meetings were facilitated by RVA and Tighe & Bond's Project Manager.

- Richard "Chip" Barrett, Highway Superintendent (*Westford Resident*)
- Stephen Cronin, Water Superintendent
- John Cunningham, Conservation Commission & Capital Planning Committee (*Westford Resident*)
- Jeremy Downs, P.E., Assistant Town Engineer
- Mark Kost, Board of Selectmen (*Westford Resident*)
- John Mangiaratti, Assistant Town Manager (*Westford Resident*)
- Jeff Morrissette, Town Planner
- Titus Palmer, Westford Real Estate, Inc. (*Westford Resident*)
- Paul Starratt, P.E., Town Engineer
- Beverly Woods, Northern Middlesex Council of Governments (NMCOG) Executive Director (*Westford Resident*)

During the development of the SWMMP, public meetings were held to inform the residents of Westford about the plan development process. The first meeting included presentation

## Section 1 Introduction

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of a report on the data gathering and needs/costs identification phases; the second meeting presented a summary of the evaluation of the Town's ability to provide for the needs/costs; and the final meeting presented the final Stormwater Master Plan findings and recommendations.

A record of meeting agendas, meeting materials, minutes, and associated materials developed for public involvement are included on a CD in Appendix A.

### 1.3 Stormwater Management Master Plan Vision

The starting place for a stormwater management master plan for Westford begins with the Town's vision for its future. During the June 26, 2014 Stormwater Advisory Group meeting, RVA lead a visioning session for the planning process and outcome where the group discussed **goals, challenges, and opportunities** associated with the SWMMP. A table that summarizes discussion points in the visioning session is included in the meeting minutes in Appendix A.

**The overall vision for the SWMMP is that it holistically considers all components of stormwater management, including infrastructure, operations, staffing, and compliance needs and associated costs; it is implementable; and it has the support of the public.**

It was the consensus of the group that the SWMMP must:

- Consider the **needs of the Town**, and how the plan can benefit residents and businesses, as well as private and public infrastructure;
- Create a **balanced output** that considers what is fair and reasonable;
- Be **consistent with other ongoing related efforts** including the Town's Water Management Sustainable Water Management Initiative (SWMI) planning and Healthy Lakes & Ponds Initiative principles; and
- Actively **engage the public** throughout formation of the SWMMP and incorporate public input.

# Section 2

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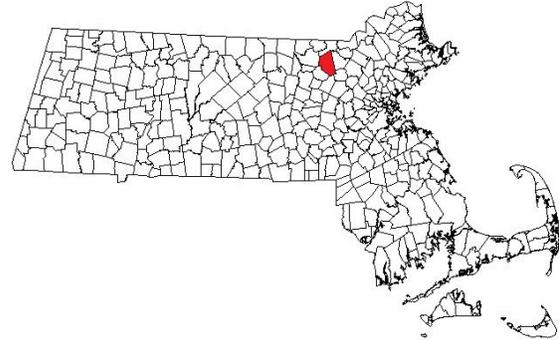


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## Section 2

# Assessment of Existing and Future Conditions

The Town of Westford is located in the northeastern area of Middlesex County in Massachusetts. It is bordered by Chelmsford to the east, Tyngsboro to the north, Groton to the west, Littleton to the southwest, Acton to the south, and Carlisle to the southeast.



**Figure 2-1: Town of Westford**

Originally Westford was noted for its farms and woolen mills, but today is mostly a bedroom community for commuters. The Town has thriving businesses including retail, restaurants, and technology industries along Littleton Road (Route 110) and Groton Road (Route 40). The Town is home to a number of cultural and recreational resources including the Roudenbush Community Center, the Parish Center for the Arts, the J.V. Fletcher Library, The Butterfly Place, the Westford Museum and Historical Society, Kimball Farm, and Nashoba Valley Ski Area. The local forests and fields provide a number of trails which are used for hiking, jogging, bird watching, horseback riding, and cross country skiing. Interstate 495, U.S. Route 3, and State Routes 27, 40, and 225 traverse the Town for easy access to Boston and destinations to the north.

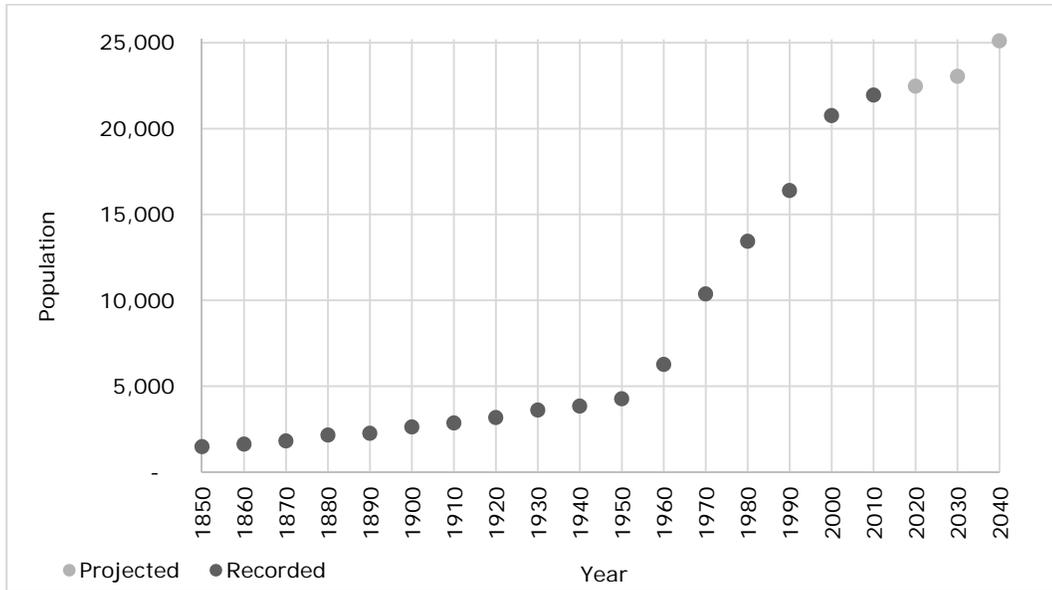
### 2.1 Demographics

The Town of Westford has a population of approximately 22,000 residents. Since 1960, the population has grown steadily, increasing by 3,000 to 4,000 people every 10 years. Prior to 1960, the population increased by only a few hundred every ten years. The steady increase in population is indicative of Westford's evolution from a semi-rural town to a suburb. Figure 2-2 shows the Town's population change from 1850 through the 2010 Census and the Massachusetts Department of Transportation (MassDOT) projected population through 2040<sup>2</sup>.

The population of Westford is well-educated, with approximately 65 percent of its adult population having completed college or beyond, and approximately 25 percent holding a master's, doctorate, or professional degree.

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<sup>2</sup> Massachusetts Department of Transportation population data with Northern Middlesex Council of Governments input



**Figure 2-2: Westford Population (1850 – 2040)**

## 2.2 Land Use

Westford is a fairly large town compared with other communities in the region and throughout the state, with a land area of 31.3 square miles, or 20,032 acres. Westford's water resources and its direct access to major transportation routes have influenced its land use pattern and caused it to be similar to an evolving suburb. Westford adopted zoning in 1955 and instituted a policy favoring single-family home development. The Town is largely zoned residential, with a few areas along Interstate 495, Routes 225, 40 and 110, and in the northeast corner of Town zoned for business, commercial, and industrial uses. The Town has traditional villages and extensive suburban housing developments throughout the community. The Town's current population and household characteristics reflect the decisions made years ago to grow as a residential community.

Table 2-1 presents a list of land use types in the Town, summarized by total area of each land use designation and percent of total Town area.



**Figure 2-3: Views from Windshield Survey**

## Section 2 Assessment of Existing and Future Conditions

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**Table 2-1  
Land Use in Westford**

| Land Use Category | Acres | % Total Town |
|-------------------|-------|--------------|
| Residential       | 4,520 | 22.5%        |
| Commercial        | 251   | 1.3%         |
| Industrial        | 660   | 3.3%         |
| Forest            | 9,792 | 48.8%        |
| Open Space        | 1,034 | 5.1%         |
| Active Quarries   | 383   | 1.9%         |
| Institutional     | 142   | 0.7%         |
| Wetlands          | 2,654 | 13.2%        |
| Water             | 635   | 3.2%         |

Notes:

- Residential land use includes multi-family residential, high density residential, medium density residential, low density residential, and very low density residential land uses.
- Commercial land use also includes spectator recreation land uses.
- Industrial land use also includes junkyard, powerline/utility, transportation, and waste disposal land uses.
- Open space land use includes cemetery, brushland/successional, cropland, golf course, nursery, open land, orchard, participation recreation, pasture, and transitional land uses.
- Institutional includes urban public/institutional land uses.
- Wetlands land use also includes cranberry bog, forested, and non-forested wetland land uses.
- Water land use also includes water-based recreation land uses.

The most recent Open Space and Recreation Plan (OSRP)<sup>3</sup>, finalized in June 2010, provides insight into potential future land uses. As stated in the OSRP, a buildout analysis prepared by NMCOG in 2001 indicates that at the time, Westford had enough vacant, developable land to support an additional 4,637 single-family homes and 17,964,654 square feet of commercial and industrial space. Since 2001, Westford has acquired two large parcels of open space, the East Boston Camps property and the Stepinski parcel, which reduce the total inventory of developable residential land. According to the OSRP, a more recent estimate of the Town's residential growth potential was prepared for the Comprehensive Plan Update, and it placed the Town's buildout potential at an additional 2,285 lots. NMCOG's 2016 Northern Middlesex Regional Transportation Plan<sup>4</sup> states that in 2010, there were approximately 7,500 houses in Westford, and by 2040, the number may increase to approximately 10,500, which is slightly greater than the recent buildout projections, but close to the OSRP estimates.

Since the majority of Westford's land is zoned for residential use, it is anticipated that the majority of future new and redevelopment will be residential. The Town's zoning code will exert significant control over its land use pattern at buildout. However, Westford is currently experiencing tear-downs and, according to the OSRP, "mansionsization". Many small, older homes in Westford have been demolished and replaced by larger dwellings, especially summer homes around some of the larger ponds in the northern section of Town, which are being expanded or rebuilt to the maximum extent possible.

The total amount of land zoned for commercial and industrial use is small compared to the size of the residential districts. However, in recent years Westford has attracted considerable interest in commercial and industrial development. Even though these uses

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<sup>3</sup> Westford Open Space and Recreation Plan. June 2010. URL:

[http://www.westfordma.gov/pages/government/towndepartments/boardsandcommittees/WestfordMA\\_concomm/documents/Open%20Space%20Plan%202010-2015,%20Final,%20June,%202010.pdf](http://www.westfordma.gov/pages/government/towndepartments/boardsandcommittees/WestfordMA_concomm/documents/Open%20Space%20Plan%202010-2015,%20Final,%20June,%202010.pdf)

<sup>4</sup> Northern Middlesex Council of Governments. Northern Middlesex Regional Transportation Plan. URL:

<http://www.nmcog.org/regional-transportation-plan>

## Section 2 Assessment of Existing and Future Conditions

are allowed in limited areas, they can exert an enormous impact on Westford's character and future growth.

As described in the OSRP, there are a number of natural areas that are unprotected from development, including undeveloped parcels along waterbodies and near drinking water supplies, the Town's remaining quarries, undeveloped hilltops, fields and farms (e.g., Parker Village, Volo Farms Scanlon Farm, and Greenwood Farm) along scenic roads, and other forested tracts (e.g., Massachusetts Institute of Technology's 570 acres around Haystack Observatory, Nashoba Valley Ski Area's 75 acres, and 200 acres of the two sportsman clubs). As development pressure increases, the Town's remaining large unprotected open spaces and more marginalized parcels (e.g., those with steeper slopes, underlying bedrock, and less suitable soil contents) could be targeted for development.

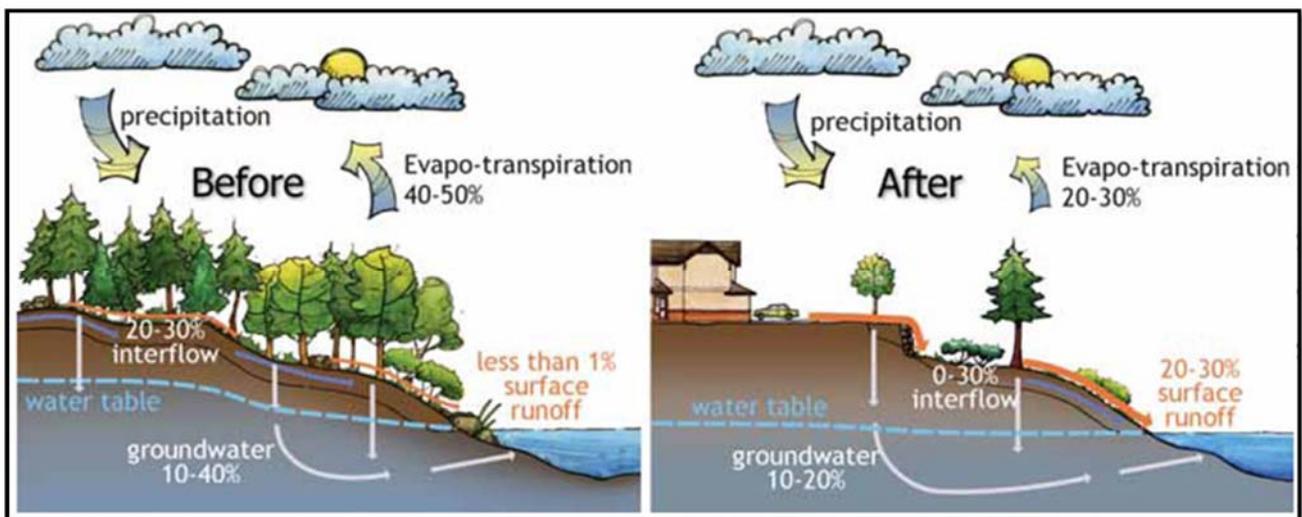
As further described in the next section, existing and future development has the potential to impact natural resources, particularly water quality, and tax the existing drainage infrastructure.

### 2.2.1 Land Development and the Water Cycle

Westford's increasing population and economic growth have resulted in a conversion of undeveloped land (forests and pastures) to suburban landscapes with increased *impervious cover*. All land uses have an effect on water quality, whether positive or negative. In forests and other areas with good vegetation cover and little disturbance from humans, most rainfall soaks into the soil rather than running off the ground, stream flows are fairly steady, and water quality is good. In built-up areas with pavement and buildings, little rainfall soaks into the soil, causing high runoff, stream flows with high peaks and low flows in between, and poorer water quality.<sup>5</sup> This is demonstrated in Figure 2-4 below.<sup>6</sup>

*What is impervious cover?*

**All hard surfaces that do not allow water to penetrate the soil, such as rooftops, driveways, streets, parking lots, swimming pools, and patios.**



**Figure 2-4: Land Development and the Water Cycle**

<sup>5</sup> Frankenberger, Dr. Jane, Assistant Professor in Agricultural and Biological Engineering. Purdue University. *Land Use and Water Quality*. URL: <https://engineering.purdue.edu/SafeWater/watershed/landuse.html>

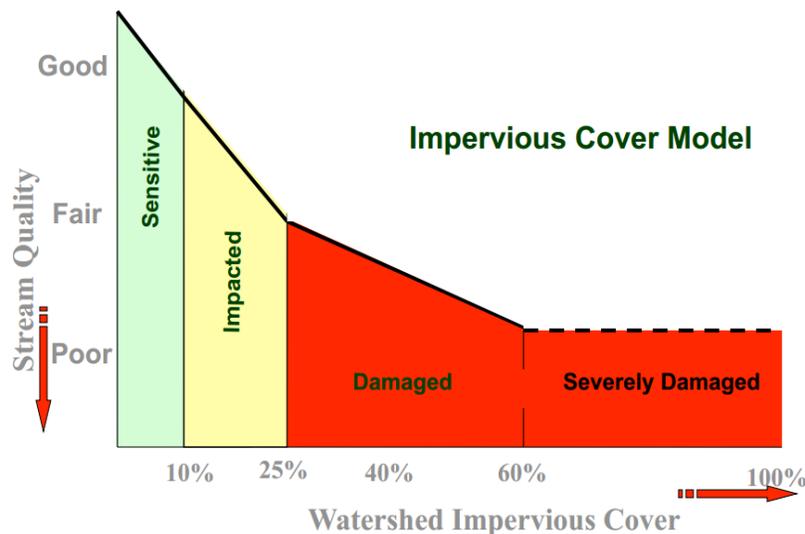
<sup>6</sup> Image from the Puget Sound Partnership. URL: [http://www.ecy.wa.gov/washington\\_waters/images/WaterCycle.jpg](http://www.ecy.wa.gov/washington_waters/images/WaterCycle.jpg)

## Section 2 Assessment of Existing and Future Conditions

Some of the consequences of increased stormwater runoff are:

- **Increased frequency and severity of flooding**, when the carrying capacity of streams and drainage infrastructure is overwhelmed.
- **Reduced ground water recharge**, which provides drinking water and base flow to streams throughout the year.
- **Decreased base flow in streams**, which is the portion of streamflow that comes from groundwater, not runoff, and is vital to the health of aquatic life.
- **Increased stream channel erosion**.
- **Thermal pollution** that increases the ambient temperature of lakes and streams, harming aquatic life and reducing dissolved oxygen concentrations.
- **Reduced natural filtration of the water** through soil particles that remove pollutants before reaching groundwater, wells, lakes, and streams.
- **Negative impacts on stream health** due to increased nonpoint source pollution, higher peak flows, degradation of stream channels, and periods of very low flow due to decreased base flow.

Research has shown that imperviousness is a “powerful and important indicator of future stream quality and that significant degradation occurs at relatively low levels of development.”<sup>7</sup> The general relationship between impervious cover in a watershed and future stream quality is shown in the Center for Watershed Protection’s Impervious Cover Model (ICM) in Figure 2-5. The ICM predictions are general and may not fully apply to every stream, but the ICM serves as a good rule of thumb. Factors such as stream gradient, stream order, stream type, age of watershed development, prior land use, and past management practices can and will make some streams differ from these



**Figure 2-5: Relationship Between Impervious Cover and Stream Water Quality**

<sup>7</sup> Schueler, T. 2000. *The Importance of Imperviousness*. The Practice of Watershed Protection. Center for Watershed Protection. Ellicott City, MD. 7-18.

## Section 2 Assessment of Existing and Future Conditions

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predictions.<sup>8</sup> Section 2.4.2 provides a more detailed assessment of sub-watershed imperviousness in Westford. The Subbasin Profiles included in Appendix B include total acres of impervious cover within each subbasin, the percent of the subbasin area that is impervious, and associated ICM basin status (i.e. sensitive, impacted, damaged, or severely damaged).

### 2.2.2 Current Preservation of Open Space

Preservation of open space and conservation of Westford's natural resources are a priority. The Town has adopted a Water Resource Protection Overlay District, a Floodplain Overlay District, and a Conservation Overlay District to implement more stringent land uses and development requirements for those sensitive resource areas.

Toward achieving the goal of preserving forested land, the Open Space Rural Development section of the Zoning Bylaws requires that a portion of each residential development site be reserved as common open space at a ratio of 10,000 square feet of upland per dwelling unit, with some variations for larger developments or those located in an industrial zone.

Since 2002, Westford has protected more than 600 acres of open space through land acquisitions and conservation restrictions. The Town adopted the Community Preservation Act (CPA) in 2002 as a means of raising local funds for open space protection, historic preservation, and affordable housing. Westford's considerable open spaces are shown in Figure 2-6. This figure presents open space areas based on the level of protection identified in the Massachusetts Geographic Information System (MassGIS) data layers. According to MassGIS<sup>9</sup>, the following are definitions of level of protection that apply to open space in Westford:

- **In Perpetuity (P):** Legally protected in perpetuity and recorded as such in a deed or other official document. Land is considered protected in perpetuity if it is owned by the Town's conservation commission or, sometimes, by the water department; if the Town has a conservation restriction on the property in perpetuity; if it is owned by one of the state's conservation agencies (thereby covered by Article 97); if it is owned by a non-profit land trust; or if the Town received federal or state assistance for the purchase or improvement of the property. Private land is considered protected if it has a deed restriction in perpetuity, if an Agriculture Preservation Restriction has been placed on it, or a Conservation Restriction has been placed on it.
- **Limited (L):** Protected by legal mechanisms other than those above, or protected through functional or traditional use. These lands might be protected by a requirement of a majority municipal vote for any change in status. This designation also includes lands that are likely to remain open space for other reasons (e.g., cemeteries and municipal golf courses).

**In terms of protecting Westford's water resources, there is no equivalent to preservation of forested land for water quality, groundwater recharge, and temperature reduction.**

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<sup>8</sup> The Impervious Cover Model and impervious cover and stream health information are from an EPA Webcast titled "The Eight Tools of Watershed Protection" by Tom Schueler of the Center for Watershed Protection.

<sup>9</sup> MassGIS Data – Protected and Recreation Open Space, October 2015. URL:

<http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/osp.html>

## Section 2 Assessment of Existing and Future Conditions

- **None (N):** Totally unprotected by any legal or functional means. This land is usually privately owned and could be sold without restriction at any time for another use (e.g., scout camps, private golf course, and private woodland).

The Subbasin Profiles included in Appendix B summarize total area of open space within each subbasin, area of protected open space, area of unprotected open space, and associated percent of the subbasin area that is protected or unprotected open space.

### 2.2.3 Protection of Critical, Sensitive or Unique Resources

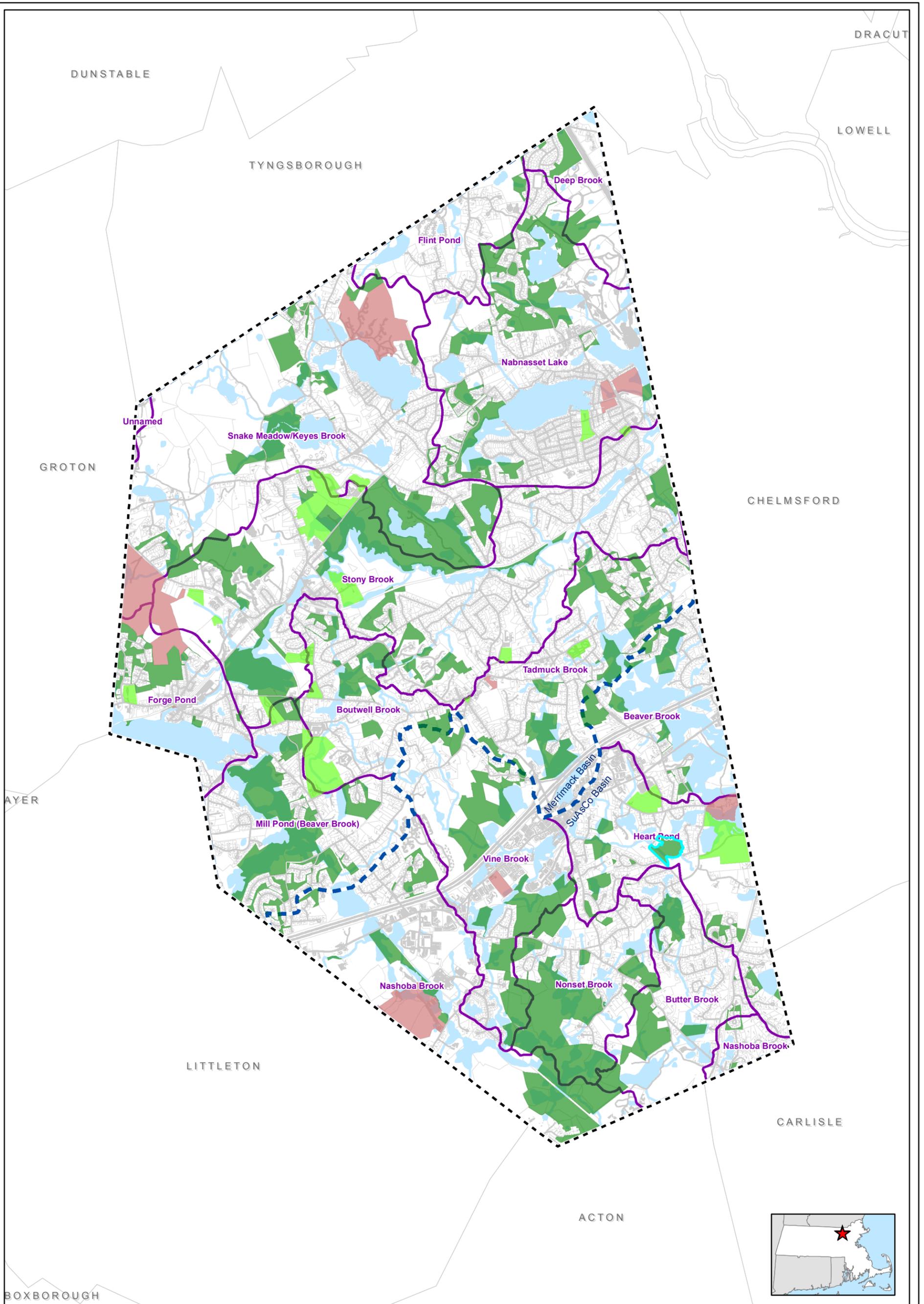
There are numerous critical, sensitive, and unique resources within the Town of Westford. These resources include state-listed rare species habitats, vernal pools, and a single coldwater fishery. Figure 2-7 shows the locations of these important assets. The Subbasin Profiles included in Appendix B summarize critical, sensitive, and unique resources within each subbasin.

Almost a third of the Town is overlain by Priority Habitat and Estimated Habitat. Priority Habitat consists of the known area of habitat for state-listed rare species, both plants and animals. Priority Habitat is regulated under the Massachusetts Endangered Species Act (MESA). Estimated Habitats are a sub-set of the Priority Habitats, and consist of the known area of habitat for state-listed rare wetlands wildlife. Estimated Habitat is regulated under the Wetlands Protection Act (WPA), which does not protect plants. State-listed wetland wildlife species are protected under the Massachusetts Endangered Species Act as well as the Wetlands Protection Act. Table 2-2 presents the list of rare species in Westford according to the National Heritage and Endangered Species Program (NHESP) listing.

**Table 2-2**  
**Rare Species in Westford**

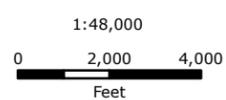
| Taxonomic Group | Common Name                        | Scientific Name                            | MESA Status <sup>1</sup> | Most Recent Observation |
|-----------------|------------------------------------|--|--------------------------|-------------------------|
| Amphibian       | Blue-spotted salamander            | <i>Ambystoma laterale</i>                  | SC                       | 2010                    |
| Vascular Plant  | Purple Milkweed                    | <i>Asclepias purpurascens</i>              | E                        | Historic                |
| Bird            | American Bittern                   | <i>Botaurus lentiginosus</i>               | E                        | 1990                    |
| Reptile         | Blanding's Turtle                  | <i>Emydoidea blandingii</i>                | T                        | 2013                    |
| Reptile         | Wood Turtle                        | <i>Glyptemys insculpta</i>                 | SC                       | 2004                    |
| Vascular Plant  | Giant St. John's Wort              | <i>Hypericum ascyron</i>                   | E                        | Historic                |
| Bird            | Least Bittern                      | <i>Ixobrychus exilis</i>                   | E                        | 1992                    |
| Vascular Plant  | New England Blazing Star           | <i>Liatris scariosa var. novae-angliae</i> | SC                       | Historic                |
| Vascular Plant  | Alternative-flowered Water-milfoil | <i>Myriophyllum alterniflorum</i>          | E                        | 1903                    |
| Vascular Plant  | Toothcup                           | <i>Rotala ramosior</i>                     | E                        | 2014                    |
| Vascular Plant  | Tall Nut-sedge                     | <i>Scleria triglomerata</i>                | E                        | 1920                    |
| Vascular Plant  | Wild senna                         | <i>Senna hebecarpa</i>                     | E                        | Historic                |

<sup>1</sup> E: Endangered; T: Threatened; SC: Special Concern



**Legend**

- ▲ Stormwater Outfalls
- Ponds
- ~ Rivers and Streams
- Impervious Surface
- - - Town Boundary
- - - Major Basin Boundary
- Sub-basin Boundary
- In Perpetuity
- Limited
- None

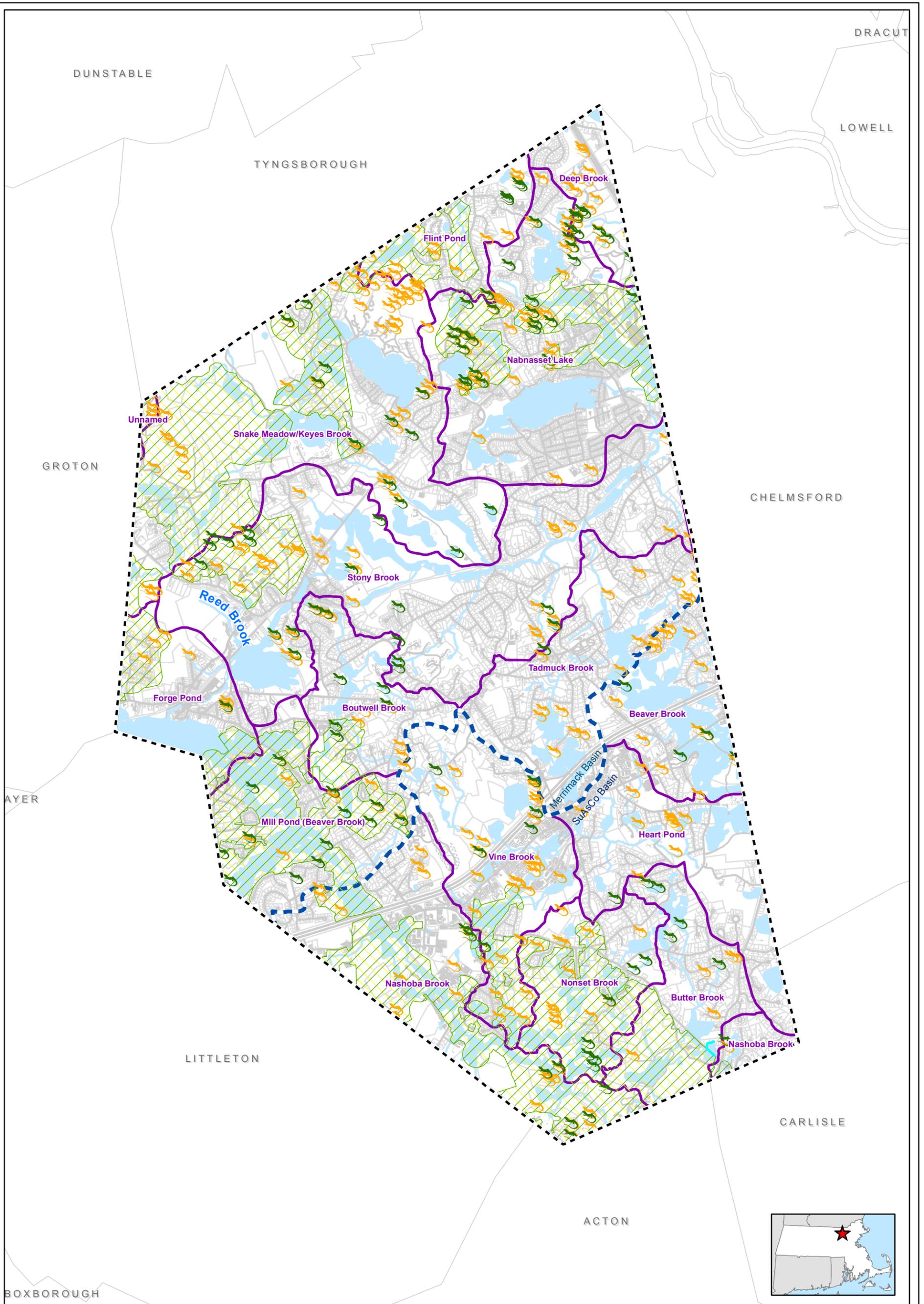


**FIGURE 2-6  
OPEN SPACE**

Westford, Massachusetts

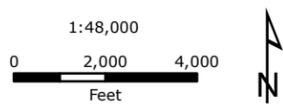
February 2016





**Legend**

- ▲ Outfalls
- Ponds
- Rivers and Streams
- Impervious Surface
- - - Town Boundary
- - - Major Basin Boundary
- ▭ Sub-basin Boundary
- NHESP Certified Vernal Pools
- NHESP Potential Vernal Pools
- ▨ NHESP Estimated Habitats for Rare Wildlife
- ▨ NHESP Priority Habitats for Rare Species



**FIGURE 2-7  
CRITICAL, SENSITIVE, OR  
UNIQUE RESOURCES**

Westford, Massachusetts

June 2015

## Section 2 Assessment of Existing and Future Conditions

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Westford has numerous identified vernal pools due to the commitment by various local environmental groups to identify and register these unique resources with the NHESP. As of the date of this report, Westford has 118 certified and 292 potential vernal pools. Vernal pools are unique wildlife habitats best known for the amphibians and invertebrate animals that use them to breed. Vernal pools (ephemeral pools, autumnal pools, or temporary woodland ponds) typically fill with water in the autumn or winter due to rainfall and rising groundwater and remain ponded through the spring and into summer. Vernal pools dry completely by the middle or end of summer each year, or at least every few years. Occasional drying prevents fish from establishing permanent populations, which is critical to the reproductive success of many amphibian and invertebrate species that rely on breeding habitats free of fish predators.

Reed Brook is a coldwater fishery resource that flows between the Blanchard Middle School and the Norman E. Day School, passes under North Main Street, and then discharges to Stony Brook<sup>10</sup>. This waterbody is listed by the Division of Fisheries and Wildlife and provides habitat for reproducing coldwater fish. Coldwater fisheries resources are very sensitive habitats, and therefore temperature, dissolved oxygen, and other factors must be protected to ensure habitat remains for this unique resource. Reed Brook is part of Westford's award-winning Living Lab program at the Norman E. Day School.

The Town protects these sensitive resources through implementation of local bylaws and regulations. Local code includes the following requirements that help protect surface and groundwater quality and manage runoff volumes:

- The General Bylaws include **Chapter 147: Stormwater Management** that regulates land disturbances greater than or equal to one acre. The Planning Board is designated the Stormwater Authority in charge of enforcing the bylaw. The objective of this bylaw is to require practices to control the flow of stormwater from new and redeveloped sites in Westford with the broad goals of reducing erosion and pollution, preventing flooding, promoting infiltration, protecting groundwater and surface water quality, and ensuring adequate long-term operation and maintenance of structural stormwater practices. The **Stormwater Regulations** provide additional detail on how construction projects can meet these goals, including the requirement to meet the Massachusetts Stormwater Management Standards and manage runoff to sensitive resources (e.g., Reed Brook and impaired waterbodies).
- The General Bylaws also include **Chapter 82: Discharges to the Municipal Storm Drain System** that prohibits illegal connections and dumping to the Town's drainage system to prevent pollutants from entering the storm sewer system and



**Figure 2-8: Reed Brook from Living Lab Outdoor Classroom**

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<sup>10</sup> Photograph in Figure 2-8 is from Westford Public Schools website. URL: <http://westfordk12.us/pages/Curric/FOV1-0006CBD5/LivingLab/story>

## Section 2 Assessment of Existing and Future Conditions

subsequently local waterbodies, as well as requires removal of these sources of pollution.

- The Zoning Bylaws establish a **Water Resource Protection Overlay District (WRPOD)** to protect aquifers and recharge areas serving an existing or potential public water supply from contamination. Areas within the Water Resource Protection Overlay District I are controlled by the standards in 310 CMR 22.00 for Zone I of a public water supply well. Uses within WRPD II and WRPD III delineated areas are restricted and may require a Special Permit from the Planning Board. New or redevelopment projects within WRPD II which will render more than 15% of the lot area or 2,500 square feet impervious are required to recharge stormwater using onsite stormwater best management practices (BMPs).
- Major commercial and retail projects that need a **Special Permit** are required to meet performance standards, including a requirement to meet the MassDEP Stormwater Management Standards.
- Planning Board Subdivision Rules and Regulations, which are referenced in the Zoning Bylaw, including Site Plan Review, require that "to the maximum extent feasible, **stormwater shall be recharged** rather than piped to surface waters. Over critical aquifer recharge areas, this may require the use of open drainage systems along streets in a subdivision. Applicants are encouraged to implement current stormwater management guidelines as established by the Department of Environmental Protection."
- The Subdivision Rules and Regulations also require that "any sites that are over 1 acre in disturbed area or for other reasons are required to submit a **NPDES Stormwater permit** under the EPA shall be required to submit to the Town Engineer a copy of the original submission, approved permit, all plans, calculations and other relevant information used to indicate compliance."

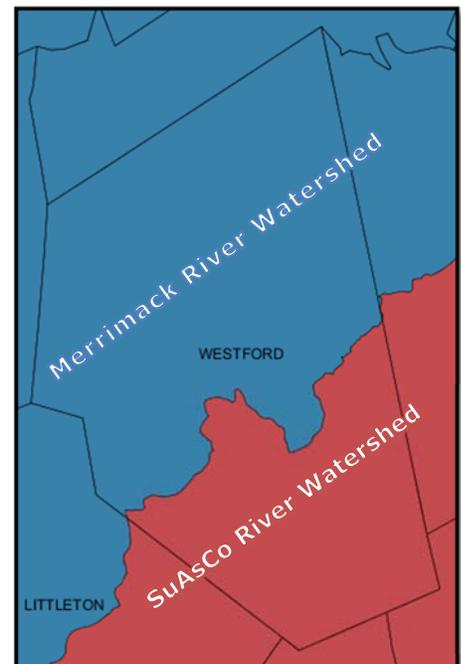
## 2.3 Water Resources

### 2.3.1 Surface Water Watersheds

Westford falls within two major watersheds, the Merrimack River and Sudbury-Assabet-Concord (SuAsCo) River watersheds, as shown in Figure 2-9.

The Merrimack River watershed covers the northern 20 square miles of Westford and can be divided into nine (9) subbasins. There is also an unnamed subbasin in the northwest corner of Town that was not included in the list below, or the subbasin analysis that was completed as part of this report, because it is largely forested and outside of the Town's regulated urbanized area. The Merrimack River watershed subbasins include:

- Main Stem Stony Brook;
- Nabnasset Lake;
- Snake Meadow Brook/Keyes Brook;
- Boutwell Brook;



**Figure 2-9: Major Watersheds in Westford**

## **Section 2 Assessment of Existing and Future Conditions**

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- Mill Pond/Beaver Brook;
- Forge Pond;
- Flint Pond;
- Deep Brook; and
- Tadmuck Brook.

The SuAsCo River watershed covers the southwestern 10.5 square miles of Westford and can be divided into the following six (6) subbasins:

- Main Stem Nashoba Brook (2 separate portions in Town);
- Vine Brook;
- Nonset Brook;
- Heart Pond;
- Beaver Brook; and
- Butter Brook.

Using a compilation of the reports, studies, and data related to the subbasins, Woodard & Curran prepared subbasin profiles for nine (9) of the 15 subbasins in the 2007 Watershed Action Plan. Each Subbasin Profile includes a map of the subbasin drainage area and presents vital statistics in the following categories:

- Physical Characteristics;
- Stream Statistics;
- Land Use – Open Space and Impervious Surface;
- Habitat Characteristics;
- Lands Critical to Sustaining Surface and Groundwater Quality and Quantity; and
- Summary of Potential Sources of Pollution.

These profile metrics were used to gauge overall subbasin health and will guide future protection with the goal of preserving the natural water resources and maintaining the character of the Town. Impervious cover and basin stress status are also used as indicators of overall watershed health in each subbasin. Tighe & Bond updated the 2007 subbasin profiles using current data and added the remaining six (6) subbasins to account for the entire Town. Appendix B includes tables that summarize the health of the 15 subbasins (i.e., percent impervious cover, impaired waterbodies, SWMI classification, percent open space, etc.).

A variety of groups actively work to protect the Stony Brook and Nashoba Brook watersheds through activities such as public education, water quality sampling and environmental monitoring, open space planning and land preservation/acquisition, water supply assessments, identification of contamination problems, and collaboration. These groups include the:

- Town of Westford;
- OARS;

## Section 2 Assessment of Existing and Future Conditions

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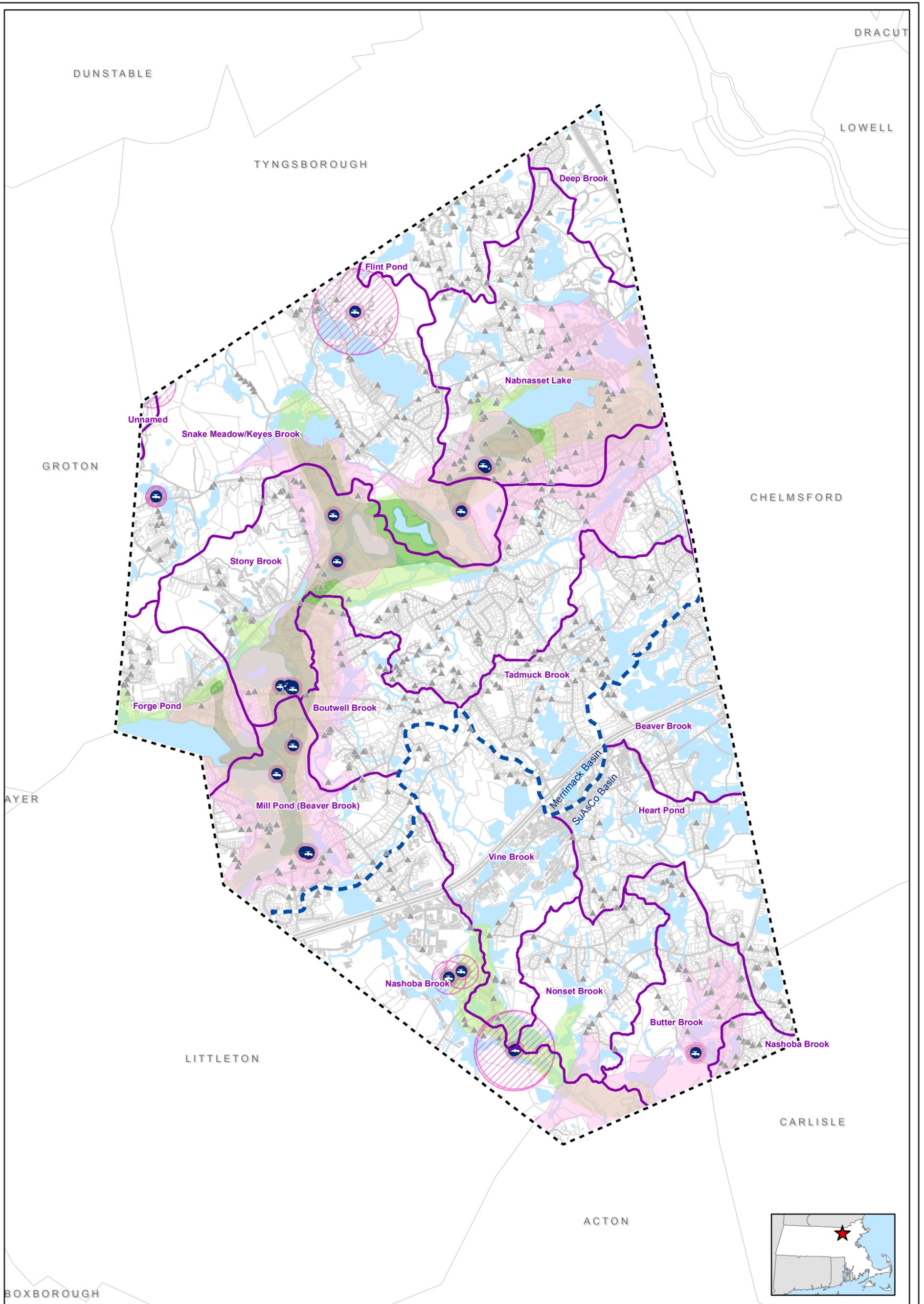
- Westford Watershed Conservation Organization;
- Massachusetts Department of Environmental Protection (MassDEP);
- Merrimack River Watershed Council;
- SuAsCo River Watershed Community Council;
- Executive Office of Energy and Environmental Affairs (EOEEA);
- Westford Conservation Trust;
- Westford Environmental News and Action Committee;
- Northern Middlesex Stormwater Collaborative; and
- Westford Land Preservation Fund.

### 2.3.2 Drinking Water

Approximately 75% of Westford's residential population and the majority of commercial and industrial areas are served by a public water supply and distribution system. The Town's water supply comes from the high- and medium-yield aquifers within the Stony Brook corridor in the Merrimack River watershed via nine gravel-packed groundwater wells. Water is treated at one of two greensand filtration plants, the Forge Village Road Water Treatment Plant or the Nutting Road Water Treatment Plant. These two water treatment facilities were brought online in 2003 and have the capacity to treat a total of 5.2 million gallons per day. The storage tanks and 124.6 miles of water main serve most of the central and northern sections of town, with limited service to the area south of Route 110. The Town's storage tanks have a combined total capacity of 4.85 million gallons. Figure 2-10 shows the extent of Westford's drinking water distribution system and the locations of wellhead protection areas (Zone II and IPWAs).

**A critical component of Westford's SWMMP will be making the connection between management of stormwater and protecting Westford's aquifer in terms of both adequate supply and water quality.**

The Commonwealth of Massachusetts' Water Management Act (WMA, 310 CMR 36.00) regulates the quantity of water communities can withdraw from groundwater resources through a permitting program. The Town of Westford is authorized to withdraw 2.44 million gallons per day from their wells through a WMA permit. All of the Town's wells are located in the Merrimack River Watershed. Table 2-3 summarizes pertinent information regarding the authorized capacity of Westford's supply sources. The Subbasin Profiles included in Appendix B summarize drinking water characteristics in each subbasin, including number of public water supply wells, wellhead protection areas (Zone I, Zone II, and IPWA), and area of aquifer.



**Legend**

|                        |   |
|------------------------|---|
| ▲ Outfalls             | ⊕ Water Supplies                                  |
| ☁ Ponds                | ■ Zone I  |
| ~ Rivers and Streams   | ■ DEP Approved Wellhead Protection Area (Zone II) |
| ■ Impervious Surface   | ▨ DEP Interim Wellhead Protection Area (IWPA)     |
| ⬛ Town Boundary        | ■ Potentially Productive Medium Yield Aquifer     |
| ⬛ Major Basin Boundary | ■ Potentially Productive High Yield Aquifer       |
| ⬛ Sub-basin Boundary   |   |

1:48,000  
 0 2,000 4,000  
 Feet

Note: The Town of Westford's Water Resource Protection Overlay District 1, consists of the Zone I per 310 CMR 22.00. District 2 includes the Zone II, IPWA, and high and medium yield aquifers. District 3 covers the remainder of Westford.

**FIGURE 2-10  
 LANDS CRITICAL TO  
 SUSTAINING SURFACE AND  
 GROUNDWATER QUALITY  
 AND QUANTITY**

Westford, Massachusetts

June 2015



## Section 2 Assessment of Existing and Future Conditions

**Table 2-3  
Westford Water Supply Sources**

| Source   | Subbasin                     | WMA Permit Limit<br>Maximum Day<br>(mgd) |
|--|------------------------------|--|
| Nutting Road Well and Satellite Wells  | Nabnasset<br>Lake            | 0.65                                     |
| Depot Road Well  | Snake<br>Meadow<br>Brook     | 0.72                                     |
| Forge Village Well Field<br>Forge Village Road Well No. 2<br>Stepinski Well<br>Cote Well | Stony Brook                  | 1.22<br>0.65                             |
| Howard Road Well Field<br>Fletcher Well<br>Country Road Well No. 2                       | Mill<br>Pond/Beaver<br>Brook | 0.43<br>0.69<br>0.61                     |
| <b>Total</b>   |                              | <b>2.44</b>                              |

The average annual withdrawal from each supply based on withdrawals in 2011, 2012, and 2013, is summarized in Table 2-4, based on the Town's Annual Statistical Reports submitted to MassDEP.

**Table 2-4  
Westford Annual Water Production**

| Source                                | Average Annual<br>Production (mg)<br>Average Range |
|---------------------------------------|--|
| Nutting Road Well and satellite wells | 39 – 66  |
| Depot Road Well                       | 28 – 31  |
| Forge Village Well Field              | 38 – 44  |
| Forge Village Road Well No. 2         | 67 – 89  |
| Howard Road Well Field                | 41 – 55  |
| Cote Well                             | 63 – 68  |
| Fletcher Well                         | 36 – 70  |
| Stepinski Well                        | 58 – 99  |
| Country Road Well No. 2               | 68 - 90  |
| <b>Total</b>                          | <b>524 – 536</b>                                   |

Westford's drinking water quality is generally good and meets Massachusetts Drinking Water Standards. More information on drinking water quality is available from the Westford Water Department and is reported on the Annual Statistical Reports submitted annually to MassDEP.

MassDEP prepares a Source Water Assessment Report (SWAP) that evaluates the existing and potential threats to water quality and identifies potential sources of pollution. The key issues noted for Westford include the need for continued monitoring of roads and other

## **Section 2 Assessment of Existing and Future Conditions**

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activities in Zone I areas, and the need to work with neighboring communities to protect Zone II areas. According to the SWAP, Westford's wells are located in an aquifer with a high vulnerability to contamination due to the absence of hydrogeologic barriers (e.g., clay or bedrock), which could prevent contaminant migration. A copy of the most recent SWAP is included in Appendix C.

In 1996, Westford adopted a Water Resource Protection Overlay District bylaw that protects not only existing public water supplies, but also the Stony Brook aquifer from which all municipal water is drawn. The bylaw delineates three water protection subdistricts:

- District 1 equates to existing DEP Zone I recharge areas;
- District 2 consists of all DEP Zone II and Interim Wellhead Protection Areas for municipal wells (including municipal wells in neighboring communities) along with surrounding high- and medium-yield aquifers; and
- District 3 consists of areas beyond District 2 that drain into a Zone II.

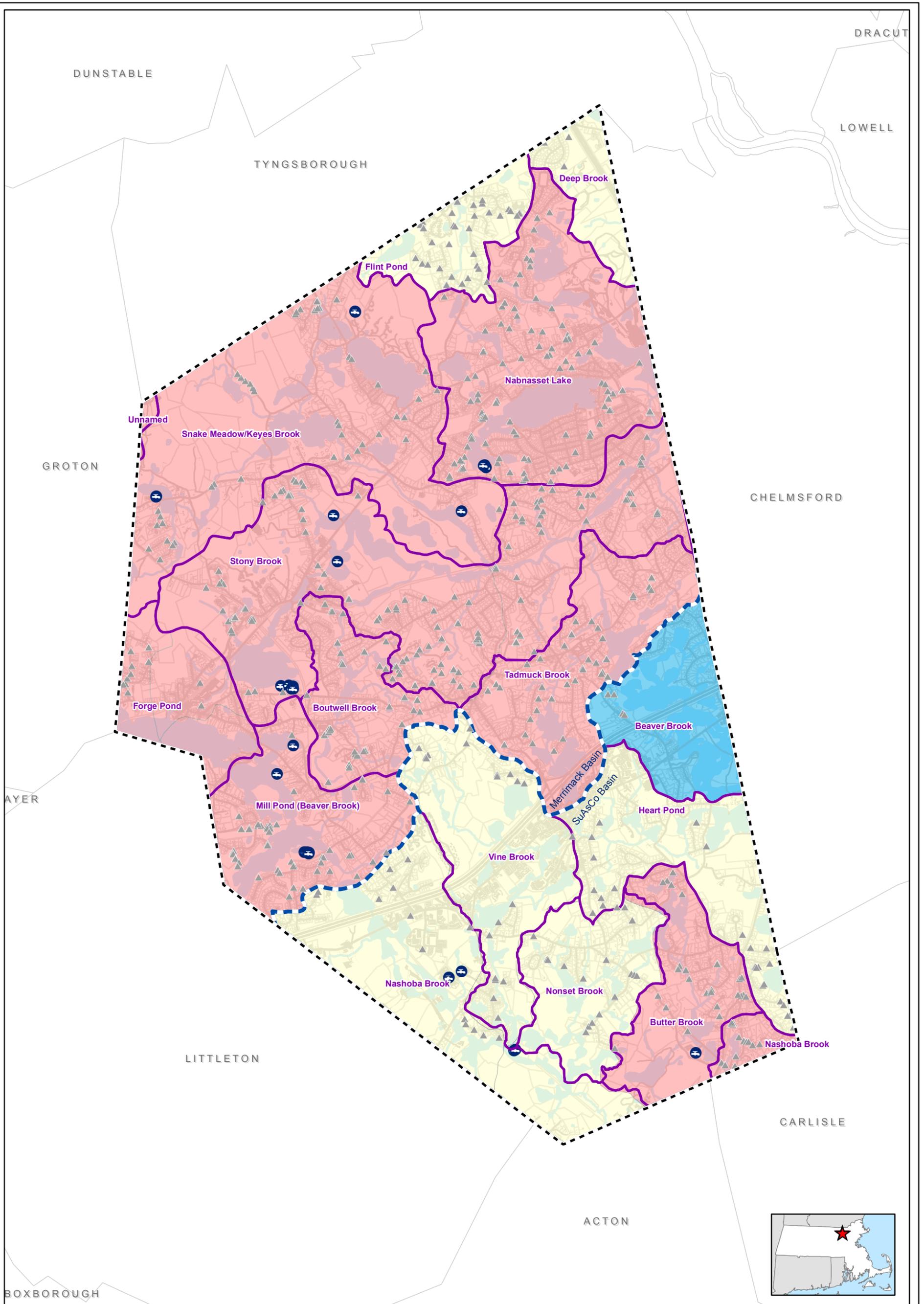
Within these districts, Westford prohibits uses that may threaten the aquifer and limits some land uses to a special permit from the Planning Board. These local Water Resource Protection Overlay Districts are shown on Figure 2-10.

In November 2014, MassDEP revised the WMA regulations (310 CMR 36.00) to implement the State's SWMI framework, which significantly changes the WMA permitting process and formally links water withdrawals to the Town's stormwater management program. SWMI sets a baseline withdrawal volume for water suppliers based on the 2003 to 2005 reported water withdrawals, and then requires mitigation for withdrawals above that baseline in the next 20-year permit period and minimization of other impacts. Mitigation can include recharging wastewater, stormwater, or indirect activities that improve habitat and streamflow. Minimization includes modifying withdrawal operations, such as changing the timing of withdrawals or shifting operations between wells as needed seasonally, using alternative sources such as interconnections, releasing water from impoundments, and implementing enhanced water conservation measures.

The Groundwater Withdrawal Category (GWC) of each subbasin in the Commonwealth was determined by MassDEP based upon the estimated percent alteration of the subbasin's "unaffected" August median flow. The Biological Category (BC) is based on estimated impervious cover, channel slope, percent wetland in the buffer zone of the river, and percent of August streamflow that is pumped as groundwater. Categories range from 1 (least impacted) to 5 (most impacted). Figure 2-11 shows the SWMI subbasins and the GWC by depletion within the Town of Westford. The Subbasin Profiles included in Appendix B also indicate the SWMI GWC and BC for each subbasin.

To meet the new WMA regulations and the SWMI framework, the Westford Water Department will have to complete extensive planning efforts as part of the permit implementation process. A key component of this planning will include considerations for recharging groundwater by collecting and infiltrating stormwater runoff, and targeting the subbasins with more severe groundwater issues for recharge.

The Town may take credit under SWMI for their local stormwater management bylaw that includes recharge requirements, developing a stormwater utility that results in increased recharge to groundwater, and/or implementing requirements of EPA's MS4 General Permit in a manner that also increases groundwater recharge.



|  |  |  |                                   |  |  |  |
|--|--|--|-----------------------------------|--|--|--|
| <b>Legend</b><br><ul style="list-style-type: none"> <li>▲ Outfalls</li> <li>● Public Water Supplies</li> <li>☁ Ponds</li> <li>~ Rivers and Streams</li> <li>■ Impervious Surface</li> <li>- - - Town Boundary</li> <li>▬ Major Basin Boundary</li> <li>▭ Sub-basin Boundary</li> </ul> |  | <b>SWMI Groundwater Category</b><br><ul style="list-style-type: none"> <li>Category 2 (&gt;3 - 10%)</li> <li>Category 3 (&gt;10% - 25%)</li> <li>Category 5 (&gt;55%)</li> </ul> | 1:48,000<br>0 2,000 4,000<br>Feet |  | <b>FIGURE 2-11</b><br><b>SWMI SUBBASINS AND</b><br><b>GROUNDWATER CATEGORY</b><br>Westford, Massachusetts<br>June 2015 |  |
|--|--|--|-----------------------------------|--|--|--|

## Section 2 Assessment of Existing and Future Conditions

### 2.3.3 Surface Water Quality

Westford is a water-rich community, and the waterbodies that receive stormwater runoff include lakes, ponds, rivers, streams, and wetlands. Water quality in many of Westford's surface waters has been monitored and recorded by various groups, including the Town, stream teams, watershed organizations, and MassDEP. Monitoring the health of the Town's water bodies has been important to residents to protect quality of life, recreational opportunities, habitat, and drinking water. As described in this section, although there are some areas for concern, the Town has been proactive in managing its water resources, which has mitigated some of the potential impacts of continued growth.

#### Stream Team Sampling

The Westford Stream Team is a group of dedicated volunteers that have conducted water quality monitoring of streams and brooks within the Town since 2005. In recent years, the sampling sites included the following brooks in the Nashoba Brook Subbasin:

1. Butter Brook at Route 27
2. Nashoba Brook at Texas Road
3. Vine Brook at Trailside Way
4. Nashoba Brook at Powers Road

The sampling sites in the Stony Brook Subbasin are located at the following brooks:

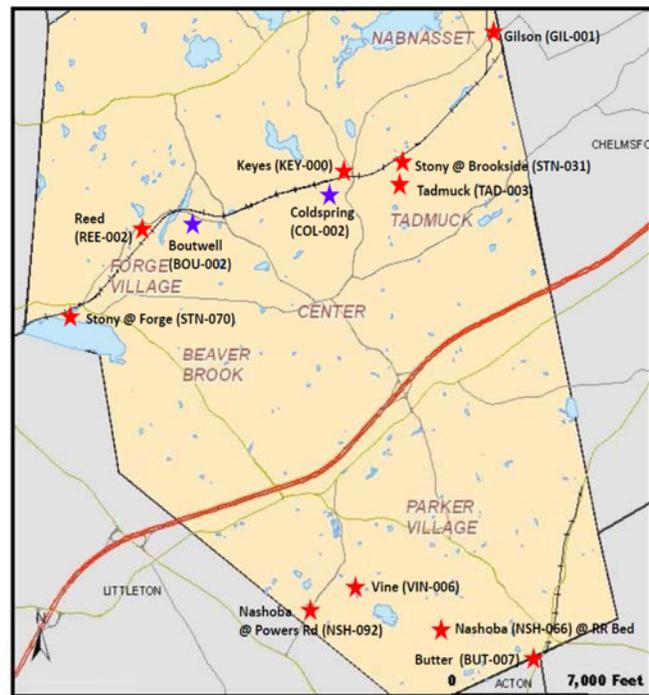
1. Stony Brook at Forge Pond
2. Reed Brook
3. Keyes Brook
4. Tadmuck Brook
5. Stony Brook at Brookside Mill
6. Gilson Brook

In 2014, two new sampling locations in Boutwell Brook and Coldspring Brook were introduced.

Figure 2-12 presents a map of sampling locations prepared by the Stream Team. The Stream Team samples multiple times per year. In the past few years, the group has sampled the standard locations anywhere between three to seven times in a year.

The Stream Team records temperature, dissolved oxygen (DO), conductivity, and pH using a YSI meter and collects samples for delivery to a certified laboratory for analysis of total and ortho-phosphorus, and nitrates. In some years, total suspended solids (TSS) were also analyzed.

In addition, the Stream Team conducts "special studies" to follow up on specific findings from the previous year of sampling. For example, in 2013, to address concerns about high phosphorus concentrations and low pH levels, the Stream Team conducted a special



**Figure 2-12: Stream Team Monitoring Locations**

## Section 2 Assessment of Existing and Future Conditions

study on Vine Brook. Throughout May and June the group sampled at various sites along the brook and its tributary to determine phosphorus, conductivity, pH, dissolved oxygen, and nitrate levels.

In 2014, two special case studies for Reed Brook and a small tributary to Vine Brook were also completed. The Stream Team was concerned about high nitrates in Reed Brook, and very low pH was previously observed in the tributary to Vine Brook. The Reed Brook study determined the approximate location of the source of high nitrates, and eliminated playing fields from the prospective sources. The Vine Brook tributary study concluded that the combination of low flow and a high quantity of leaves (and therefore a greater concentration of tannic acid) produces naturally occurring low pH. This was determined by sampling with meters at six locations along the tributary.

The Stream Team planned to monitor all named streams in Westford during 2015, and conduct a special study along Coldspring Brook to attempt to determine the cause of high nutrient levels.

The Stream Team's efforts over the past ten years provide the Town with baseline water quality information and information on trends, particularly related to nutrients. The Subbasin Profiles included in Appendix B provide an overview of monitoring work completed by the Stream Team within each subbasin.

### Healthy Lakes and Ponds Initiative

ESS Group, Inc. (ESS) was contracted by the Town in 2014 to prepare a Lakes and Ponds Management and Preservation Program Plan (Lakes Management Plan) for the nine ponds located within the Town that offer some degree of public access and use. Westford's lakes and ponds are shown in Figure 2-13. All were included in the Plan except Greystone, Gilson Brook, and Flushing Ponds. The goals of this Plan were to:

1. Provide for the ongoing **assessment of the health** of the ponds;
2. Identify any **threats or issues** which may compromise the short-term or long-term health of the ponds; and
3. Develop recommendations for management strategies and/or future studies that will **ensure the preservation** and/or enhancement of the ponds.

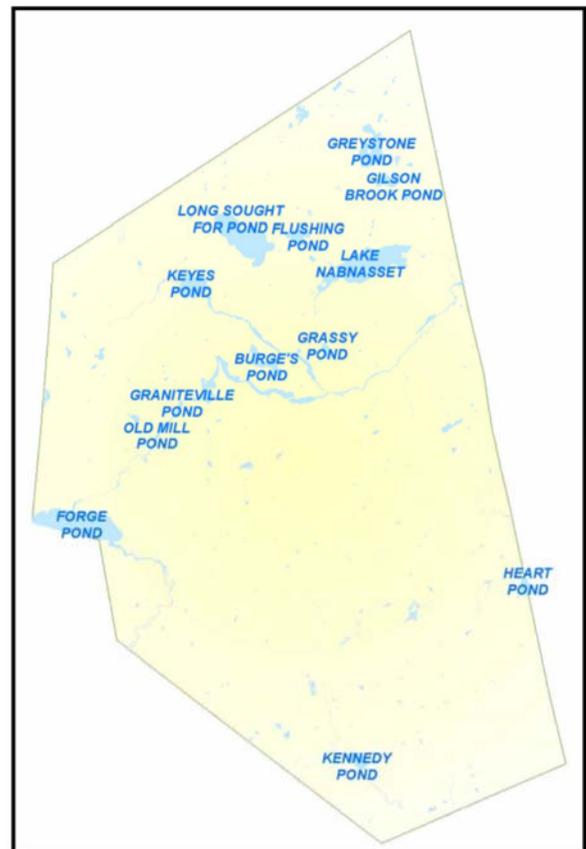


Figure 2-13: Westford's Lakes and Ponds

## Section 2 Assessment of Existing and Future Conditions

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Of the nine ponds included in the Lakes Management Plan, five ponds had not previously been formally studied or managed, including:

1. Keyes Pond,
2. Burge's Pond,
3. Grassy Pond,
4. Old Mill/Graniteville Pond, and
5. Kennedy Pond.

The assessment of these ponds included water quality sampling (conducted during the spring and summer), aquatic plant surveys (conducted during the summer), and zooplankton and phytoplankton sampling (conducted during the summer). **The focus of this study was to characterize the condition of each lake and pond, however, the study did not include evaluation of the watershed, non-point sources of pollution, or other causes of the degraded condition.**

Based on the results of the field-based assessment, the overall condition of each of the five previously unstudied ponds was classified as *Excellent*, *Good*, *Fair*, or *Poor*. Among the five ponds, the overall condition (including water quality and biological conditions) was as follows:

- Keyes, Burge's, and Old Mill/Graniteville Ponds were classified as *Fair*. Each will need additional management attention to ensure that ecological and recreational value do not continue to degrade.
- Grassy and Kennedy Ponds were classified as *Good* and do not appear to face an immediate threat. Therefore, minimal management, primarily in the form of monitoring, is currently necessary to preserve the condition of these ponds.

Ongoing monitoring was recommended for each of the five previously unstudied ponds to track overall conditions, provide early detection of future invasive species or other emerging management issues, and provide for periodic evaluation of trends and updates to the monitoring or management program. Volunteer education and monitoring through the Massachusetts Weed Watchers program and Westford Stream Team was also encouraged. Of the nine ponds included in the Lakes Management Plan, four ponds in the Lakes Management Plan had previously been studied and/or managed, including:

1. Long Sought for Pond,
2. Nabnasset Lake,
3. Forge Pond and
4. Heart Pond.

**An additional action recommended for all ponds is undertaking an initial stormwater assessment study to identify opportunities to reduce loading of sediments and nutrients from stormwater sources watershed.**

## Section 2 Assessment of Existing and Future Conditions

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The Town provided ESS with existing reports on the four previously studied ponds, and the information reviewed indicated that each of the ponds has faced some significant management challenges, including aquatic invasive species and, in some cases, algae blooms or other water quality issues. However, **pond-specific water quality and aquatic plant monitoring programs are already in place and tailored to the management needs of each pond**. Therefore, the primary recommendation for these ponds is that the management and monitoring programs continue to be implemented and periodically updated or expanded to address the management challenges and maintain or improve water quality.

The Lakes Management Plan *Five Year Management Plan Summary* is included in Appendix D. The Subbasin Profiles included in Appendix B summarize results from work completed in waterbodies within each subbasin under the Healthy Lakes and Ponds Initiative.

### Impaired Waterbodies

The objective of the Federal Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. As a step to reach this goal, under Section 305(b) of the CWA, MassDEP is tasked with monitoring and assessing the quality of waters of Massachusetts, and to evaluate whether the water bodies can support designated uses. Designated uses include aquatic life support, fish and shellfish consumption, drinking water supply, and primary (e.g., swimming) and secondary (e.g., boating) contact recreation as identified in the State Surface Water Quality Standards (314 CMR 4.00). Under Section 303(d) of the CWA, the State is required to identify those waterbodies that are *Impaired* (not expected to meet surface water quality standards and designated uses after the implementation of technology-based controls) and develop a plan and schedule to bring the impaired waters back into compliance with the water quality standards through a Total Maximum Daily Load (TMDL), which is further discussed in the next section. The Integrated List of Waters identifies specific segments of each water body based on the following categories:

- Category 1 Waters – “Waters attaining all designated uses”
- Category 2 Waters – “Attaining some uses; other uses not assessed”
- Category 3 Waters – “No uses assessed”
- Category 4a Waters – “TMDL is completed”
- Category 4b Waters – “Impairment controlled by alternative pollution control requirements”
- Category 4c Waters – “Impairment not caused by a pollutant”
- Category 5 Waters – “Waters requiring a TMDL”



**Figure 2-14: Stony Brook**

Source: Mary Lyman, Westford Conservation Trust

## **Section 2 Assessment of Existing and Future Conditions**

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Water bodies identified as Category 5 waters on the Integrated List are equivalent to the “303(d) list” of water quality impaired waters under the Clean Water Act.

The Final Massachusetts Year 2014 Integrated List of Waters was approved by EPA in February 2016.

Waterbodies within Westford, their category on the Final 2012 Integrated List and Final 2014 Integrated List, respective impairments (pollutants of concern), and State water body classification are listed in the table included in Appendix E. Category 5 (impaired) and Category 4a (TMDL complete) waterbodies are also shown on Figure 2-15. The Subbasin Profiles included in Appendix B list impaired waterbodies within each sub-basin and associated pollutants of concern.

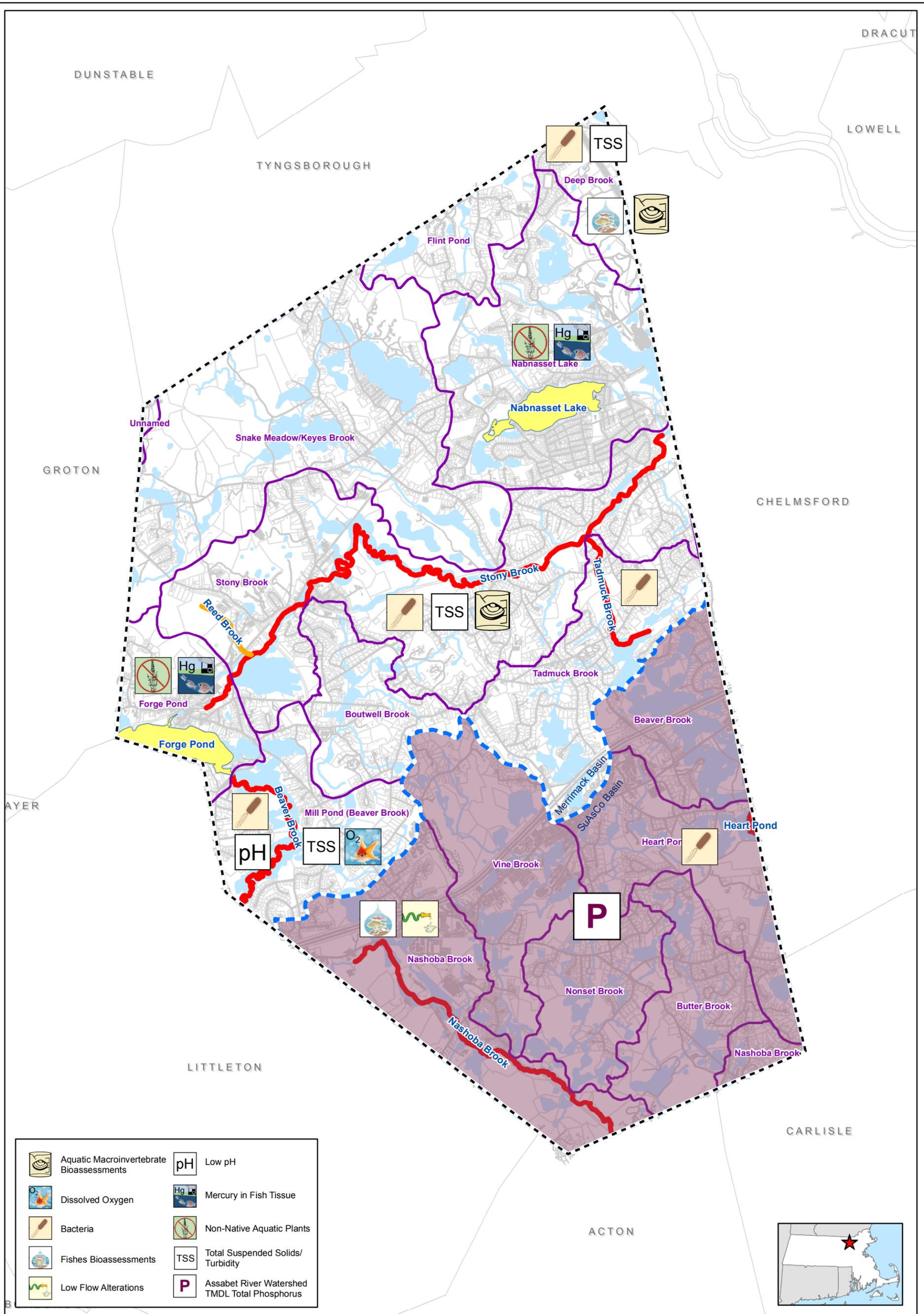
### **Total Maximum Daily Loads**

Once a body of water is identified as a Category 5 water body on the Integrated List of Waters, MassDEP is required by the CWA to develop a “pollution budget” designed to restore the health of the impaired body of water. The process of developing this budget, generally referred to as a TMDL, includes identifying the source(s) of the pollutant from direct discharges (point sources) and indirect discharges (non-point sources), determining the maximum amount of the pollutant that can be discharged to a specific water body to meet water quality standards, and assigning pollutant load allocations to the sources.

This section discusses the applicable TMDLs for all receiving water bodies in Westford by major watershed: the Merrimack River Watershed, which covers the northern portion of Town, and the Concord River Watershed, which covers the southern portion of Town. Watershed delineations are shown on Figure 2-15. Watersheds were previously described in Section 2.3.1. The Subbasin Profiles included in Appendix B list draft and final TMDLs within each sub-basin and associated pollutants of concern.

#### *Merrimack River Watershed*

A Draft Pathogen TMDL was developed for the Merrimack River Watershed, which applies to the 303(d) listed segments of Stony Brook and Beaver Brook in Westford, and to Tadmuck Brook in the finalized 2014 Integrated List of Waters. Waterborne pathogens, such as disease-causing bacteria, viruses, and protozoa, can be difficult to identify and isolate, so non-pathogenic bacteria are used as easily measurable indicators of contamination from sewage or feces of warm-blooded wildlife (birds and mammals). The TMDL establishes indicator bacteria limits for fecal coliform and outlines corrective actions to achieve these limits. Table 2-5 presents the waste location allocation and load allocation limits for various pathogen sources for applicable waterbodies in Westford. It is important to note that these fecal coliform limits were established based on the Surface Water Quality Standards in effect at the time of release of the draft TMDL, and have since been updated. The new water quality standards are for *E. coli* and are reflected in Table 2-5.



|  |  |  |   |
|--|--|--|---|
|  | Aquatic Macroinvertebrate Bioassessments |  | Low pH  |
|  | Dissolved Oxygen                         |  | Mercury in Fish Tissue                        |
|  | Bacteria                                 |  | Non-Native Aquatic Plants                     |
|  | Fishes Bioassessments                    |  | TSS Total Suspended Solids/Turbidity          |
|  | Low Flow Alterations                     |  | Assabet River Watershed TMDL Total Phosphorus |

**Legend**

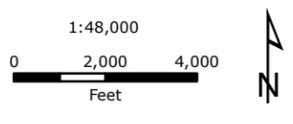
- ▲ Outfalls
- ▭ Ponds
- Rivers and Streams
- ▭ Impervious Surface
- Town Boundary
- Major Basin Boundary
- Sub-basin Boundary
- ▭ Assabet River Watershed

**2014 Impairments - Ponds**

- ▭ Category 4A - TMDL Complete
- ▭ Category 5 ("303(d)")

**2014 Impairments - Rivers and Streams**

- Category 2
- Category 5 ("303(d)")



Note: Impairments shown are from Proposed 2014 Massachusetts Integrated List of Waters are not yet finalized as of the date of this map, but are expected to be accepted by the EPA.

**FIGURE 2-15  
IMPAIRED WATERBODIES  
AND TMDLS**

Westford, Massachusetts

April 2016

## Section 2 Assessment of Existing and Future Conditions

**Table 2-5  
Sources and Expectations for Limiting Bacterial Contamination in the Merrimack River Watershed**<sup>11</sup>

| <b>Pathogen Source</b>  | <b>Waste Load Allocation Indicator Bacteria (CFU/100 mL)</b> <sup>12</sup>   | <b>Load Allocation Indicator Bacteria (CFU/100 mL)</b> <sup>12</sup>   |
|---|--|--|
| Illicit discharges to storm drains  | 0  | N/A  |
| Leaking sanitary sewer lines  | 0  | N/A  |
| Failing septic systems  | N/A  | 0  |
| Stormwater runoff Phase I and II  | The geometric mean of all E. coli samples taken within the most recent six months shall not exceed 126 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 235 colonies per 100 ml <sup>13,14</sup> | N/A  |
| Direct storm water runoff not regulated by NPDES and livestock, wildlife & pets | N/A  | The geometric mean of all E. coli samples taken within the most recent six months shall not exceed 126 colonies per 100 ml typically based on a minimum of five samples and no single sample shall exceed 235 colonies per 100 ml <sup>13,14</sup> |

The Draft Pathogen TMDL for the Merrimack River has identified leaking sewer pipes, illicit connections to the municipal separate storm sewer system (MS4), sanitary sewer overflows (SSOs), failing septic systems, recreational activities, and wildlife and domesticated animals as potential sources of disease-causing pathogens.<sup>15</sup>

### Sudbury-Assabet-Concord (SuAsCo) River Watershed

As shown on the Figure 2-15, there are two impaired waterbodies in Westford within the SuAsCo River watershed: Nashoba Brook and Heart Pond. There are no draft or Final TMDLs that apply to Nashoba Brook, but MassDEP and EPA recommends that the information contained in the Final Total Phosphorus TMDL for the Assabet River and the Draft Pathogen TMDLs for the Concord River Watershed, which apply to waterbodies downstream of Westford, guide management activities for other waters throughout the watersheds to help maintain and protect existing water quality. As development in the Nashoba Brook watershed continues, it is possible that stormwater runoff, septic tanks, and illicit MS4 connections may contain phosphorus and pathogens and lead to degradation of water quality.

However, the Draft Pathogen TMDL for the Concord River Watershed applies to Heart Pond. Much like the Draft Pathogen TMDL for the Merrimack River Watershed, the TMDL

<sup>11</sup> This table represents waste load and load reductions based on current water quality standards. Any future changes made to the Massachusetts water quality standards will become the governing water quality standards for these TMDLs.

<sup>12</sup> For Class B waterbodies

<sup>13</sup> The expectation for WLAs and LAs for stormwater discharges is that they will be achieved through the implementation of BMPs and other controls.

<sup>14</sup> Previous water quality standard was for Fecal Coliform bacteria, and therefore TMDL was "Not to exceed a geometric mean of 200 organisms in any set of representative samples, nor shall 10% of the samples exceed 400 organisms"

<sup>15</sup> Draft Pathogen TMDL for the Merrimack River Watershed

establishes limits for indicator organisms (fecal coliform, E. coli, and enterococcus bacteria) and outlines corrective actions to achieve these limits. The waste load and load allocations for the Concord River Draft Pathogen TMDL match those of the Merrimack River Watershed as presented in Table 2-5, and therefore a redundant table is not included in this report.

## 2.4 Conclusions: Future Drivers for an Enhanced Program

To characterize future conditions expected within the next 20 years, Tighe & Bond took advantage of the land use, population, development, and economic growth trends identified in the 2009 *Westford Comprehensive Master Plan*. We updated each Subbasin Profile with projections for future conditions, focusing on changes in land use, increased impervious cover, change in runoff and recharge, additional infrastructure needs, and impacts on water quality and quantity.

There are three interconnected, emerging trends that will impact stormwater and water resources management during the planning period:

- Continued growth and development in Westford;
- Increased imperviousness due to development and redevelopment of land; and
- Higher temperatures and more intense storms due to climate change.

This section discusses the need for enhanced stormwater management to mitigate the impacts of these factors on Westford's water resources.

### 2.4.1 Population, Development, and Economic Growth

As previously discussed in Section 2.1, Westford's population has grown quickly during the second half of the twentieth century and is expected to continue growing at a more modest pace through the next 15 years. As the population and economy grow, the Town will continue developing to accommodate the influx of residents and businesses. This development will lead to changes in land use and the Town's infrastructure.

**Water, Sewer, and Drainage Infrastructure:** With increased land development, more impervious surfaces, roadways, and drainage infrastructure will be added to the Town. This may overwhelm carrying capacity of existing stream channels, drainage structures, pipes, or culverts, resulting in localized flooding. This also adds to the Town's operation and maintenance burden, due to the need to maintain new drainage systems, upgrade aging infrastructure, and sweep new roads.

Increased population density, particularly near sensitive receptors, may drive the Town to consider centralized wastewater treatment options. Onsite wastewater disposal may no longer provide adequate treatment to protect drinking water and surface water.

**Demand for Potable Water:** As the population approaches 25,000 and businesses locate to Westford, there will be an increasing need for residential and possibly industrial or commercial use of potable water. This will put more pressure on Westford's aquifer, requiring mitigating measures to recharge uncontaminated groundwater, as well as water conservation efforts like reuse and xeriscaping.

## Section 2 Assessment of Existing and Future Conditions

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**Land Development and Redevelopment:** Continued development and redevelopment will add to the Town's impervious surfaces. Public safety concerns and a desire for walkable neighborhoods may push the Town toward widening roads and adding sidewalks, further increasing impervious cover. The current extent and impact of impervious cover in the Town's watersheds is discussed below, as well as opportunities to control and mitigate this trend.

### 2.4.2 Impervious Cover

Tighe & Bond assessed impervious cover in the subbasins within Merrimack River and Sudbury-Assabet-Concord River watersheds. Tighe & Bond used impervious cover as a surrogate for overall watershed health, based on the Center for Watershed Protection's Impervious Cover Model. Table 2-6 includes the percent impervious surface and associated ICM basin status in each subbasin. The total impervious cover percentages in the Merrimack River and Sudbury-Assabet-Concord River watersheds are approximately 9% and 10%, respectively. Most of the subbasins have around 10% impervious cover. Watersheds with about 10% impervious cover are relatively healthy, but sometimes signs of stream erosion and loss of good habitat are apparent.

Impacted basins with 10% to 25% impervious cover generally have fair stream quality. Impacted basins are identified by yellow shading in Figure 2-16. While these subbasins are on the lower end of the "impacted" basin imperviousness range, they are the most densely developed areas within Town. As a basin becomes increasingly impervious, stream erosion is worsened, bank vegetation is limited, and habitat to support aquatic life is substantially diminished.

In basins with less than 5% impervious cover, streams are typically healthy and pristine, provide a variety of habitats, maintain a diverse aquatic ecosystem, and have good tree coverage. The subbasins that have between 5% and 10% impervious cover are considered sensitive basins and generally have fair to good stream quality. Subbasins that have between 10% and 25% impervious cover are considered impacted and generally have fair to poor stream quality. For planning purposes, Tighe & Bond has set a target maximum impervious cover of 10-15% for each subbasin. In terms of habitat quality and stream biodiversity, there is a sharp decline beyond 15% imperviousness.<sup>16</sup> Figure 2-16 shows the status of each basin in the context of the Impervious Cover Model. The Subbasin Profiles included in Appendix B include total acres of impervious cover within each subbasin, the percent of the subbasin area that is impervious, and associated ICM basin status (i.e. sensitive, impacted, damaged, or severely damaged).

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<sup>16</sup> Schueler, 2000.

## Section 2 Assessment of Existing and Future Conditions

**Table 2-6  
Impervious Cover by Subbasin**

| Subbasin                                       | % Impervious Surface | ICM Basin Status |
|--|----------------------|------------------|
| <b>Merrimack River Watershed</b>               |                      |                  |
| Stony Brook (Main Stem)                        | 8.76%                | Sensitive        |
| Boutwell Brook                                 | 10.41%               | Impacted         |
| Snake Meadow/Keyes Brook                       | 4.91%                | Sensitive        |
| Tadmuck Brook                                  | 11.35%               | Impacted         |
| Nabnasset Lake                                 | 12.23%               | Impacted         |
| Mill Pond (Beaver Brook)                       | 8.17%                | Sensitive        |
| Forge Pond                                     | 11.82%               | Impacted         |
| Flint Pond                                     | 8.35%                | Sensitive        |
| Deep Brook                                     | 8.76%                | Sensitive        |
| <b>Sudbury-Assabet-Concord River Watershed</b> |                      |                  |
| Nashoba Brook (Main Stem)                      | 11.32%               | Impacted         |
| Vine Brook                                     | 12.01%               | Impacted         |
| Nonset Brook                                   | 5.00%                | Sensitive        |
| Heart Pond                                     | 12.91%               | Impacted         |
| Beaver Brook                                   | 9.12%                | Sensitive        |
| Butter Brook                                   | 6.87%                | Sensitive        |

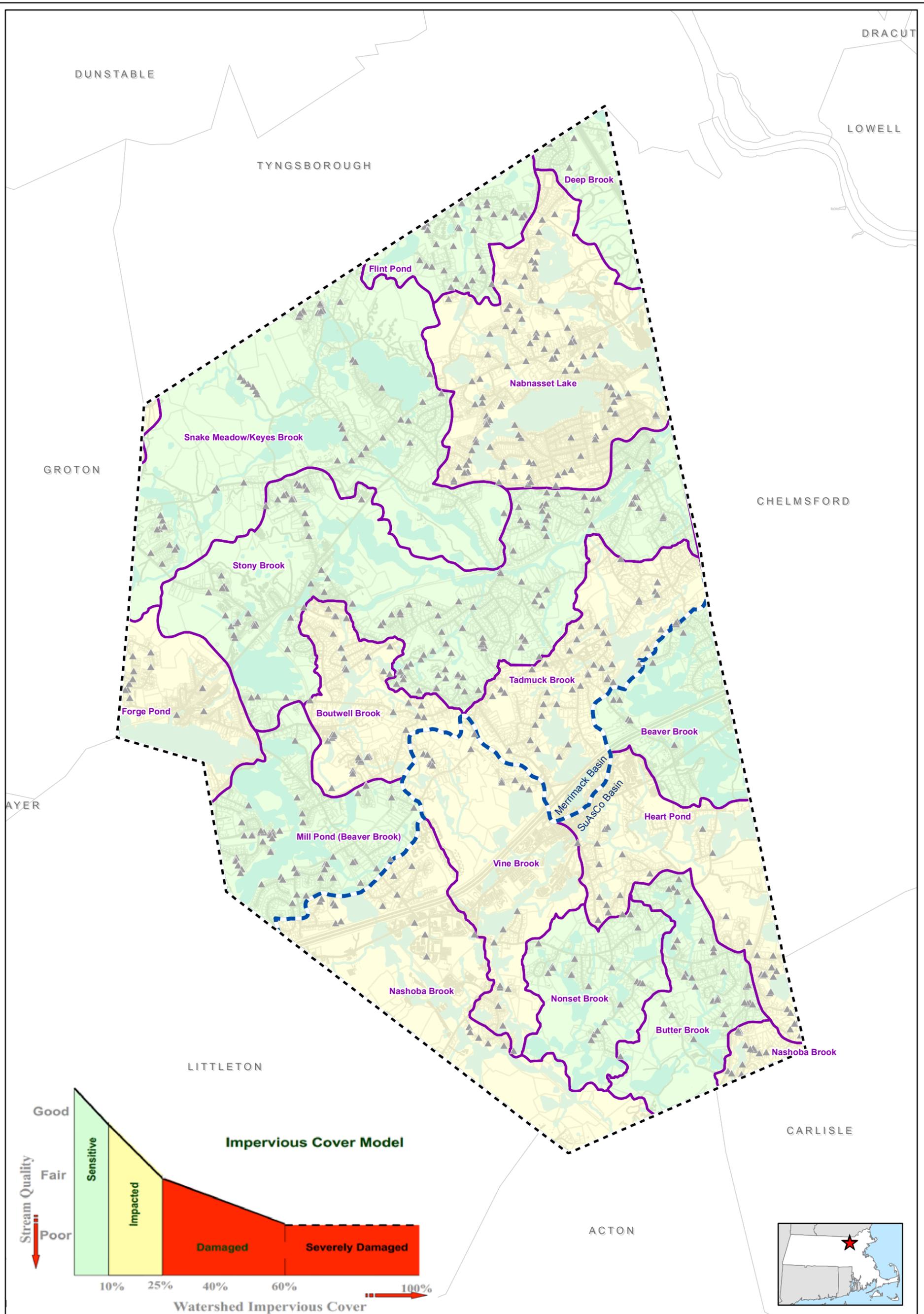
To maintain this threshold, a combination of open space reduction and better site design for development projects will need to be employed. Additionally, through the use of green stormwater infrastructure techniques that infiltrate and filter runoff from impervious areas, the amount of effective impervious cover can be reduced. Tighe & Bond's structural, non-structural, and regulatory recommendations to mitigate the effects of development and redevelopment are detailed in the Long-Term Capital Improvement Plan (CIP) in Volume 2, and NPDES Stormwater Program Compliance Plan in Volume 4.

### 2.4.3 Climate Change

To paraphrase from the *Massachusetts Climate Change Adaptation Report* from September 2011:

*It is widely accepted by the scientific community that the increased amount of emissions from anthropogenically generated greenhouse gases, such as carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O), are contributing to changing climatic conditions. Peer-reviewed scientific projections and existing data and observations were examined and compiled in the following Table 2-7 to help define current conditions and the range of predicted climate changes in Massachusetts. Where available, Massachusetts-specific data were used for this report, but, for the most part, assessments and projected impacts developed for the northeast United States were used as a surrogate for impacts in Massachusetts.<sup>17</sup>*

<sup>17</sup> Massachusetts Executive Office of Energy and Environmental Affairs (EEA) and Adaptation Advisory Committee. *Massachusetts Climate Change Adaptation Report*. September 2011. URL: <http://www.mass.gov/eea/docs/eea/energy/cca/eea-climate-adaptation-report.pdf>

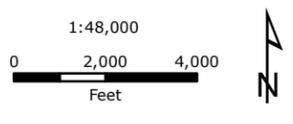


**Legend**

- ▲ Outfalls
- ☪ Ponds
- ~ Rivers and Streams
- Impervious Surface
- - - Town Boundary
- - - Major Basin Boundary
- ▭ Sub-basin Boundary

**Impervious Cover Model Status**

- Impacted
- Sensitive



**FIGURE 2-16 IMPERVIOUS SURFACE**

Westford, Massachusetts

March 2016



## Section 2 Assessment of Existing and Future Conditions

**Table 2-7  
Changes in Massachusetts' Climate<sup>18</sup>**

| Parameter   | Current Conditions (1961–1990) | Predicted Range of Change by 2050 |
|---|--------------------------------|-----------------------------------|
| Annual temperature <sup>1</sup> (°C/°F)   | 8/46                           | 2 to 3 / 4 to 5                   |
| Winter temperature <sup>1</sup> (°C/°F)   | -5/23                          | 1 to 3 / 2 to 5                   |
| Summer temperature <sup>1</sup> (°C/°F)   | 20/68                          | 2 to 3 / 4 to 5                   |
| Over 90 °F (32.2 °C) temperature <sup>2</sup> (days/yr)   | 5 to 20                        | —                                 |
| Over 100 °F (37.7 °C) temperature <sup>2</sup> (days/yr)  | 0 to 2                         | —                                 |
| Ocean pH <sup>3,4</sup>   | 7 to 8                         | —                                 |
| Annual sea surface temperature (°C/°F)  | 12/53 <sup>5</sup>             | 2/3 (in 2050) <sup>5</sup>        |
| Annual precipitation <sup>1</sup>   | 103 cm/41 in.                  | 5% to 8%                          |
| Winter precipitation <sup>1</sup>   | 21 cm/8 in.                    | 6% to 16%                         |
| Summer precipitation <sup>1</sup>   | 28 cm/11 in.                   | -1% to -3%                        |
| Streamflow—timing of spring peak flow <sup>1</sup><br>(number of calendar days following January <sup>1</sup> ) | 85                             | -5 to -8                          |
| Droughts lasting 1–3 months <sup>1</sup> (#/30 yrs)   | 13                             | 5 to 7                            |
| Snow days (number of days/month) <sup>1</sup>   | 5                              | -2                                |
| Length of growing season <sup>1</sup> (days/year)   | 184                            | 12 to 27                          |

Sources: 1-Hayhoe et al., 2006; 2-Frumhoff et al., 2007; 3-Intergovernmental Panel on Climate Change, 2007; 4-Massachusetts Water Resources Authority, unpublished; 5-Nixon et al., 2004

Note: All numbers have been rounded to the nearest whole number. Unless otherwise indicated, the predictions for the year listed as 2050 are for the period between 2035 and 2064.

Throughout development of the SWMMP, we recognize that climate change will be a factor for Westford to consider in their stormwater program. In the absence of a more robust climate study, we will generally consider the following in this section:

- What is the impact on Westford's groundwater and surface waters?
- Are current design standards sufficient for the future weather patterns (frequency, intensity, and duration of storms) in New England?
- Are existing drainage infrastructure and dams adequate for future weather patterns?

### Impacts on Groundwater and Surface Water

Given the changes predicted in Table 2-7, such as less snow pack, warmer temperatures, increased periods of drought, and more intense rainfall, coupled with continued development, we believe future conditions could result in:

- Changes to the water cycle that increase runoff and evaporation while reducing groundwater infiltration that feeds Westford's lakes, streams, and water supply;
- A larger volume, velocity, and duration of flow carries more pollutants from the land surface and intensifies the erosion and sediment transport from the landscape and stream banks;
- Stream channel alterations that impact habitat and impair the waterway's ability to accommodate large peak runoff volumes;
- Increased likelihood of more frequent and more severe flooding;
- Harmful algal blooms that occur more often and in more waterbodies (discussed further in the next section);

<sup>18</sup> EEA, 2011

## Section 2 Assessment of Existing and Future Conditions

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- Increased surface water temperatures that impact ecosystems; and
- More frequent periods of drought that increase demands on Westford's aquifer and stress ecosystems.

### Harmful Algal Blooms

Naturally-occurring cyanobacteria can develop into a Harmful Algal Bloom (HAB), or cyanobacteria that accumulate in great numbers, which produces toxins, reduces dissolved oxygen, and can alter aquatic ecosystems. On August 31, 2012 the beaches on Nabnasset Lake in Westford were closed due to high cyanobacteria levels resulting from algae blooms, as shown in the Figure 2-17. The Massachusetts Department of Public Health guidelines recommend that levels above 70,000 cells/mL should not be exceeded due to the potential negative health effects that may result in people and pets from exposure to cyanobacteria. Since levels reached 130,000 cells/mL, swimming in the lake was restricted.



**Figure 2-17: Algal Bloom at Nabnasset Lake**

Source: Westford Patch

Although there is much research to be done, scientists predict that climate change will have many effects on freshwater environments. These effects, along with nutrient pollution, might cause harmful algal blooms to occur more often, in more waterbodies, and to be more intense. Algal blooms endanger human health, the environment, and economies across the United States.<sup>19</sup> Climate change may favor harmful algal blooms in a number of ways:

- Harmful algae usually bloom during the warm summer season or when water temperatures are warmer than usual. Temperatures are expected to rise in the coming years, which promotes the growth of toxic blue-green algae that prefer warmer water.
- Larger and more extreme runoff events will lead to more nutrients being washed into receiving waters with stormwater runoff, which will increase the rate of algal blooms. This scenario will most likely occur if elevated winter to spring rainfalls are followed by extended periods of drought, which is predicted in the Westford area in future years.<sup>20</sup>
- Drought conditions reduce flow into receiving waters, which reduces mixing and therefore allows bacteria to accumulate and stay amassed more easily. Warmer temperatures also prevent water from mixing, allowing algae to grow thicker and faster.
- Algae need carbon dioxide to survive. Higher levels of carbon dioxide in the air and water can lead to rapid growth of algae, especially toxic blue-green algae that can float to the surface of the water.

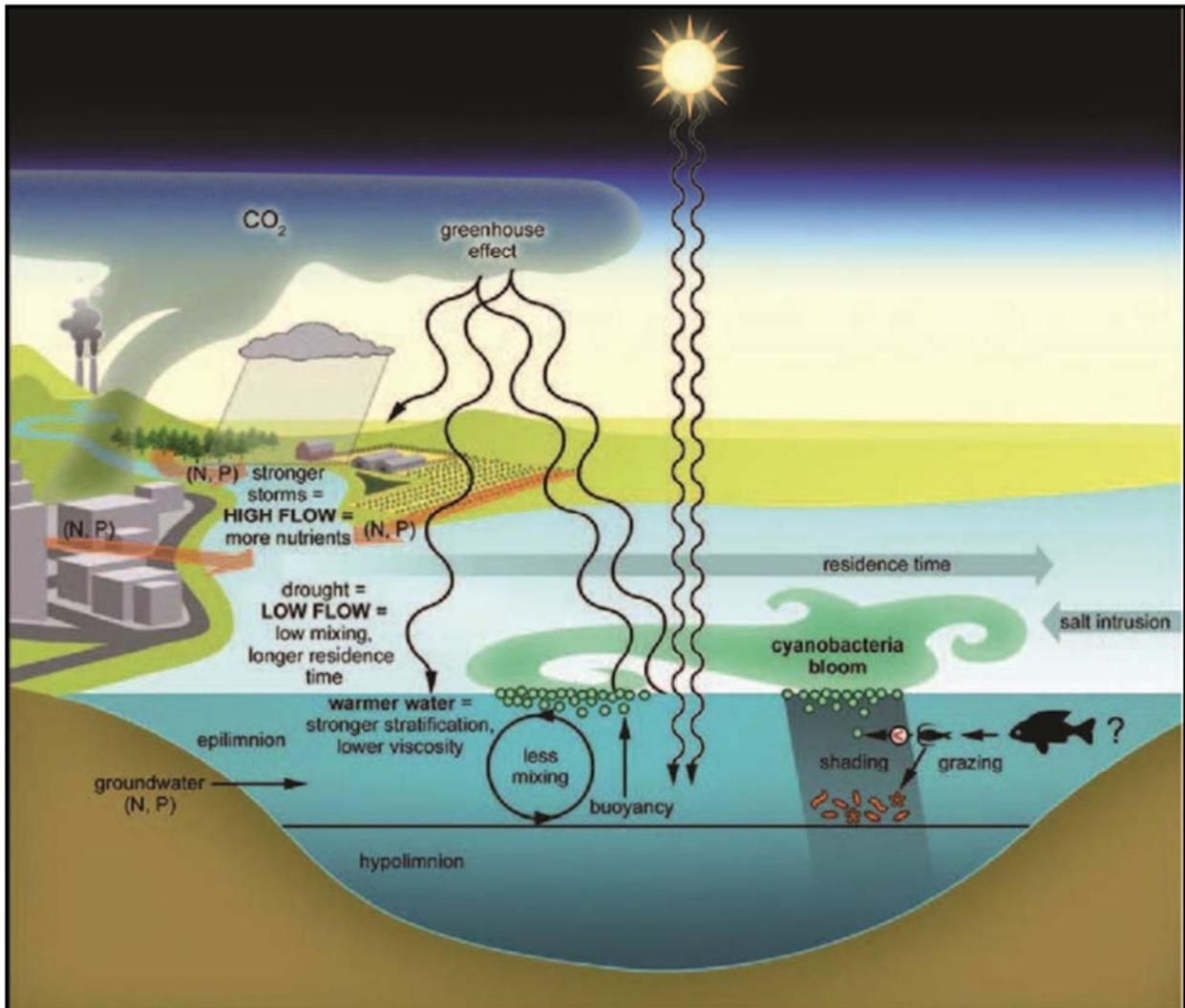
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<sup>19</sup> U.S. EPA. *Climate Change and Harmful Algal Blooms*. URL: <http://www2.epa.gov/nutrientpollution/climate-change-and-harmful-algal-blooms>.

<sup>20</sup> Huisman, J., Paerl, H.W. *Climate change: a catalyst for global expansion of harmful cyanobacterial blooms*. *Environmental Microbiology Reports*. 2009. 27–37.

## Section 2 Assessment of Existing and Future Conditions

Figure 2-18, from Huisman and Paerl's 2009 article, demonstrates the effects that climate change may have on cyanobacteria blooms.



**Figure 2-18: Environmental Controls of Cyanobacteria Blooms and the Effects of Climate Change on Them**

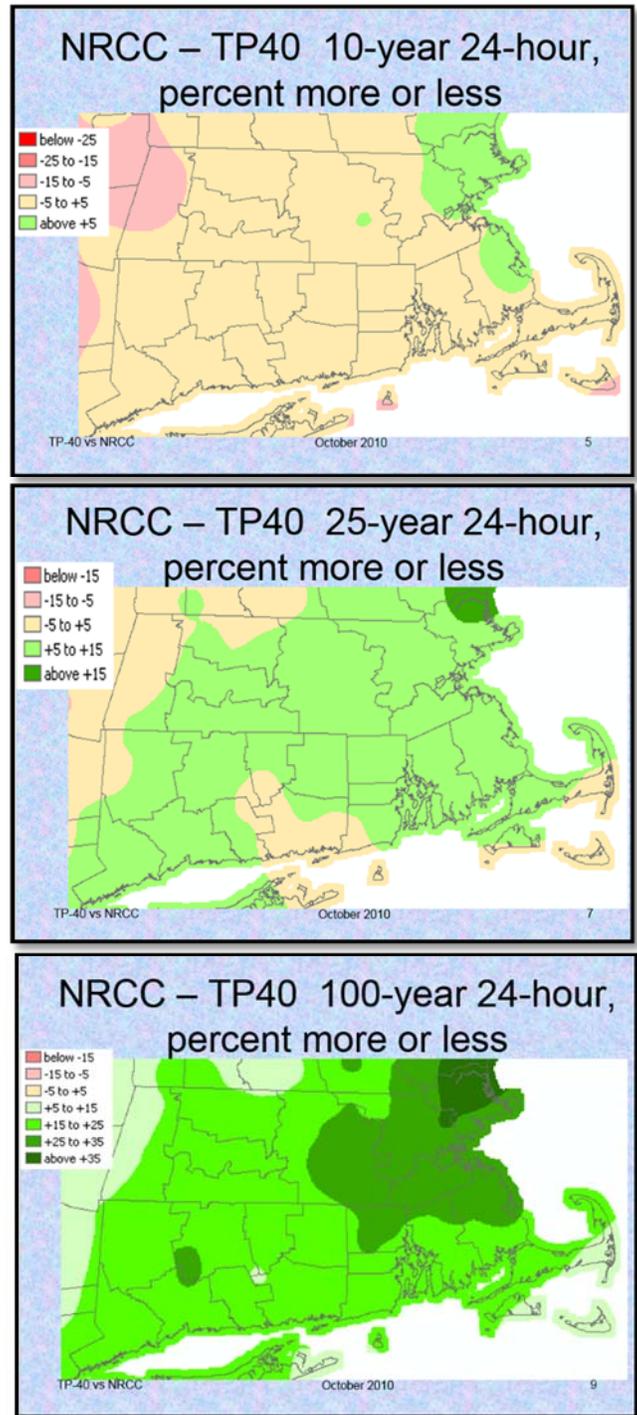
Source: Huisman and Paerl, 2009

**Local Stormwater Design Standards**

The Town of Westford, like many communities in Massachusetts, defer to the Massachusetts Stormwater Management Standards and Massachusetts Stormwater Handbook to govern drainage design and stormwater management standards for development and redevelopment projects locally permitted by the Conservation Commission or Planning Board. The Massachusetts Stormwater Handbook currently requires the use of the *Rainfall Frequency Atlas of the United States* or Technical Paper 40 (TP-40) for calculations under the Wetlands Protection Regulations and the Stormwater Management Policy. More stringent design storms may be used under a local bylaw or ordinance. However, TP-40 is almost universally used and widely accepted at this time.

TP-40 was initially published by the National Oceanic and Atmospheric Administration (NOAA) in 1961 using available rainfall information from the stations that existed at the time, which was far fewer than exist today. In recent years, there have been questions about whether TP-40 adequately projects rainfall depths given recent storms.

In 1993, Cornell University's Northeast Regional Climate Center (NRCC) published the *Atlas of Precipitation Extremes for the Northeastern United States and Southeastern Canada*. This atlas uses daily precipitation data from 1,473 stations within the study area only. Stations used were restricted to those with at least 30 years of records. Many consider these climatic maps better approximate conditions in New England that should be used instead of TP-40 for drainage design. In general, **NRCC data shows that less frequent, long duration storms are bigger than predicted in TP-40.** NRCC predicts less rainfall for most of the shorter duration (30 minute or 1 hour) storms from 1-year to 100-year return periods. The slides to the right were prepared by U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) in 2010 to compare and discuss select storm durations and return periods.



**Figure 2-19: NRCC and TP-40 Comparison for the 10-, 25-, and 100-year 24-hour storms**

Source: NRCS

## **Section 2 Assessment of Existing and Future Conditions**

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Due to uncertain future conditions and the lack of updated and widely accepted design storm information that accounts for climate change, the Town should continue to defer to the Massachusetts Stormwater Handbook. However, for projects where it is necessary to evaluate the impact of peak discharges from the 100-year 24-hour storm, the Town may wish consider NRCC rainfall amounts which are over 20% greater than TP-40 and may better protect downstream properties and Town infrastructure.

Other aspects of the Massachusetts Handbook are expected to help communities mitigate expected rainfall and increased temperature, such as use of wide-spread, small scale, decentralized stormwater treatment (i.e., green infrastructure and low impact development) and more stringent infiltration requirements. In the future, the Town may wish to implement additional requirements to mitigate thermal water pollution and the “urban heat island” effect, such as more vegetated areas (especially trees, green roofs, or cool roofs). This may be particularly useful to protect sensitive ecosystems such as Reed Brook, which has been designated as a Coldwater Fishery Resource.

### **Existing Drainage System Capacity**

To understand whether existing drainage infrastructure is adequate for future weather patterns, there is a great deal of additional work to be done to complete the drainage system inventory with pipe size, material, and condition. The Town has already identified culverts that are undersized and roadways that need to be brought to a higher elevation to accommodate today’s storms without causing flooding. This is further explained in Section 3.2 and recommendations to address this are included in Volumes 2 and 3.

The ongoing evaluation and repair of the Town’s dams is also critical. This work is part of the Town’s Long-Term Capital Improvement Plan (Volume 2). The Town must understand the risk and consequences of dam failure for downstream as well as upstream property owners.

### **Conclusions**

The combination of climate change and development will undoubtedly create additional demands and challenges for Westford’s water resources. Through proactive implementation of this Stormwater Management Master Plan, the Town will be able to gradually implement adaptation measures to mitigate many of the possible impacts on water quality and quantity.

# Section 3

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## Section 3

# Stormwater Program Responsibilities and Gap Analysis

### 3.1 NPDES Phase II (Small) MS4 Program

Through the National Pollutant Discharge Elimination System (NPDES) program, the U.S. Environmental Protection Agency (EPA) nationally regulates the discharge of stormwater runoff that is transported into local water bodies via Municipal Separate Storm Sewer Systems (MS4s). EPA's MS4 stormwater program was enacted in two phases:

- Phase I, issued in 1990, requires *medium* and *large* cities or certain counties with populations of 100,000 or more to obtain NPDES permit coverage for their stormwater discharges.
- Phase II, issued in 1999, requires regulated *small* MS4s in urbanized areas, as well as small MS4s outside the urbanized areas that are designated by the permitting authority, to obtain NPDES permit coverage for their stormwater discharges.

#### 3.1.1 Westford's Regulated Area

Urbanized Areas (also known as "regulated areas") are defined by the latest United States decennial census. On March 26, 2012, the Census Bureau published the final listing of urbanized areas for the 2010 census. An urbanized area encompasses a densely settled territory that consists of core census block groups or blocks that have a population of at least 1,000 people per square mile and surrounding census blocks that have an overall density of at least 500 people per square mile or are included to link outlying densely settled territory with a densely settled urban core.<sup>21</sup>

Figure 3-1 on the next page shows Westford's Urbanized Area based on the 2000 and 2010 census listings. **According to EPA Region 1, the area covered by both the 2000 census and the 2010 census are regulated by EPA under the MS4 program.** Therefore, Westford is considered nearly entirely regulated with the exception of the northwest corner of town.

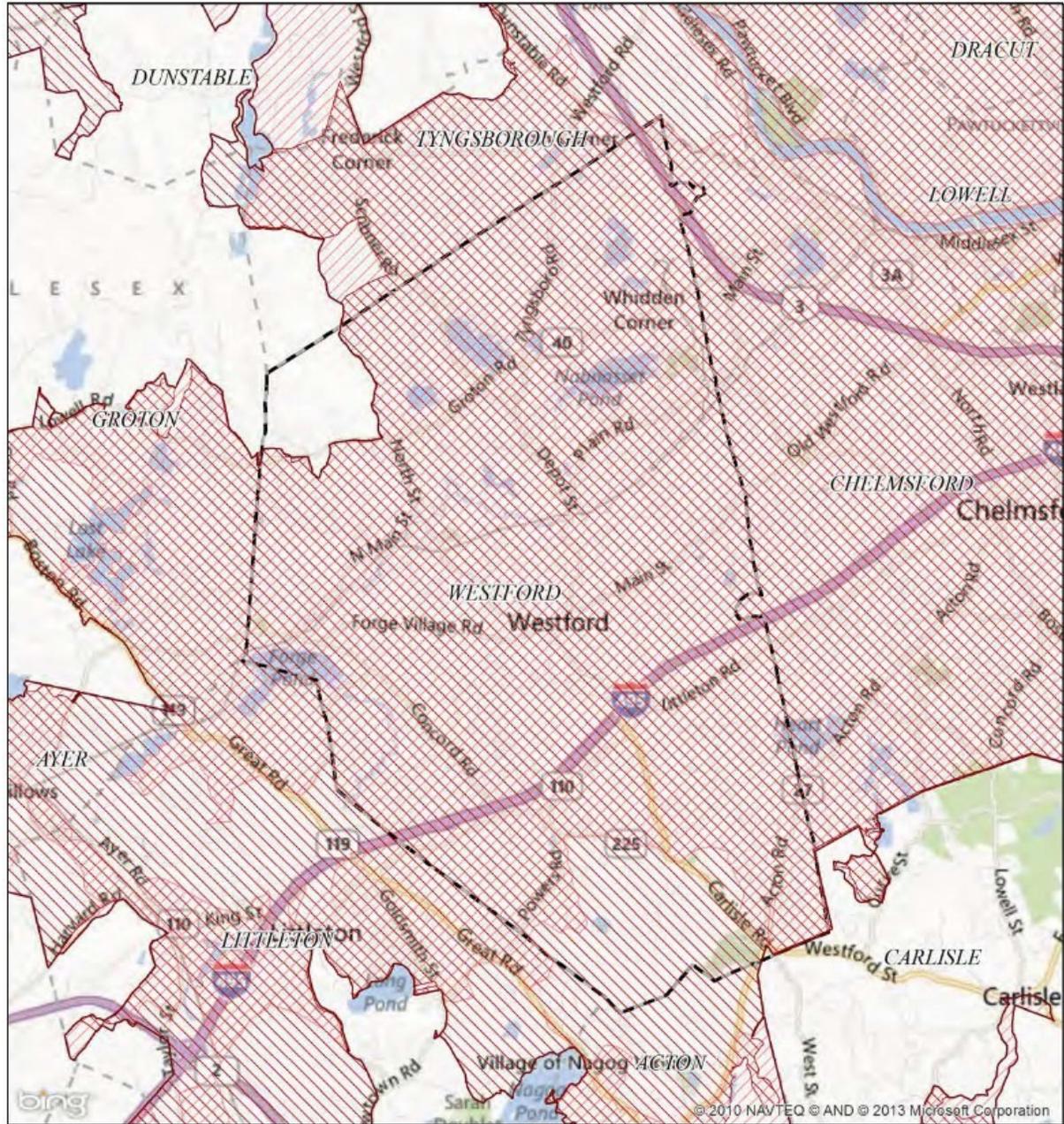
The Phase II regulations require a small MS4 to implement its program in the urbanized area. However, EPA encourages MS4s to implement the Storm Water Management Plan (SWMP) in the entire jurisdiction, especially for areas that discharge to waters that are subject to approved TMDLs.<sup>22</sup> For the ease of implementing this plan and to meet water quality goals, the Town will continue to address stormwater in the entire community.

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<sup>21</sup> U.S. EPA. *Fact Sheet: Draft General Permits for Stormwater Discharges From Small Municipal Separate Storm Sewer Systems in Massachusetts*. September 2014. For a complete definition of Urbanized Area see Federal Register, August 24, 2011. Vol. 76 No. 164 p. 53030. URL: <http://www2.census.gov/geo/pdfs/reference/fedreg/fedregv76n164.pdf>.

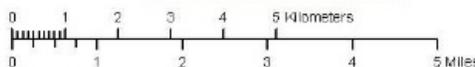
<sup>22</sup> U.S. EPA, 2014.

**Section 3 Stormwater Program Responsibilities and Gap Analysis**



**NPDES Phase II Stormwater Program  
Automatically Designated MS4 Areas  
Westford MA**

**Regulated Area:**



Town Population: **21797**  
Regulated Population: **21758**  
(Populations estimated from 2010 Census)



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

US EPA Region 1 GIS Center Map #0024, 6/9/2013

**Figure 3-1: EPA’s Regulated Area Map for Westford dated August 2013**

## **Section 3 Stormwater Program Responsibilities and Gap Analysis**

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### **3.1.2 2003 General Permit Requirements and Gap Analysis**

Since the Town of Westford meets EPA's regulatory threshold for a Phase II (small) MS4, the Town was required to obtain coverage under a NPDES permit for its stormwater discharges from the MS4 within its Urbanized Area.

In Massachusetts, the EPA Region 1 and the Massachusetts Department of Environmental Protection (MassDEP) jointly administer the municipal stormwater program, and authorize Westford to discharge stormwater under the 2003 *NPDES General Permit for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems*, known as the "Small MS4 General Permit." Under this permit, the Town has developed and implemented a SWMP to reduce the contamination of stormwater runoff. The Small MS4 Program contains six elements called *minimum control measures* that, when implemented, should result in a significant reduction in pollutants discharged into receiving waters. The minimum control measures are:

1. Public Education and Outreach;
2. Public Involvement and Participation;
3. Illicit Discharge Detection and Elimination (IDDE) Program;
4. Construction Site Stormwater Runoff Control;
5. Stormwater Management in New Development and Redevelopment; and
6. Good Housekeeping and Pollution Prevention.

Tighe & Bond reviewed the Town of Westford's current Stormwater Management Program using the EPA's 2003 Small MS4 General Permit, the Program Evaluation Worksheets included in Appendix B of EPA's *MS4 Program Evaluation Guidance*, and firsthand experience with compliance audits by EPA Region 1. The purpose of the evaluation was to identify and assess the stormwater management requirements the Town is currently addressing and make recommendations for program improvements. The following documents were reviewed as part of the evaluation:

- Town of Westford Stormwater Bylaw (Chapter 147: Stormwater Management), adopted May 9, 2008;
- Town of Westford Stormwater Regulations, November 5, 2012;
- Town of Westford Illicit Discharge Bylaw (Chapter 82: Discharges to the Municipal Storm Drain System) adopted May 9, 2008;
- Town of Westford NPDES Stormwater General Permit Notice of Intent, 2003;
- NPDES PII Small MS4 General Permit Annual Reports for the past five years (2010 – 2014);
- Other Town-provided stormwater Record Keeping files (e.g., Illicit Discharge Detection and Elimination and Training, Stormwater Sampling Manual, etc.).

Tighe & Bond met with Engineering and Highway staff to discuss initial findings and recommendations. The draft memorandum, *Summary of the Town of Westford's Current Stormwater Management Program*, was delivered to the Stormwater Advisory Group on October 30, 2014 for discussion. The group was invited to provide additional written comments after the meeting.

## **Section 3 Stormwater Program Responsibilities and Gap Analysis**

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**We have concluded that the Town of Westford has an outstanding stormwater management program and is in compliance with the 2003 General Permit.** It is clear that stormwater management is a priority for Westford.

Appendix F includes the aforementioned summary memo that details each EPA Minimum Control Measure (MCM) along with highlights of Westford's current stormwater program activities within the MCM and Tighe & Bond's recommendations for improvement. Since the Town is in compliance with the current permit, the recommendations focused on areas for improvement to prepare for the anticipated new permit requirements.

### **3.1.3 2016 General Permit Requirements and Gap Analysis**

EPA released a draft of a "next generation" Massachusetts Small MS4 General Permit for public comment on September 30, 2014. Following the public comment period and public hearings (which ended February 29, 2015), EPA responded to comments and finalized and promulgated the permit. **The final permit was issued on April 13, 2016, and will be effective on July 1, 2017.** A Notice of Intent (NOI) must be submitted within 90 days of the effective date of the permit. A Stormwater Management Plan must be submitted within one year of the effective date of the permit.

The new General Permit is intended to be more prescriptive than the 2003 General Permit, and to build upon the regulations already in place. The new General Permit substantially increases stormwater management requirements and mandates specific timelines for compliance. A few of the major differences for each minimum control measure are summarized in the following points:

- **Public Education and Outreach:** More specific messages required and prescriptive deadlines compared to the 2003 General Permit.
- **Public Involvement and Participation:** No substantial change from the 2003 General Permit.
- **Illicit Discharge Detection and Elimination (IDDE) Program:** Add interconnections to the outfall inventory. Delineate catchment areas and prioritize catchment investigations. Perform dry weather screening and sampling of high priority and low priority MS4 interconnections and outfall by the end of Year 3. Perform wet weather screening in the spring for the catchments that indicate the presence of one or more System Vulnerability Factors. Complete catchment investigations. For impaired waters without TMDLs, implement a multi-step approach to address the discharges including BMPs, source identification, and an evaluation of retrofit feasibility.
- **Construction Site Stormwater Runoff Control:** If it does not already exist, add inspection and enforcement to the site plan review procedure.
- **Stormwater Management in New Development and Redevelopment:** For new development, retain the first inch of runoff from all impervious surfaces on site, or provide pollutant removal with a BMP. For redevelopment, retain the first 0.80 inches of runoff from all impervious surfaces on site or provide pollutant removal with a BMP. Offsite mitigation may be used for redevelopment projects.
- **Good Housekeeping and Pollution Prevention:** Develop a program to repair and rehabilitate the MS4 infrastructure. Sweep/clean municipal streets once in the spring. Include all activities that occur at a municipal facility and potential pollutants associated with each activity in the stormwater pollution prevention plan (SWPPP) for the facility.

## **Section 3 Stormwater Program Responsibilities and Gap Analysis**

Since Westford is largely in compliance with the 2003 General Permit and in some aspects exceeding the current requirements, the Town is well positioned for the new permit. However, the Town will have work to do to meet the enhanced requirements of the six MCMs. The largest cost and effort will be to improve drainage system mapping and GIS based data collection and management. This is discussed in detail in Section 3.2.3. **The full list of recommendations and schedule is included in the NPDES Stormwater Compliance Plan (Volume 4). Cost for implementation are included in the Capital Improvement Plan (Volume 3).**

### **3.2 Stormwater Infrastructure**

Stormwater infrastructure serves several important functions which can be broadly organized into two groups: drainage and water quality. The original goal of stormwater infrastructure was to remove water from roadways and other improved surfaces to prevent icing and flooding. The systems were designed to collect runoff and quickly discharge it to the nearest water course.

Now that we better understand the role of stormwater as a transport mechanism for non-point source pollution, the scope of stormwater infrastructure design has expanded to include water quality treatment, groundwater infiltration, and peak flow attenuation.



**Figure 3-2: Stony Brook Road Bridge**  
Source: Highway Department

#### **Westford is responsible for the following stormwater infrastructure:**

- **52 miles of drain pipes**
- **5,160 drainage structures (catch basins and manholes)**
- **616 outfalls**
- **150 miles of publicly maintained roadways**
- **278 culvert pipes totaling 3.2 miles in length**
- **3.5 miles of natural drainage conveyances**
- **110 miles of Roadway curb**
- **Three dams**
- **Unknown number of stormwater management and/or treatment structures**

**The total pipe length and number of catch basins and manholes will increase as mapping is improved.**

**Westford's current drainage system is worth more than \$150 Million. This is a necessary Town utility, and adequate operation and maintenance is critical to protect public health and safety of residents, promote clean drinking water, and to ensure operation of local businesses.**

## **Section 3 Stormwater Program Responsibilities and Gap Analysis**

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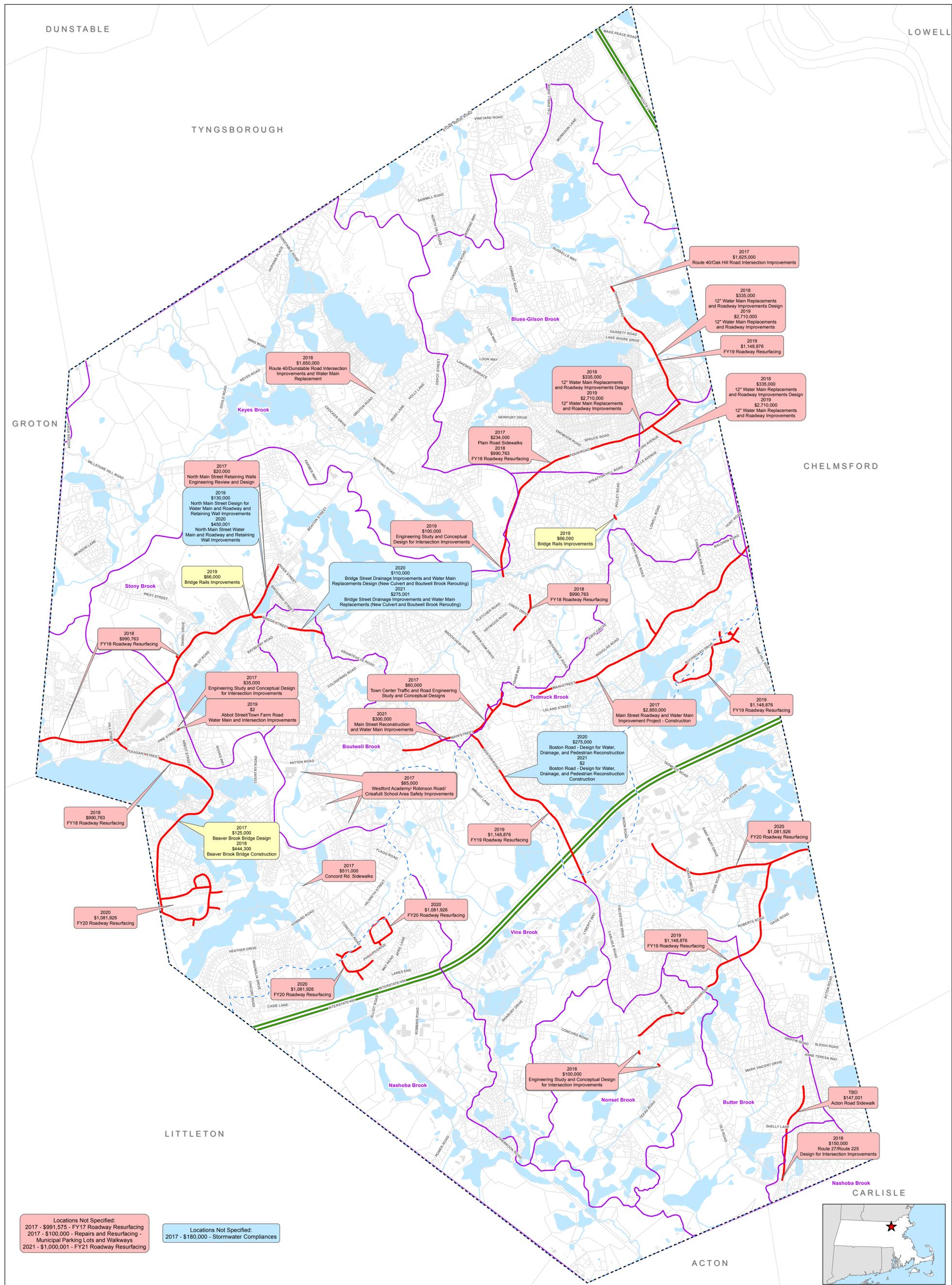
### **3.2.1 Stormwater Infrastructure Responsibilities and Needs**

Tighe & Bond completed an assessment of the Town's stormwater infrastructure inventory, including a review of the most recent five-year Capital Plan as well as areas/locations with known drainage system deficiencies related to flooding, frequent maintenance, and overall functionality, with an eye for potential improvements to water quality. Figure 2-15, previously discussed in Section 2.3.3, shows the water quality impairments and pollutants of concern.

The Town of Westford maintains a five-year Capital Plan that is updated on a yearly basis. Projects may include roadway, drainage, drinking water, dam, and bridge work. The plan includes descriptions and costs for various improvement projects. Figure 3-3 shows the projects from the Town's Capital Plan on a map. The projects defined in the Capital Plan may include or overlap with potential stormwater and/or drainage improvement projects. Many roadway improvement projects include water main and/or drainage system improvements. The drainage projects identified in Figure 3-3 include at least some portion of drainage improvements as part of the project, though it may not be only a drainage project.

To identify and better understand drainage system deficiencies (e.g., capacity limitations and flooding, failing drainage infrastructure, chronic maintenance problems, etc.) not already addressed in the Town's Capital Plan, information on known problem areas was collected from Police, School, Fire, and Highway Departments. On March 9, 2015, Tighe & Bond also interviewed Highway and Engineering Department staff to obtain more detail on these known deficiencies. Information provided by the Town is summarized in Table 3-1. The locations of the areas with known deficiencies are shown in Figure 3-4. While some of the drainage areas of concern will require future capital improvements, others were categorized as operation and maintenance needs to be addressed in the MS4 Infrastructure section of the Operation & Maintenance Plan, Volume 3 of the SWMMP.

Based on this input, Tighe & Bond staff completed two (2) days of field work to further evaluate these locations and identify potential remedies and associated costs for use in the Long-Term Capital Improvement Plan, Volume 2 of the SWMMP.

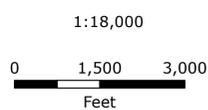


Locations Not Specified:  
 2017 - \$991,575 - FY17 Roadway Resurfacing  
 2017 - \$100,000 - Repairs and Resurfacing -  
 Municipal Parking Lots and Walkways  
 2021 - \$1,000,001 - FY21 Roadway Resurfacing

Locations Not Specified:  
 2017 - \$180,000 - Stormwater Compliances

**Legend**

- Major Basin Boundary
- Sub-Basin Boundary
- Capital Improvement Projects
- Roadway Projects (May include Water Component)
- Includes Drainage Component in Project
- Dam/Bridge Projects



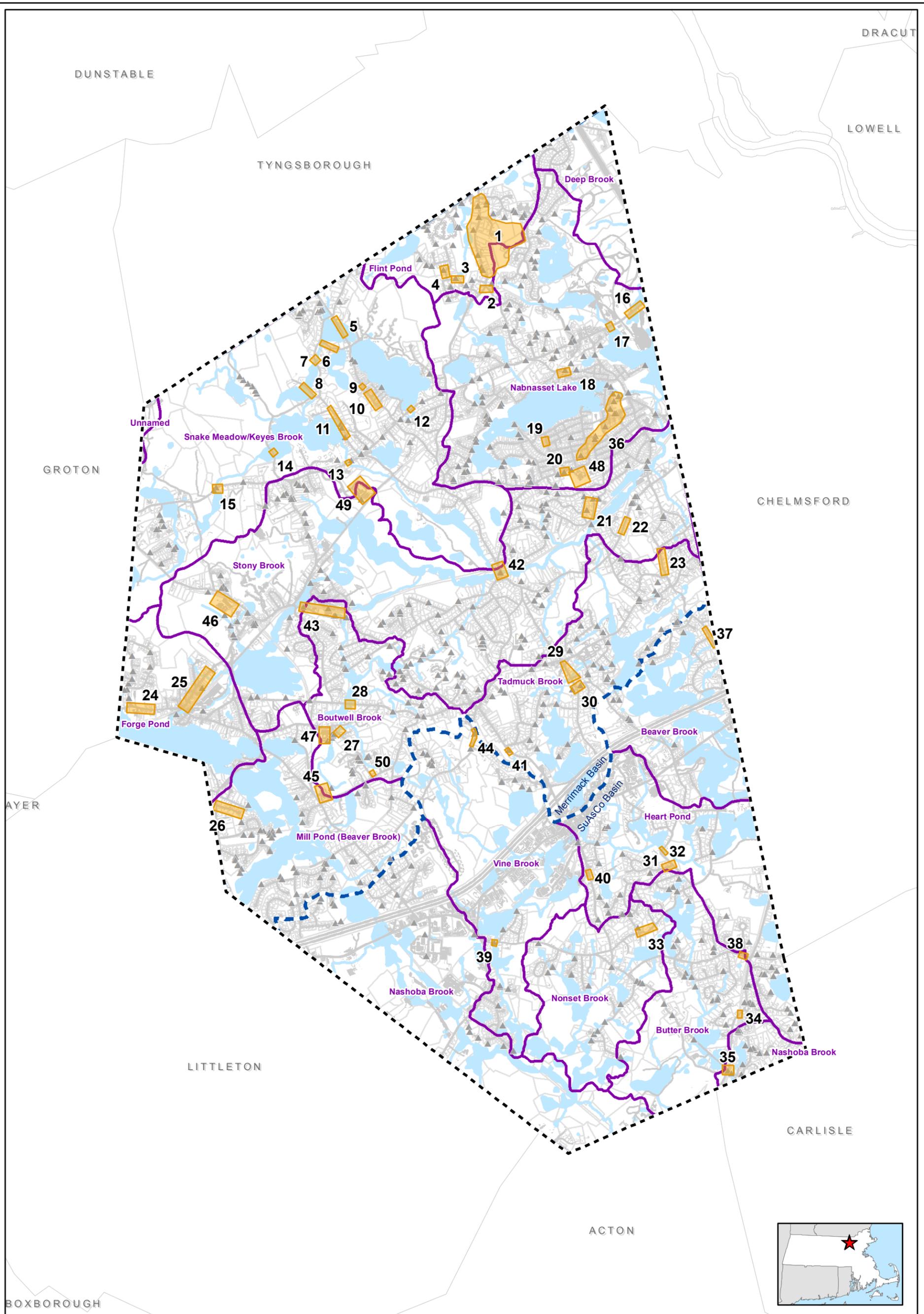
Based on MassGIS Data

**FIGURE 3-3  
 CAPITAL IMPROVEMENT PROJECTS**

Westford, Massachusetts

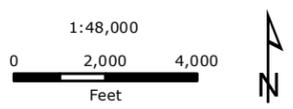
January 2016





**Legend**

- ▲ Outfalls
- Locations of Known Drainage System Deficiencies
- ☑ Ponds
- ~ Rivers and Streams
- Impervious Surface
- - - Town Boundary
- - - Major Basin Boundary
- ▭ Sub-basin Boundary



**FIGURE 3-4  
LOCATIONS OF KNOWN  
DRAINAGE SYSTEM  
DEFICIENCIES**

Westford, Massachusetts

March 2016



**Section 3 Stormwater Program Responsibilities and Gap Analysis**

**Table 3-1  
Locations of Known Drainage System Deficiencies**

| Location ID | Location  | Description of Conditions   |
|-------------|---|---|
| 1           | <p style="text-align: center;"><b>Tyngsboro Road</b></p>                   | <p>There is an open paved swale with an outdated drop inlet that needs to be replaced with new catch basin with sump. Due to the current configuration, there are issues with debris buildup, and therefore there is some ponding and water backup.</p> <p><b>Source:</b> Highway Department</p>                |
| 2           | <p style="text-align: center;"><b>Forrest Road at Tyngsboro Road</b></p>  | <p>There is an existing open drainage system that results in road flooding every Spring.</p> <p><b>Source:</b> Highway Department</p>   |
| 3           | <p style="text-align: center;"><b>North Hill Road</b></p>                | <p>This subdivision was installed with country drainage and ditches. Lack of maintenance and illegal dumping have limited capacity of the system and resulted in road flooding every Spring. Need to evaluate drainage in the subdivision and conduct maintenance.</p> <p><b>Source:</b> Highway Department</p> |

**Section 3 Stormwater Program Responsibilities and Gap Analysis**

**Table 3-1  
Locations of Known Drainage System Deficiencies**

| Location ID | Location   | Description of Conditions  |
|-------------|--|--|
| 4           | <p style="text-align: center;"><b>Hidden Valley Road</b></p>                                    | <p>Open drainage ditches need maintenance, and some segments of drainage need structure replacement.</p> <p><b>Source:</b> Highway Department</p>  |
| 5           | <p style="text-align: center;"><b>Dunstable Road (near intersection with Tenney Road)</b></p>  | <p>The road grade is too low, and beavers impact flows and cause flooding. Historically, the flooding has closed either one lane or the entire road biennially. The existing culvert is buried and needs replacement or upsizing. The road was replaced recently.</p> <p><b>Source:</b> Highway and Police Departments</p> |
| 6           | <p style="text-align: center;"><b>Long Sought for Pond Road</b></p>                           | <p>Beavers cause flooding, and one nearby driveway is flooded periodically. Need to clear obstructions and address the beaver problem.</p> <p><b>Source:</b> Highway and Police Departments</p>  |

**Section 3 Stormwater Program Responsibilities and Gap Analysis**

**Table 3-1  
Locations of Known Drainage System Deficiencies**

| Location ID | Location   | Description of Conditions  |
|-------------|--|--|
| 7           | <p><b>Tenney Road (south of Long Sought for Pond Road and north of Keyes Road)</b></p>  | <p>Beavers cause flooding, however, the flood waters have never crossed the crest of the road. Need to replace the existing culvert, which is located off the road within a trail easement, just downstream and to the west of the existing Tenney Road culvert. This culvert is deteriorated and may be undersized. Potentially need to install a control structure.</p> <p><b>Source:</b> Highway Department</p> |
| 8           | <p><b>Wing Road at Keyes Road</b></p>    | <p>Beavers cause flooding. There has been at least one significant flood event in the past five years. The existing corrugated metal culvert is rusted and needs to be replaced.</p> <p><b>Source:</b> Highway Department</p>  |
| 9           | <p><b>Dunstable Road</b></p>    | <p>This road has an open ditch drainage system. When debris accumulates, it impedes flow and causes icing on the road. The system should be evaluated and maintained. A subdivision is planned for the area between Project #9, #10, and #11, which may help solve drainage concerns.</p> <p><b>Source:</b> Highway Department</p>   |

**Section 3 Stormwater Program Responsibilities and Gap Analysis**

**Table 3-1  
Locations of Known Drainage System Deficiencies**

| Location ID | Location   | Description of Conditions  |
|-------------|--|--|
| 10          | <p style="text-align: center;"><b>Dunstable Road at Pond Road</b></p>   | <p>This road has an open ditch drainage system. When debris accumulates, it impedes flow and causes icing on the road. The system should be evaluated and maintained. A subdivision is planned for the area between Project #9, #10, and #11, which may help solve drainage concerns.</p> <p><b>Source:</b> Highway Department</p>   |
| 11          | <p style="text-align: center;"><b>Keyes Road at Slifer</b></p>         | <p>The existing road grade is too low, and the swamp floods the road. The road typically floods once every five years, when there is at least a 3 to 4 inch rain event in 24 hours. Flooding can cause safety issues when emergency vehicles need to pass. The road needs to be raised to solve the flooding issue. The Town has done some hydraulic modeling of the area as part of an existing Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant. This project could be completed in conjunction with Project #13.</p> <p><b>Source:</b> Highway and Police Departments</p> |
| 12          | <p style="text-align: center;"><b>Groton Road at Boat Launch</b></p>  | <p>The Massachusetts Department of Conservation and Recreation (DCR) parking lot at the boat launch does not have a clear connection to the drainage system and needs to be investigated. This project may overlap with the Dunstable Transportation Improvement Program (TIP) project on Route 40, which is funded by MassDOT.</p> <p><b>Source:</b> Highway Department</p>   |

**Section 3 Stormwater Program Responsibilities and Gap Analysis**

**Table 3-1  
Locations of Known Drainage System Deficiencies**

| Location ID | Location  | Description of Conditions   |
|-------------|---|---|
| 13          | <b>Groton Road at Pages Hill</b>  | <p>The Keyes Brook culvert crosses under Groton Road and needs replacement. This project is already planned under the Town's CIP and will be funded through the FEMA Hazard Mitigation Grant.</p> <p><b>Source:</b> Highway Department</p>  |
| 14          | <p><b>Gould Road</b></p>                     | <p>Gould Road floods approximately 10 times per year with a 2 to 3 inch rain event. The flood waters can reach up to 1 foot deep. The existing culvert needs to be replaced and the road grade needs to be raised to prevent flooding. May need to change the size of the culvert to aid in this issue. Upstream of Keyes Pond is a beaver dam that contains some 12 inch pipes. This project will include impacts to bordering vegetated wetlands, which needs new headwalls and retaining walls.</p> <p><b>Source:</b> Highway and Police Departments</p> |
| 15          | <b>Groton Road and Snake Meadow</b>   | <p>Beavers at the existing culvert cause flooding of one house. The culvert requires routine clearing and maintenance.</p> <p><b>Source:</b> Highway Department</p>   |
| 16          | <b>Groton Road at Commerce Way</b>  | <p>A nearby asphalt plant causes water quality and drainage issues. The area is low lying with country drainage, and wetlands are only 6 inches below drainage outlets. There is a large amount of silt and sediment. A solution to the country drainage is needed, and long-term maintenance will be an issue.</p> <p><b>Source:</b> Highway Department</p>  |
| 17          | <p><b>Groton Road at Gilson Brook</b></p>  | <p>The culvert has been widened, but a joint has failed. Replacement will be completed as part of the Route 40 &amp; Oak Hill Road intersection improvement project. As part of the project, a sidewalk should be added to other side of the road and the existing culvert should be replaced with a modern culvert. Construction will be funded by MassDOT through the Dunstable TIP project on Route 40.</p> <p><b>Source:</b> Highway Department</p>   |

**Section 3 Stormwater Program Responsibilities and Gap Analysis**

**Table 3-1  
Locations of Known Drainage System Deficiencies**

| Location ID | Location   | Description of Conditions   |
|-------------|--|---|
| 18          | <b>Forrest Road between Lawson Road and Pollyanna Lane</b>   | <p>There are leaching catch basins with no outfalls in this area. Flooding occurs on the side of the road. Investigation of drainage problems and connectivity is needed.</p> <p><b>Source:</b> Highway Department</p>  |
| 19          | <b>Pine Road at Birch Road</b>   | <p>There is an issue with a failing leaching structure. Water does not infiltrate and therefore causes minor flooding.</p> <p><b>Source:</b> Highway Department</p>   |
| 20          | <b>88 Plain Road</b>   | <p>The existing basin and pipe needs replacement.</p> <p><b>Source:</b> Highway Department</p>  |
| 21          | <p><b>Polley Road</b></p>  | <p>The existing open ditches behind houses flow into Stony Brook, and maintenance is a challenge due to existing conditions and conflicts with private property. The existing ditches should be converted to buried pipes.</p> <p><b>Source:</b> Highway Department</p> |
| 22          | <b>Lowell Road</b>   | <p>There are repeated ice issues on this road due to residences sump pump discharges. The discharges cause flooding at foot of hill and erosion of yards.</p> <p><b>Source:</b> Highway Department</p>  |

**Section 3 Stormwater Program Responsibilities and Gap Analysis**

**Table 3-1  
Locations of Known Drainage System Deficiencies**

| Location ID | Location  | Description of Conditions  |
|-------------|---|--|
| 23          | <p style="text-align: center;"><b>Chamberlain Road and Swedes Crossing</b></p>  | <p>This road has an open ditch drainage system, and sump pump discharges drain into the ditch. This causes ice issues on the road. A new buried trunk line needs to be installed, and the sumps need to be connected.</p> <p><b>Source:</b> Highway Department</p>   |
| 24          | <p style="text-align: center;"><b>West Prescott Street</b></p>  | <p>This is an old area of Forge Village with old pipe. Some of East Prescott Street had open drainage in the center of the street which discharged into a common septic/storage system. There used to be connections from each basement (and maybe sewer) into the 10 inch drainage system. A separate stormwater system should be installed, but this could result in basement flooding. Need to evaluate connectivity and drainage system update options.</p> <p><b>Source:</b> Highway Department</p> |
| 25          | <p style="text-align: center;"><b>East Prescott Street</b></p>  | <p>The existing system consists of old fieldstone brick storm drains that go under buildings. The drainage system needs to be investigated and replaced where applicable. There is also an issue with railroad crossing.</p> <p><b>Source:</b> Highway and Police Departments</p>  |

### Section 3 Stormwater Program Responsibilities and Gap Analysis

**Table 3-1  
Locations of Known Drainage System Deficiencies**

| Location ID | Location                                 | Description of Conditions   |
|-------------|--|---|
| 26          | <b>Woodland Drive</b>                    | <p>This is a slow draining area with a pipeline through back yards. The connectivity is unknown, but the bottom of the hill floods and backs up with water and debris. The drainage system needs to be investigated and a plan for upgrade needs to be developed.</p> <p><b>Source:</b> Highway Department</p>  |
| 27          | <b>Hartford Road at Westford Academy</b> | <p>Wetlands are too full of water and sediment/organic debris, beaver issues, flat low lying area, maybe need to remove sediment organic debris and restore channel.</p> <p><b>Source:</b> Highway and Police Departments</p>   |
| 28          | <b>Forge Village Road</b>                | <p>The wetlands are too full of water and sediment/organic debris. There are beaver issues in this area, and it is a flat low lying area. There may be a need to remove sediment organic debris and restore the channel. The road is built through the wetlands, and raising the road grade may be a solution.</p> <p><b>Source:</b> Highway and Police Departments</p> |
| 29          | <b>Providence Road at Jester Road</b>    | <p>There is a flooding issue in this area. The road grade may need to be raised, and/or the culvert resized. The project would include hydrologic and hydraulic evaluation of Tadmuck Brook. The downstream culvert is undersized.</p> <p><b>Source:</b> Highway and Police Departments</p>   |
| 30          | <b>Providence Road at Palace Road</b>    | <p>There is a flooding issue due to culvert sizing.</p> <p><b>Source:</b> Highway Department</p>  |

**Section 3 Stormwater Program Responsibilities and Gap Analysis**

**Table 3-1  
Locations of Known Drainage System Deficiencies**

| Location ID | Location   | Description of Conditions   |
|-------------|--|---|
| 31          | <p style="text-align: center;"><b>Vose Road</b></p>               | <p>The existing culvert has been replaced, but beavers are a problem and have caused flooding.</p> <p><b>Source:</b> Highway Department</p>   |
| 32          | <p style="text-align: center;"><b>Steeple Chase Circle</b></p>  | <p>There is a failing subsurface infiltration/detention/retention system in this location that was installed in the mid-1990s. There is an inlet to the system, but no outlet to allow water out. The system may be undersized and may not infiltrate. When the system is full, it causes surcharges out of drainage system. For these reasons, the street floods almost every rain event.</p> <p><b>Source:</b> Highway Department</p> |
| 33          | <p style="text-align: center;"><b>Old Lowell Road</b></p>  | <p>New drainage is needed to address the existing flooding issue. Leaching basins will be replaced and installed as needed.</p> <p><b>Source:</b> Highway and Police Departments</p>  |

**Section 3 Stormwater Program Responsibilities and Gap Analysis**

**Table 3-1  
Locations of Known Drainage System Deficiencies**

| Location ID | Location  | Description of Conditions   |
|-------------|---|---|
| 34          | <b>Acton Road at Bruce Freeman Rail Trail Bike Path</b>   | <p>The Bruce Freeman Rail Trail bike path has two drains which flood. The state owns the trail but the Town maintains it. New drainage is needed along the trail.</p> <p><b>Source:</b> Highway Department</p>  |
| 35          | <b>Acton Road at Old Road</b>   | <p>Replace drainage.</p> <p><b>Source:</b> Highway Department</p>   |
| 36          | <p><b>Open drainage swale from Spruce Road to Williams Avenue to Pine Tree Trail to downstream outlet Nabnasset Lake</b></p>  | <p>All of the water flows into the golf course area, where it floods the golf course. Throughout neighborhood, houses experience wet basements. There are many places where pipes go under buildings and under roads (e.g., Oak Hill Road). Some of the ditches are full of organic materials from residents dumping leaves and yard waste. Overall, there are issues with capacity in the drainage system. The culvert may need replacement. This area could benefit from additional studies and investigation.</p> <p><b>Source:</b> Highway Department</p> |
| 37          | <p><b>Pine Hill Road</b></p>   | <p>Flooding has been reported in this area, and the culvert capacity needs to be increased.</p> <p><b>Source:</b> Highway and Police Departments</p>  |
| 38          | <b>Shannon Circle</b>   | <p>The last four catch basins are leaching, which causes flooding. There are limited, if any, locations to connect drainage system for discharge.</p> <p><b>Source:</b> Highway Department</p>  |

**Section 3 Stormwater Program Responsibilities and Gap Analysis**

**Table 3-1  
Locations of Known Drainage System Deficiencies**

| Location ID | Location   | Description of Conditions  |
|-------------|--|--|
| 39          | <p><b>Concord Road between Powers Road and Banbury Drive</b></p>  | <p>The existing culvert is undersized. After 3 inches of steady rain, the culvert does not have enough capacity and road floods.</p> <p><b>Source:</b> Highway and Police Departments</p>  |
| 40          | <p><b>Carlisle Road between Applewood Drive and Whitney Drive</b></p>  | <p>Carlisle Road experiences flooding, sometimes up to 1.5 feet deep, due to high groundwater and private parcel discharges. A few leaching catch basins have been installed. There is an infiltration system under the parking lot, and a low spot near daycare has been filled.</p> <p><b>Source:</b> Highway Department</p>   |
| 41          | <p><b>Boston Road at Crown Road</b></p>                         | <p>The existing drainage causes flooding into the street. Road and drainage, including culverts and ditches, improvements are planned as part of capital planning. The existing drainage is clay pipe and may be capped at Providence Street. The impact on downstream problem areas (Project #29 and #30) would need to be assessed.</p> <p><b>Source:</b> Highway Department</p> |
| 42          | <p><b>East Boston Camps</b></p>  | <p>Puddles form due to drainage from railroad. This area may benefit from additional investigations into drainage connectivity.</p> <p><b>Source:</b> Highway and Police Departments</p>   |

### Section 3 Stormwater Program Responsibilities and Gap Analysis

**Table 3-1  
Locations of Known Drainage System Deficiencies**

| Location ID | Location                                    | Description of Conditions   |
|-------------|---|---|
| 43          | <b>Graniteville Pond at Bridge Street</b>   | Boutwell Brook crosses under the road. The pipe is not big enough for the brook, and development has caused drainage issues. This causes about 1 foot of flooding on Pine Ridge Road every 1 to 3 years. There has been limited maintenance over the years.<br><br><b>Source:</b> Police Department                 |
| 44          | <b>Hildreth Street north of Wright Lane</b> | This area experiences icing issues. Groundwater breaks out of the side of the hill, which may be due to a nearby, new subdivision. There are concerns about utilities and grading in the new subdivision.<br><br><b>Source:</b> Police Department   |
| 45          | <b>Robinson School</b>                      | There is a sunken catch basin by the gazebo.<br><br><b>Source:</b> School Department  |
| 46          | <b>Blanchard Middle School</b>              | A catch basin near the Café is clogged with sand from hill erosion. The front entrance sinks in winter, most likely due to poor soils that move with the freeze/thaw cycle. There is a sunken area by the basketball court.<br><br><b>Source:</b> School Department   |
| 47          | <b>Westford Academy</b>                     | The area near the ticket booth does not drain.<br><br><b>Source:</b> School Department  |
| 48          | <b>Nabnasset School</b>                     | The drainage system that was installed as part of the addition was poorly constructed. Stone was not used around the leaching basins that were installed and several of those structures have failed over the years. The catch basin in the back of the school is too high.<br><br><b>Source:</b> School Department |
| 49          | <b>Stony Brook School</b>                   | There is a sunken catch basin in the back parking lot. The catch basin near the football field ticket booth is filled with sand and does not drain.<br><br><b>Source:</b> School Department   |
| 50          | <b>John Crisafulli School</b>               | Catch basins do not drain.<br><br><b>Source:</b> School Department  |

### **3.2.2 Stormwater System Map and Data Management**

An accurate and complete storm drain asset inventory and system map is a vital element of Westford's stormwater management program. Complete system mapping allows the Town to fully understand its drainage system operation and maintenance needs. Spatially accurate mapping of system connectivity and drainage catchment areas also allows the Town to swiftly respond to spills and reports of illicit discharges and illegal dumping to protect downstream receiving waters.

EPA's mapping requirements in the 2003 Small MS4 General Permit were minimal, including complete outfall mapping with respect to receiving waters. To achieve the goals described above, EPA has greatly increased mapping requirements, in short, asking communities to complete a fully functional map of the MS4 within the first two years of the new permit. Table 3-2 compares the MS4 mapping requirements of the 2003 MS4 General Permit to the final 2016 General Permit.

Mapping in GIS can also be enhanced to provide opportunities for multiple Town Departments, Boards, and Commissions to manage local permitting processes, verify that private parties are meeting their obligations for long-term operation and maintenance of stormwater BMPs, track the project-by-project addition and subtraction of impervious areas and directly connected impervious areas, and efficiently and cost-effectively meet other data management and tracking requirements in the Small MS4 General Permit. EPA has included requirements throughout the final 2016 Small MS4 General Permit that could be best facilitated through GIS-based data collection and tracking. Table 3-3 shows a list of the numerous permit requirements and local stormwater management program components that would benefit from more advanced use of GIS.

**Section 3 Stormwater Program Responsibilities and Gap Analysis**

**Table 3-2  
Comparison of Mapping Requirements for the 2003 and 2016 MS4 General Permits**

|                        | <b>2003 General Permit</b>  | <b>2016 General Permit</b>   |
|------------------------|---|--|
|                        | "If not already existing, the permittee must develop a storm sewer system map."   | "The permittee shall develop a revised and more detailed map than was required by the MS4-2003 permit."  |
| <b>Requirements</b>    | <ul style="list-style-type: none"> <li>• Outfalls</li> <li>• Receiving waters</li> </ul>  | <ul style="list-style-type: none"> <li>• Municipal separate storm sewer system                             <ul style="list-style-type: none"> <li>○ Outfalls and receiving waters (outfalls must be mapped at a minimum accuracy of +/- 30 feet)</li> <li>○ Pipes</li> <li>○ Open channel conveyances</li> <li>○ Catch basins</li> <li>○ Manholes</li> <li>○ Interconnections with other MS4s</li> <li>○ Municipally-owned stormwater treatment structures</li> </ul> </li> <li>• Catchment delineations</li> <li>• Waterbodies and indication of all use impairments as identified on the most recent Integrated List of Waters report</li> <li>• Municipal sanitary sewer system (where applicable)</li> <li>• Municipal combined sewer system (where applicable)</li> </ul> |
| <b>Recommendations</b> | <ul style="list-style-type: none"> <li>• Location of catch basins</li> <li>• Location of manholes</li> <li>• Location of pipes within the system</li> </ul> | <ul style="list-style-type: none"> <li>• Storm sewer material, size, and age</li> <li>• Sanitary sewer system material, size, and age</li> <li>• Privately owned stormwater treatment structures</li> <li>• Properties known or suspected to be served by a septic system</li> <li>• Area where the MS4 has received or could receive flow from septic system discharges</li> <li>• Seasonal high water table elevations impacting sanitary alignments</li> <li>• Topography</li> <li>• Orthophotography</li> <li>• Alignments, dates and representation of work completed (with legend) of past illicit discharge investigations</li> <li>• Locations of suspected, confirmed and corrected illicit discharges (with dates and flow estimates)</li> </ul>                     |

### Section 3 Stormwater Program Responsibilities and Gap Analysis

**Table 3-3  
Stormwater Program Data Collection and Management Needs**

| GIS Modes of Analysis and Data Attributes |   | Municipal Programs and MS4 Phase II Permit Requirements |                    |                       |                     |                     |              |                             |                         |                            |                            |                 |                                |                              |                      |
|---|---|---|--------------------|-----------------------|---------------------|---------------------|--------------|-----------------------------|-------------------------|----------------------------|----------------------------|-----------------|--------------------------------|------------------------------|----------------------|
|   |   | MS4 System Mapping                                      | Outfall Inspection | Catchbasin Inspection | Catchbasin Cleaning | Stormwater Sampling | IDDE Program | Municipal Good Housekeeping | Climate Change Analysis | Impervious Area Assessment | Tracking Bylaw Performance | TMDL Compliance | Stormwater Utility Feasibility | Snow and Ice Control Program | Capital Improvements |
| MS4 Infrastructure                        | Catchbasins                                 | ●   |                    | ●                     | ●                   |                     | ●            | ●                           |                         |                            |                            |                 |                                |                              | ●                    |
|   | Manholes                                    | ●   |                    |                       |                     |                     | ●            | ●                           |                         |                            |                            |                 |                                |                              | ●                    |
|   | Pipes                                       | ●   |                    |                       |                     |                     | ●            | ●                           |                         |                            |                            |                 |                                |                              | ●                    |
|   | Outfalls                                    | ●   | ●                  |                       |                     | ●                   | ●            | ●                           |                         | ●                          |                            |                 |                                | ●                            | ●                    |
|   | Swales                                      | ●   | ●                  |                       |                     | ●                   |              | ●                           |                         |                            |                            |                 |                                | ●                            | ●                    |
|   | Town-owned Treatment Structures             | ●   |                    |                       |                     |                     |              | ●                           | ●                       |                            |                            |                 |                                | ●                            | ●                    |
|   | Neighboring Interconnections                | ●   |                    |                       |                     |                     |              | ●                           |                         | ●                          |                            |                 |                                |                              |                      |
|   | Sewer System and/or Combined SSO            | ●   |                    |                       |                     |                     | ●            | ●                           |                         |                            |                            |                 |                                |                              | ●                    |
| Spatial Locations                         | Culverts                                    |   |                    |                       |                     |                     | ●            | ●                           |                         |                            |                            |                 |                                |                              | ●                    |
|   | Outfall Catchment Delineations              | ●   | ●                  |                       |                     | ●                   | ●            | ●                           |                         | ●                          |                            |                 |                                |                              |                      |
|   | Waterbody w/ Watershed Delineations         |   |                    | ●                     |                     | ●                   | ●            | ●                           | ●                       | ●                          | ●                          | ●               | ●                              | ●                            |                      |
|   | Areas subject to Flooding- high groundwater | ●   |                    | ●                     |                     | ●                   | ●            | ●                           |                         |                            |                            |                 | ●                              | ●                            | ●                    |
|   | Areas Subject to Flooding- surface water    | ●   |                    |                       | ●                   | ●                   | ●            | ●                           |                         |                            |                            |                 | ●                              | ●                            | ●                    |
| Point Locations                           | Topography                                  |   |                    |                       |                     |                     |              | ●                           |                         |                            |                            |                 |                                | ●                            | ●                    |
|   | Pipe Drainage- flow direction               | ●   | ●                  |                       |                     |                     | ●            |                             |                         |                            | ●                          |                 |                                | ●                            |                      |
|   | Impaired Waters                             |   |                    |                       |                     |                     | ●            | ●                           | ●                       | ●                          | ●                          |                 |                                |                              |                      |
| Impervious Calcs                          | Point Source Discharges                     |   |                    |                       |                     |                     | ●            | ●                           |                         | ●                          | ●                          |                 |                                |                              |                      |
|   | Septic System Locations                     | ●   |                    |                       |                     |                     | ●            | ●                           |                         | ●                          | ●                          |                 |                                |                              |                      |
|   | Planned Projects                            |   |                    |                       |                     |                     |              | ●                           |                         | ●                          | ●                          |                 |                                |                              | ●                    |
|   | Impervious Cover                            |   |                    |                       |                     |                     | ●            | ●                           | ●                       | ●                          | ●                          | ●               | ●                              | ●                            |                      |
| Facilities Management                     | Building Footprints                         |   |                    |                       |                     |                     |              | ●                           | ●                       | ●                          | ●                          | ●               | ●                              |                              |                      |
|   | Land use Classification                     |   |                    |                       | ●                   | ●                   |              | ●                           | ●                       | ●                          | ●                          | ●               | ●                              |                              |                      |
|   | Directly Connected Impervious Area          |   |                    |                       |                     |                     |              | ●                           | ●                       | ●                          | ●                          | ●               | ●                              | ●                            |                      |
|   | Facility Classification                     |   |                    |                       |                     |                     |              | ●                           |                         |                            |                            |                 |                                |                              |                      |
|   | Managed Turf                                |   |                    |                       |                     |                     |              | ●                           |                         |                            | ●                          |                 |                                |                              |                      |
| Records and Asset Management              | Hazardous Materials Use                     |   |                    |                       |                     | ●                   |              | ●                           |                         |                            |                            |                 |                                |                              |                      |
|   | Parking Areas                               |   |                    |                       |                     |                     |              | ●                           |                         |                            | ●                          | ●               | ●                              |                              |                      |
|   | Roadways by Type                            |   |                    |                       |                     |                     |              | ●                           |                         |                            |                            |                 | ●                              |                              |                      |
|   | Storm Sewer Material- size and age          | ●   |                    |                       |                     |                     |              | ●                           |                         |                            |                            |                 |                                |                              | ●                    |
|   | Sanitary Sewer Material- size and age       | ●   |                    |                       |                     |                     |              | ●                           |                         |                            |                            |                 |                                |                              | ●                    |
|   | Water Quality Sampling                      |   |                    |                       | ●                   | ●                   | ●            |                             |                         |                            | ●                          |                 |                                |                              |                      |
|   | Routine Inspections                         |   | ●                  | ●                     |                     | ●                   | ●            | ●                           |                         | ●                          |                            |                 |                                |                              | ●                    |
|   | Street Sweeping Statistics                  |   |                    |                       |                     |                     |              | ●                           |                         |                            | ●                          | ●               | ●                              | ●                            | ●                    |
|   | Catchbasins Cleaning Statistics             |   |                    |                       | ●                   |                     |              | ●                           |                         |                            | ●                          | ●               | ●                              | ●                            | ●                    |
|   | IDDE Problem Locations                      |   |                    |                       | ●                   | ●                   |              |                             |                         |                            |                            |                 |                                |                              | ●                    |
|   | Repairs                                     |   |                    | ●                     |                     |                     |              | ●                           | ●                       |                            |                            | ●               |                                |                              | ●                    |
|   | Local Stormwater Permits                    |   |                    |                       |                     |                     |              |                             | ●                       | ●                          |                            |                 |                                |                              |                      |
|   | New Building Impervious Cover               |   |                    |                       |                     |                     |              |                             | ●                       | ●                          |                            |                 |                                |                              |                      |
| Salt Application                          |   |   |                    |                       |                     |                     | ●            | ●                           |                         |                            |                            |                 | ●                              | ●                            |                      |
| Erosion Control Inspections               |   |   |                    |                       |                     |                     | ●            | ●                           |                         | ●                          |                            |                 |                                |                              |                      |
| Maintenance Agreements                    |   |   |                    |                       |                     |                     |              |                             | ●                       | ●                          |                            |                 | ●                              | ●                            |                      |

### **3.2.3 Westford's Current Stormwater System Map and Gap Analysis**

The Town manages drainage assets through a robust GIS. Westford was an early adopter of Global Positioning System (GPS) technology and stormwater mapping was ongoing through multiple Town staff and consultant efforts starting in 2000. Due to technology limitations 15 years ago and involvement of multiple parties, stormwater system mapping accuracy and completeness is highly variable. Although the majority of the Town's drainage system mapping is included in GIS, maps of some portions of Town are only available on paper (most are scanned) or in AutoCAD record drawings.

Westford employs a dedicated GIS Coordinator who oversees and maintains the GIS inventory. Westford's GIS provides an online component that facilitates user-friendly public access to the data and improves efficiency in government by linking the business process of various departments to common spatial elements. The Town has contracted with PeopleGIS to add a web-based component that will allow municipal employee access to the GIS. PeopleGIS will also be developing customized forms, accessible online and via tablet for Town staff to utilize for various asset management efforts including inspections and surveys, field data collection, and recording maintenance work. These forms are being piloted as part of the Northern Middlesex Regional Stormwater Collaborative, and the Town will be a part of that group's assessment of the software.

#### **Mapping Evaluation**

As part of developing this SWMMP, Tighe & Bond completed a desktop assessment of the Town's current stormwater mapping. The goal of this exercise was to provide the Town with an understanding of the current accuracy and completeness of the Town-wide map, and to integrate recommendations for improvements into the Long-Term Capital Improvement Plan in Volume 2 of this plan. GIS specialists performed a visual assessment to evaluate spatial accuracy, estimate completeness of system mapping and connectivity, and review the attribute coding for mapped structures.

The Westford Stormwater spatial database (i.e., geodatabase) contains several feature classes, including drain pipes, drain structures (catch basins, manholes, outlet structures, inlets/outlets, and "other"), outfalls, and headwalls. The geodatabase also contains curbing (though not Town-wide), culverts, and channels.

**Pipes:** The drain pipes are drawn in the direction of flow and, in general, appear to be correctly linked ("snapped") to other features. The pipes have attribute data including pipe size and material, ownership, some notes, and metadata consisting of original date and source, data creator, and modified date and source. Most of the values in these fields are populated.

**Catch Basins and Manholes:** The Drain Structures feature class contains different types of point features, including catch basins and manholes. Some of these are attributed as "not applicable". There is a Structure ID mostly populated with integers, some of which are negative. Other attribute fields include Structure type (includes catch basins, manholes, outfall structures, inlets/outlets, and other), catch basin/manhole type, condition, rim elevation (reasonably populated for approximately 3,500 of 5,500 features), rim to sump distance (reasonably populated for approximately 3,500 features) and barrel diameter (reasonably populated for approximately 4,200 features). Metadata consists of original date and source, data creator, and modified date and source. A Notes field exists and is occasionally populated, and a Photo field contains a network path link that presumably references photos of the outfalls.

### Section 3 Stormwater Program Responsibilities and Gap Analysis

**Outfalls:** The Outfalls feature class consists of 616 locations, attributed with an Outlet type, material, diameter, structural and maintenance condition, where it discharges to (and whether it includes a detention pond), some notes, and the standard metadata fields as noted above. A separate table exists that links to the outfalls via the OF\_ID and contains some inspection data including presence of dry weather flow, outlet position, and condition. Fields called Sediment, Submerged, Status, and Detention Pond condition, as well as several metadata fields, exist in this table but none are populated.

**Regulated Area Coverage:** Together, the pipes and features cover most of town, with the exceptions of some subdivisions discussed below.

**Spatial accuracy:** In general the features are spatially reliable, but in some areas where catch basins are clearly seen on the orthophoto, the GIS feature is several meters away.

**Connectivity:** Many features are not networked with piping, and many networks are incomplete (e.g., a catch basin and a nearby outfall are mapped, but there is no pipe connecting them; pipe flowing into a catch basin or manhole with no outlet, etc.). There are several outfalls that do not have any piping network attached to them, and several pipes that look to lead to an outfall but no outfall point exists. Overall, there are issues with connectivity in numerous areas in Town. Figure 3-5 illustrates some examples.



**Figure 3-5: Example of Outfalls Not Connected to Piped Network in GIS.**

**Attribute Information:** Generally, the majority of attributes are populated. However, the accuracy of these values are not indicated nor is the source (e.g., GPS, Field, As-built-plan).

**Public and Private Stormwater BMPs:** The Town lacks information on the location and ownership status of stormwater detention and treatment facilities built in Subdivisions or other private developments, even on Town properties. As part of the Post-Construction Stormwater Management MCM, the Town will need to know the locations of private BMPs and if/when they are being maintained. Recommendations to meet this requirement will be included in Volume 4 of the SWMMP. Likewise, under the Good Housekeeping MCM, the Town will need to formalize operation of BMPs on Town properties or within the right-of-way in the Town-wide Operation and Maintenance Plan, Volume 3 of the SWMMP.

Table 3-4 presents a summary of the types of drainage system structures mapped, and the associated completes of the data attributes.

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**Table 3-4  
Summary of GIS Structures and Associated Attribute Completeness**

| Category and Associated Attributes               | Total Quantity | Attribute % Complete |
|--|----------------|----------------------|
| <b>Structures</b>                                |                |                      |
| Drain Pipes                                      | 3,752          |                      |
| Pipe Diameter                                    |                | 97.2                 |
| Pipe Material                                    |                | 99                   |
| Year Installed                                   |                | 0                    |
| Date Created                                     |                | 99                   |
| Source   |                | 99                   |
| Structures                                       | 5,518          |                      |
| Structure Type                                   |                | 89                   |
| Rim Elevation                                    |                | 65                   |
| Rim to Sump                                      |                | 79                   |
| Date Created                                     |                | <1%                  |
| Source   |                | <1%                  |
| Outfalls   | 616            |                      |
| Outfall ID                                       |                | 100                  |
| Outfall Type                                     |                | 99                   |
| Outfall Diameter                                 |                | 90                   |
| Outfall Material                                 |                | 99                   |
| Discharge Location                               |                | 99                   |
| Date Created                                     |                | 99                   |
| Source   |                | 99                   |
| <b>Connectivity</b>                              |                |                      |
| Outfalls with pipe attached                      | 206            | 33                   |
| Outfalls attached to culverts                    | 7              | -                    |
| Outfalls near a pipe (20 feet) but not snapped   | 47             | -                    |
| Outfalls near a culvert but not snapped          | 58             | -                    |
| Structures snapped to pipes                      | 4,107          | 74                   |
| Structures near a pipe (20 feet) but not snapped | 77             | -                    |

### Accuracy and Completeness of Subdivision Drainage

Tighe & Bond completed a visual inspection of the GIS to identify subdivisions that are missing mapped data. Though not every subdivision has drainage infrastructure, the majority do. **Approximately 50 subdivisions (11%) lacked any stormwater mapping.** Many reviewed have incomplete mapping, such as pipes depicted but no outfalls shown in the subdivision area, outfalls depicted with no pipes or other drainage structures, or otherwise incompletely networked features. These will be a priority for future mapping described in this SWMMP.

Figure 3-6 shows an overlay of the GIS drainage system map on the Rose Lane subdivision's paper as-built plan stamped by a Registered Professional Land Surveyor in September 1998<sup>23</sup>. The two catch basins mapped in GIS are located in approximately the same places as the plan, however, the GIS drainage manhole is somewhat southeast of the manhole shown in the plan. In addition, no outfall location is identified on either the plan or in the GIS, however, an outfall could be located at the end of the pipe length shown. One additional source of confusion is that the pipes mapped in GIS have an attribute that states the locations were collected in the field, but the manhole has a note that references placement based on the paper plan, and therefore is not located in the correct location in the GIS. Documentation included in the GIS mapping cites a few

<sup>23</sup> Rose Lane as-built plan in Westford, Massachusetts. Prepared for Tidan Corporation, 288 Littleton Road, Westford, MA. September 1998. File No. 313/313ASB. Recorded in Book 5463 document AB3.

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different sources of the information. One catch basin was GPS located in 2004, and the manhole was GPS located in March 2005 with a note saying "inserted because seen on plan AB3-5463 39" (i.e., the as-built).

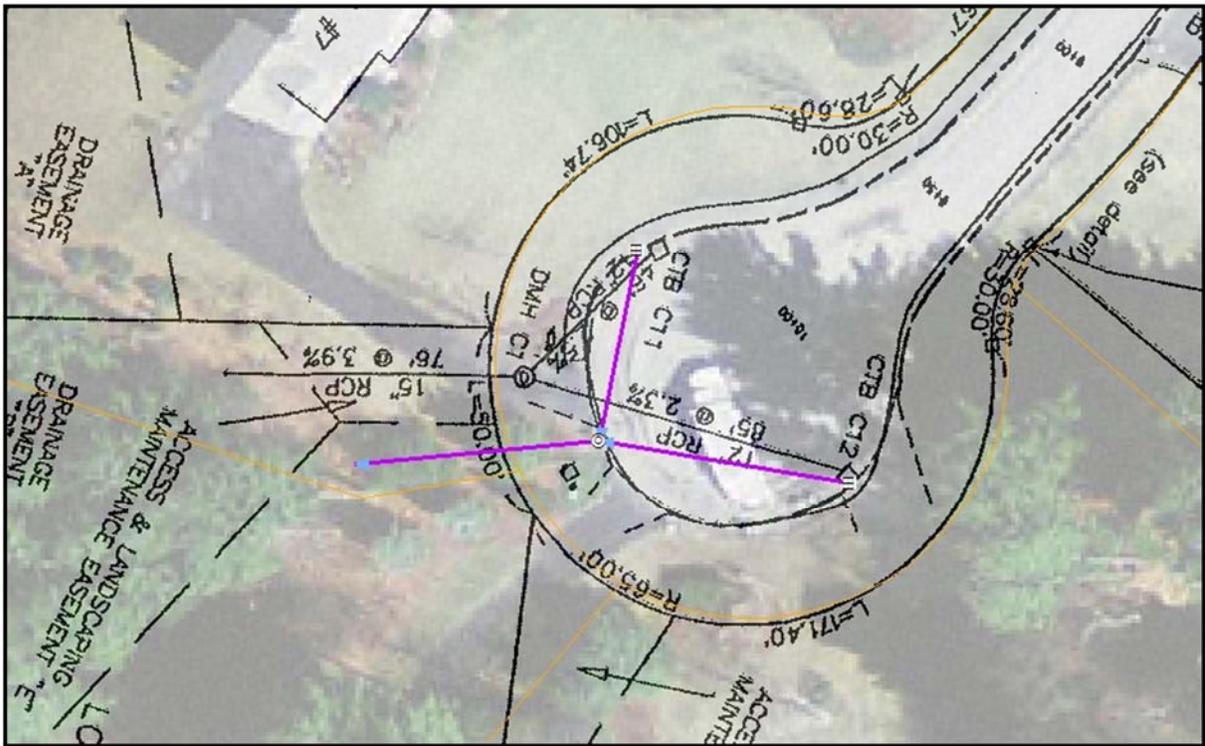


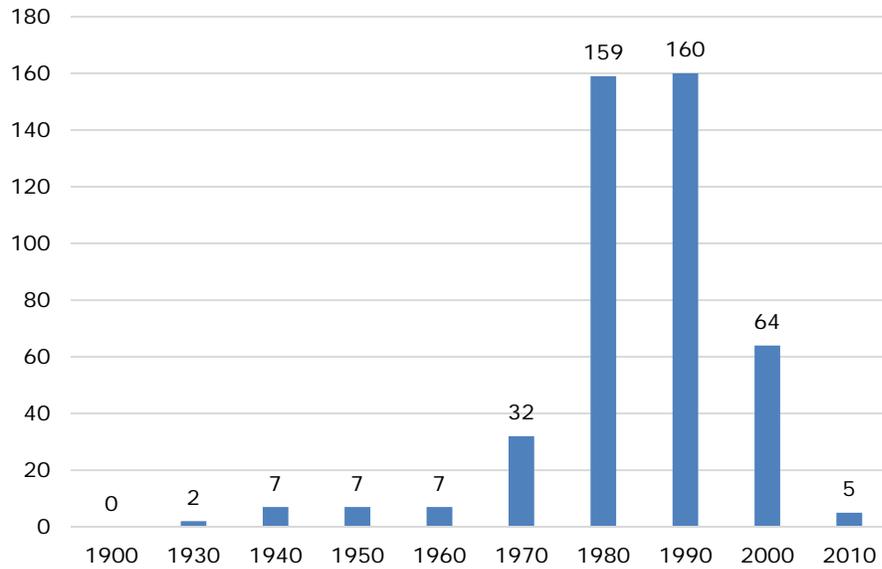
Figure 3-6: Example Mapping Discrepancies between GIS and As-Built Paper Maps

#### 3.2.4 Condition and Adequacy of Westford's Drainage Infrastructure

As of the date of this report, data available in the Town's GIS mapping prohibited Tighe & Bond from determining the age and condition of drainage components, such as pipes, catch basins, and manholes. All of this information is necessary to understand the cost and effort to provide adequate operation and maintenance to meet the Town's desired level of service. Likewise, we were unable to evaluate criticality of the drainage network and understand how likely are components of Westford's stormwater system to fail, and how serious will the consequences will be if the component does fail.

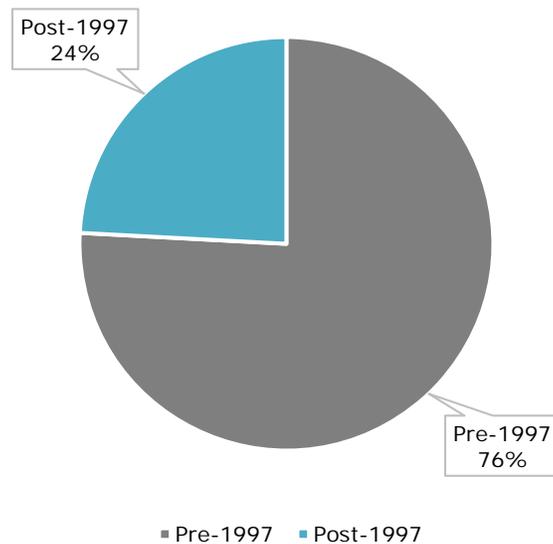
To gain some knowledge of the age of the drainage system, we looked at the age distribution of subdivision plans. Figure 3-7 below presents the breakdown of subdivision plans by decade. Over 70% of the subdivisions in Westford were constructed in the 1980s and 1990s.

### Section 3 Stormwater Program Responsibilities and Gap Analysis



**Figure 3-7: Definitive Subdivisions by Decade**

A more comprehensive condition assessment of the Town's aging drainage infrastructure is also necessary to identify the adequacy of drainage systems pre-1997 to treat water quality. Figure 3-8 below presents the breakdown of subdivisions before and after the Massachusetts Stormwater Handbook was promulgated in 1997, which shows that approximately three-quarters of the subdivisions and associated drainage did not incorporate components to manage water quality as part of design and construction.



**Figure 3-8: Definitive Subdivisions and the MA Stormwater Management Policy (1997)**

Likewise, an assessment of current and past design standards is necessary to understand if the standards are adequate to handle future storms and a warmer climate (Refer to Section 2.4.3 on Climate Change.) These water quality considerations are included in

## **Section 3 Stormwater Program Responsibilities and Gap Analysis**

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recommendations for further evaluation of the existing infrastructure in the Long-Term Capital Improvement Plan.

As part of the Long-Term Capital Improvement Plan, Town staff identified select as-built and definitive subdivision plans in areas of Town with poor or a lack of mapping and Tighe & Bond staff digitized the locations and attributes (e.g., install date, materials, dimensions, etc.) of drainage components, including structural stormwater treatment systems (e.g., detention ponds, etc.) from these plans to further the inventory of Town drainage assets. Tighe & Bond and Town staff also completed a representative condition assessment of the Town's stormwater assets that included using a zoom camera to record the condition and performance of drainage components including structures (catch basins and manholes) and pipes. The results of the representative condition assessment are included in Volume 2 of this SWMMP, the Long-Term Capital Improvement Plan. In addition, Volume 2 includes recommendations to further the inventory and condition/performance assessment of Westford's drainage system to move toward a proactive program of ongoing capital improvements.

### **3.3 Municipal Operations and Facilities Inventory**

As detailed in both the 2003 General Permit and the final 2016 General Permit, the Town must develop and implement a Town-wide operations and maintenance program that has a goal of preventing or reducing pollutant runoff and protecting water quality from municipal operations. This program must address municipal maintenance activities under the following categories designated by EPA:

- Municipally owned or operated **parks and open space** and **buildings and facilities**;
- **Vehicles and equipment**; and
- **MS4 infrastructure**.

As a first step in developing this program, Tighe & Bond worked closely with Town staff to develop an inventory of municipal operations and facilities. Appendix G provides the inventory of municipal properties and facilities where operations and activities have potential to contribute to stormwater pollution. Tighe & Bond and Town staff visited a number of the sites to complete site-specific evaluations. Figure 3-11 presents a map showing the locations of the facilities visited. This inventory serves as the basis for the Town's Operation and Maintenance Plan, Volume 3 of the SWMMP.

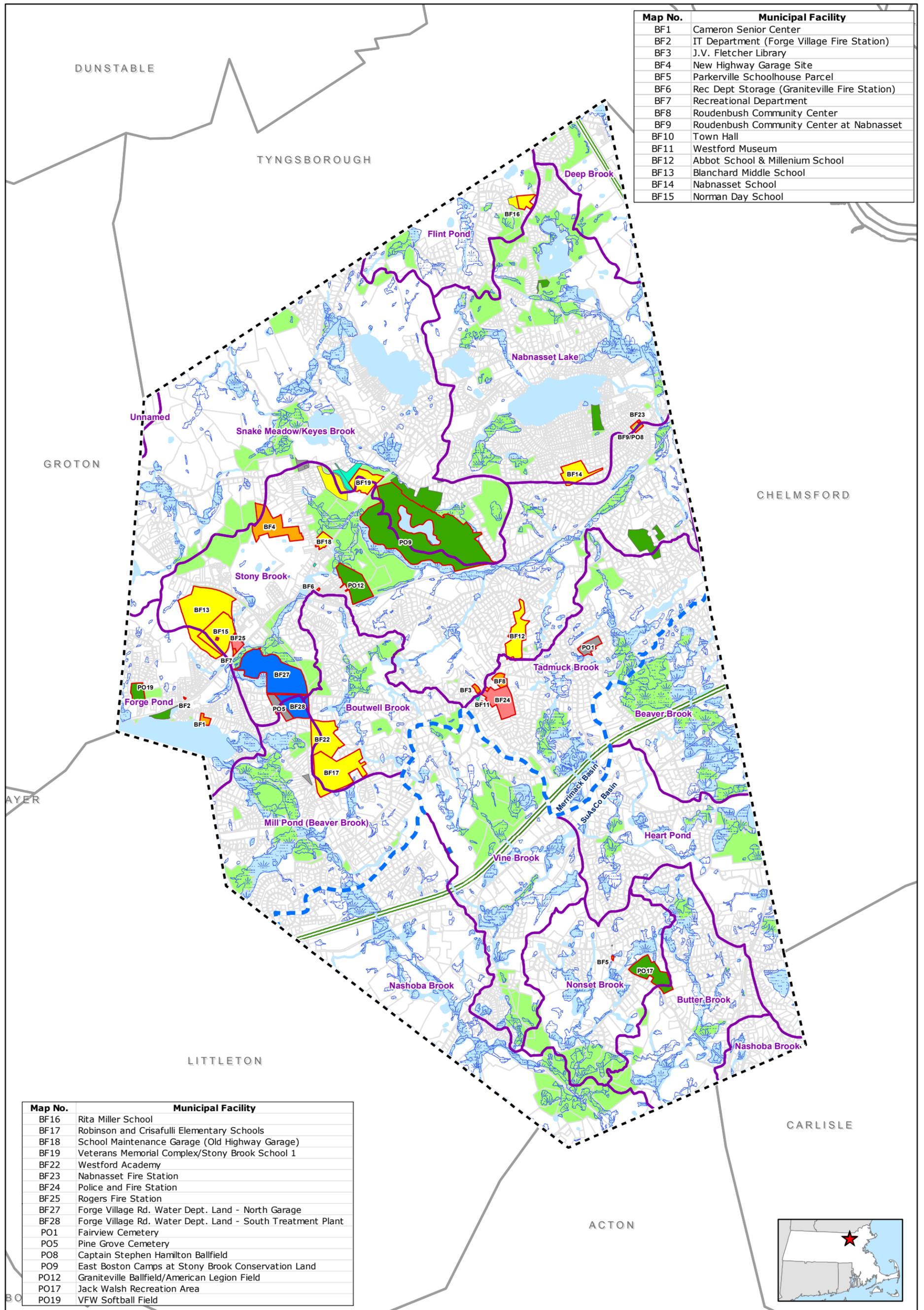


**Figure 3-9: Westford Highway Garage**



**Figure 3-10: Fire House #4**

| Map No. | Municipal Facility                           |
|---------|--|
| BF1     | Cameron Senior Center                        |
| BF2     | IT Department (Forge Village Fire Station)   |
| BF3     | J.V. Fletcher Library                        |
| BF4     | New Highway Garage Site                      |
| BF5     | Parkerville Schoolhouse Parcel               |
| BF6     | Rec Dept Storage (Graniteville Fire Station) |
| BF7     | Recreational Department                      |
| BF8     | Roudenbush Community Center                  |
| BF9     | Roudenbush Community Center at Nabnasset     |
| BF10    | Town Hall                                    |
| BF11    | Westford Museum                              |
| BF12    | Abbot School & Millenium School              |
| BF13    | Blanchard Middle School                      |
| BF14    | Nabnasset School                             |
| BF15    | Norman Day School                            |

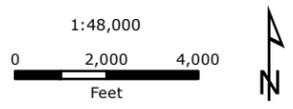


| Map No. | Municipal Facility   |
|---------|--|
| BF16    | Rita Miller School   |
| BF17    | Robinson and Crisafulli Elementary Schools                 |
| BF18    | School Maintenance Garage (Old Highway Garage)             |
| BF19    | Veterans Memorial Complex/Stony Brook School 1             |
| BF22    | Westford Academy   |
| BF23    | Nabnasset Fire Station                                     |
| BF24    | Police and Fire Station                                    |
| BF25    | Rogers Fire Station  |
| BF27    | Forge Village Rd. Water Dept. Land - North Garage          |
| BF28    | Forge Village Rd. Water Dept. Land - South Treatment Plant |
| PO1     | Fairview Cemetery  |
| PO5     | Pine Grove Cemetery  |
| PO8     | Captain Stephen Hamilton Ballfield                         |
| PO9     | East Boston Camps at Stony Brook Conservation Land         |
| PO12    | Graniteville Ballfield/American Legion Field               |
| PO17    | Jack Walsh Recreation Area                                 |
| PO19    | VFW Softball Field   |

- Legend**
- Municipal Facilities Visited (31)
  - Municipal Facilities**
  - Buildings and Facilities**
  - Municipal Buildings
  - Municipal Buildings/ Active Recreation
  - Fire and Safety
  - School Buildings
  - Water

- Municipal Facilities**
- Parks and Open Space**
- Garden and Active Recreation
- Municipal Buildings/ Active Recreation
- Cemetery
- Commons
- Municipal Parks and Open Space Parcels

- Major Basin Boundary
- Sub-basin Boundary
- Town Boundary
- Parcels
- Westford Town Boundary
- Inland Wetlands
- Lakes, Ponds and Rivers
- Rivers and Streams



Based on MassGIS Data and Town of Westford Data

**FIGURE 3-11  
MUNICIPAL FACILITIES  
VISITED**

Westford, Massachusetts

April 2016





# Appendix A

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## Public Involvement and Participation

Educational materials are available on the stormwater advisory group shared folders site. This appendix will be finalized once the SWMMP is complete.



# Appendix B

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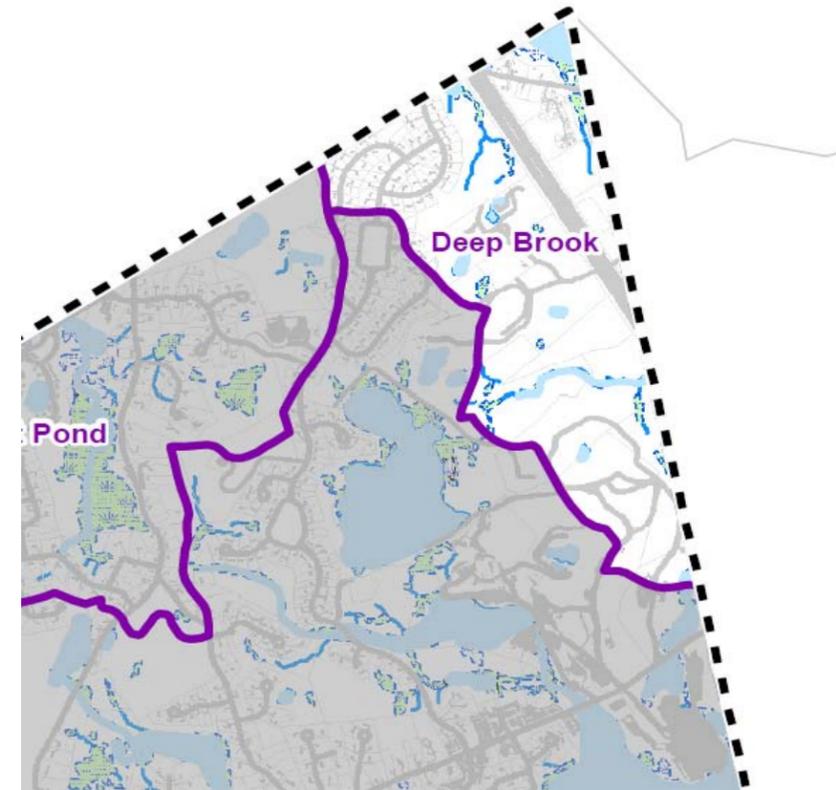
## Subbasin Profiles

## Deep Brook Subbasin Statistics

|   | 2015 <sup>1</sup> |
|---|-------------------|
| <b>Physical Characteristics</b>   |                   |
| Drainage area (sq. mi)  | 0.6               |
| Drainage area (acres)   | 390.5             |
| Contribution of subbasin to entire watershed in Westford (%)            | 2.9%              |
| <b>Stream Statistics</b>  |                   |
| Miles of perennial streams  | 0.6               |
| Total acres of perennial streams with 200 foot buffers                  | 29.7              |
| Miles of intermittent streams   | 0.0               |
| Acres of intermittent streams with 200-foot buffers                     | 3.0               |
| <b>Impairments and TMDLs</b>  |                   |
| Impaired Waterbody in subbasin  | Yes               |
| Final TMDL for waters in subbasin                                       | No                |
| <b>Land Use</b>   |                   |
| Acres of open space   | 66.0              |
| Acres of protected open space   | 65.0              |
| % protected open space  | 16.6%             |
| Acres of unprotected open space   | 1.0               |
| % unprotected open space  | 0.3%              |
| Acres of impervious surface   | 34.2              |
| % impervious surface  | 8.8%              |
| Impervious Cover Model Status   | Sensitive         |
| <b>Habitat Characteristics</b>  |                   |
| Number of certified vernal pools  | 8                 |
| Number of potential vernal pools  | 13                |
| Acres of vernal pools with 200-foot buffers                             | 20.0              |
| Acres of Area of Critical Environmental Concern (ACEC)                  | n/a               |
| Acres of NHESP Priority Habitats of Rare Species                        | 4.4               |
| Acres of NHESP Estimated Habitats of Rare Wildlife                      | 4.4               |
| Acres of Wetlands, Marsh, Swamp, and Bogs                               | 3.9               |
| Acres of Pond/Lakes   | 0.6               |
| <b>Lands Critical to Sustaining Surface and GW Quality and Quantity</b> |                   |
| Number Public Water Supply Wells  | 0                 |
| Acres Zone I  | 0.0               |
| Acres Zone II   | 0.0               |
| Acres Interim Well Protection Areas                                     | 0.0               |
| Acres low-yield aquifer   | 0.0               |
| Acres medium-yield aquifer  | 0.0               |
| Acres high-yield aquifer  | 0.0               |
| Stressed Basin (Y/N)  | N                 |
| SWMI Groundwater Withdrawal Category                                    | 3                 |
| SWMI Biological Category  | 5                 |
| <b>Summary of Potential Sources of Pollution</b>                        |                   |
| NPDES surface water discharge   | 0                 |
| Groundwater discharges  | 0                 |
| BWP Major Facility  | 0                 |
| MassDEP 21 E Sites  | 0                 |
| Underground Storage Tank  | 0                 |

## Notes from Relevant Water Quality Monitoring

The Westford Stream Team does not currently conduct water quality sampling in the Deep Brook subbasin. Deep Brook waterbodies were not evaluated as part of the Healthy Lakes and Ponds Initiative.



Merrimack River Watershed

Deep Brook Subbasin Profile

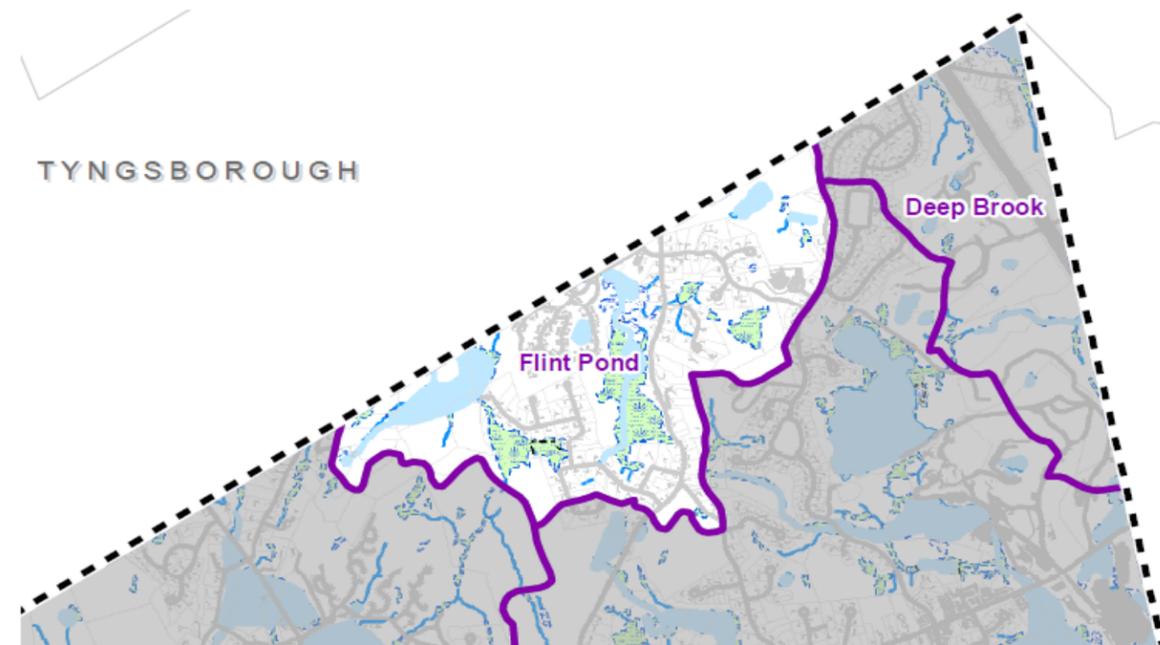
<sup>1</sup> Data from the Stormwater Management Master Plan Volume I, prepared by Tighe & Bond, 2015 - 2016. Note that this sub-basin was not included in from the Watershed Action Plan prepared by Woodard & Curran, 200

## Flint Pond Subbasin Statistics

|   | 2015 <sup>1</sup> |
|---|-------------------|
| <b>Physical Characteristics</b>   |                   |
| Drainage area (sq. mi)  | 0.9               |
| Drainage area (acres)   | 546.9             |
| Contribution of subbasin to entire watershed in Westford (%)            | 4.1%              |
| <b>Stream Statistics</b>  |                   |
| Miles of perennial streams  | 0.6               |
| Total acres of perennial streams with 200 foot buffers                  | 31.9              |
| Miles of intermittent streams   | 0.4               |
| Acres of intermittent streams with 200-foot buffers                     | 0.9               |
| <b>Impairments and TMDLs</b>  |                   |
| Impaired Waterbody in subbasin  | No                |
| Final TMDL for waters in subbasin                                       | No                |
| <b>Land Use</b>   |                   |
| Acres of open space   | 71.6              |
| Acres of protected open space   | 21.2              |
| % protected open space  | 3.9%              |
| Acres of unprotected open space   | 50.4              |
| % unprotected open space  | 9.2%              |
| Acres of impervious surface   | 45.7              |
| % impervious surface  | 8.4%              |
| Impervious Cover Model Status   | Sensitive         |
| <b>Habitat Characteristics</b>  |                   |
| Number of certified vernal pools  | 5                 |
| Number of potential vernal pools  | 15                |
| Acres of vernal pools with 200-foot buffers                             | 10.6              |
| Acres of Area of Critical Environmental Concern (ACEC)                  | n/a               |
| Acres of NHESP Priority Habitats of Rare Species                        | 211.7             |
| Acres of NHESP Estimated Habitats of Rare Wildlife                      | 211.7             |
| Acres of Wetlands, Marsh, Swamp, and Bogs                               | 5.5               |
| Acres of Pond/Lakes   | 2.8               |
| <b>Lands Critical to Sustaining Surface and GW Quality and Quantity</b> |                   |
| Number Public Water Supply Wells  | 0                 |
| Acres Zone I  | 0.0               |
| Acres Zone II   | 0.0               |
| Acres Interim Well Protection Areas                                     | 8.0               |
| Acres low-yield aquifer   | 0.0               |
| Acres medium-yield aquifer  | 1.0               |
| Acres high-yield aquifer  | 0.0               |
| Stressed Basin (Y/N)  | N                 |
| SWMI Groundwater Withdrawal Category                                    | 3                 |
| SWMI Biological Category  | 5                 |
| <b>Summary of Potential Sources of Pollution</b>                        |                   |
| NPDES surface water discharge   | 0                 |
| Groundwater discharges  | 1                 |
| BWP Major Facility  | 0                 |
| MassDEP 21 E Sites  | 0                 |
| Underground Storage Tank  | 0                 |

## Notes from Relevant Water Quality Monitoring

The Westford Stream Team does not currently conduct water quality sampling in the Flint Pond subbasin. Flint Pond subbasin waterbodies were not evaluated as part of the Healthy Lakes and Ponds Initiative.



Merrimack River Watershed

Flint Pond Subbasin Profile

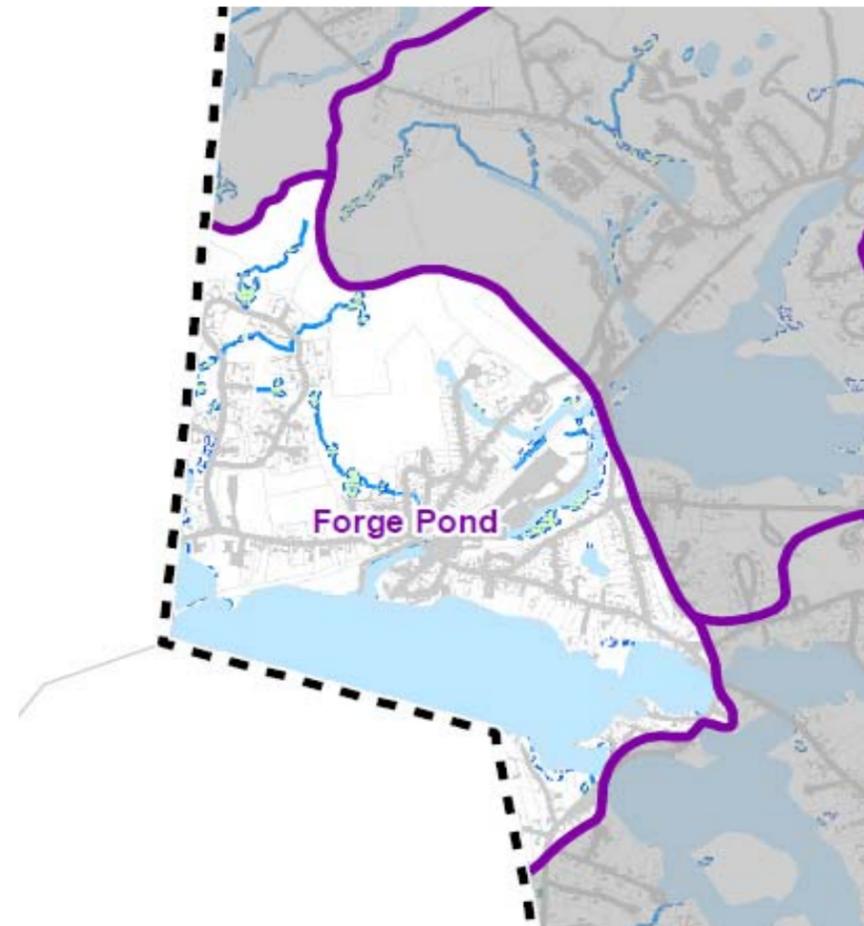
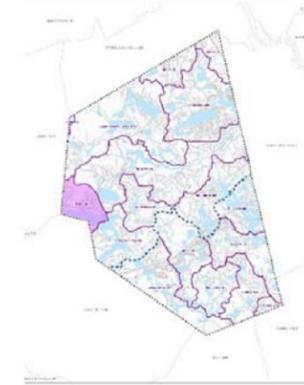
<sup>1</sup> Data from the Stormwater Management Master Plan Volume I, prepared by Tighe & Bond, 2015 - 2016. Note that this subbasin was not included in from the Watershed Action Plan prepared by Woodard & Curran, 200

## Forge Pond Subbasin Statistics

|   | 2015 <sup>1</sup> |
|---|-------------------|
| <b>Physical Characteristics</b>   |                   |
| Drainage area (sq. mi)  | 1.1               |
| Drainage area (acres)   | 706.8             |
| Contribution of subbasin to entire watershed in Westford (%)            | 5.3%              |
| <b>Stream Statistics</b>  |                   |
| Miles of perennial streams  | 0.5               |
| Total acres of perennial streams with 200 foot buffers                  | 27.4              |
| Miles of intermittent streams   | 0.7               |
| Acres of intermittent streams with 200-foot buffers                     | 32.3              |
| <b>Impairments and TMDLs</b>  |                   |
| Impaired Waterbody in subbasin  | Yes               |
| Final TMDL for waters in subbasin                                       | No                |
| <b>Land Use</b>   |                   |
| Acres of open space   | 177.0             |
| Acres of protected open space   | 101.1             |
| % protected open space  | 14.3%             |
| Acres of unprotected open space   | 75.9              |
| % unprotected open space  | 10.7%             |
| Acres of impervious surface   | 83.5              |
| % impervious surface  | 11.8%             |
| Impervious Cover Model Status   | Impacted          |
| <b>Habitat Characteristics</b>  |                   |
| Number of certified vernal pools  | 1                 |
| Number of potential vernal pools  | 7                 |
| Acres of vernal pools with 200-foot buffers                             | 2.9               |
| Acres of Area of Critical Environmental Concern (ACEC)                  | n/a               |
| Acres of NHESP Priority Habitats of Rare Species                        | 219.7             |
| Acres of NHESP Estimated Habitats of Rare Wildlife                      | 219.7             |
| Acres of Wetlands, Marsh, Swamp, and Bogs                               | 7.1               |
| Acres of Pond/Lakes   | 1.5               |
| <b>Lands Critical to Sustaining Surface and GW Quality and Quantity</b> |                   |
| Number Public Water Supply Wells  | 0                 |
| Acres Zone I  | 0.0               |
| Acres Zone II   | 178.0             |
| Acres Interim Well Protection Areas                                     | 0.0               |
| Acres low-yield aquifer   | 0.0               |
| Acres medium-yield aquifer  | 149.6             |
| Acres high-yield aquifer  | 57.8              |
| Stressed Basin (Y/N)  | N                 |
| SWMI Groundwater Withdrawal Category                                    | 5                 |
| SWMI Biological Category  | 5                 |
| <b>Summary of Potential Sources of Pollution</b>                        |                   |
| NPDES surface water discharge   | 0                 |
| Groundwater discharges  | 0                 |
| BWP Major Facility  | 1                 |
| MassDEP 21 E Sites  | 0                 |
| Underground Storage Tank  | 0                 |

## Notes from Relevant Water Quality Monitoring

The Westford Stream Team conducts water quality sampling at Stony Brook near Forge Pond multiple times each year. Constituents that are monitored include nutrients, temperature, dissolved oxygen, pH, conductivity, and occasionally total suspended solids. The sampling results are used to monitor the overall health of the waterbody, Forge Pond subbasin, and Stony Brook watershed. Further information is available from the Westford Stream Team.



**Merrimack River Watershed**

**Forge Pond Subbasin Profile**

<sup>1</sup> Data from the Stormwater Management Master Plan Volume I, prepared by Tighe & Bond, 2015 - 2016. Note that this subbasin was not included in from the Watershed Action Plan prepared by Woodard & Curran, 200

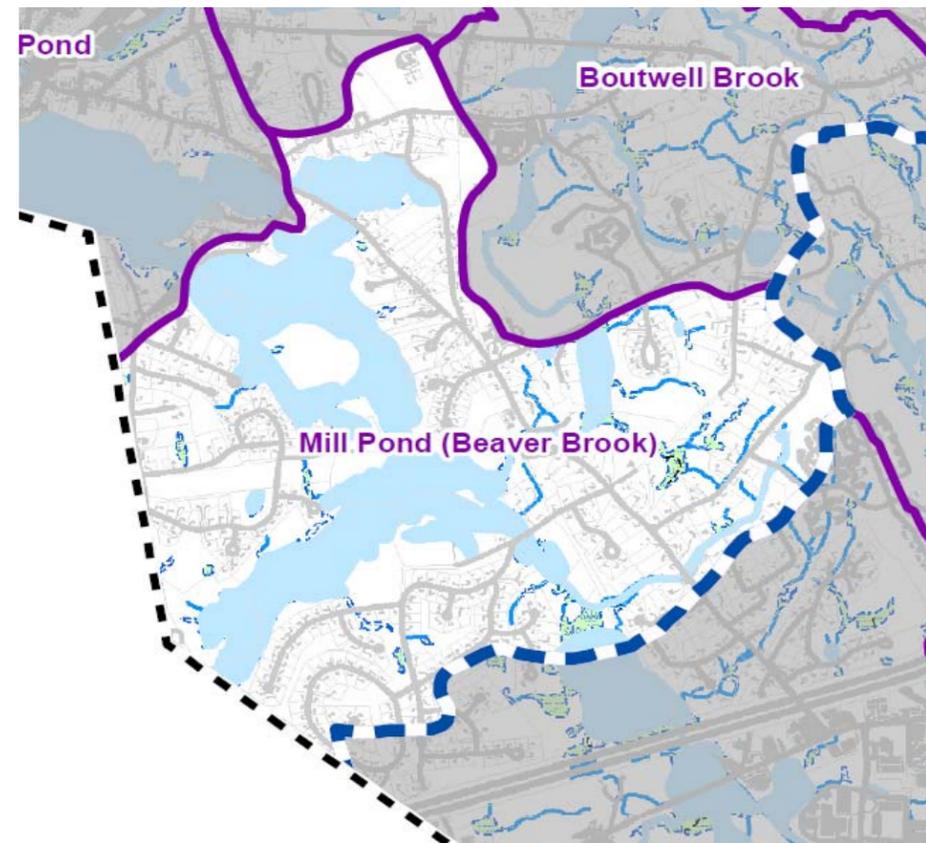
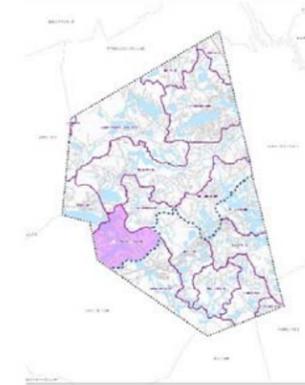
### Mill Pond Beaver Brook Subbasin Statistics

2015<sup>1</sup>

|   |           |
|---|-----------|
| <b>Physical Characteristics</b>   |           |
| Drainage area (sq. mi)  | 1.8       |
| Drainage area (acres)   | 1164.4    |
| Contribution of subbasin to entire watershed in Westford (%)            | 9.0%      |
| <b>Stream Statistics</b>  |           |
| Miles of perennial streams  | 0.9       |
| Total acres of perennial streams with 200 foot buffers                  | 53.1      |
| Miles of intermittent streams   | 0.9       |
| Acres of intermittent streams with 200-foot buffers                     | 48.1      |
| <b>Impairments and TMDLs</b>  |           |
| Impaired Waterbody in subbasin  | Yes       |
| Final TMDL for waters in subbasin                                       | No        |
| <b>Land Use</b>   |           |
| Acres of open space   | 511.0     |
| Acres of protected open space   | 372.0     |
| % protected open space  | 31.9%     |
| Acres of unprotected open space   | 139.0     |
| % unprotected open space  | 11.9%     |
| Acres of impervious surface   | 95.1      |
| % impervious surface  | 8.2%      |
| Impervious Cover Model Status   | Sensitive |
| <b>Habitat Characteristics</b>  |           |
| Number of certified vernal pools  | 13        |
| Number of potential vernal pools  | 9         |
| Acres of vernal pools with 200-foot buffers                             | 37.0      |
| Acres of Area of Critical Environmental Concern (ACEC)                  | n/a       |
| Acres of NHESP Priority Habitats of Rare Species                        | 753.5     |
| Acres of NHESP Estimated Habitats of Rare Wildlife                      | 753.3     |
| Acres of Wetlands, Marsh, Swamp, and Bogs                               | 1164.4    |
| Acres of Pond/Lakes   | 210.3     |
| <b>Lands Critical to Sustaining Surface and GW Quality and Quantity</b> |           |
| Number Public Water Supply Wells  | 7         |
| Acres Zone I  | 39.3      |
| Acres Zone II   | 736.9     |
| Acres Interim Well Protection Areas                                     | 0.0       |
| Acres low-yield aquifer   | 0.0       |
| Acres medium-yield aquifer  | 234.3     |
| Acres high-yield aquifer  | 194.9     |
| Stressed Basin (Y/N)  | N         |
| SWMI Groundwater Withdrawal Category                                    | 5         |
| SWMI Biological Category  | 5         |
| <b>Summary of Potential Sources of Pollution</b>                        |           |
| NPDES surface water discharge   | 0         |
| Groundwater discharges  | 1         |
| BWP Major Facility  | 0         |
| MassDEP 21 E Sites  | 0         |
| Underground Storage Tank  | 1         |

### Notes from Relevant Water Quality Monitoring

The Westford Stream Team does not currently conduct water quality sampling in the Mill Pond/Beaver Brook subbasin. Mill Pond/ Beaver Brook subbasin waterbodies were not evaluated as part of the Healthy Lakes and Ponds Initiative.



**Merrimack River Watershed**

**Mill Pond Beaver Brook Subbasin Profile**

<sup>1</sup> Data from the Stormwater Management Master Plan Volume I, prepared by Tighe & Bond, 2015 - 2016. Note that this subbasin was not included in from the Watershed Action Plan prepared by Woodard & Curran, 200

## Stony Brook Main Stem Subbasin Statistics

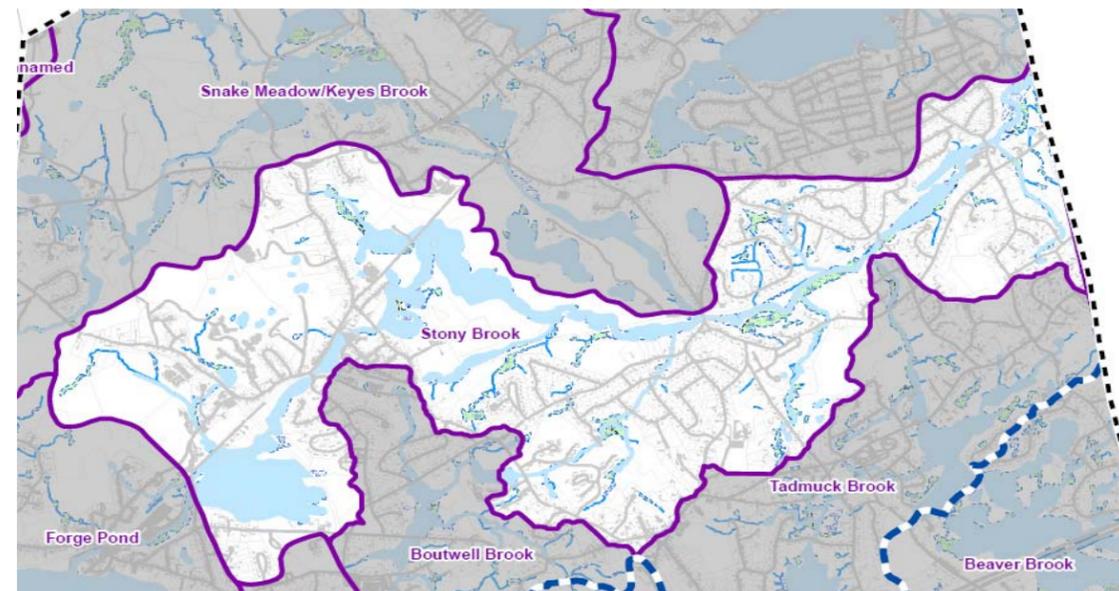
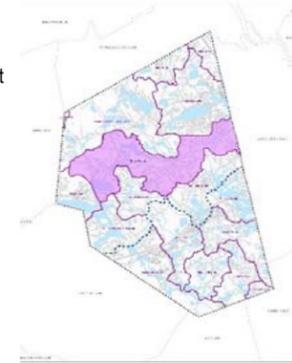
|   | 2007 <sup>1</sup> | 2015 <sup>2</sup> |
|---|-------------------|-------------------|
| <b>Physical Characteristics</b>   |                   |                   |
| Drainage area (sq. mi)  | 5.0               | 5.0               |
| Drainage area (acres)   | 3213.3            | 3213.1            |
| Contribution of subbasin to entire watershed in Westford (%)            | 30.7%             | 24.2%             |
| <b>Stream Statistics</b>  |                   |                   |
| Miles of perennial streams  | 3.9               | 4.6               |
| Total acres of perennial streams with 200 foot buffers                  | 227.8             | 224.6             |
| Miles of intermittent streams   | 3.1               | 3.1               |
| Acres of intermittent streams with 200-foot buffers                     | 177.6             | 176.2             |
| <b>Impairments and TMDLs</b>  |                   |                   |
| Impaired Waterbody in subbasin  | n/a               | Yes               |
| Final TMDL for waters in subbasin                                       | n/a               | No                |
| <b>Land Use</b>   |                   |                   |
| Acres of open space   | 902.4             | 1089.5            |
| Acres of protected open space   | 455.1             | 697.0             |
| % protected open space  | 14.2%             | 21.7%             |
| Acres of unprotected open space   | 447.3             | 392.5             |
| % unprotected open space  | 13.9%             | 12.2%             |
| Acres of impervious surface   | 261.0             | 2.8               |
| % impervious surface  | 8.1%              | 8.8%              |
| Impervious Cover Model Status   | Sensitive         | Sensitive         |
| <b>Habitat Characteristics <sup>3</sup></b>                             |                   |                   |
| Number of certified vernal pools  | 15                | 16                |
| Number of potential vernal pools  | 33                | 33                |
| Acres of vernal pools with 200-foot buffers                             | 42.8              | 46.8              |
| Acres of Area of Critical Environmental Concern (ACEC)                  | n/a               | n/a               |
| Acres of NHESP Priority Habitats of Rare Species                        | 409.2             | 298.7             |
| Acres of NHESP Estimated Habitats of Rare Wildlife                      | 409.2             | 298.7             |
| Acres of Wetlands, Marsh, Swamp, and Bogs                               | 171.8             | 3213.1            |
| Acres of Pond/Lakes   | 73.8              | 245.6             |
| <b>Lands Critical to Sustaining Surface and GW Quality and Quantity</b> |                   |                   |
| Number Public Water Supply Wells  | 8                 | 8                 |
| Acres Zone I  | 45.9              | 45.9              |
| Acres Zone II   | 1022.6            | 1022.5            |
| Acres Interim Well Protection Areas                                     | 0.0               | 0.0               |
| Acres low-yield aquifer   | 0.0               | 0.0               |
| Acres medium-yield aquifer  | 416.0             | 416.0             |
| Acres high-yield aquifer  | 393.4             | 393.4             |
| Stressed Basin (Y/N)  | N                 | N                 |
| SWMI Groundwater Withdrawal Category                                    | 5                 |                   |
| SWMI Biological Category  | 5                 |                   |
| <b>Summary of Potential Sources of Pollution</b>                        |                   |                   |
| NPDES surface water discharge   | 0                 | 0                 |
| Groundwater discharges  | 1                 | 4                 |
| BWP Major Facility  | 0                 | 0                 |
| MassDEP 21 E Sites  | 1                 | 2                 |
| Underground Storage Tank  | 2                 | 3                 |

## Notes from Relevant Water Quality Monitoring

The Westford Stream Team conducts water quality sampling at Tadmuck Brook, Coldspring Brook, Reed Brook, and two sites at Stony Brook multiple times each year. Constituents that are monitored include nutrients, temperature, dissolved oxygen, pH, conductivity, and occasionally total suspended solids. The sampling results are used to monitor the overall health of the waterbodies, Stony Brook subbasin, and Stony Brook watershed. In 2014, the source of high nitrate concentrations in Reed Brook were investigated as part of a special study. Further information on the routine monitoring and special study is available from the Westford Stream Team.

As part of the Healthy Lakes and Ponds initiative., ESS Group evaluated Old Mill/Graniteville Pond. As documented in the *Lakes & Ponds Management Plan* Old Mill/Graniteville Pond has overall condition.

- DO levels high during spring; Parts of the pond had adequate DO and one sampling location had poor DO during the summer
- Anoxic at the bottom of the pond during the spring
- High specific conductance (= high levels of dissolved salts) during spring and summer; may be naturally occurring
- Low turbidity, good pH levels during spring and summer
- "Generally acceptable" water clarity
- Ammonia/nitrate levels highest of all 5 ponds (approx.: ammonia 0.05 - 0.5 mg/L; nitrate 0.1 - 0.2 mg/L)
- Phosphorus at acceptable levels



Merrimack River Watershed

Stony Brook Main Stem Subbasin Profile

<sup>1</sup> Data from the Watershed Action Plan prepared by Woodard & Curran, 2007

<sup>2</sup> Data from the Stormwater Management Master Plan Volume I, prepared by Tighe & Bond, 2015 - 2016

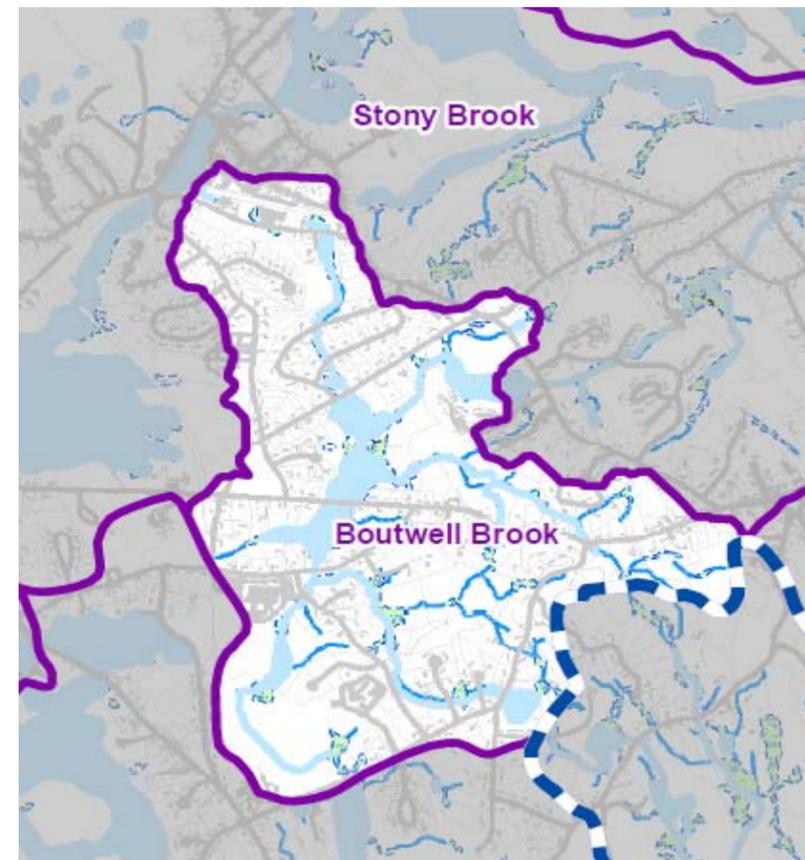
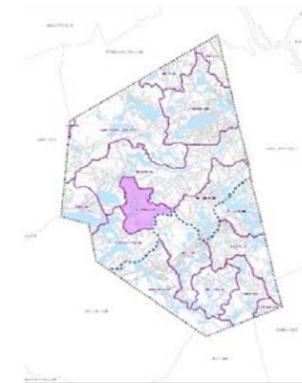
<sup>3</sup> Reed Brook is a coldwater fishery in this subbasin

## Boutwell Brook Subbasin Statistics

|   | 2007 <sup>1</sup> | 2015 <sup>2</sup> |
|---|-------------------|-------------------|
| <b>Physical Characteristics</b>   |                   |                   |
| Drainage area (sq. mi)  | 1.2               | 1.2               |
| Drainage area (acres)   | 759.9             | 759.9             |
| Contribution of subbasin to entire watershed in Westford (%)            | 7.3%              | 5.7%              |
| <b>Stream Statistics</b>  |                   |                   |
| Miles of perennial streams  | 1.3               | 1.3               |
| Total acres of perennial streams with 200 foot buffers                  | 71.2              | 69.5              |
| Miles of intermittent streams   | 2.5               | 2.5               |
| Acres of intermittent streams with 200-foot buffers                     | 130.6             | 130.9             |
| <b>Impairments and TMDLs</b>  |                   |                   |
| Impaired Waterbody in subbasin  | n/a               | No                |
| Final TMDL for waters in subbasin                                       | n/a               | No                |
| <b>Land Use</b>   |                   |                   |
| Acres of open space   | 245.5             | 212.0             |
| Acres of protected open space   | 125.8             | 191.0             |
| % protected open space  | 16.6%             | 25.1%             |
| Acres of unprotected open space   | 119.8             | 21.0              |
| % unprotected open space  | 15.8%             | 2.8%              |
| Acres of impervious surface   | 77.2              | 0.8               |
| % impervious surface  | 10.2%             | 10.4%             |
| Impervious Cover Model Status   | Impacted          | Impacted          |
| <b>Habitat Characteristics</b>  |                   |                   |
| Number of certified vernal pools  | 8                 | 8                 |
| Number of potential vernal pools  | 9                 | 9                 |
| Acres of vernal pools with 200-foot buffers                             | 23.0              | 22.3              |
| Acres of Area of Critical Environmental Concern (ACEC)                  | n/a               | n/a               |
| Acres of NHESP Priority Habitats of Rare Species                        | 118.2             | 108.6             |
| Acres of NHESP Estimated Habitats of Rare Wildlife                      | 118.2             | 108.6             |
| Acres of Wetlands, Marsh, Swamp, and Bogs                               | 28.1              | 28.1              |
| Acres of Pond/Lakes   | 1.8               | 1.8               |
| <b>Lands Critical to Sustaining Surface and GW Quality and Quantity</b> |                   |                   |
| Number Public Water Supply Wells  | 0                 | 0                 |
| Acres Zone I  | 0.0               | 0.0               |
| Acres Zone II   | 300.1             | 300.1             |
| Acres Interim Well Protection Areas                                     | 0.0               | 0.0               |
| Acres low-yield aquifer   | 0.0               | 0.0               |
| Acres medium-yield aquifer  | 125.2             | 125.2             |
| Acres high-yield aquifer  | 30.7              | 30.7              |
| Stressed Basin (Y/N)  | N                 | N                 |
| SWMI Groundwater Withdrawal Category                                    | 5                 |                   |
| SWMI Biological Category  | 5                 |                   |
| <b>Summary of Potential Sources of Pollution</b>                        |                   |                   |
| NPDES surface water discharge   | 0                 | 0                 |
| Groundwater discharges  | 0                 | 0                 |
| BWP Major Facility  | 0                 | 0                 |
| MassDEP 21 E Sites  | 0                 | 0                 |
| Underground Storage Tank  | 0                 | 3                 |

## Notes from Relevant Water Quality Monitoring

The Westford Stream Team does not currently conduct water quality sampling in the Boutwell Brook subbasin. Boutwell Brook waterbodies were not evaluated as part of the Healthy Lakes and Ponds Initiative.



Merrimack River Watershed

Boutwell Brook Subbasin Profile

<sup>1</sup> Data from the Watershed Action Plan prepared by Woodard & Curran, 2007

<sup>2</sup> Data from the Stormwater Management Master Plan Volume I, prepared by Tighe & Bond, 2015 - 2016

## Snake Meadow/Keyes Brook Subbasin Statistics

|   | 2007 <sup>1</sup> | 2015 <sup>2</sup> |
|---|-------------------|-------------------|
| <b>Physical Characteristics</b>   |                   |                   |
| Drainage area (sq. mi)  | 4.7               | 4.7               |
| Drainage area (acres)   | 3031.8            | 3031.5            |
| Contribution of subbasin to entire watershed in Westford (%)            | 28.9%             | 22.8%             |
| <b>Stream Statistics</b>  |                   |                   |
| Miles of perennial streams  | 7.1               | 7.1               |
| Total acres of perennial streams with 200 foot buffers                  | 352.6             | 349.2             |
| Miles of intermittent streams   | 0.7               | 0.8               |
| Acres of intermittent streams with 200-foot buffers                     | 51.3              | 48.5              |
| <b>Impairments and TMDLs</b>  |                   |                   |
| Impaired Waterbody in subbasin  | n/a               | No                |
| Final TMDL for waters in subbasin                                       | n/a               | No                |
| <b>Land Use</b>   |                   |                   |
| Acres of open space   | 791.6             | 829.0             |
| Acres of protected open space   | 521.0             | 495.0             |
| % protected open space  | 17.2%             | 16.3%             |
| Acres of unprotected open space   | 270.7             | 334.0             |
| % unprotected open space  | 8.9%              | 11.0%             |
| Acres of impervious surface   | 121.7             | 148.8             |
| % impervious surface  | 4.0%              | 4.9%              |
| Impervious Cover Model Status   | Sensitive         | Sensitive         |
| <b>Habitat Characteristics</b>  |                   |                   |
| Number of certified vernal pools  | 9                 | 12                |
| Number of potential vernal pools  | 46                | 46                |
| Acres of vernal pools with 200-foot buffers                             | 25.9              | 35.4              |
| Acres of Area of Critical Environmental Concern (ACEC)                  | n/a               | n/a               |
| Acres of NHESP Priority Habitats of Rare Species                        | 1368.8            | 1230.1            |
| Acres of NHESP Estimated Habitats of Rare Wildlife                      | 1368.8            | 1230.1            |
| Acres of Wetlands, Marsh, Swamp, and Bogs                               | 190.6             | 190.6             |
| Acres of Pond/Lakes   | 183.1             | 183.1             |
| <b>Lands Critical to Sustaining Surface and GW Quality and Quantity</b> |                   |                   |
| Number Public Water Supply Wells  | 3                 | 5                 |
| Acres Zone I  | 23.5              | 24.0              |
| Acres Zone II   | 486.5             | 486.5             |
| Acres Interim Well Protection Areas                                     | 42.9              | 283.0             |
| Acres low-yield aquifer   | 0.0               | 0.0               |
| Acres medium-yield aquifer  | 250.5             | 250.5             |
| Acres high-yield aquifer  | 190.5             | 190.5             |
| Stressed Basin (Y/N)  | N                 | N                 |
| SWMI Groundwater Withdrawal Category                                    | 5                 |                   |
| SWMI Biological Category  | 5                 |                   |
| <b>Summary of Potential Sources of Pollution</b>                        |                   |                   |
| NPDES surface water discharge   | 0                 | 0                 |
| Groundwater discharges  | 0                 | 1                 |
| BWP Major Facility  | 0                 | 0                 |
| MassDEP 21 E Sites  | 0                 | 0                 |
| Underground Storage Tank  | 2                 | 2                 |

## Notes from Relevant Water Quality Monitoring

The Westford Stream Team conducts water quality sampling at Keyes Brook multiple times each year. Constituents that are monitored include nutrients, temperature, dissolved oxygen, pH, conductivity, and occasionally total suspended solids. The sampling results are used to monitor the overall health of the waterbody, Snake Meadow/Keyes Brook subbasin, and Stony Brook watershed. Further information is available from the Westford Stream Team.

As part of the Healthy Lakes and Ponds initiative, ESS Group evaluated three ponds in the subbasin: Keyes Pond, Burges Pond, and Grassy Pond. As documented in the *Lakes & Ponds Management Plan* these ponds have the following overall condition.

### Keyes Pond – Fair

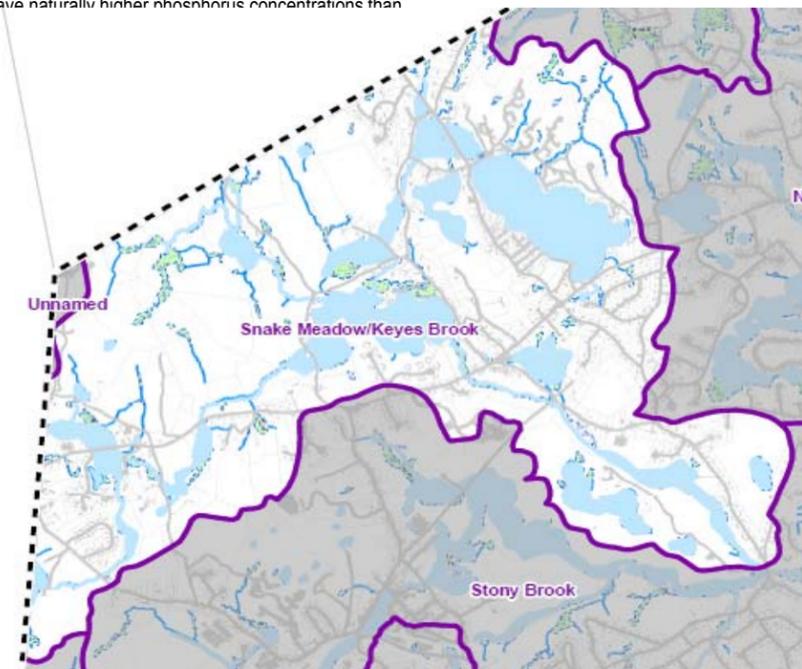
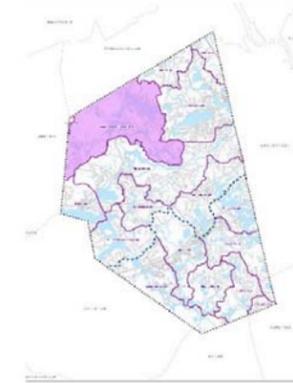
- Dissolved oxygen concentrations above state standard (5 mg/L) during spring and summer, but the pond became anoxic ( $\leq 1$  mg/L) at the bottom of the pond in the summer
- Dissolved ionic solids (salts) present, increasing specific conductance
- Low turbidity
- pH typically within acceptable parameters, but elevated at one sampling location in the summer
- Okay water clarity
- Phosphorus and ammonia concentrations are not "excessive" (nitrate ND), but phosphorus had higher concentrations at the bottom of the pond

### Burges Pond – Fair

- Water quality was "fair"
- DO levels are adequate, but the pond is anoxic near the bottom
- Low specific conductance and turbidity; pH levels within acceptable parameters
- Okay water clarity
- Ammonia/nitrate low/ND
- Phosphorus had levels higher than desired ( $> 0.2$  mg/L), especially during the summer

### Grassy Pond (directly east from Burges Pond) – Fair

- DO is high during the spring, low during the summer
- Turbidity low during the spring, high during the summer
- Specific conductance and pH low both spring and summer
- Good water clarity
- Ammonia/nitrate low/ND
- Phosphorus had levels higher than desired ( $> 0.2$  mg/L), especially during the summer
- "Given the shallow water depth and abundant growth of emergent plants at Grassy Pond, the water body functions much like an emergent wetland and may have naturally higher phosphorus concentrations than



Merrimack River Watershed

Snake Meadow/Keyes Brook Subbasin Profile

<sup>1</sup> Data from the Watershed Action Plan prepared by Woodard & Curran, 2007

<sup>2</sup> Data from the Stormwater Management Master Plan Volume I, prepared by Tighe & Bond, 2015 - 2016

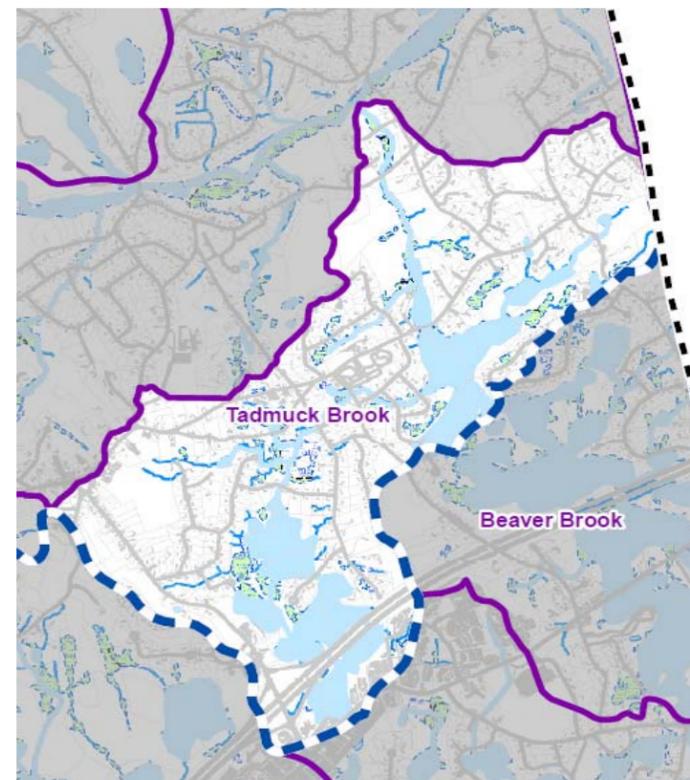
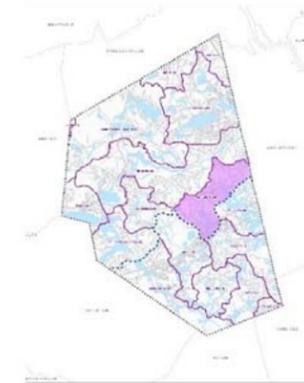
## Tadmuck Subbasin Statistics

|   | 2007 <sup>1</sup> | 2015 <sup>2</sup> |
|---|-------------------|-------------------|
| <b>Physical Characteristics</b>   |                   |                   |
| Drainage area (sq. mi)  | 2.0               | 2.0               |
| Drainage area (acres)   | 1284.2            | 1283.4            |
| Contribution of subbasin to entire watershed in Westford (%)            | 12.3%             | 9.7%              |
| <b>Stream Statistics</b>  |                   |                   |
| Miles of perennial streams  | 2.9               | 2.9               |
| Total acres of perennial streams with 200 foot buffers                  | 150.8             | 149.0             |
| Miles of intermittent streams   | 2.1               | 2.1               |
| Acres of intermittent streams with 200-foot buffers                     | 108.8             | 108.8             |
| <b>Impairments and TMDLs</b>  |                   |                   |
| Impaired Waterbody in subbasin  | n/a               | Yes               |
| Final TMDL for waters in subbasin                                       | n/a               | No                |
| <b>Land Use</b>   |                   |                   |
| Acres of open space   | 315.3             | 297.0             |
| Acres of protected open space   | 253.5             | 263.0             |
| % protected open space  | 19.7%             | 20.5%             |
| Acres of unprotected open space   | 61.8              | 34.0              |
| % unprotected open space  | 4.8%              | 2.6%              |
| Acres of impervious surface   | 137.9             | 1.5               |
| % impervious surface  | 10.7%             | 11.4%             |
| Impervious Cover Model Status   | Impacted          | Impacted          |
| <b>Habitat Characteristics</b>  |                   |                   |
| Number of certified vernal pools  | 1                 | 1                 |
| Number of potential vernal pools  | 16                | 16                |
| Acres of vernal pools with 200-foot buffers                             | 2.9               | 2.2               |
| Acres of Area of Critical Environmental Concern (ACEC)                  | n/a               | n/a               |
| Acres of NHESP Priority Habitats of Rare Species                        | 101.9             | 0.0               |
| Acres of NHESP Estimated Habitats of Rare Wildlife                      | 101.9             | 0.0               |
| Acres of Wetlands, Marsh, Swamp, and Bogs                               | 102.1             | 102.1             |
| Acres of Pond/Lakes   | 8.3               | 8.3               |
| <b>Lands Critical to Sustaining Surface and GW Quality and Quantity</b> |                   |                   |
| Number Public Water Supply Wells  | 0                 | 0                 |
| Acres Zone I  | 0.0               | 0.0               |
| Acres Zone II   | 32.6              | 32.6              |
| Acres Interim Well Protection Areas                                     | 0.0               | 0.0               |
| Acres low-yield aquifer   | 0.0               | 0.0               |
| Acres medium-yield aquifer  | 0.0               | 0.0               |
| Acres high-yield aquifer  | 0.0               | 0.0               |
| Stressed Basin (Y/N)  | N                 | N                 |
| SWMI Groundwater Withdrawal Category                                    | 5                 |                   |
| SWMI Biological Category  | 5                 |                   |
| <b>Summary of Potential Sources of Pollution</b>                        |                   |                   |
| NPDES surface water discharge   | 0                 | 0                 |
| Groundwater discharges  | 0                 | 0                 |
| BWP Major Facility  | 0                 | 0                 |
| MassDEP 21 E Sites  | 1                 | 0                 |
| Underground Storage Tank  | 4                 | 5                 |

## Notes from Relevant Water Quality Monitoring

The Westford Stream Team conducts water quality sampling at Boutwell Brook multiple times each year. Constituents that are monitored include nutrients, temperature, dissolved oxygen, pH, and conductivity. The sampling results are used to monitor the overall health of the waterbody, Tadmuck Brook subbasin, and Stony Brook watershed. Further information is available from the Westford Stream Team.

Tadmuck Brook waterbodies were not evaluated as part of the Healthy Lakes and Ponds Initiative.



Merrimack River Watershed

Tadmuck Brook Subbasin Profile

<sup>1</sup> Data from the Watershed Action Plan prepared by Woodard & Curran, 2007

<sup>2</sup> Data from the Stormwater Management Master Plan Volume I, prepared by Tighe & Bond, 2015 - 2016

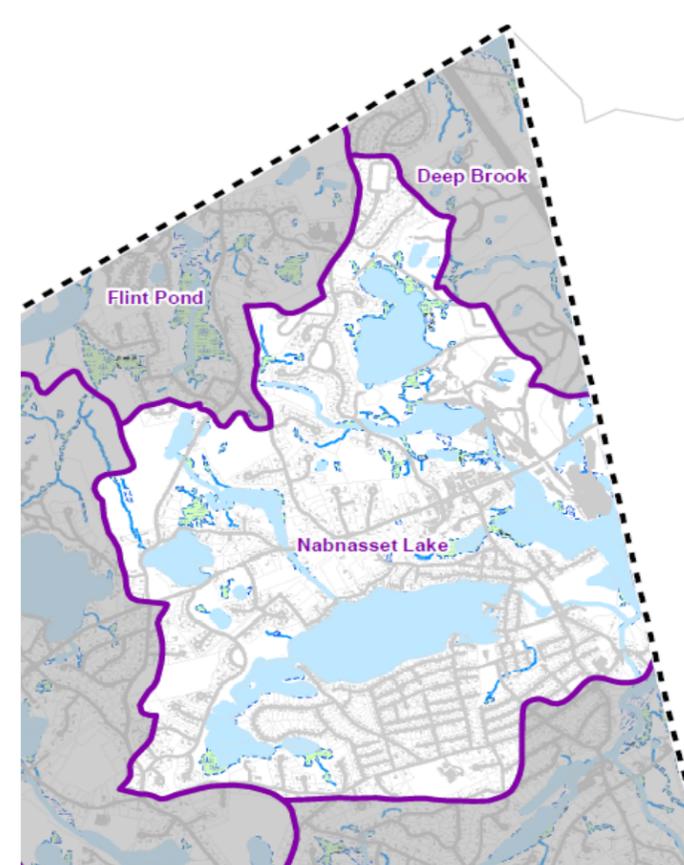
## Nabnasset Pond Subbasin Statistics

|   | 2007 <sup>1</sup> | 2015 <sup>2</sup> |
|---|-------------------|-------------------|
| <b>Physical Characteristics</b>   |                   |                   |
| Drainage area (sq. mi)  | 3.4               | 3.4               |
| Drainage area (acres)   | 2187.9            | 2187.4            |
| Contribution of subbasin to entire watershed in Westford (%)            | 20.9%             | 16.0%             |
| <b>Stream Statistics</b>  |                   |                   |
| Miles of perennial streams  | 3.0               | 3.1               |
| Total acres of perennial streams with 200 foot buffers                  | 163.8             | 164.0             |
| Miles of intermittent streams   | 0.9               | 0.9               |
| Acres of intermittent streams with 200-foot buffers                     | 52.0              | 52.0              |
| <b>Impairments and TMDLs</b>  |                   |                   |
| Impaired Waterbody in subbasin  | n/a               | Yes               |
| Final TMDL for waters in subbasin                                       | n/a               | No                |
| <b>Land Use</b>   |                   |                   |
| Acres of open space   | 447.6             | 492.0             |
| Acres of protected open space   | 360.9             | 344.0             |
| % protected open space  | 16.5%             | 15.7%             |
| Acres of unprotected open space   | 86.6              | 148.0             |
| % unprotected open space  | 4.0%              | 6.8%              |
| Acres of impervious surface   | 214.5             | 2.7               |
| % impervious surface  | 9.8%              | 12.2%             |
| Impervious Cover Model Status   | Sensitive         | Impacted          |
| <b>Habitat Characteristics</b>  |                   |                   |
| Number of certified vernal pools  | 18                | 23                |
| Number of potential vernal pools  | 41                | 41                |
| Acres of vernal pools with 200-foot buffers                             | 48.7              | 65.0              |
| Acres of Area of Critical Environmental Concern (ACEC)                  | n/a               | n/a               |
| Acres of NHESP Priority Habitats of Rare Species                        | 625.0             | 594.4             |
| Acres of NHESP Estimated Habitats of Rare Wildlife                      | 625.0             | 594.4             |
| Acres of Wetlands, Marsh, Swamp, and Bogs                               | 107.5             | 107.5             |
| Acres of Pond/Lakes   | 220.3             | 220.3             |
| <b>Lands Critical to Sustaining Surface and GW Quality and Quantity</b> |                   |                   |
| Number Public Water Supply Wells  | 3                 | 3                 |
| Acres Zone I  | 17.8              | 14.4              |
| Acres Zone II   | 939.6             | 939.3             |
| Acres Interim Well Protection Areas                                     | 0.0               | 0.0               |
| Acres low-yield aquifer   | 0.0               | 0.0               |
| Acres medium-yield aquifer  | 443.1             | 443.0             |
| Acres high-yield aquifer  | 92.1              | 92.1              |
| Stressed Basin (Y/N)  | N                 | N                 |
| SWMI Groundwater Withdrawal Category                                    | 5                 |                   |
| SWMI Biological Category  | 5                 |                   |
| <b>Summary of Potential Sources of Pollution</b>                        |                   |                   |
| NPDES surface water discharge   | 1                 | 0                 |
| Groundwater discharges  | 0                 | 0                 |
| BWP Major Facility  | 0                 | 2                 |
| MassDEP 21 E Sites  | 3                 | 0                 |
| Underground Storage Tank  | 0                 | 0                 |

## Notes from Relevant Water Quality Monitoring

The Westford Stream Team conducts water quality sampling at Gilson Brook multiple times each year. Constituents that are monitored include nutrients, temperature, dissolved oxygen, pH, conductivity, and occasionally total suspended solids. The sampling results are used to monitor the overall health of the waterbody, Nabnasset Pond subbasin, and Stony Brook watershed. Further information is available from the Westford Stream Team.

A Cyanobacteria bloom closed Nabnasset Lake to swimming in 2012. No bloom in 2013. Pond treated with copper-based algacide in 2014 to prevent any cyano blooms. No consistent increase in phosphorus has been observed since pond since annual monitoring began.



Merrimack River Watershed

Nabnasset Pond Subbasin Profile

<sup>1</sup> Data from the Watershed Action Plan prepared by Woodard & Curran, 2007

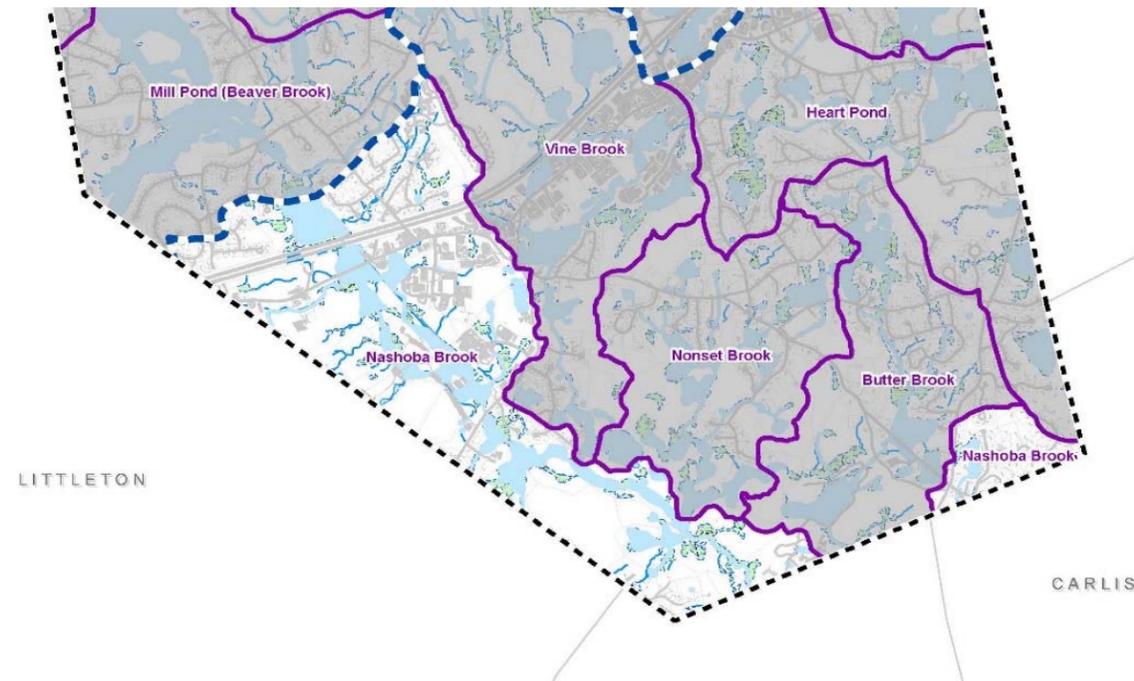
<sup>2</sup> Data from the Stormwater Management Master Plan Volume I, prepared by Tighe & Bond, 2015 - 2016

## Nashoba Brook Subbasin Statistics

|  | 2007 <sup>1</sup> | 2015 <sup>2</sup> |
|--|-------------------|-------------------|
| <b>Physical Characteristics</b>  |                   |                   |
| Drainage area (sq. mi)   | 2.7               | 2.7               |
| Drainage area (acres)  | 1730.0            | 1728.3            |
| Contribution of subbasin to entire watershed in Westford (%)                     | 36.3%             | 25.6%             |
| <b>Stream Statistics</b>   |                   |                   |
| Miles of perennial streams   | 4.5               | 4.5               |
| Total acres of perennial streams with 200 foot buffers                           | 212.3             | 204.0             |
| Miles of intermittent streams  | 2.1               | 2.1               |
| Acres of intermittent streams with 200-foot buffers                              | 115.5             | 112.6             |
| <b>Impairments and TMDLs</b>   |                   |                   |
| Impaired Waterbody in subbasin   | n/a               | Yes               |
| Final TMDL for waters in subbasin  | n/a               | Yes               |
| <b>Land Use</b>  |                   |                   |
| Acres of open space  | 587.5             | 659.8             |
| Acres of protected open space  | 402.0             | 264.0             |
| % protected open space   | 23.2%             | 15.3%             |
| Acres of unprotected open space  | 185.5             | 395.8             |
| % unprotected open space   | 10.7%             | 22.9%             |
| Acres of impervious surface  | 167.1             | 2.0               |
| % impervious surface   | 9.7%              | 11.3%             |
| Impervious Cover Model Status  | Sensitive         | Impacted          |
| <b>Habitat Characteristics</b>   |                   |                   |
| Number of certified vernal pools   | 3                 | 9                 |
| Number of potential vernal pools   | 23                | 23                |
| Acres of vernal pools with 200-foot buffers                                      | 8.4               | 24.8              |
| Acres of Area of Critical Environmental Concern (ACEC)                           | n/a               | n/a               |
| Acres of NHESP Priority Habitats of Rare Species                                 | 867.0             | 830.2             |
| Acres of NHESP Estimated Habitats of Rare Wildlife                               | 859.0             | 822.0             |
| Acres of Wetlands, Marsh, Swamp, and Bogs  | 145.8             | 145.8             |
| Acres of Pond/Lakes  | 9.9               | 9.9               |
| <b>Lands Critical to Sustaining Surface and Groundwater Quality and Quantity</b> |                   |                   |
| Number Public Water Supply Wells   | 5                 | 4                 |
| Acres Zone I   | 36.9              | 15.8              |
| Acres Zone II  | 214.5             | 213.3             |
| Acres Interim Well Protection Areas  | 326.3             | 212.3             |
| Acres low-yield aquifer  | 0.0               | 0.0               |
| Acres medium-yield aquifer   | 258.3             | 258.1             |
| Acres high-yield aquifer   | 0.0               | 0.0               |
| Stressed Basin (Y/N)   | Y, highly         | Y, highly         |
| SWMI Groundwater Withdrawal Category   | 3                 |                   |
| SWMI Biological Category   | 5                 |                   |
| <b>Summary of Potential Sources of Pollution</b>                                 |                   |                   |
| NPDES surface water discharge  | 0                 | 0                 |
| Groundwater discharges   | 1                 | 4                 |
| BWP Major Facility   | 0                 | 1                 |
| MassDEP 21 E Sites   | 2                 | 0                 |
| Underground Storage Tank   | 0                 | 2                 |

## Notes from Relevant Water Quality Monitoring

The Westford Stream Team conducts water quality sampling at multiple points along Nashoba Brook multiple times each year. Constituents that are monitored include nutrients, temperature, dissolved oxygen, pH, conductivity, and occasionally total suspended solids. The sampling results are used to monitor the overall health of the waterbody, Nashoba Brook subbasin, and Nashoba Brook watershed. Two sites in the Nashoba Brook are sampled: one at Powers Road and one at the railroad bed. Further information is available from the Westford Stream Team.



Sudbury-Assabet-Concord (SuAsCo) River Watershed

Nashoba Brook Main Stem Subbasin Profile

<sup>1</sup> Data from the Watershed Action Plan prepared by Woodard & Curran, 2007

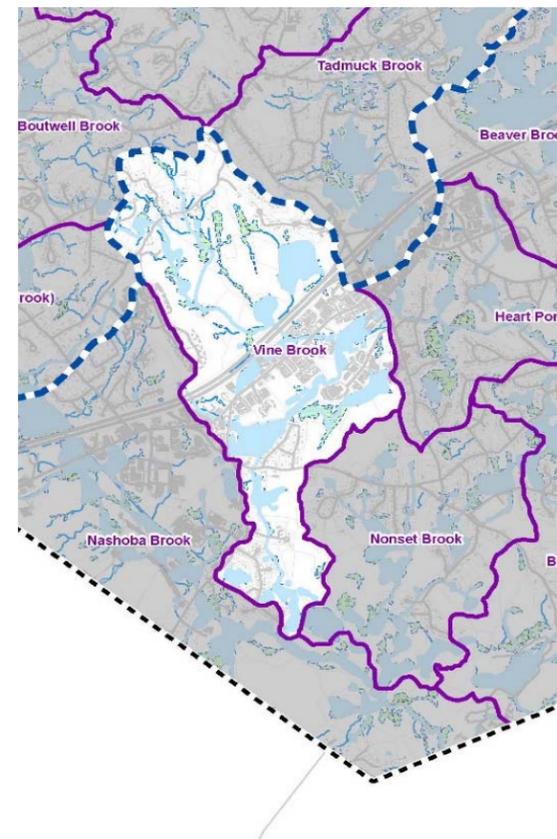
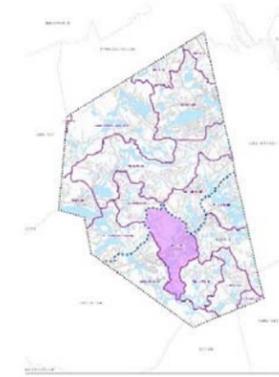
<sup>2</sup> Data from the Stormwater Management Master Plan Volume I, prepared by Tighe & Bond, 2015 - 2016

## Vine Brook Subbasin Statistics

|   | 2007 <sup>1</sup> | 2015 <sup>2</sup> |
|---|-------------------|-------------------|
| <b>Physical Characteristics</b>   |                   |                   |
| Drainage area (sq. mi)  | 2.1               | 2.1               |
| Drainage area (acres)   | 1312.2            | 1312.2            |
| Contribution of subbasin to entire watershed in Westford (%)            | 27.5%             | 19.5%             |
| <b>Stream Statistics</b>  |                   |                   |
| Miles of perennial streams  | 3.8               | 3.8               |
| Total acres of perennial streams with 200 foot buffers                  | 176.6             | 175.0             |
| Miles of intermittent streams   | 2.9               | 2.9               |
| Acres of intermittent streams with 200-foot buffers                     | 157.5             | 157.2             |
| <b>Impairments and TMDLs</b>  |                   |                   |
| Impaired Waterbody in subbasin  | n/a               | No                |
| Final TMDL for waters in subbasin                                       | n/a               | Yes               |
| <b>Land Use</b>   |                   |                   |
| Acres of open space   | 400.4             | 489.9             |
| Acres of protected open space   | 367.7             | 343.0             |
| % protected open space  | 28.0%             | 26.1%             |
| Acres of unprotected open space   | 32.7              | 146.9             |
| % unprotected open space  | 2.5%              | 11.2%             |
| Acres of impervious surface   | 137.5             | 1.6               |
| % impervious surface  | 10.5%             | 12.0%             |
| <b>Habitat Characteristics</b>  |                   |                   |
| Number of certified vernal pools  | 4                 | 6                 |
| Number of potential vernal pools  | 32                | 32                |
| Acres of vernal pools with 200-foot buffers                             | 11.5              | 17.3              |
| Acres of Area of Critical Environmental Concern (ACEC)                  | n/a               | n/a               |
| Acres of NHESP Priority Habitats of Rare Species                        | 239.2             | 221.6             |
| Acres of NHESP Estimated Habitats of Rare Wildlife                      | 239.2             | 211.6             |
| Acres of Wetlands, Marsh, Swamp, and Bogs                               | 123.0             | 123.0             |
| Acres of Pond/Lakes   | 4.8               | 4.8               |
| Impervious Cover Model Status   | Sensitive         | Sensitive         |
| <b>Lands Critical to Sustaining Surface and GW Quality and Quantity</b> |                   |                   |
| Number Public Water Supply Wells  | 0                 | 0                 |
| Acres Zone I  | 6.3               | 2.5               |
| Acres Zone II   | 0.0               | 0.0               |
| Acres Interim Well Protection Areas                                     | 95.6              | 41.8              |
| Acres low-yield aquifer   | 0.0               | 0.0               |
| Acres medium-yield aquifer  | 100.8             | 101.0             |
| Acres high-yield aquifer  | 0.0               | 0.0               |
| Stressed Basin (Y/N)  | Y, highly         | Y, highly         |
| SWMI Groundwater Withdrawal Category                                    | 3                 |                   |
| SWMI Biological Category  | 5                 |                   |
| <b>Summary of Potential Sources of Pollution</b>                        |                   |                   |
| NPDES surface water discharge   | 0                 | 0                 |
| Groundwater discharges  | 3                 | 3                 |
| BWP Major Facility  | 1                 | 2                 |
| MassDEP 21 E Sites  | 0                 | 0                 |
| Underground Storage Tank  | 1                 | 2                 |

## Notes from Relevant Water Quality Monitoring

The Westford Stream Team conducts water quality sampling at Vine Brook multiple times each year. Constituents that are monitored include nutrients, temperature, dissolved oxygen, pH, conductivity, and occasionally total suspended solids. The sampling results are used to monitor the overall health of the waterbody, Vine Brook subbasin, and Nashoba Brook watershed. In 2013 and 2014, the source of a high total phosphorus concentration and consistent low pH in Vine Brook and one of its tributaries were investigated as part of a special study. Further information on the routine monitoring and special study is available from the Westford Stream Team.



Sudbury-Assabet-Concord (SuAsCo) River Watershed

Vine Brook Subbasin Profile

<sup>1</sup> Data from the Watershed Action Plan prepared by Woodard & Curran, 2007

<sup>2</sup> Data from the Stormwater Management Master Plan Volume I, prepared by Tighe & Bond, 2015 - 2016

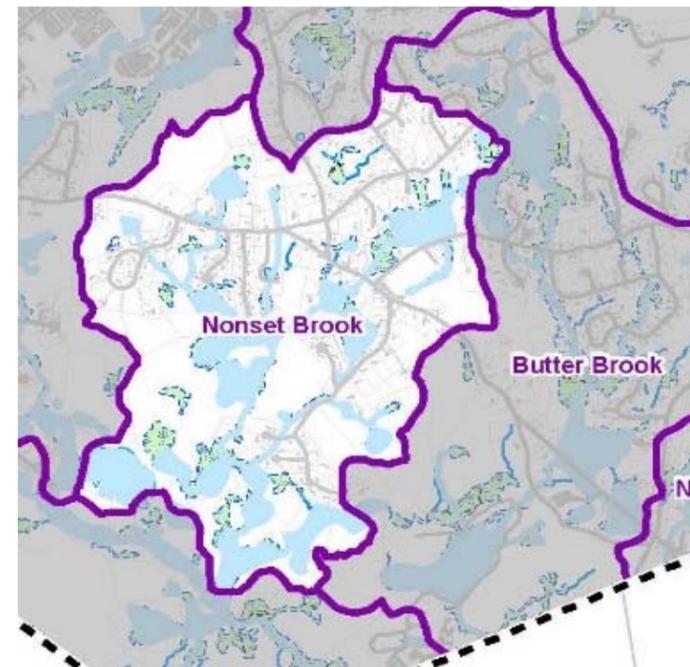
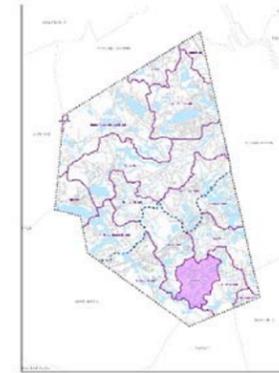
## Nonset Brook Subbasin Statistics

|   | 2007 <sup>1</sup> | 2015 <sup>2</sup> |
|---|-------------------|-------------------|
| <b>Physical Characteristics</b>   |                   |                   |
| Drainage area (sq. mi)  | 1.3               | 1.3               |
| Drainage area (acres)   | 856.5             | 856.5             |
| Contribution of subbasin to entire watershed in Westford (%)            | 18.0%             | 12.7%             |
| <b>Stream Statistics</b>  |                   |                   |
| Miles of perennial streams  | 1.9               | 1.9               |
| Total acres of perennial streams with 200 foot buffers                  | 93.4              | 91.6              |
| Miles of intermittent streams   | 2.7               | 2.7               |
| Acres of intermittent streams with 200-foot buffers                     | 152.2             | 152.1             |
| <b>Impairments and TMDLs</b>  |                   |                   |
| Impaired Waterbody in subbasin  | n/a               | No                |
| Final TMDL for waters in subbasin                                       | n/a               | Yes               |
| <b>Land Use</b>   |                   |                   |
| Acres of open space   | 355.7             | 428.0             |
| Acres of protected open space   | 327.4             | 379.0             |
| % protected open space  | 38.2%             | 44.3%             |
| Acres of unprotected open space   | 28.3              | 49.0              |
| % unprotected open space  | 3.3%              | 5.7%              |
| Acres of impervious surface   | 39.9              | 0.4               |
| % impervious surface  | 4.7%              | 5.0%              |
| Impervious Cover Model Status   | Sensitive         | Sensitive         |
| <b>Habitat Characteristics</b>  |                   |                   |
| Number of certified vernal pools  | 7                 | 7                 |
| Number of potential vernal pools  | 14                | 14                |
| Acres of vernal pools with 200-foot buffers                             | 19.7              | 20.1              |
| Acres of Area of Critical Environmental Concern (ACEC)                  | n/a               | n/a               |
| Acres of NHESP Priority Habitats of Rare Species                        | 560.8             | 544.3             |
| Acres of NHESP Estimated Habitats of Rare Wildlife                      | 560.8             | 544.3             |
| Acres of Wetlands, Marsh, Swamp, and Bogs                               | 79.6              | 79.6              |
| Acres of Pond/Lakes   | 15.1              | 15.1              |
| <b>Lands Critical to Sustaining Surface and GW Quality and Quantity</b> |                   |                   |
| Number Public Water Supply Wells  | 0                 | 0                 |
| Acres Zone I  | 3.1               | 1.5               |
| Acres Zone II   | 46.2              | 46.2              |
| Acres Interim Well Protection Areas                                     | 101.0             | 39.2              |
| Acres low-yield aquifer   | 0.0               | 0.0               |
| Acres medium-yield aquifer  | 87.8              | 87.8              |
| Acres high-yield aquifer  | 0.0               | 0.0               |
| Stressed Basin (Y/N)  | Y, highly         | Y, highly         |
| SWMI Groundwater Withdrawal Category                                    | 3                 |                   |
| SWMI Biological Category  | 5                 |                   |
| <b>Summary of Potential Sources of Pollution</b>                        |                   |                   |
| NPDES surface water discharge   | 0                 | 0                 |
| Groundwater discharges  | 0                 | 0                 |
| BWP Major Facility  | 0                 | 0                 |
| MassDEP 21 E Sites  | 0                 | 0                 |
| Underground Storage Tank  | 0                 | 0                 |

## Notes from Relevant Water Quality Monitoring

As part of the Healthy Lakes and Ponds initiative., ESS Group evaluated Kennedy Pond. As documented in the *Lakes & Ponds Management Plan* Kennedy Pond has excellent overall condition.

- DO above state standards during spring and summer, but below standards at 6 – 7 meters deep
- Specific conductance and pH within acceptable levels, turbidity low in spring and summer
- Good water clarity
- Low ammonia/nitrate and phosphorus levels – lowest phosphorus levels of the 5 ponds



Sudbury-Assabet-Concord (SuAsCo) River Watershed

Nonset Brook Subbasin Profile

<sup>1</sup> Data from the Watershed Action Plan prepared by Woodard & Curran, 2007

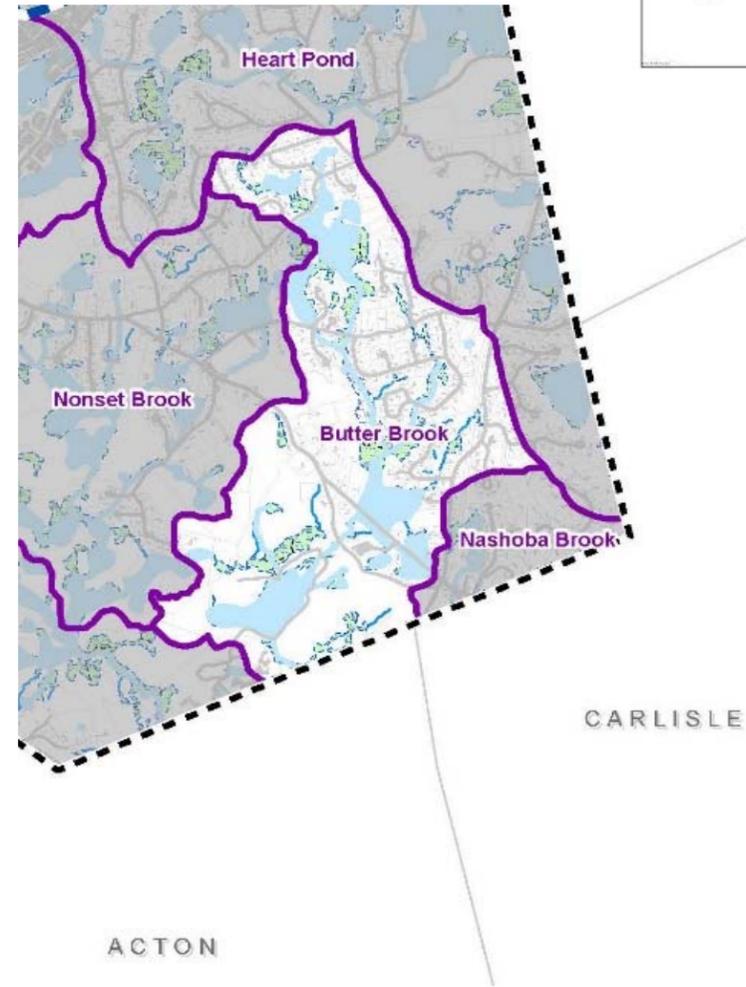
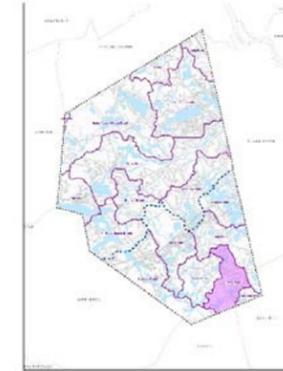
<sup>2</sup> Data from the Stormwater Management Master Plan Volume I, prepared by Tighe & Bond, 2015 - 2016

## Butter Brook Subbasin Statistics

|   | 2007 <sup>1</sup> | 2015 <sup>2</sup> |
|---|-------------------|-------------------|
| <b>Physical Characteristics</b>   |                   |                   |
| Drainage area (sq. mi)  | 1.4               | 1.4               |
| Drainage area (acres)   | 865.9             | 864.7             |
| Contribution of subbasin to entire watershed in Westford (%)            | 18.2%             | 12.8%             |
| <b>Stream Statistics</b>  |                   |                   |
| Miles of perennial streams  | 2.7               | 2.7               |
| Total acres of perennial streams with 200 foot buffers                  | 133.7             | 130.5             |
| Miles of intermittent streams   | 1.6               | 1.6               |
| Acres of intermittent streams with 200-foot buffers                     | 88.4              | 88.3              |
| <b>Impairments and TMDLs</b>  |                   |                   |
| Impaired Waterbody in subbasin  | n/a               | No                |
| Final TMDL for waters in subbasin                                       | n/a               | Yes               |
| <b>Land Use</b>   |                   |                   |
| Acres of open space   | 193.1             | 175.8             |
| Acres of protected open space   | 188.5             | 162.0             |
| % protected open space  | 21.8%             | 18.7%             |
| Acres of unprotected open space   | 4.6               | 13.8              |
| % unprotected open space  | 0.5%              | 1.6%              |
| Acres of impervious surface   | 55.0              | 0.6               |
| % impervious surface  | 6.3%              | 6.9%              |
| Impervious Cover Model Status   | Sensitive         | Sensitive         |
| <b>Habitat Characteristics</b>  |                   |                   |
| Number of certified vernal pools  | 5                 | 5                 |
| Number of potential vernal pools  | 6                 | 6                 |
| Acres of vernal pools with 200-foot buffers                             | 14.4              | 14.0              |
| Acres of Area of Critical Environmental Concern (ACEC)                  | n/a               | n/a               |
| Acres of NHESP Priority Habitats of Rare Species                        | 324.3             | 323.5             |
| Acres of NHESP Estimated Habitats of Rare Wildlife                      | 324.3             | 323.5             |
| Acres of Wetlands, Marsh, Swamp, and Bogs                               | 79.3              | 79.3              |
| Acres of Pond/Lakes   | 1.6               | 1.6               |
| <b>Lands Critical to Sustaining Surface and GW Quality and Quantity</b> |                   |                   |
| Number Public Water Supply Wells  | 1                 | 1                 |
| Acres Zone I  | 11.5              | 2.0               |
| Acres Zone II   | 356.7             | 355.5             |
| Acres Interim Well Protection Areas                                     | 15.2              | 15.2              |
| Acres low-yield aquifer   | 0.0               | 0.0               |
| Acres medium-yield aquifer  | 18.9              | 18.8              |
| Acres high-yield aquifer  | 0.0               | 0.0               |
| Stressed Basin (Y/N)  | Y, highly         | Y, highly         |
| SWMI Groundwater Withdrawal Category                                    | 5                 |                   |
| SWMI Biological Category  | 5                 |                   |
| <b>Summary of Potential Sources of Pollution</b>                        |                   |                   |
| NPDES surface water discharge   | 0                 | 0                 |
| Groundwater discharges  | 0                 | 0                 |
| BWP Major Facility  | 0                 | 0                 |
| MassDEP 21 E Sites  | 0                 | 0                 |
| Underground Storage Tank  | 0                 | 0                 |

## Notes from Relevant Water Quality Monitoring

The Westford Stream Team conducts water quality sampling at Butter Brook multiple times each year. Constituents that are monitored include nutrients, temperature, dissolved oxygen, pH, conductivity, and occasionally total suspended solids. The sampling results are used to monitor the overall health of the waterbody, Butter brook subbasin, and Nashoba Brook watershed. Further information is available from the Westford Stream Team.



Sudbury-Assabet-Concord (SuAsCo) River Watershed

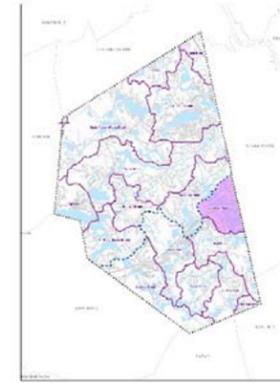
Butter Brook Subbasin Profile

<sup>1</sup> Data from the Watershed Action Plan prepared by Woodard & Curran, 2007

<sup>2</sup> Data from the Stormwater Management Master Plan Volume I, prepared by Tighe & Bond, 2015 - 2016

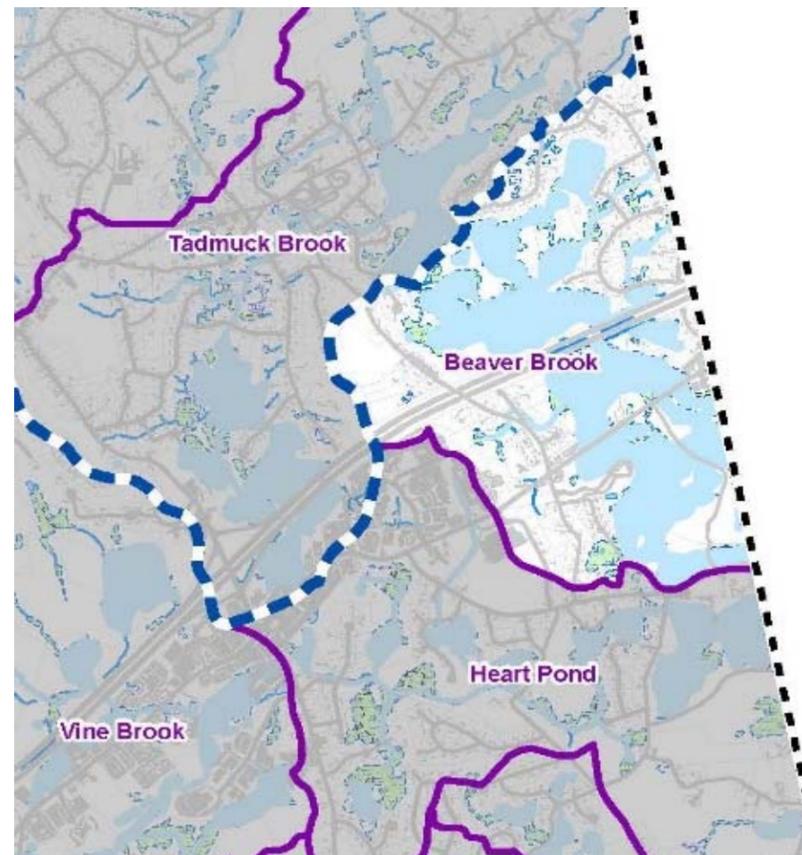
# Beaver Brook Subbasin Profile

## Sudbury-Assabet-Concord (SuAsCo) River Watershed



### Notes from Relevant Water Quality Monitoring

The Westford Stream Team does not currently conduct water quality sampling in the Beaver Brook subbasin. Beaver Brook waterbodies were not evaluated as part of the Healthy Lakes and Ponds Initiative.



### Beaver Brook Subbasin Statistics

|   | 2015 <sup>1</sup> |
|---|-------------------|
| <b>Physical Characteristics</b>   |                   |
| Drainage area (sq. mi)  | 1.3               |
| Drainage area (acres)   | 819.9             |
| Contribution of subbasin to entire watershed in Westford (%)            | 12.2%             |
| <b>Stream Statistics</b>  |                   |
| Miles of perennial streams  | 2.1               |
| Total acres of perennial streams with 200 foot buffers                  | 97.0              |
| Miles of intermittent streams   | 0.6               |
| Acres of intermittent streams with 200-foot buffers                     | 29.5              |
| <b>Impairments and TMDLs</b>  |                   |
| Impaired Waterbody in subbasin  | No                |
| Final TMDL for waters in subbasin                                       | Yes               |
| <b>Land Use</b>   |                   |
| Acres of open space   | 123.3             |
| Acres of protected open space   | 93.7              |
| % protected open space  | 11.4%             |
| Acres of unprotected open space   | 29.6              |
| % unprotected open space  | 0.6%              |
| Acres of impervious surface   | 0.7               |
| % impervious surface  | 9.1%              |
| Impervious Cover Model Status   | Sensitive         |
| <b>Habitat Characteristics</b>  |                   |
| Number of certified vernal pools  | 3                 |
| Number of potential vernal pools  | 14                |
| Acres of vernal pools with 200-foot buffers                             | 9.8               |
| Acres of Area of Critical Environmental Concern (ACEC)                  | 0.0               |
| Acres of NHESP Priority Habitats of Rare Species                        | 0.0               |
| Acres of NHESP Estimated Habitats of Rare Wildlife                      | 0.0               |
| Acres of Wetlands, Marsh, Swamp, and Bogs                               | 8.2               |
| Acres of Pond/Lakes   | 2.1               |
| <b>Lands Critical to Sustaining Surface and GW Quality and Quantity</b> |                   |
| Number Public Water Supply Wells  | 0                 |
| Acres Zone I  | 0.0               |
| Acres Zone II   | 0.0               |
| Acres Interim Well Protection Areas                                     | 0.0               |
| Acres low-yield aquifer   | 0.0               |
| Acres medium-yield aquifer  | 0.0               |
| Acres high-yield aquifer  | 0.0               |
| Stressed Basin (Y/N)  | Y, highly         |
| SWMI Groundwater Withdrawal Category                                    | 2                 |
| SWMI Biological Category  | 5                 |
| <b>Summary of Potential Sources of Pollution</b>                        |                   |
| NPDES surface water discharge   | 0                 |
| Groundwater discharges  | 0                 |
| BWP Major Facility  | 0                 |
| MassDEP 21 E Sites  | 0                 |
| Underground Storage Tank  | 1                 |

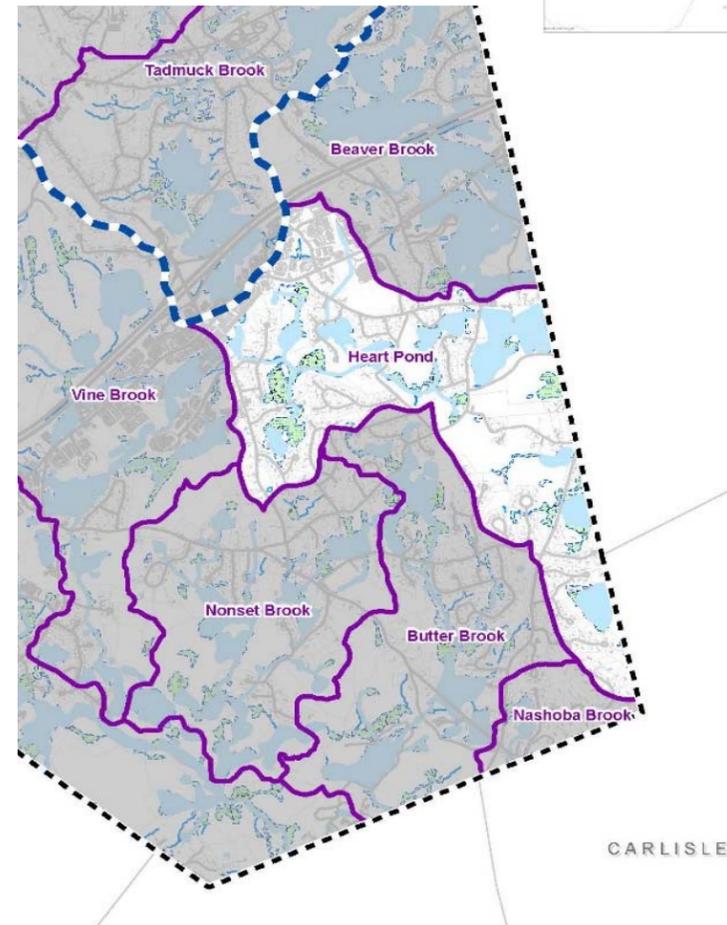
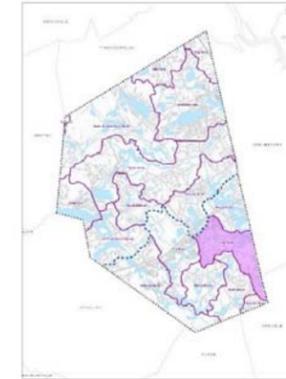
<sup>1</sup> Data from the Stormwater Management Master Plan Volume I, prepared by Tighe & Bond, 2015 - 2016. Note that this subbasin was not included in from the Watershed Action Plan prepared by Woodard & Curran, 2007

# Heart Pond Subbasin profile

## Sudbury-Assabet-Concord (SuAsCo) River Watershed

### Notes from Relevant Water Quality Monitoring

The Westford Stream Team does not currently conduct water quality sampling in the Heart Pond subbasin. Heart Pond waterbodies were not evaluated as part of the Healthy Lakes and Ponds Initiative.



### Heart Pond Subbasin Statistics

|   | 2015 <sup>1</sup> |
|---|-------------------|
| <b>Physical Characteristics</b>   |                   |
| Drainage area (sq. mi)  | 1.8               |
| Drainage area (acres)   | 1162.8            |
| Contribution of subbasin to entire watershed in Westford (%)            | 17.2%             |
| <b>Stream Statistics</b>  |                   |
| Miles of perennial streams  | 2.3               |
| Total acres of perennial streams with 200 foot buffers                  | 117.5             |
| Miles of intermittent streams   | 1.7               |
| Acres of intermittent streams with 200-foot buffers                     | 92.6              |
| <b>Impairments and TMDLs</b>  |                   |
| Impaired Waterbody in subbasin  | Yes               |
| Final TMDL for waters in subbasin                                       | Yes               |
| <b>Land Use</b>   |                   |
| Acres of open space   | 302.0             |
| Acres of protected open space   | 190.0             |
| % protected open space  | 16.3%             |
| Acres of unprotected open space   | 112.0             |
| % unprotected open space  | 9.6%              |
| Acres of impervious surface   | 1.5               |
| % impervious surface  | 12.9%             |
| Impervious Cover Model Status   | Impacted          |
| <b>Habitat Characteristics</b>  |                   |
| Number of certified vernal pools  | 1                 |
| Number of potential vernal pools  | 11                |
| Acres of vernal pools with 200-foot buffers                             | 2.9               |
| Acres of Area of Critical Environmental Concern (ACEC)                  | 0.0               |
| Acres of NHESP Priority Habitats of Rare Species                        | 0.2               |
| Acres of NHESP Estimated Habitats of Rare Wildlife                      | 0.2               |
| Acres of Wetlands, Marsh, Swamp, and Bogs                               | 11.6              |
| Acres of Pond/Lakes   | 1.1               |
| <b>Lands Critical to Sustaining Surface and GW Quality and Quantity</b> |                   |
| Number Public Water Supply Wells  | 0                 |
| Acres Zone I  | 0.0               |
| Acres Zone II   | 0.0               |
| Acres Interim Well Protection Areas                                     | 0.0               |
| Acres low-yield aquifer   | 0.0               |
| Acres medium-yield aquifer  | 0.0               |
| Acres high-yield aquifer  | 0.0               |
| Stressed Basin (Y/N)  | Y, highly         |
| SWMI Groundwater Withdrawal Category                                    | 3                 |
| SWMI Biological Category  | 4                 |
| <b>Summary of Potential Sources of Pollution</b>                        |                   |
| NPDES surface water discharge   | 0                 |
| Groundwater discharges  | 2                 |
| BWP Major Facility  | 1                 |
| MassDEP 21 E Sites  | 0                 |
| Underground Storage Tank  | 3                 |

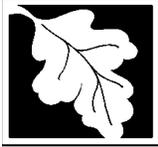
<sup>1</sup> Data from the Stormwater Management Master Plan Volume I, prepared by Tighe & Bond, 2015 - 2016. Note that this subbasin was not included in from the Watershed Action Plan prepared by Woodard & Curran, 2007



# Appendix C

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## Source Water Assessment Report for Public Water Supply



Massachusetts Department of Environmental Protection  
Source Water Assessment and Protection (SWAP) Report  
for  
**Westford Water Department**

### What is SWAP?

The Source Water Assessment and Protection (SWAP) program, established under the federal Safe Drinking Water Act, requires every state to:

- inventory land uses within the recharge areas of all public water supply sources;
- assess the susceptibility of drinking water sources to contamination from these land uses; and
- publicize the results to provide support for improved protection.

### Susceptibility and Water Quality

Susceptibility is a measure of a water supply's potential to become contaminated due to land uses and activities within its recharge area.

A source's susceptibility to contamination does *not* imply poor water quality.

Water suppliers protect drinking water by monitoring for more than 100 chemicals, disinfecting, filtering, or treating water supplies, and using source protection measures to ensure that safe water is delivered to the tap.

Actual water quality is best reflected by the results of regular water tests. To learn more about your water quality, refer to your water supplier's annual Consumer Confidence Reports.

**Table 1: Public Water System Information**

|                      |                           |
|----------------------|---------------------------|
| <i>PWS Name</i>      | Westford Water Department |
| <i>PWS Address</i>   | 63 Forge Village Road     |
| <i>City/Town</i>     | Westford, Massachusetts   |
| <i>PWS ID Number</i> | 2330000                   |
| <i>Local Contact</i> | Warren Sweetser           |
| <i>Phone Number</i>  | (978) 692-5529            |

### Introduction

We are all concerned about the quality of the water we drink. Drinking water wells may be threatened by many potential contaminant sources, including storm runoff, road salting, and improper disposal of hazardous materials. Citizens and local officials can work together to better protect these drinking water sources.

#### **Purpose of this report:**

This report is a planning tool to support local and state efforts to improve water supply protection. By identifying land uses within water supply protection areas that may be potential sources of contamination, the assessment helps focus protection efforts on appropriate Best Management Practices (BMPs) and drinking water source protection measures.

Refer to Table 3 for Recommendations to address potential sources of contamination. Department of Environmental Protection (DEP) staff are available to provide information about funding and other resources that may be available to your community.

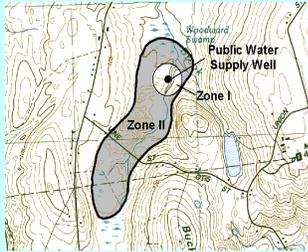
#### **This report includes the following sections:**

1. Description of the Water System
2. Land Uses within Protection Areas
3. Source Water Protection Conclusions and Recommendations
4. Appendices

## Section 1: Description of the Water System

### What is a Protection Area?

A well's water supply protection area is the land around the well where protection activities should be focused. Each well has a Zone I protective radius and a Zone II protection area.



### Glossary

**Aquifer:** An underground water-bearing layer of permeable material that will yield water in a usable quantity to a well.

**Hydrogeologic Barrier:** An underground layer of impermeable material (i.e. clay) that resists penetration by water.

**Recharge Area:** The surface area that contributes water to a well.

**Zone I:** The area closest to a well; a 100 to 400 foot radius proportional to the well's pumping rate. This area should be owned or controlled by the water supplier and limited to water supply activities.

**Zone II:** The primary recharge area for the aquifer. This area is defined by hydrogeologic studies that must be approved by DEP. Refer to the attached map to determine the land within your Zone II.

#### Zone II #: 115

*Susceptibility:* Moderate

| <i>Well Names</i> | <i>Source IDs</i> |
|-------------------|-------------------|
| Cote GPW          | 2330000-07G       |

#### Zone II #: 128

*Susceptibility:* High

| <i>Well Names</i> | <i>Source IDs</i> |
|-------------------|-------------------|
| Nutting Rd GPW    | 2330000-02G       |
| Depot Rd GPW      | 2330000-03G       |

#### Zone II #: 278

*Susceptibility:* High

| <i>Well Names</i> | <i>Source IDs</i> |
|-------------------|-------------------|
| Fletcher Well     | 2330000-08G       |

#### Zone II #: 434

*Susceptibility:* High

| <i>Well Names</i>              | <i>Source IDs</i> |
|--------------------------------|-------------------|
| Forge Village Wellfield 1.1    | 2330000-01G       |
| Country Road GPW               | 2330000-04G       |
| Forge Village Wellfield GPW #2 | 2330000-05G       |
| Howard Road Wellfield 6.1      | 2330000-06G       |
| Forge Village Wellfield 1.2    | 2330000-09G       |
| Forge Village Wellfield 1.3    | 2330000-10G       |
| Forge Village Wellfield 1.4    | 2330000-11G       |
| Forge Village Wellfield 1.5    | 2330000-12G       |
| Howard Road Wellfield 6.2      | 2330000-13G       |
| Howard Road Wellfield 6.3      | 2330000-14G       |
| Howard Road Wellfield 6.4      | 2330000-15G       |
| Howard Road Wellfield 6.5      | 2330000-16G       |

The wells for the Westford Water Department are located in four Zone II largely on the western edge of the town. The Zone II #434 has a small portion that extends in to the town of Littleton. Each well has a Zone I of 400 feet. The wells are located in an aquifer with a high vulnerability to contamination due to the absence of hydrogeologic barriers (i.e. clay) that can prevent contaminant migration. Please refer to the attached map to view the boundaries of the Zone II.

Water from the wells is disinfected, has iron and manganese removed, is treated for corrosion control, and is fluoridated for dental health. For current information on monitoring results and treatment, please contact the Public

Water System contact person listed above in Table 1 for a copy of the most recent Consumer Confidence Report. Drinking water monitoring reporting data are also available on the web at <http://www.epa.gov/safewater/ccr1.html>.

## Section 2: Land Uses in the Protection Areas

The Zone II for Westford are a mixture of residential, wetland, and forested land uses, with small areas of commercial and light industrial land uses (refer to attached map for details). Land uses and activities that are potential sources of contamination are listed in Table 2.

### Key Land Uses and Protection Issues include:

1. Zone I Protection
2. Residential land uses
3. Transportation corridors
4. Hazardous materials storage and use
5. Agricultural activities
6. Comprehensive wellhead protection planning

The overall ranking of susceptibility to contamination for the system is high, based on the presence of at least one high threat land use within the water supply protection areas, as seen in Table 2.

**1. Zone I Protection** – The Zone I for each of the wells is a 400 foot radius around the wellhead. Massachusetts drinking water regulations (310 CMR 22.00 Drinking Water) requires public water suppliers to own the Zone I, or control the Zone I through a conservation restriction. The Zone Is for the wells are owned or controlled by the public water system. Only water supply activities are allowed in the Zone I. However, many public water supplies were developed prior to the Department's regulations and contain non water supply activities such as homes and public roads. The following non water supply activities occur in the Zone Is of the system wells:

**Well 04G** - There is a local road that runs through the Zone I of the Country Road Gravel Pack Well.

## Benefits of Source Protection

Source Protection helps protect public health and is also good for fiscal fitness:

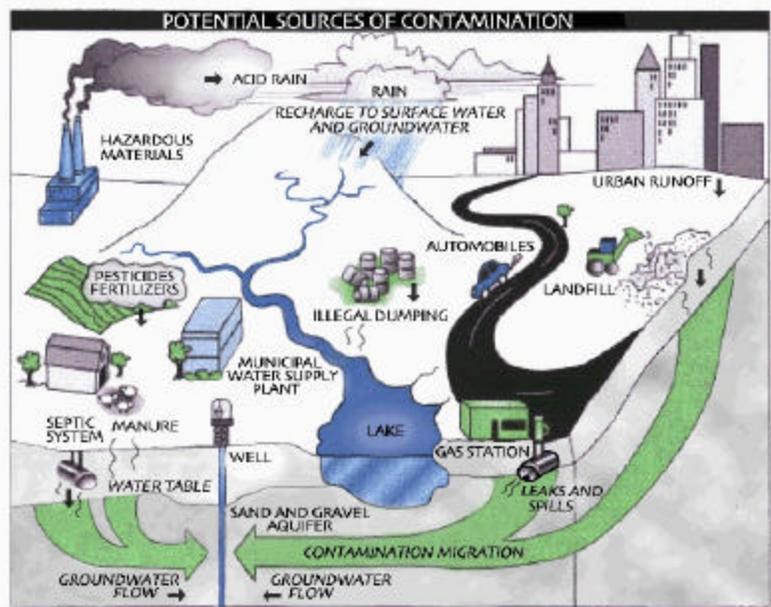
- Protects drinking water quality at the source
- Reduces monitoring costs through the DEP Waiver Program
- Treatment can be reduced or avoided entirely, saving treatment costs
- Prevents costly contamination clean-up
- Preventing contamination saves costs on water purchases, and expensive new source development

Contact your regional DEP office for more information on Source Protection and the Waiver Program.

### Zone I Recommendations:

- ✓ To the extent possible, remove all non water supply activities from the Zone Is to comply with DEP's Zone I requirements.
- ✓ Use BMPs for the storage, use, and disposal of hazardous materials such as water supply chemicals and maintenance chemicals.
- ✓ Do not use or store pesticides, fertilizers or road salt within the Zone I.
- ✓ Keep any new non water supply activities out of the Zone I.

**2. Residential Land Uses** – The most common land use throughout the Zone II is residential areas. None of the areas have public sewers, and so all use septic systems. If managed improperly, activities associated



Modified from © 2009 The Groundwater Foundation. Illustrated by C. Mansfield, The Groundwater Foundation

with residential areas can contribute to drinking water contamination. Common potential sources of contamination include:

- **Septic Systems** – Improper disposal of household hazardous chemicals to septic systems is a potential source of contamination to the groundwater because septic systems lead to the ground. If septic systems fail or are not properly maintained they can be a potential source of microbial contamination.
- **Household Hazardous Materials** - Hazardous materials may include automotive wastes, paints, solvents, pesticides, fertilizers, and other substances. Improper use, storage, and disposal of chemical products used in homes are potential sources of contamination.
- **Heating Oil Storage** - If managed improperly, Underground and Aboveground Storage Tanks (UST and AST) can be potential sources of contamination due to leaks or spills of the fuel oil they store.
- **Stormwater** – Catch basins transport stormwater from roadways and adjacent properties to the ground. As flowing stormwater travels, it picks up debris and contaminants from streets and lawns. Common potential contaminants include lawn chemicals, pet waste, and contaminants from automotive leaks, maintenance, washing, or accidents.

**Residential Land Use Recommendations:**

- ✓ Educate residents on best management practices (BMPs) for protecting water supplies. Distribute the fact sheet “Residents Protect Drinking Water” available in Appendix A and on [www.mass.gov/dep/brp/dws/protect.htm](http://www.mass.gov/dep/brp/dws/protect.htm), which provides BMPs for common residential issues.
- ✓ Work with planners to control new residential developments in the water supply protection areas.
- ✓ Promote BMPs for stormwater management and pollution controls. Visit DEP’s web site for additional information and assistance at <http://www.state.ma.us/dep/brp/wm/nonpoint.htm>.

**What are "BMPs?"**

Best Management Practices (BMPs) are measures that are used to protect and improve surface water and groundwater quality. BMPs can be structural, such as oil & grease trap catch basins, nonstructural, such as hazardous waste collection days or managerial, such as employee training on proper disposal procedures.

**For More Information**

Contact Josephine Yemoh-Ndi in DEP’s Worcester Office at (508) 849-4030 for more information and assistance on improving current protection measures.

Copies of this report have been provided to the public water supplier, board of health, and the town.

**3. Transportation Corridors** - Route 40 runs through the Zone II #115 and Route 225 runs through Zone II #434 and #278. Local roads are common throughout the Zone II. Roadway construction, maintenance, and typical highway use can all be potential sources of contamination. Accidents can lead to spills of gasoline and other potentially dangerous transported chemicals. Roadways are frequent sites for illegal dumping of hazardous or other potentially harmful wastes. De-icing salt, automotive chemicals and other debris on roads are picked up by stormwater and wash in to catchbasins.

Railroad tracks run through the southern edge of Zone II #128 and along the northern edge of Zone II #434. Rail corridors serving passenger or freight trains are potential sources of contamination due to chemicals released during normal use, track maintenance, and accidents. Accidents can release spills of train engine fluids and commercially transported chemicals.

*(Continued on page 7)*

**Source Protection Decreases Risk**

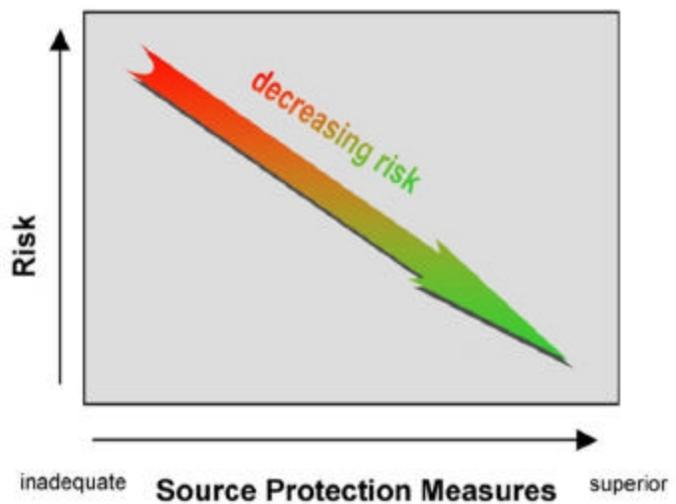


Figure 2: Risk of contamination decreases as source protection increases. This is true for public water systems of any susceptibility ranking, whether High, Moderate, or Low.

### Potential Source of Contamination vs. Actual Contamination

The activities listed in Table 2 are those that typically use, produce, or store contaminants of concern, which, if managed improperly, are potential sources of contamination (PSC).

It is important to understand that a release may never occur from the potential source of contamination provided facilities are using best management practices (BMPs). If BMPs are in place, the actual risk may be lower than the threat ranking identified in Table 2. Many potential sources of contamination are regulated at the federal, state and/or local levels, to further reduce the risk.

**Table 2: Land Use in the Protection Areas (Zones I and II)**

| Land Uses                          | Quantity | Threat | Zone II #     | Potential Contaminant Sources*   |
|------------------------------------|----------|--------|---------------|--|
| <b>Agricultural</b>                |          |        |               |  |
| Livestock Operations               | 2        | M      | #434,<br>#278 | Manure (microbial contaminants): improper handling   |
| <b>Commercial</b>                  |          |        |               |  |
| Cemeteries                         | 2        | M      | #115,<br>#128 | Over-application of pesticides: leaks, spills, improper handling; historic embalming fluids  |
| Railroad Tracks And Yards          | 1        | H      | #434,<br>#128 | Herbicides: over-application or improper handling; fuel storage, transported chemicals, and maintenance chemicals: leaks or spills |
| Sand And Gravel Mining/<br>Washing | 1        | M      | #115          | Heavy equipment, fuel storage, clandestine dumping: spills or leaks  |
| <b>Industrial</b>                  |          |        |               |  |
| Foundries Or Metal Fabricators     | 1        | H      | #434          | Solvents and other chemicals: spills, leaks, or improper handling or storage   |
| <b>Residential</b>                 |          |        |               |  |
| Fuel Oil Storage (at residences)   | 170+     | M      | All           | Fuel oil: spills, leaks, or improper handling  |
| Lawn Care / Gardening              | 450+     | M      | All           | Pesticides: over-application or improper storage and disposal  |
| Septic Systems / Cesspools         | 450+     | M      | All           | Hazardous chemicals: microbial contaminants, and improper disposal   |

**Table 2 Notes:**

1. When specific potential contaminants are not known, typical potential contaminants or activities for that type of land use are listed. Facilities within the watershed may not contain all of these potential contaminant sources, may contain other potential contaminant sources, or may use Best Management Practices to prevent contaminants from reaching drinking water supplies.
2. For more information on regulated facilities, refer to Appendix B: Regulated Facilities within the Water Supply Protection Area information about these potential sources of contamination.
3. For information about Oil or Hazardous Materials Sites in your protection areas, refer to Appendix C: Tier Classified Oil and/or Hazardous Material Sites.

\* **THREAT RANKING** - The rankings (high, moderate or low) represent the relative threat of each land use compared to other PSCs. The ranking of a particular PSC is based on a number of factors, including: the type and quantity of chemicals typically used or generated by the PSC; the characteristics of the contaminants (such as toxicity, environmental fate and transport); and the behavior and mobility of the pollutants in soils and groundwater.

Table 2 Continued on Page 6

**Table 2 (Continued): Land Use in the Protection Areas (Zones I and II)**

For more information, refer to Appendix A: Regulated Facilities within the Water Supply Protection Area

| Land Uses   | Quantity | Threat | Zone II #        | Potential Contaminant Sources*   |
|---|----------|--------|------------------|--|
| <b>Miscellaneous</b>                                    |          |        |                  |  |
| Aboveground Storage Tanks                               | 2        | M      | #434             | Materials stored in tanks: spills, leaks, or improper handling   |
| Aquatic Wildlife  | 4        | L      | All              | Microbial contaminants   |
| Fishing/Boating   | 4        | L      | All              | Fuel and other chemical spills, microbial contaminants   |
| Landfills and Dumps                                     | 1        | H      | #434             | Seepage of leachate. Note: Landfill is now closed.   |
| Schools, Colleges, and Universities                     | 2        | M      | #434, #278       | Fuel oil, laboratory, art, photographic, machine shop, and other chemicals: spills, leaks, or improper handling or storage |
| Small Quantity Hazardous Waste Generators               | 1        | M      | #434, #278       | Hazardous materials and waste: spills, leaks, or improper handling or storage  |
| Stormwater Drains/ Retention Basins                     | 5        | L      | #434, #278       | Debris, pet waste, and chemicals in stormwater from roads, parking lots, and lawns   |
| Tire Dumps  | 1        | M      | #115             | Tires: improper handling or management   |
| Transmission Line Rights-of-Way                         | 1        | L      | #434, #278       | Corridor maintenance pesticides: over-application or improper handling; construction                                       |
| Transportation Corridors                                | 2        | M      | #434, #278, #115 | Fuels and other hazardous materials: accidental leaks or spills; pesticides: over-application or improper handling         |
| Underground Storage Tanks                               | 3        | H      | #434, #278       | Stored materials: spills, leaks, or improper handling  |
| Very Small Quantity Hazardous Waste Generator           | 1        | L      | #434, #278       | Hazardous materials and waste: spills, leaks, or improper handling or storage  |
| Waste Transfer/Recycling Station                        | 1        | M      | #434, #278       | Water contacting waste materials: improper management, seepage, and runoff   |
| Wastewater Treatment Plant/ Collection Facility/ Lagoon | 1        | M      | #434, #278       | Treatment chemicals or equipment maintenance materials: improper handling or storage; wastewater: improper management      |

**Transportation Corridor Recommendations:**

- ✓ Identify stormwater drains and the drainage system along transportation corridors. Wherever possible, ensure that drains discharge stormwater outside of the Zone II.
- ✓ Work with the Town and State to have catch basins inspected, maintained, and cleaned on a regular schedule. Street sweeping reduces the amount of potential contaminants in runoff.
- ✓ Work with local emergency response teams to ensure that any spills within the Zone II can be effectively contained.
- ✓ If storm drainage maps are available, review the maps with emergency response teams. If maps aren't yet available, work with town officials to investigate mapping options such as the upcoming Phase II Stormwater Rule requiring some communities to complete stormwater mapping.
- ✓ Work with local officials during their review of the railroad right of way Yearly Operating Plans to ensure that water supplies are protected during vegetation control.

**4. Hazardous Materials Storage and Use** – One percent of the land area within the Zone II are commercial or industrial land uses. Many small businesses and industries use hazardous materials, produce hazardous waste products, and/or store large quantities of hazardous materials in UST/AST. If hazardous materials are improperly stored, used, or disposed, they become potential sources of contamination. Hazardous materials should never be disposed of to a septic system or floor drain leading directly to the ground.

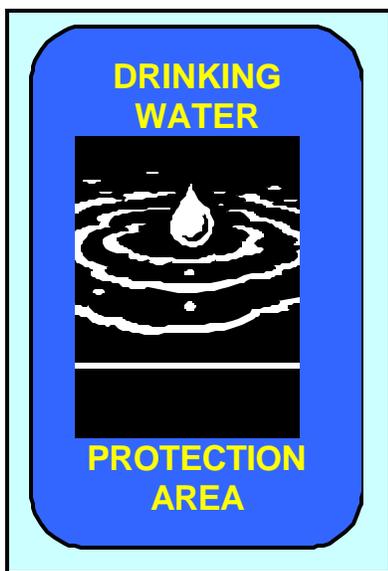
**Hazardous Materials Storage and Use Recommendations:**

- ✓ Educate local businesses on best management practices for protecting water supplies. Distribute the fact sheet “Businesses Protect Drinking Water” available in Appendix A and on [www.mass.gov/dep/brp/dws/protect.htm](http://www.mass.gov/dep/brp/dws/protect.htm), which provides BMP’s for common business issues.
- ✓ Work with local businesses to register those facilities that are unregistered generators of hazardous waste or waste oil. Partnerships between businesses, water suppliers, and communities enhance successful public drinking water protection practices.
- ✓ Educate local businesses on Massachusetts floordrain requirements. See

**Top 5 Reasons to Develop a Local Wellhead Protection Plan**

- ❶ Reduces Risk to Human Health
- ❷ Cost Effective! Reduces or Eliminates Costs Associated With:
  - ♦ Increased groundwater monitoring and treatment
  - ♦ Water supply clean up and remediation
  - ♦ Replacing a water supply
  - ♦ Purchasing water
- ❸ Supports municipal bylaws, making them less likely to be challenged
- ❹ Ensures clean drinking water supplies for future generations
- ❺ Enhances real estate values – clean drinking water is a local amenity. A community known for its great drinking water in a place people want to live and businesses want to locate.

brochure “Industrial Floor Drains” for more information.



**5. Agricultural Activities** – There is pastureland and small horse farms within the Zone II. Pesticides and fertilizers have the potential to contaminate a drinking water source if improperly stored, applied, or disposed. If not contained or applied properly, animal waste from barnyards, manure pits and field application are potential sources of contamination to ground and surface water.

**Agricultural Activities Recommendation:**

- ✓ Work with farmers in your protection areas to make them aware of your water supply and to encourage the use of a US Natural Resources Conservation Service farm plan to protect water supplies.

**6. Protection Planning** – Currently, the Town has water supply protection controls for Zone II #128, #115, and #278 that meet DEP’s Wellhead Protection regulations 310 CMR 22.21(2). The controls were revised in 2002 to include Zone II #434, however DEP has not reviewed the controls to verify that they meet 310 CMR 22.21(2). Protection planning protects drinking water by managing the land area that supplies water to a well. A Wellhead Protection Plan

*(Continued on page 9)*

**Table 3: Current Protection and Recommendations**

| <b>Protection Measures</b>   | <b>Status</b> | <b>Recommendations</b>   |
|--|---------------|--|
| <b>Zone I</b>  |               |  |
| Does the Public Water Supplier (PWS) own or control the entire Zone I?                         | <b>YES</b>    | Follow Best Management Practices (BMP's) that focus on good housekeeping, spill prevention, and operational practices to reduce the use and release of hazardous materials.  |
| Is the Zone I posted with "Public Drinking Water Supply" Signs?                                | <b>YES</b>    | Additional economical signs are available from the Northeast Rural Water Association (802) 660-4988.   |
| Is Zone I regularly inspected?   | <b>YES</b>    | Continue daily inspections of drinking water protection areas.   |
| Are water supply-related activities the only activities within the Zone I?                     | <b>NO</b>     | Continue monitoring roads and other non-water supply activities in Zone Is.  |
| <b>Municipal Controls (Zoning Bylaws, Health Regulations, and General Bylaws)</b>              |               |  |
| Does the municipality have Wellhead Protection Controls that meet 310 CMR 22.21(2)?            | <b>YES</b>    | The Town "Aquifer Protection District" bylaw meets DEP's requirements for wellhead protection, though a revised aquifer protection district map is not on file at DEP. Refer to <a href="http://www.state.ma.us/dep/brp/dws/">www.state.ma.us/dep/brp/dws/</a> for model bylaws and health regulations, and current regulations. |
| Do neighboring communities protect the Zone II areas extending into their communities?         | <b>NO</b>     | Work with Littleton to include Zone II areas in their wellhead protection controls.  |
| <b>Planning</b>  |               |  |
| Does the PWS have a Wellhead Protection Plan?  | <b>YES</b>    | Update, maintain, and implement your wellhead protection plan. Follow "Developing a Local Wellhead Protection Plan" available at: <a href="http://www.state.ma.us/dep/brp/dws/">www.state.ma.us/dep/brp/dws/</a> .   |
| Does the PWS have a formal "Emergency Response Plan" to deal with spills or other emergencies? | <b>YES</b>    | Augment plan by developing a joint emergency response plan with fire department, Board of Health, DPW, and local and state emergency officials. Coordinate emergency response drills with local teams.   |
| Does the municipality have a wellhead protection committee?                                    | <b>YES</b>    | Include representatives from citizens' groups, neighboring communities, and the business community.  |
| Does the Board of Health conduct inspections of commercial and industrial activities?          | <b>YES</b>    | For more guidance see "Hazardous Materials Management: A Community's Guide" at <a href="http://www.state.ma.us/dep/brp/dws/files/hazmat.doc">www.state.ma.us/dep/brp/dws/files/hazmat.doc</a>  |
| Does the PWS provide wellhead protection education?  | <b>YES</b>    | Aim additional efforts at commercial, industrial and residential uses within the Zone II.  |

(Continued from page 7)

coordinates community efforts, identifies protection strategies, establishes a timeframe for implementation, and provides a forum for public participation. There are resources available to help communities develop a plan for protecting drinking water supply wells.

**Protection Planning Recommendations:**

- ✓ Update, maintain, and implement your Wellhead Protection Plan. Refer your protection team to <http://mass.gov/dep/brp/dws/protect.htm> for a copy of DEP's guidance, "Developing a Local Wellhead Protection Plan".
- ✓ Coordinate efforts with local officials to compare local wellhead protection controls with current MA Wellhead Protection Regulations 310 CMR 22.21 (2). If there are no local controls for Zone II #434, or they do not meet the current regulations, adopt controls that meet 310 CMR 22.21(2). For more information on DEP land use controls see <http://mass.gov/dep/brp/dws/protect.htm>.
- ✓ Work with town boards to review and provide recommendations on proposed development within your water supply protection areas. To obtain information on build-out analyses for the town, see the Executive Office of Environmental Affairs' community preservation web site, <http://commpres.env.state.ma.us/>.

Other land uses and activities within the Zone II include a metal fabricator and schools. Refer to Table 2 for more information about these land uses.

Identifying potential sources of contamination is an important initial step in protecting your drinking water sources. Further local investigation will provide more in-depth information and may identify new land uses and activities that are potential sources of contamination. Once potential sources of contamination are identified, specific recommendations like those below should be used to better protect your water supply.

**Section 3: Source Water Protection Conclusions and Recommendations**

**Current Land Uses and Source Protection:**

As with many water supply protection areas, the system Zone IIs contain potential sources of contamination. However, source protection measures reduce the risk of actual contamination, as illustrated in Figure 2. The water supplier is commended for taking an active role in promoting source protection measures in the Water Supply Protection Areas through:

- Working with the Highway Department to ensure that highway runoff is directed away from the Zone II.
- Acquiring land to protect the wells within Zone II #434.
- Working with schools to improve management of athletic field runoff.

**Source Protection Recommendations:**

To better protect the sources for the future:

- ✓ Inspect the Zone I regularly, and when feasible, remove any non-water supply activities.
- ✓ Educate residents on ways they can help you to protect drinking water sources.
- ✓ Work with emergency response teams to ensure that they are aware of the stormwater drainage in your Zone II and to cooperate on responding to spills or accidents.
- ✓ Partner with local businesses to ensure the proper storage, handling, and disposal of hazardous materials.
- ✓ Work with farmers in your protection areas to make them aware of your water

**What is a Zone III?**

A Zone III (the secondary recharge area) is the land beyond the Zone II from which surface and ground water drain to the Zone II and is often coincident with a watershed boundary.

The Zone III is defined as a secondary recharge area for one or both of the following reasons:

1. The low permeability of underground water bearing materials in this area significantly reduces the rate of groundwater and potential contaminant flow into the Zone II.
2. The groundwater in this area discharges to a surface water feature such as a river, rather than discharging directly into the aquifer.

The land uses within the Zone III are assessed only for sources that are shown to be groundwater under the direct influence of surface water.

**Additional Documents:**

To help with source protection efforts, more information is available by request or online at [mass.gov/dep/brp/dws](http://mass.gov/dep/brp/dws) including:

1. Water Supply Protection Guidance Materials such as model regulations, Best Management Practice information, and general water supply protection information.
2. MA DEP SWAP Strategy
3. Land Use Pollution Potential Matrix
4. Draft Land/Associated Contaminants Matrix

- supply and to encourage the use of a NRCS farm plan to protect water supplies.
- ✓ Develop and implement a Wellhead Protection Plan.

**Conclusions:**

These recommendations are only part of your ongoing local drinking water source protection. Additional source protection recommendations are listed in Table 3 and the Key Issues above.

DEP staff, informational documents, and resources are available to help you build on this SWAP report as you continue to improve drinking water protection in your community. Grants and loans are available through the Drinking Water State Revolving Loan Fund, the Clean Water State Revolving Fund, and other sources. For more information on grants and loans, visit the Bureau of Resource Protection's Municipal Services web site at: <http://mass.gov/dep/brp/mf/mfpubs.htm>.

The assessment and protection recommendations in this SWAP report are provided as a tool to encourage community discussion, support ongoing source protection efforts, and help set local drinking water protection priorities. Citizens and community officials should use this SWAP report to spur discussion of local drinking water protection measures. The water supplier should supplement this SWAP report with local information on potential sources of contamination and land uses. Local information should be maintained and updated periodically to reflect land use changes in the Zone II. Use this information to set priorities, target inspections, focus education efforts, and to develop a long-term drinking water source protection plan.

**Section 4: Appendices**

- A. Protection Recommendations
- B. Regulated Facilities within the Water Supply Protection Area
- C. Additional Documents on Source Protection



# Appendix D

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## Lakes Management Five Year Management Plan Summary



# Lakes and Ponds Management and Preservation Program Plan

Town of Westford, Massachusetts

Supported by Westford Community Preservation Act funds



*Burge's Pond, Westford, May 2014*

**PREPARED FOR**  
Town of Westford  
55 Main Street  
Westford, Massachusetts 01866

**PREPARED BY**  
ESS Group, Inc.  
100 Fifth Avenue, 5th Floor  
Waltham, Massachusetts 02451



[www.essgroup.com](http://www.essgroup.com)

Project No. W314-000  
Revised December 11, 2014



## **EXECUTIVE SUMMARY**

ESS Group, Inc. (ESS) was contracted by the Town of Westford, Massachusetts (the Town) in early 2014 to prepare a Lakes and Ponds Management and Preservation Program Plan (Lakes Management Plan) for the nine ponds located within the Town that offer some degree of public access and use. The Town's stated goals were to 1) provide for the ongoing assessment of the health of the ponds, 2) identify any threats or issues which may compromise the short-term or long-term health of the ponds, and 3) develop recommendations for management strategies and/or future studies that will ensure the preservation and/or enhancement of the ponds.

### **Previously Unstudied Ponds**

Of the nine ponds included in the Lakes Management Plan, five ponds had not previously been formally studied or managed, including Keyes, Burge's, Grassy, Old Mill/Graniteville, and Kennedy Ponds.

The assessment of these ponds comprised three primary elements: water quality sampling, aquatic plant surveys, and zooplankton and phytoplankton sampling. Water quality sampling was conducted during the spring and summer, while aquatic plant surveys and plankton sampling were conducted during the summer only.

Based on the results of the field-based assessment, the overall condition of each of the five previously unstudied ponds was classified as *Excellent*, *Good*, *Fair*, or *Poor*. Among the five ponds, the overall condition (including water quality and biological conditions) was as follows:

- Keyes, Burge's, and Old Mill/Graniteville Ponds were classified as *Fair*. Each will need additional management attention to ensure that ecological and recreational value do not continue to degrade.
- Grassy and Kennedy Ponds were classified as *Good* and do not appear to face an immediate threat. Therefore, minimal management, primarily in the form of monitoring, is currently necessary to preserve the condition of these ponds.

Ongoing monitoring was recommended for each of the five previously unstudied ponds to track overall conditions, provide early detection of future invasive species or other emerging management issues, and provide for periodic evaluation of trends and updates to the monitoring or management program. Monitoring of all five ponds will require an estimated total of \$80,000 over five years. Volunteer education and monitoring through the Massachusetts Weed Watchers program and Westford Stream Team is also encouraged.

Each of the previously unstudied ponds were also prioritized for management action to maintain or improve the condition of the pond. Permitting of the management plan for all of these ponds together is anticipated to cost \$17,500, assuming it can be handled as one filing. Estimated costs to actually implement the management plan for each of the five ponds, in order of priority, are as follows:

1. Keyes Pond, which will require an estimated total of \$107,000 to implement the recommended plan over the next five years. This includes \$34,600 in Year 1 to begin management of the pond. Management actions recommended for Keyes Pond include chemical treatment for nuisance plants and algae, supplemental diver/hand harvesting of nuisance plants, and biological control of purple loosestrife.
2. Burge's Pond, which will require an estimated total of \$57,200 to implement the recommended plan over the next five years. This includes \$18,800 in Year 1 to begin treatment of the pond. Management actions recommended for Burge's Pond include chemical treatment for nuisance plants, supplemental diver/hand harvesting of nuisance plants, and biological control of purple loosestrife.



3. Old Mill/Graniteville Pond, which will require an estimated total of \$72,500 to implement the recommended plan over the next five years. This includes \$26,100 in Year 1 to begin treatment of the pond. Management actions recommended for Old Mill/Graniteville Pond include chemical treatment for nuisance plants, supplemental diver/hand harvesting of nuisance plants, and biological control of purple loosestrife. Winter drawdown is a low-cost nuisance plant management tool that should be more thoroughly assessed for feasibility at Old Mill/Graniteville Pond.
4. Kennedy Pond, which will require an estimated total of \$12,500 to implement the recommended plan over the next five years. This includes \$2,500 in Year 1 to begin management of the pond. Management actions recommended for Kennedy Pond include hand harvesting of nuisance plants.
5. Grassy Pond requires monitoring over the next five years.

An additional action recommended for all ponds is undertaking an initial stormwater assessment study, to identify opportunities to reduce loading of sediments and nutrients from stormwater sources watershed. If stormwater is assessed for all ponds together, the estimated cost would be \$15,000.

### **Previously Studied Ponds**

In addition, four ponds had previously been formerly studied and/or managed, including Long Sought for Pond, Nabnasset Lake, Forge Pond and Heart Pond. The Town provided ESS with existing reports on the four previously studied ponds, which were reviewed and synthesized to extract information relevant to the Lakes Management Plan.

The information reviewed indicated that each of the previously studied ponds have faced some significant management challenges, including aquatic invasive species and, in some cases, algae blooms or other water quality issues. However, pond-specific water quality and aquatic plant monitoring programs are already in place and tailored to the management needs of each pond. Therefore, the primary recommendation for these ponds is that the management and monitoring programs continue to be implemented and periodically updated or expanded to address the management challenges and maintain or improve water quality. The ponds that have experienced recurring algae blooms or hypolimnetic dissolved oxygen depletion, including Long Sought-for Pond, Nabnasset Lake and Heart Pond would benefit from an updated nutrient budget study to quantify the sources and target the most cost-effective source reduction actions at each pond. Such a study could be completed for \$5,000 to \$10,000, depending on scope of the potential nutrient sources.

Appendix B. Five-year Management Plan Summary

| Pond                  | Management Action                                       | Notes  | Timeline and Estimated Cost |                 |                 |                 |                 | 5-year Cost      |
|-----------------------|---|--|-----------------------------|-----------------|-----------------|-----------------|-----------------|------------------|
|                       |   |  | Year 1                      | Year 2          | Year 3          | Year 4          | Year 5          |                  |
| All Ponds             | Permit primary management actions                       | Assumes 5-yr permit granted under one filing                   |                             |                 |                 |                 |                 |                  |
|                       |   |  | \$17,500                    |                 |                 |                 |                 | \$17,500         |
|                       | Implement monitoring program                            | Annual program   |                             |                 |                 |                 |                 |                  |
|                       |   |  | \$20,000                    | \$15,000        | \$15,000        | \$15,000        | \$15,000        | \$80,000         |
|                       | Initial stormwater assessment study                     |  |                             | \$15,000        |                 |                 |                 | \$15,000         |
|                       | <i>Subtotal</i>   |  | <i>\$37,500</i>             | <i>\$30,000</i> | <i>\$15,000</i> | <i>\$15,000</i> | <i>\$15,000</i> | <i>\$112,500</i> |
| Keyes                 | Chemical treatment (plants)                             | Control variable-leaf milfoil                                  |                             |                 |                 |                 |                 |                  |
|                       |   |  | \$26,000                    | \$4,500         | \$4,500         | \$4,500         | \$4,500         | \$44,000         |
|                       | Chemical treatment (algae)                              | Algaecide treatment  |                             |                 |                 |                 |                 |                  |
|                       |   |  | \$6,000                     | \$6,000         | \$6,000         | \$6,000         | \$6,000         | \$30,000         |
|                       | Harvesting  | Supplemental diver harvesting                                  |                             | \$5,000         | \$5,000         | \$5,000         | \$5,000         | \$20,000         |
|                       | Biological control                                      | Purple loosestrife control                                     |                             |                 |                 |                 |                 |                  |
|                       |   |  | \$2,600                     | \$2,600         | \$2,600         | \$2,600         | \$2,600         | \$13,000         |
|                       | <i>Subtotal</i>   |  | <i>\$34,600</i>             | <i>\$18,100</i> | <i>\$18,100</i> | <i>\$18,100</i> | <i>\$18,100</i> | <i>\$107,000</i> |
| Burge's               | Chemical treatment (plants)                             | Control variable-leaf milfoil                                  |                             |                 |                 |                 |                 |                  |
|                       |   |  | \$16,200                    | \$3,500         | \$3,500         | \$3,500         | \$3,500         | \$30,200         |
|                       | Harvesting  | Supplemental diver harvesting                                  |                             |                 |                 |                 |                 |                  |
|                       |   |  |                             | \$3,500         | \$3,500         | \$3,500         | \$3,500         | \$14,000         |
|                       | Biological control                                      | Purple loosestrife control                                     |                             |                 |                 |                 |                 |                  |
|                       |   |  | \$2,600                     | \$2,600         | \$2,600         | \$2,600         | \$2,600         | \$13,000         |
|                       | <i>Subtotal</i>   |  | <i>\$18,800</i>             | <i>\$9,600</i>  | <i>\$9,600</i>  | <i>\$9,600</i>  | <i>\$9,600</i>  | <i>\$57,200</i>  |
| Old Mill/Graniteville | Chemical treatment (plants)                             | Control fanwort, variable-leaf milfoil and curly-leaf pondweed |                             |                 |                 |                 |                 |                  |
|                       |   |  | \$15,000                    | \$3,500         | \$3,500         | \$3,500         | \$3,500         | \$29,000         |
|                       | Harvesting  | Supplemental diver harvesting                                  |                             |                 |                 |                 |                 |                  |
|                       |   |  |                             | \$3,500         | \$3,500         | \$3,500         | \$3,500         | \$14,000         |
|                       | Biological control                                      | Purple loosestrife control                                     |                             |                 |                 |                 |                 |                  |
|                       |   |  | \$2,600                     | \$2,600         | \$2,600         | \$2,600         | \$2,600         | \$13,000         |
|                       | Drawdown feasibility study and permitting (if feasible) |  |                             |                 |                 |                 |                 |                  |
|                       |   |  | \$8,500                     | \$8,000         |                 |                 |                 | \$16,500         |
|                       | <i>Subtotal</i>   |  | <i>\$26,100</i>             | <i>\$17,600</i> | <i>\$9,600</i>  | <i>\$9,600</i>  | <i>\$9,600</i>  | <i>\$72,500</i>  |
| Kennedy               | Harvesting  | Harvest emergent exotic species                                |                             |                 |                 |                 |                 |                  |
|                       |   |  | \$2,500                     | \$2,500         | \$2,500         | \$2,500         | \$2,500         | \$12,500         |
|                       | <i>Subtotal</i>   |  | <i>\$2,500</i>              | <i>\$2,500</i>  | <i>\$2,500</i>  | <i>\$2,500</i>  | <i>\$2,500</i>  | <i>\$12,500</i>  |
| <b>Totals</b>         |   |  | <b>\$119,500</b>            | <b>\$77,800</b> | <b>\$54,800</b> | <b>\$54,800</b> | <b>\$54,800</b> | <b>\$361,700</b> |



# Appendix E

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## Summary of Waterbodies and Impairments

**Summary of Waterbodies and Impairments**

| Waterbody Name <sup>1</sup>      | Segment ID <sup>2</sup> | Description <sup>2</sup>   | Length/Size <sup>2</sup> | Watershed | Final 2012 Integrated List of Waters |   | Final 2014 Integrated List of Waters |   | Waterbody Classification <sup>3</sup> |
|----------------------------------|-------------------------|--|--------------------------|-----------|--------------------------------------|---|--------------------------------------|---|---------------------------------------|
|                                  |                         |  |                          |           | Category                             | Impairment Cause (Pollutant of Concern)   | Category                             | Impairment Cause (Pollutant of Concern)   |                                       |
| <b>Merrimack River Watershed</b> |                         |  |                          |           |                                      |   |                                      |   |                                       |
| Reed Brook                       | MA84B-08                | Headwaters, south of the West Street/Cowdry Hill Road intersection, Westford to the confluence with Stony Brook, Westford. | 0.6 miles                | Merrimack | 2                                    | -   | 2                                    | -   | B, high quality, cold water           |
| Forge Pond                       | MA84015                 | Westford/ Littleton  | 203 acres                | Merrimack | 4a                                   | Non-Native Aquatic Plants*<br>TMDL Completed for Mercury in fish tissue   | 4a                                   | Non-Native Aquatic Plants*<br>TMDL Completed for Mercury in fish tissue   | B, high quality                       |
| Nabnasset Pond                   | MA84044                 | Westford   | 134 acres                | Merrimack | 4a                                   | Non-Native Aquatic Plants*<br>TMDL Completed for Mercury in fish tissue   | 4a                                   | Non-Native Aquatic Plants*<br>TMDL Completed for Mercury in fish tissue   | B, high quality                       |
| Beaver Brook                     | MA84B-02                | Outlet Mill Pond, Littleton, to inlet Forge Pond, Westford.  | 4.9 miles                | Merrimack | 5                                    | TSS<br>low pH<br>fecal coliforms<br>dissolved oxygen  | 5                                    | TSS<br>low pH<br>fecal coliforms<br>dissolved oxygen  | B, cold water                         |
| Stony Brook                      | MA83B-03                | Outlet Forge Pond, Westford to Brookside Road, Westford.   | 6.5 miles                | Merrimack | 5                                    | Fecal Coliform<br>Turbidity<br>Aquatic Macroinvertebrate Bioassessments   | 5                                    | Fecal Coliform<br>Turbidity<br>Aquatic Macroinvertebrate Bioassessments   | B, warm water                         |
| Stony Brook                      | MA83B-04                | Brookside Road, Westford to confluence with Merrimack River, Chelmsford  | 3.4 miles                | Merrimack | 5                                    | Escherichia coli<br>Aquatic Macroinvertebrate Bioassessments  | 5                                    | Escherichia coli<br>Aquatic Macroinvertebrate Bioassessments  | B, warm water                         |
| Deep Brook                       | MA83A-21                | Headwaters east of Everett Turnpike, Tyngsborough to confluence with Merrimack River, Chelmsford.                          | 2.9 miles                | Merrimack | 5                                    | Habitat Assessment (Streams)*<br>Aquatic Macroinvertebrate Bioassessments<br>Escherichia coli<br>Fishes Bioassessments<br>Sedimentation/Siltation | 5                                    | Habitat Assessment (Streams)*<br>Aquatic Macroinvertebrate Bioassessments<br>Escherichia coli<br>Fishes Bioassessments<br>Sedimentation/Siltation | B, high quality                       |
| Tadmuck Brook                    | MA84B-07                | Headwaters south of Main Street, Westford to confluence with Stony Brook, Westford   | 1.4 miles                | Merrimack | 5                                    | Escherichia coli  | 5                                    | Escherichia coli  | B, high quality                       |

**Summary of Waterbodies and Impairments**

| Waterbody Name <sup>1</sup>      | Segment ID <sup>2</sup> | Description <sup>2</sup> | Length/Size <sup>2</sup> | Watershed | Final 2012 Integrated List of Waters |   | Final 2014 Integrated List of Waters |   | Waterbody Classification <sup>3</sup> |
|----------------------------------|-------------------------|--------------------------|--------------------------|-----------|--------------------------------------|---|--------------------------------------|---|---------------------------------------|
|                                  |                         |                          |                          |           | Category                             | Impairment Cause (Pollutant of Concern) | Category                             | Impairment Cause (Pollutant of Concern) |                                       |
| <b>Merrimack River Watershed</b> |                         |                          |                          |           |                                      |   |                                      |   |                                       |
| Old Mill Pond                    | -                       | -                        | -                        | Merrimack |                                      |   | -                                    | -                                       | B, high quality                       |
| Long Sought for Pond             | -                       | -                        | -                        | Merrimack |                                      |   | -                                    | -                                       | B, high quality                       |
| Keyes Pond                       | -                       | -                        | -                        | Merrimack |                                      |   | -                                    | -                                       | B, high quality                       |
| Greystone Pond                   | -                       | -                        | -                        | Merrimack |                                      |   | -                                    | -                                       | B, high quality                       |
| Grassy Pond                      | -                       | -                        | -                        | Merrimack |                                      |   | -                                    | -                                       | B, high quality                       |
| Graniteville Pond                | -                       | -                        | -                        | Merrimack |                                      |   | -                                    | -                                       | B, high quality                       |
| Gilson Brook Pond                | -                       | -                        | -                        | Merrimack |                                      |   | -                                    | -                                       | B, high quality                       |
| Flushing Pond                    | -                       | -                        | -                        | Merrimack |                                      |   | -                                    | -                                       | B, high quality                       |
| Burges Pond                      | -                       | -                        | -                        | Merrimack |                                      |   | -                                    | -                                       | B, high quality                       |
| Snake Meadow Brook               | -                       | -                        | -                        | Merrimack |                                      |   | -                                    | -                                       | B, high quality                       |

**Summary of Waterbodies and Impairments**

| Waterbody Name <sup>1</sup>    | Segment ID <sup>2</sup> | Description <sup>2</sup>   | Length/Size <sup>2</sup> | Watershed | Final 2012 Integrated List of Waters |  | Final 2014 Integrated List of Waters |  | Waterbody Classification <sup>3</sup> |
|--------------------------------|-------------------------|--|--------------------------|-----------|--------------------------------------|--|--------------------------------------|--|---------------------------------------|
|                                |                         |  |                          |           | Category                             | Impairment Cause (Pollutant of Concern)        | Category                             | Impairment Cause (Pollutant of Concern)        |                                       |
| <b>Concord River Watershed</b> |                         |  |                          |           |                                      |  |                                      |  |                                       |
| Keyes Brook                    | -                       | -  | -                        | Merrimack |                                      |  | -                                    | -  | B, high quality                       |
| Gilson Brook                   | -                       | -  | -                        | Merrimack |                                      |  | -                                    | -  | B, high quality                       |
| Cold Spring Brook              | -                       | -  | -                        | Merrimack |                                      |  | -                                    | -  | B, high quality                       |
| Boutwell Brook                 | -                       | -  | -                        | Merrimack |                                      |  | -                                    | -  | B, high quality                       |
| Heart Pond                     | MA82059                 | Chelmsford/Westford  | 93.862 acres             | Concord   | 5                                    | Escherichia coli                               | 5                                    | Escherichia coli                               | B, high quality                       |
| Nashoba Brook                  | MA82B-14                | From source just south of Route 110 in Westford to confluence with Fort Pond Brook, Concord. | 9.411 miles              | Concord   | 5                                    | Low flow alterations*<br>Fishes Bioassessments | 5                                    | Low flow alterations*<br>Fishes Bioassessments | B, high quality                       |
| Butter Brook                   | -                       | -  | -                        | -         |                                      |  | -                                    | -  | B, high quality                       |
| Kennedy Pond                   | -                       | -  | -                        | -         |                                      |  | -                                    | -  | B, high quality                       |
| Vine Brook                     | -                       | -  | -                        | -         |                                      |  | -                                    | -  | B, high quality                       |
| Nonset Brook                   | -                       | -  | -                        | -         |                                      |  | -                                    | -  | B, high quality                       |

**Summary of Waterbodies and Impairments**

| Waterbody Name <sup>1</sup>    | Segment ID <sup>2</sup> | Description <sup>2</sup> | Length/Size <sup>2</sup> | Watershed | Final 2012 Integrated List of Waters |   | Final 2014 Integrated List of Waters |   | Waterbody Classification <sup>3</sup> |
|--------------------------------|-------------------------|--------------------------|--------------------------|-----------|--------------------------------------|---|--------------------------------------|---|---------------------------------------|
|                                |                         |                          |                          |           | Category                             | Impairment Cause (Pollutant of Concern) | Category                             | Impairment Cause (Pollutant of Concern) |                                       |
| <b>Concord River Watershed</b> |                         |                          |                          |           |                                      |   |                                      |   |                                       |
| Butter Brook                   | -                       | -                        | -                        | -         |                                      |   | -                                    | -                                       | B, high quality                       |
| Pond Brook                     | -                       | -                        | -                        | -         |                                      |   | -                                    | -                                       | B, high quality                       |
| Beaver Brook                   | -                       | -                        | -                        | -         |                                      |   | -                                    | -                                       | B, high quality                       |

Footnotes:

- 1 Waterbody names are from Town's ArcGIS shapefile, Integrated List of Waters, and EPA's maps available online.
- 2 Segment ID, Description, and Length/Size from Massachusetts Final 2012 Integrated List of Waters
- 3 Waterbody classification from the State Water Quality Standards at 314 CMR 4.00
- \* TMDL not required (Non-pollutant)



# **Appendix F**

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## **Summary of the Town of Westford's Current Stormwater Management Program**

## Summary of Town of Westford's Current Stormwater Management Program

**TO:** Stormwater Advisory Group  
**FROM:** Emily J. Scerbo  
**COPY:** Todd M. Brown  
**DATE:** October 30, 2014

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Tighe & Bond reviewed the Town of Westford's current Stormwater Management Program using the Environmental Protection Agency's (EPA's) 2003 National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4), hereafter referred to as the "General Permit." We also relied on our past experience with compliance audits by EPA Region 1 and Appendix B – Program Evaluation Worksheets of EPA's *MS4 Program Evaluation Guidance*. Appendix B serves as the master list of questions that EPA will likely use in a full MS4 compliance audit. The purpose of the evaluation was to identify and assess the stormwater management requirements the Town is currently addressing and make recommendations for program improvements. The following documents were reviewed as part of the evaluation:

- Town of Westford Stormwater Bylaw (Chapter 147: Stormwater Management), adopted May 9, 2008;
- Town of Westford Stormwater Regulations, November 5, 2012;
- Town of Westford Illicit Discharge Bylaw (Chapter 82: Discharges to the Municipal Storm Drain System) adopted May 9, 2008;
- Town of Westford NPDES Stormwater General Permit Notice of Intent, 2003;
- NPDES PII Small MS4 General Permit Annual Reports for the past five years (2010 – 2014);
- Other Town-provided stormwater Record Keeping files (e.g., Illicit Discharge Detection and Elimination and Training, Stormwater Sampling Manual, etc.).

**We have concluded that the Town of Westford has an outstanding stormwater management program and are in compliance with the 2003 General Permit.** It is clear that stormwater management is a priority for Westford.

Below is a breakdown of each EPA Minimum Control Measure (MCM) along with highlights of Westford's current stormwater program activities within the MCM and our recommendations for improvement.

### Minimum Control Measures (Permit Section Part II.B)

#### MCM 1 - Public Education and Outreach (Permit Section II.B.1)

##### General Permit Requirements

*"The permittee must implement a public outreach and education program to distribute educational materials to the community. The public education program must provide information concerning the impact of stormwater discharges on water bodies. It must address the steps and/or activities that the public can take to reduce the pollutants in stormwater runoff.*

*The following should be included in the education and outreach efforts:*

*(a.) information regarding both industrial and residential activities including illegal dumping into storm drains.*

*(b.) coordination with local groups (i.e., watershed associations, or schools).*

*(c.) materials for outreach/education may include, but are not limited to, pamphlets; fact sheets; brochures; public service announcements; storm drain stenciling and newspaper advertisements.*

*(d.) topics may include, but are not limited to, litter disposal, pet waste, household hazardous waste disposal, proper use of fertilizer and pesticides, and effects of impervious areas on water bodies."*

### **MCM Highlights**

The Town has been able to provide a robust multi-media public education program related to nonpoint source pollution and stormwater management targeted at multiple audiences. The Town has achieved this by distributing brochures, maintaining a stormwater website, taking advantage of regional educational programs like the Stormwater Matters materials prepared by the Sudbury Assabet Concord (SuAsCo) Watershed Community Council and national stormwater videos, as well as the unique Living Lab program. The Town has taken low-cost and innovative approaches to meet many of the requirements of this Minimum Control Measure.

The Living Lab, located at the Norman E. Day School, is an award-winning program that introduces fifth grade students to the preservation of natural resources and the functionality of storm drains along a local brook through a "Stormwater Matters" curriculum.<sup>1</sup> The stormwater website<sup>2</sup> is extremely detailed and updated often, and includes copies of local bylaws, regulations, trainings, water quality sampling, and other pertinent documents.

The public is informed of events, and many educational activities take place in the Town throughout the year.

### **Recommendations**

1. **Develop a Public Education Strategy.** We recommend that the Town develop a written comprehensive education and outreach strategy that identifies target audiences and pollutants of concern. The Town must make the connection between the impact of stormwater runoff on the Town's water bodies and provide actions that the target audience can take to reduce pollutants in stormwater runoff. Potential topics could be tailored to specific businesses and activities, such as automotive dealerships, restaurants, retail stores, and other businesses located in the Town with a potential to impact stormwater discharges. The Town should consider providing bilingual materials when appropriate and available. We encourage the Town to continue to work with the SuAsCo Watershed Community Council and the Northern Middlesex Council of

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<sup>1</sup> Westford Public Schools "Welcome to the Living Lab" website, available online at:

<http://westfordk12.us/pages/curric/subjectsfolder/LivingLab/index>

<sup>2</sup> Westford "Storm Water Management" website, available online at:

[http://www.westfordma.gov/pages/government/towndepartments/WestfordMA\\_engdept/stormwater](http://www.westfordma.gov/pages/government/towndepartments/WestfordMA_engdept/stormwater)

Governments (NMCOG) to coordinate regional educational efforts, and to take advantage of all of the excellent materials that are available free of charge through the Massachusetts Department of Environmental Protection (MassDEP) and EPA websites.

## **MCM 2 – Public Involvement and Participation (Permit Section II.B.2)**

### **General Permit Requirements**

*“All public involvement activities must comply with state public notice requirements at MGL Chapter 39 Section 23B and local public notice requirements.*

*(a.) The permittee must provide opportunity for the public to participate in the implementation and review of the stormwater management program.*

*(b.) Activities may also include volunteer stream monitoring or formation of a stormwater management committee.”*

### **MCM Highlights**

The Town of Westford meets the requirements for the 2003 EPA General Permit. Notice of public meetings complies with State and Local public meeting notice requirements and there are many opportunities for residents of all ages to participate in Westford’s stormwater program and overall environmental stewardship. For example, the Annual Strategic Planning Retreat provides residents an opportunity to discuss local issues with Town staff. This year, the Stormwater Management Master Plan was a session topic. The session included getting feedback from residents and providing educational materials to attendees.

Town staff and local citizen groups are actively involved in monitoring the water quality of Westford’s surface waters including lakes and ponds through the Healthy Lakes and Ponds Collaborative and rivers through the Stream Team. The Town is an active participant in regional groups including the SuAsCo Watershed Community Council and Northern Middlesex Stormwater Collaborative (NMSC). Through these groups, Westford has participated in training, shared ideas and resources, and obtained grants for stormwater improvements and inspection of outlets.

Other public participation efforts include the annual poster contest for fourth graders, which has a water conservation and pollution prevention theme, and regular recycling and hazardous waste events.

### **Recommendations**

- 1. Encourage Public Participation at the Program Level.** Please note that when EPA reissues the Small MS4 General Permit, the Town will be required to seek public input during the development of the next Notice of Intent (NOI) and Stormwater Management Plan. **Many of these requirements will be achieved through the public education and outreach associated with the Stormwater Management Master Plan. Public and stakeholder input to the Stormwater Management Master Plan, through the Stormwater Advisory Group and the general public, is a critical component of the planning process.** The Town will continue to hold regular meetings with professional staff that are involved in municipal stormwater and nonpoint source pollution management prior to EPA’s promulgation of the reissued General Permit.

## **MCM 3 – Illicit Discharge and Detection Elimination (Permit Section II.B.3)**

### **General Permit Requirements**

*"The permittee must develop, implement and enforce a program to detect and eliminate illicit discharges. An illicit discharge is any discharge to a municipal separate storm sewer that is not composed entirely of stormwater. Exceptions are discharges pursuant to a NPDES permit (other than the NPDES permit for discharges from the municipal sewer system), allowable non stormwater discharges described at Part I.F. and discharges resulting from firefighting activities.*

*(a.) If not already existing, the permittee must develop a storm sewer system map. At a minimum, the map must show the location of all outfalls and the names of all waters that receive discharges from those outfalls. Additional elements may be included on the map, such as, location of catch basins, location of manholes, and location of pipes within the system. Initial mapping should be based on all existing information available to the permittee including city records and drainage maps. Field surveys may be necessary to verify existing records and locate all outfalls.*

*(b.) To the extent allowable under state or local law, the permittee must effectively prohibit, through an ordinance or other regulatory mechanism, non-stormwater discharges into the system and implement appropriate enforcement procedures and actions. If a regulatory mechanism does not exist, development and adoption of such a mechanism must be included as part of the stormwater management program.*

*(c.) The permittee must develop and implement a plan to detect and address non-stormwater discharges, including illegal dumping, into the system. The illicit discharge plan must contain the following elements:*

*i. Procedures to identify priority areas. This includes areas suspected of having illicit discharges, for example: older areas of the city, areas of high public complaints and areas of high recreational value or high environmental value such as beaches and drinking water sources.*

*ii. Procedures for locating illicit discharges (i.e., visual screening of outfalls for dry weather discharges, dye or smoke testing).*

*iii. Procedures for locating the source of the discharge and procedures for the removal of the source.*

*iv. Procedures for documenting actions and evaluating impacts on the storm sewer system subsequent to the removal.*

*(d.) The permittee must inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper waste disposal.*

*(e.) The non-stormwater discharges listed in Part I.F. must be addressed if they are identified as being significant contributors of pollutants to the small MS4."*

### **MCM Highlights**

The Town has spent considerable effort on their IDDE Program over the past eight years. The Town has satisfied the mapping requirements of the 2003 General Permit and is well on the way to meeting the requirements in the 2014 Massachusetts MS4 Draft General Permit. Since mapping began around 2000, the Town has nearly completed a map of the storm drainage system that includes catch basins, manholes, outfalls, culverts, other structures, receiving waters, and some connectivity. Mapping is available in ArcGIS and is updated frequently. A more thorough evaluation of the completeness and accuracy of stormdrain system mapping is underway as part of the Stormwater Management Master Plan.

The Town has inventoried all outfalls (more than 600) and has inspected them for the presence of illicit discharges during dry weather using procedure developed by the Center for Watershed Protection and further detailed in the Town-specific IDDE Plan, formalized in June 2012.

Westford is also utilizing an application for the iPad to update the mapping and stormwater drainage system database. The application is used for outfall and drainage structure inspections.

Westford adopted a bylaw that prohibits illicit discharges (Chapter 82: *Discharges to the Municipal Storm Drain System*) in May of 2008, which regulates illicit discharges and illegal connections to the MS4. The Board of Health serves as the enforcement agency.

The Town Staff and volunteers (see MCM 2) have been trained on illicit discharges and stormwater outfall investigations and sampling and continue to look for the presence of illicit discharges.

### **Recommendations**

1. **Employee Training.** Continue to provide training for municipal employees and volunteers annually.
2. **Focused Public Education.** Refer to Recommendation No. 1 under Public Education.

### **MCM 4 – Construction Site Stormwater Runoff Control (Permit Section II.B.4)**

#### **General Permit Requirements**

*“The permittee must develop, implement, and enforce a program to reduce pollutants in any stormwater runoff to the MS4 from construction activities that result in a land disturbance of greater than or equal to one acre. The permittee must include disturbances less than one acre if part of a larger common plan. The permittee does not need to apply its construction program provisions to projects that receive a waiver from EPA under the provisions of 40 CFR§122.26(b)(15)(i). At a minimum, the program must include:*

*(a.) To the extent allowable under state or local law, an ordinance or other regulatory mechanism to require sediment and erosion control at construction sites. If such an ordinance does not exist, development and adoption of an ordinance must be part of the program.*

*(b.) Sanctions to ensure compliance with the program. To the extent allowable under state or local law sanctions may include both monetary and non-monetary penalties.*

*(c.) Requirements for construction site operators to implement a sediment and erosion control program which includes BMPs that are appropriate for the conditions at the construction site, including efforts to minimize the area of the land disturbance.*

*(d.) Requirements for the control of wastes, including but not limited to, discarded building materials, concrete truck wash out, chemicals, litter, and sanitary wastes.*

*(e.) Procedures for site plan review including procedures which incorporate consideration of potential water quality impacts. The site plan review should include procedures for preconstruction review.*

*(f.) Procedures for receipt and consideration of information submitted by the public.*

*(g.) Procedures for inspections and enforcement of control measures at construction sites."*

### **MCM Highlights**

Westford adopted the Stormwater Management Bylaw (Chapter 147 of the General Bylaws) in May of 2008 and the Planning Board adopted the associated Rules & Regulations in November 2012. The Bylaw requires that all land disturbing activities greater than or equal to one acre obtain a stormwater permit, meet performance stormwater standards and develop a stormwater management plan. The Bylaw includes monetary penalties, and the Regulations include EPA requirements (c-g) above. In addition, the Westford Wetlands Bylaw and Regulations were updated in April 2012. Between these two bylaws, procedures for site plan reviews are established and enforced, and reviews by the Engineering Department the Conservation Commission are conducted. These reviews include regular inspections and communication with the developer to ensure adherence to local requirements during construction.

### **Recommendations**

1. **Track Permits and Inspections.** We recommend that the Town of Westford enhance the program to track permits issued, site inspections conducted, including dates and locations, and enforcement actions and corrective measures taken. The goal of this tracking is to allow various entities that are involved in the permit issuance, inspections, and enforcement to more easily coordinate.

### **MCM 5 – Post Construction Stormwater Management in New Development and Redevelopment (Permit Section II.B.5)**

#### **General Permit Requirements**

*"The permittee must develop, implement and enforce a program to address stormwater runoff from new development and redevelopment projects that disturb greater than one acre and discharge into the municipal system. The program must include projects less than one acre if the project is part of a larger common plan of development which disturbs greater than one acre. The post construction program must include:*

*(a.) To the extent allowable under state or local law, an ordinance or other regulatory mechanism to address post construction runoff from new development and redevelopment. If such an ordinance does not exist, development and adoption of an ordinance must be part of the program.*

*(b.) Procedures to ensure adequate long term operation and maintenance of best management practices.*

*(c.) Procedure to ensure that any controls that are put in place will prevent or minimize impacts to water quality."*

### **MCM Highlights**

Westford adopted the Stormwater Management Bylaw (Chapter 147 of the General Bylaws) in May of 2008 and the Planning Board adopted the associated Rules & Regulations in November 2012. The Bylaw requires that all land disturbing activities greater than or equal to one acre obtain a stormwater permit, meet performance stormwater standards and develop a stormwater management plan. The Bylaw includes requirements for installation of structural and non-structural BMPs, long term operation and maintenance of the BMPs considerations to address water quality, and inspection procedures. In addition, the Westford Wetlands Bylaw and Regulations were updated in April 2012. Between these two

bylaws, the Town implements robust post-construction stormwater management procedures.

### Recommendations

1. **Track Long-Term O&M of Private BMPs.** It is recommended that the Town of Westford implement a program to track the long-term operation and maintenance of privately owned and/or operated structural stormwater BMPs and institute a formal post-construction inspection process.

## MCM 6 – Pollution Prevention and Good Housekeeping (Permit Section II.B.6)

### General Permit Requirements

*“The permittee must:*

*(a.) Develop and implement a program with a goal of preventing and/or reducing pollutant runoff from municipal operations. The program must include an employee training component.*

*(b.) Include, at a minimum, maintenance activities for the following: parks and open space (areas such as public golf course and playing fields); fleet maintenance, building maintenance; new construction and land disturbance; and road way drainage system maintenance and stormwater system maintenance.*

*(c.) Develop schedules for municipal maintenance activities described in paragraph (b) above.*

*(d) Develop inspection procedures and schedules for long-term structural controls.”*

### MCM Highlights

The Town implements numerous actions to reduce pollutant runoff from municipal operations. The following activities are key components of the pollution prevention program:

- The Engineering and Highway Departments share responsibility in implementing the Good Housekeeping program.
- All catch basins are proactively cleaned by the Town each year, and those on hills are cleaned twice. The catch basins are visually inspected during each cleaning and visible signs of potential illicit discharges are noted.
- The Town sweeps streets throughout the entire Town twice each year.
- Oil and hazardous materials are stored indoors and managed in accordance with local, state, and federal requirements.
- Winter de-icing materials are stored under cover.
- The Staff of the Engineering and Highway Departments are routinely trained on pollution prevention and good housekeeping.
- A SWPPP was prepared for the Highway Department Garage and BMPs are implemented to prevent pollution and improve good housekeeping practices.
- A Spill Prevention Control and Countermeasures Plan (SPCC) was prepared for the Town’s Highway Department, Transfer Station and the Water Department based on above ground oil storage volumes. Employee training was provided on the specific contents of the SPCC.

## Recommendations

1. **Formalize a Written Operation and Maintenance Plan for Town-wide Activities.** It is recommended that the Town of Westford formalize a written O&M Plan and schedule for town wide maintenance activities for parks and open space, fleet, building maintenance, drainage system and roadway maintenance, and structural BMPs.

## Additional Permit Requirements

### Cooperation Between Interconnected MS4 Systems (Permit Section II.B.7)

#### General Permit Requirements

*“Cooperation between interconnected MS4 systems is encouraged. The permittee should identify interconnections within the system. The permittee should attempt to work cooperatively with an interconnected municipality in instances of discharges impacting a system.”*

#### Program Highlights

There are no known interconnections between Westford’s MS4 and another MS4.

#### Recommendations

1. **Identify Existing Interconnections in the MS4 System.** The Town should identify any connections between Westford’s MS4 and other MS4s and, as appropriate, establish a working relationship with the interconnected entity.
2. **Create a Plan with Interconnected MS4s.** If an interconnection exists, establish a written plan that identifies responsibilities for drainage system maintenance and responsibilities for response to an illicit discharge or illegal connection impacting the MS4.

### Groundwater Recharge and Infiltration (Permit Section II.B.8)

#### General Permit Requirements

*“The permittee must evaluate physical conditions, site design, and best management practices to promote groundwater recharge and infiltration where feasible in the implementation of the control measures. During the implementation of the storm water management program, the permittee must address recharge and infiltration for the minimum control measures, as well as any reasons for electing not to implement recharge and infiltration. Loss of annual recharge to ground water should be minimized through the use of infiltration measures to the maximum extent practicable. Permittees in areas identified as ‘high’ or ‘medium’ in the most recent Massachusetts Water Resources commission’s Stressed Basins in Massachusetts report in effect at the time the permittee submits a Notice of Intent and accompanying storm water management program, must minimize the loss of annual recharge to ground water from new development and redevelopment, including but not limited to drainage improvements done in conjunction with road improvements, street drain improvement projects and flood mitigation projects, consistent with Standard 3 of the Storm Water Management Policy in areas both within and outside of the jurisdiction of the Massachusetts Wetlands Protections Act.”*

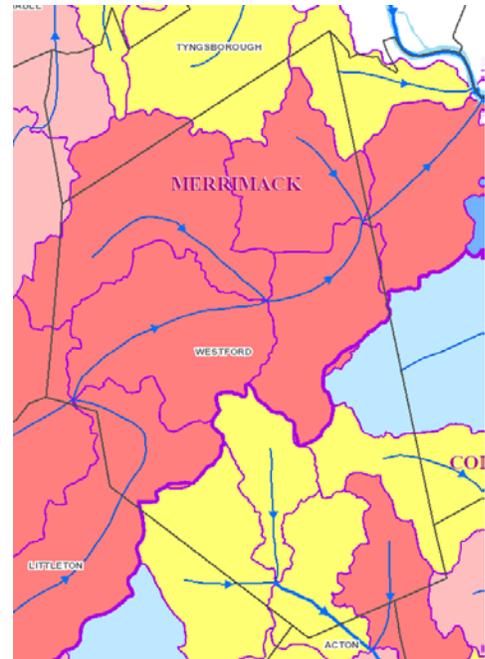
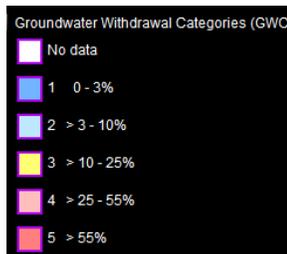
#### Program Highlights

Through implementation of the Stormwater Management Bylaw and Regulations, the Town evaluates site conditions and design and promotes infiltration BMPs to the maximum extent practicable. Land development activities that require a stormwater management permit must

submit a Stormwater Report to document compliance with the ten Massachusetts Stormwater Management Standards. This report must include the existing site hydrology with both groundwater recharge and surface runoff, measures for the detention, retention or infiltration of water, a description of non-structural BMPs, and pre-development and post-development conditions, including provisions for protecting the infiltration capacity of soil during construction, and infiltration rates. The Town also requires that site plans and landscape plans for all proposed projects must take appropriate steps to minimize water use for irrigation and to allow for natural recharge of groundwater.

The Merrimack River watershed is classified as a “low stress” basin and the SuAsCo Watershed is classified as a “medium stress” basin in the 2001 *Stressed Basins in Massachusetts* report. However, though not recognized in the 2003 MS4 General Permit, more recent basin assessments completed as part of the Water Management Act Sustainable Water Management Initiative (SWMI) program show the Merrimack River watershed sub-basins in Westford are impaired such that groundwater withdrawals alter August median stream flows by 55% or more (Groundwater Withdrawal Category (GWC) 5). The areas in Town within the SuAsCo basin are less impacted by groundwater withdrawals (between 10 to 25%, GWC 3) with one subbasin being a GWC 5 and a portion of one basin being a GWC 2.

The Westford Water Department is proactively assessing the ramifications of proposed regulatory changes to the Water Management Act permitting process, and the Stormwater Management Master Plan will further evaluate opportunities and challenges associated with implementing the Small MS4 program and SWMI program concurrently.



**Figure 1: Westford's SWMI Groundwater Withdrawal Categories**

As part of its road improvement, drainage improvement, and flood mitigation projects, the Town meets Massachusetts Stormwater Management Standard 3 in areas within jurisdiction of the Massachusetts Wetlands Protection Act. Large projects (one or more acres) also meet Standard 3.

### Recommendations

1. **Continue Upholding Stormwater Management Bylaw.** Continue implementing the Bylaw and holding new development and redevelopment to applicable performance standards, including groundwater recharge and infiltration of runoff.
2. **Integrate SWMI Requirements with Stormwater Management.** Once the revised Water Management Act regulations are finalized, the Town should coordinate actions to manage stormwater runoff and efforts to mitigate withdrawal impacts under SWMI.

## Public Drinking Water Supply Requirements (Permit Section II.C)

### General Permit Requirements

1. *“MS4s which discharge to public drinking water sources and their protection areas should consider this water a priority in implementation of the stormwater program.*
2. *Discharges to public drinking water supply sources and their protection areas should provide pretreatment and spill control capabilities to the extent feasible.*
3. *Direct discharges to Zone I wellhead protection areas should be avoided to the extent feasible.”*

### Program Highlights

In its Zoning Bylaw, Westford has a Water Resource Protection Overlay District II (WRPODII) to ensure adequate drinking water quality and quantity, preserve and protect drinking water supplies, conserve natural resources, and prevent contamination of the environment. This district is bounded by Approved Wellhead Protection Areas (Zone IIs), Interim Wellhead Protection Areas (IWPAs), and high and medium yield aquifers. The Town has inventoried the outfalls within these areas and considers water supply sources and protection areas a priority for stormwater management, particularly IDDE activities.

### Recommendations

1. **Review current Town Regulations and Bylaws.** The Town should review its zoning and subdivision bylaws to address pretreatment requirements for projects within Wellhead Protection Areas, and to confirm that existing bylaws satisfy General Permit requirements.

## Record Keeping (Permit Section II.E)

### General Permit Requirements

1. *All records required by this permit must be kept for a periods of at least five years. Records include information used in the development of the storm water management program, and monitoring, copies of reports, and all data used in the development of the notice of intent.*
2. *Records need to be submitted only when specifically required by the permitting authority.*
3. *The permittee must make the records relating to this permit available to the public, including the storm water management program. The public may view the records during normal business hours. The permittee may charge a reasonable fee for copying requests.”*

### Program Highlights

The Town of Westford maintains stormwater management program records that are organized by year and MCM. Records are available to the public at the Town Engineering office located in the Highway facility.

### Recommendations

1. Continue maintaining records pertaining to the stormwater management program and General Permit.

## Discharges to Water Quality Impaired Waters (Permit Section I.C) and Total Maximum Daily load (TMDL) Allocations (Permit Section I.D)

### General Permit Requirements

#### *C. Discharges to Water Quality Impaired Waters*

- 1. The permittee must determine whether storm water discharges from any part of the MS4 contribute; either directly or indirectly, to a 303(d) listed water body.*
- 2. The storm water management program must include a section describing how the program will control the discharge of the pollutants of concern and ensure that the discharges will not cause an instream exceedance of the water quality standards. This discussion must specifically identify control measures and BMPs that will collectively control the discharge of the pollutant(s) of concern. Pollutant(s) of concern refer to the pollutant identified as causing the impairment.*

#### *D. Total Maximum Daily Load Allocations*

*If a TMDL has been approved for any water body into which the MS4 discharges, the permittee must:*

- 1. Determine whether the approved TMDL is for a pollutant likely to be found in storm water discharges from the MS4.*
- 2. Determine whether the TMDL includes a pollutant waste load allocation (WLA), BMP recommendations or other performance requirements for storm water discharges. This storm water WLA may be expressed in the TMDL as a gross allotment for the impaired water body. Or, provided no specific WLA for the MS4 exists, determine if a Performance Agreement or Memorandum of Understanding has been established between the MS4, EPA, and MA DEP or NH DES which modifies the BMPs or performance standards of the TMDL. Such Memoranda are posted on the TMDL websites:*

*The Massachusetts site is: <http://www.state.ma.us/dep/brp/wm/tmdl.htm>.*

*The New Hampshire site is: <http://www.des.state.nh.us/wmb/TMDL>.*

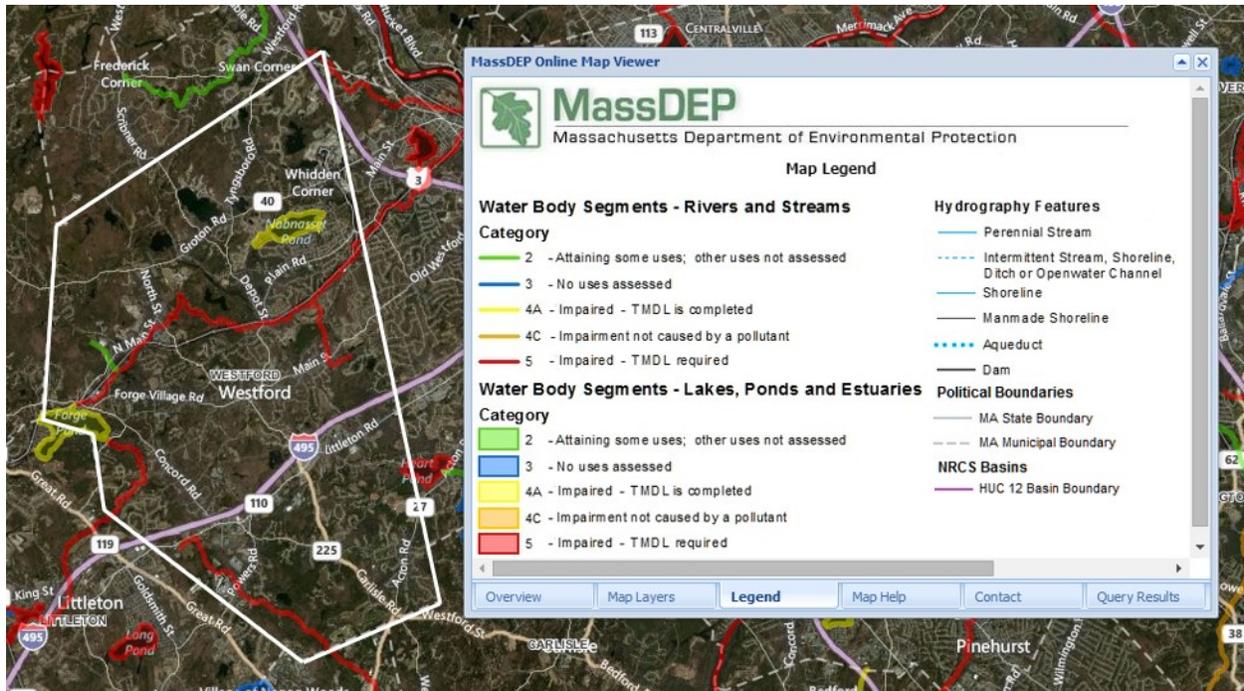
- 3. If the MS4 is required to implement storm water waste load allocation provisions of the TMDL, the permittee must assess whether the WLA is being met through implementation of existing storm water control measures or if additional control measures are necessary. The permittee's assessment of whether the WLA is being met is expected to focus on the adequacy of the permittee's storm water controls (implementation and maintenance), not on the response of the receiving water.*
- 4. Highlight in the storm water management program and annual reports all control measures currently being implemented or planned to be implemented to control pollutants of concern identified in approved TMDLs. Also include a schedule of implementation for all planned controls. Document the assessment which demonstrates that the WLA will be met including any calculations, maintenance log books, or other appropriate controls.*

### Program Highlights

Westford's stormwater program is addressing many of the current requirements for discharges to impaired water bodies. The June 2012 "Receiving Water Impairment and TMDL Update" report provides a list of receiving waterbodies in Westford, a summary of water quality impairments including pollutant sources, applicable TMDLs and respective waste load allocations,

and classification under the State Surface Water Quality Standards (310 CMR 4.00). This report also provides a summary of the town-wide and watershed specific BMPs the Town is implementing to control pollutants of concern. Through implementation of its current stormwater program, the Town is controlling the discharge of the pollutants of concern.

MassDEP has an interactive map and website to explore the current impairment status of Massachusetts water bodies, available at <http://maps.massgis.state.ma.us/images/dep/omv/il2012viewer.htm>. Figure 2 below shows the Category for each of Westford's water bodies.



**Figure 2: Map of Westford's Water Bodies and Category**

## Recommendations

1. **Monitor Impairments.** The Town should update review the most recent EPA Approved Integrated List of Waters for Massachusetts and update the 2012 "Receiving Water Impairment and TMDL Update" report with current impairments and categories. The most current information can be found on MassDEP's website: <http://www.mass.gov/eea/agencies/massdep/water/watersheds/total-maximum-daily-loads-tmdls.html#2>.
2. **As needed, update BMPs.** Determine whether stormwater discharges from any part of the MS4 contribute either directly or indirectly to these water bodies. This review should be updated annually to reflect changes in impairment status and updated storm drain mapping. For discharges contributing to an impairment, Westford's BMPs should be updated to address pollutants of concern.



# Appendix G

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## Municipal Facilities Inventory

**Inventory of Municipal Facilities**

| Map No.                         | Name  | Address              | Parcel                | Responsible Board/<br>Commission/Department | Size<br>(acres) | Building<br>(Y/N) |
|---------------------------------|---|----------------------|-----------------------|---|-----------------|-------------------|
| <b>Buildings and Facilities</b> |   |                      |                       |   |                 |                   |
| <b>Municipal Buildings</b>      |   |                      |                       |   |                 |                   |
| BF1                             | Cameron Senior Center                             | 20 Pleasant Street   | 330/053.0-0091-0000.0 | Council on Aging                            | 3.422           | Y                 |
| BF2                             | IT Department (Forge Village Fire Station)        | E Prescott Street    | 330/057.0-0028-0000.0 | Selectmen                                   | 0.103           | Y                 |
| BF3                             | J.V. Fletcher Library                             | 50 Main Street       | 330/059.0-0018-0000.0 | Library Trustees                            | 1.590           | Y                 |
| BF4                             | New Highway Garage Site                           | North Main Street    | 330/030.0-0030-0000.0 | Selectmen                                   | 44.000          | Y                 |
| BF5                             | Parkerville Schoolhouse Parcel                    | Carlisle Road        | 330/012.0-0101-0000.0 | Parkerville School Reuse<br>Committee       | 0.342           | Y                 |
| BF6                             | Rec Dept Storage (Graniteville Fire Station)      | 54 Broadway Street   | 330/062.0-0030-0000.0 | Selectmen                                   | 0.250           | Y                 |
| BF7                             | Recreational Department                           | 35 Town Farm Road    | 330/024.0-0023-0000.0 | Selectmen                                   | 0.680           | Y                 |
| BF8                             | Roudenbush Community Center                       | 73 Main Street       | 330/059.0-0042-0000.0 | Selectmen                                   | 5.200           | Y                 |
| BF9                             | Roudenbush Community Center at<br>Nabnasset       | Plain Road           | 330/074.0-0108-0000.0 | Selectmen                                   | 3.750           | Y                 |
| BF10                            | Town Hall   | 55 Main Street       | 330/059.0-0046-0000.0 | Selectmen                                   | 0.500           | Y                 |
| BF11                            | Westford Museum                                   | 2 Boston Road        | 330/055.0-0013-0000.0 | Historical Commission                       | 0.359           | Y                 |
| <b>School Buildings</b>         |   |                      |                       |   |                 |                   |
| BF12                            | Abbot School & Millennium School                  | 25 Depot Street      | 330/026.0-0086-0000.0 | School Department                           | 32.070          | Y                 |
| BF13                            | Blanchard Middle School                           | 20 West Street       | 330/029.0-0002-0000.0 | School Department                           | 85.620          | Y                 |
| BF14                            | Nabnasset School                                  | 99 Plain Road        | 330/069.0-0253-0000.0 | School Department                           | 21.980          | Y                 |
| BF15                            | Norman Day School                                 | 75 E Prescott Street | 330/024.0-0005-0000.0 | School Department                           | 40.100          | Y                 |
| BF16                            | Rita Miller School                                | Vineyard Road Ext.   | 330/048.0-0011-0232.0 | School Committee                            | 8.560           | Y                 |
| BF17                            | Robinson and Crisafulli Elementary Schools        | 33 Robinson Road     | 330/020.0-0102-0000.0 | School Department                           | 68.800          | Y                 |
| BF18                            | School Maintenance Garage (Old Highway<br>Garage) | 30 Beacon Street     | 330/030.0-0045-0000.0 | Selectmen                                   | 5.000           | Y                 |
| BF19                            | Veterans Memorial Complex/Stony Brook<br>School 1 | Farmer Way           | 330/035.0-0108-0000.0 | School Department                           | 22.300          | Y                 |
| BF20                            | Veterans Memorial Complex/Stony Brook<br>School 2 | Farmer Way           | 330/035.0-0112-0000.0 | School Department                           | 20.900          | N                 |
| BF21                            | Vineyard Rd Ext School Land - North               | Vineyard Road Ext.   | 330/048.0-0005-0001.0 | School Committee                            | 3.760           | Partial           |
| BF22                            | Westford Academy                                  | 30 Patten Road       | 330/020.0-0082-0000.0 | School Department                           | 37.900          | Y                 |
| <b>Fire and Safety</b>          |   |                      |                       |   |                 |                   |
| BF23                            | Nabnasset Fire Station                            | Oak Hill Road        | 330/074.0-0278-0000.0 | Fire Department                             | 0.207           | Y                 |
| BF24                            | Police and Fire Station                           | 53 Main Street       | 330/059.0-0047-0000.0 | Selectmen                                   | 30.000          | Y                 |
| BF25                            | Rogers Fire Station                               | E Prescott Street    | 330/024.0-0022-0000.0 | Selectmen                                   | 5.900           | Y                 |

**Inventory of Municipal Facilities**

| Map No.      | Name   | Address            | Parcel                | Responsible Board/<br>Commission/Department | Size<br>(acres) | Building<br>(Y/N) |
|--------------|--|--------------------|-----------------------|---|-----------------|-------------------|
| <b>Water</b> |  |                    |                       |   |                 |                   |
| BF26         | E. Prescott Water Tower                                    | E Prescott Street  | 330/024.0-0006-0000.0 | Water Department                            | 0.500           | N                 |
| BF27         | Forge Village Rd. Water Dept. Land - North Garage          | Forge Village Road | 330/025.0-0010-0000.0 | Water Department/<br>Selectmen              | 88.260          | Y                 |
| BF28         | Forge Village Rd. Water Dept. Land - South Treatment Plant | Forge Village Road | 330/020.0-0043-0000.0 | Water Department                            | 26.100          | Y                 |
| BF29         | Hildreth Hills Water Tank                                  | Hildreth Street    | 330/016.0-0024-0000.0 | Water Department                            | 1.670           | N                 |
| BF30         | Hunt Road Water Tower                                      | Hunt Road          | 330/033.0-0017-0000.0 | Water Department                            | 1.070           | N                 |
| BF31         | Prospect Hill Water Tower                                  | Main Street        | 330/055.0-0002-0000.0 | Water Department                            | 0.735           | N                 |

**Parks and Open Space**

**Cemetery**

|     |                               |                    |                       |                     |        |   |
|-----|-------------------------------|--------------------|-----------------------|---------------------|--------|---|
| PO1 | Fairview Cemetery             | Main Street        | 330/027.0-0170-0000.0 | Cemetery Commission | 10.450 | Y |
| PO2 | Hillside Cemetery             | Nutting Road       | 330/036.0-0035-0000.0 | Cemetery Commission | 0.939  | N |
| PO3 | Keyes Cemetery                | Jonas Road         | 330/043.0-0022-0000.0 | Cemetery Commission | 0.048  | N |
| PO4 | Picking-Wright Cemetery Annex | Groton Road        | 330/035.0-0004-0004.0 | Cemetery Commission | 4.490  | N |
| PO5 | Pine Grove Cemetery           | Forge Village Road | 330/020.0-0043-0001.0 | Cemetery Commission | 11.700 | Y |
| PO6 | Westlawn Cemetery             | Concord Road       | 330/020.0-0028-0000.0 | Cemetery Commission | 1.700  | N |
| PO7 | Wright Cemetery               | Groton Road        | 330/035.0-0005-0000.0 | Cemetery Commission | 0.416  | N |

**Garden and Active Recreation**

|      |  |                      |                       |                          |         |   |
|------|--|----------------------|-----------------------|--------------------------|---------|---|
| PO8  | Captain Stephen Hamilton Ballfield                             | Plain Road           | 330/074.0-0108-0000.0 | Selectmen                | 3.750   | N |
| PO9  | East Boston Camps at Stony Brook Conservation Land             | Depot Street         | 330/031.0-0037-0000.0 | Conservation Commission  | 237.230 | Y |
| PO10 | Edwards Beach Parcel   | Williams Avenue      | 330/074.0-0002-0000.0 | Conservation Commission. | 10.000  | Y |
| PO11 | Forge Pond Town Beach  | Pleasant Street      | 330/053.0-0012-0000.0 | Selectmen                | 5.670   | Y |
| PO12 | Graniteville Ballfield/American Legion Field                   | 15 River Street      | 330/062.0-0102-0000.0 | Recreation Commission    | 31.000  | Y |
| PO13 | Greystone Playing Fields (Lot Q)                               | Russell's Way        | 330/046.0-0011-0244.0 | Selectmen                | 3.280   | N |
| PO14 | Hill Orchard Farm Stand  | Hunt Road            | 330/033.0-0012-0000.0 | Conservation Commission  | 3.480   | Y |
| PO15 | Hill Orchard West 1  | Chamberlin Road      | 330/033.0-0006-0000.0 | Conservation Commission  | 2.000   | N |
| PO16 | Hill Orchard West 2  | Chamberlin Road      | 330/033.0-0007-0003.0 | Conservation Commission  | 18.000  | N |
| PO17 | Jack Walsh Recreation Area                                     | Carlisle Road        | 330/007.0-0009-0000.0 | Recreation Commission    | 32.800  | Y |
| PO18 | Stony Brook Conservation Land - Recreation Commission Parcel 1 | Nutting Road         | 330/036.0-0008-0000.0 | Selectmen                | 29.800  |   |
| PO19 | VFW Softball Field   | 52 W Prescott Street | 330/056.0-0055-0000.0 | Recreation Commission    | 10.000  | Y |

**Inventory of Municipal Facilities**

| Map No.                 | Name  | Address              | Parcel                | Responsible Board/<br>Commission/Department | Size<br>(acres) | Building<br>(Y/N) |
|-------------------------|---|----------------------|-----------------------|---|-----------------|-------------------|
| <b>Commons</b>          |   |                      |                       |   |                 |                   |
| PO20                    | Civil War Soldiers Monument                 | Boston Road          | 330/055.0-0041-0001.0 | Selectmen                                   | < 1.000         | N                 |
| PO21                    | Graniteville Memorial Triangle              | North Main Street    | 330/030.0-0068-0001.0 | Selectmen                                   | < 0.100         | N                 |
| PO22                    | Odell W. Prescott St. Land Donation         | W Prescott Street    | 330/053.0-0013-0000.0 | Selectmen                                   | 0.092           | N                 |
| PO23                    | Old Pioneer Burial Ground                   | Carlisle Road        | 330/012.0-0099.0001.0 | Selectmen                                   | < .10           | N                 |
| PO24                    | Town Common                                 | Main Street          | 330/059.0-0001-0000.0 | Selectmen                                   | 1.130           | N                 |
| PO25                    | Veterans Memorial Complex Municipal Land 1  | Farmer Way           | 330/035.0-0113-0000.0 | Selectmen                                   | 4.410           | N                 |
| PO26                    | Veterans Memorial Complex Municipal Land 2  | Farmer Way           | 330/035.0-0110-0000.0 | Selectmen                                   | 7.790           | N                 |
| <b>Undeveloped Land</b> |   |                      |                       |   |                 |                   |
|                         | Minot's Corner Parcel                       | Littleton Road       | 330/017.0-0027-0001   | Selectmen                                   | 0.027           | N                 |
|                         | Old Landfill/New Meadow                     | Cold Spring Road     | 330/025.0-0015-0000.0 | Selectmen                                   | 17.020          | N                 |
| <b>Other Open Space</b> |   |                      |                       |   |                 |                   |
|                         | Acton Road Tax Title Parcel 1               | Acton Road           | 330/013.0-0047-0000.0 | Tax Possession Sale<br>Committee            | 9.400           |                   |
|                         | Acton Road Tax Title Parcel 2               | Acton Road           | 330/007.0-0055-0000.0 | Tax Possession Sale<br>Committee            | 0.930           |                   |
|                         | Acton Road Tax Title Parcel 3 (Vose Parcel) | Acton Road           | 330/007.0-0086-0000.0 | Conservation Commission                     | 0.263           |                   |
|                         | Acton Road Tax Title Parcel 4               | Acton Road           | 330/013.0-0038-0000.0 | Tax Possession Sale<br>Committee            | 0.810           |                   |
|                         | Allie Lane Parcel                           | Allie Lane           | 330/035.0-0101-0000.0 | Selectmen                                   | 15.000          |                   |
|                         | Anderson Conservation Land 1                | Baldwin Road         | 330/033.0-0023-0019.0 | Conservation Commission                     | 1.010           |                   |
|                         | Anderson Conservation Land 2                | Hunt Road            | 330/033.0-0023-0014.0 | Conservation Commission                     | 0.420           |                   |
|                         | Arch Bridge 1                               | Milot Roat           | 330/025.0-0085-0000.0 | Conservation Commission                     | 1.070           |                   |
|                         | Arch Bridge 2                               | Milot Road           | 330/025.0-0090-0000.0 | Conservation Commission                     | 2.700           |                   |
|                         | B&M Stony Brook Conservation Parcel         | Milot Road           | 330/025.0-0083-0000.0 | Conservation Commission                     | 4.458           |                   |
|                         | Balas Conservation Land                     | Carolina Lane        | 330/069.0-0001-0000.0 | Conservation Commission                     | 11.950          |                   |
|                         | Banbury Drive Conservation Parcel           | Banbury Drive        | 330/011.0-0061-0000.0 | Conservation Commission                     | 1.480           |                   |
|                         | Beacon St. Water Department Land            | Beacon Street        | 330/030.0-0032-0001.0 | Water Department                            | 26.000          |                   |
|                         | Beaver Brook Conservation Land              | Southwick Circle     | 330/015.0-0002-0025.0 | Conservation Commission                     | 46.350          |                   |
|                         | Beaver Brook Village Conservation Land      | Conservation Way     | 330/051.0-0006-0000.0 | Conservation Commission                     | 2.900           |                   |
|                         | Beaver Brook/Concord Rd Conservation Land   | 33 Beaver Brook Road | 330/020.0-0016-0000.0 | Conservation Commission                     | 26.130          |                   |
|                         | Beers Conservation Land 1                   | Oakdale Street       | 330/050.0-0014-0000.0 | Conservation Commission                     | 0.096           |                   |
|                         | Beers Conservation Land 2                   | Sand Beach Road      | 330/050.0-0016-0000.0 | Conservation Commission                     | 0.195           |                   |
|                         | Blue Brook Conservation Land                | Flushing Pond Road   | 330/041.0-0155-0002.0 | Conservation Commission                     | 19.100          |                   |
|                         | Boston Rd Drew Orchard                      | Boston Road          | 330/022.0-0003-0004.0 | Selectmen                                   | 4.810           | N                 |
|                         | Briarwood Drive Tax Title Parcel            | Briarwood Drive      | 330/045.0-0083-0020.0 | Tax Possession Sale<br>Committee            | 0.017           |                   |

**Inventory of Municipal Facilities**

| <b>Map No.</b> | <b>Name</b>   | <b>Address</b>    | <b>Parcel</b>         | <b>Responsible Board/<br/>Commission/Department</b> | <b>Size<br/>(acres)</b> | <b>Building<br/>(Y/N)</b> |
|----------------|---|-------------------|-----------------------|---|-------------------------|---------------------------|
|                | Brookside Mill Conservation Parcel 1                                | Brookside Road    | 330/067.0-0005-0000.0 | Conservation Commission                             | 1.720                   |                           |
|                | Brookside Mill Conservation Parcel 2                                | Brookside Road    | 330/067.0-0050-0000.0 | Conservation Commission                             | 12.470                  |                           |
|                | Brookside Mill Conservation Parcel 3                                | Brookside Road    | 330/038.0-0021-0000.0 | Conservation Commission                             | 3.360                   |                           |
|                | Brookside Mill Conservation Parcel 4                                | Brookside Road    | 330/038.0-0020-0000.0 | Conservation Commission                             | 5.420                   |                           |
|                | Brookside Mill Tax Title Parcel 1                                   | Depot Street      | 330/031.0-0051-0000.0 | Tax Possession Sale<br>Committee                    | 0.240                   |                           |
|                | Byrne Ave Gibbons Land Donation                                     | 31 Byrne Avenue   | 330/078.0-0076-0000.0 | Selectmen   | 0.128                   |                           |
|                | Catalog Realty Trust Conservation Land                              | Old Lowell Road   | 330/013.0-0018-0005.0 | Conservation Commission                             | 12.830                  |                           |
|                | Cider Mill Pond Conservation Land 1 (Taylor Parcel)                 | Stony Brook Road  | 330/032.0-0075-0000.0 | Conservation Commission                             | 14.640                  |                           |
|                | Cider Mill Pond Conservation Land 2 (MacDougall Parcel)             | Lowell Road       | 330/032.0-0080-0000.0 | Conservation Commission                             | 3.040                   |                           |
|                | Cider Mill Pond Conservation Land 3 (Agnew Parcel)                  | Lowell Road       | 330/032.0-0081-0000.0 | Conservation Commission                             | 21.130                  |                           |
|                | Cline Conservation Land   | Littleton Road    | 330/012.0-0010-0000.0 | Conservation Commission                             | 4.000                   |                           |
|                | Cold Spring Rd Municipal Land - West                                | Cold Spring Road  | 330/025.0-0202-0002.0 | Selectmen   | 0.450                   |                           |
|                | Cold Spring Road Municipal Land - East                              | Cold Spring Road  | 330/025.0-0202-0003.0 | Selectmen   | 0.840                   |                           |
|                | Coolidge Street Land  | Coolidge Street   | 330/056.0-0075-0000.0 | Selectmen   | 0.138                   |                           |
|                | Cote Well Land  | North Street      | 330/030.0-0047-0000.0 | Water Department                                    | 16.800                  |                           |
|                | Country Rd Well Land  | Country Road      | 330/020.0-0090-0000.0 | Water Department                                    | 8.140                   |                           |
|                | Country Rd West Future Well Site 1                                  | Country Road      | 330/020.0-0018-0002.0 | Water Department                                    | 3.880                   |                           |
|                | Country Rd West Future Well Site 2                                  | Country Road      | 330/020.0-0034-0000.0 | Water Department                                    | 5.500                   |                           |
|                | Crescent St. Tax Title Parcel - East                                | Crescent Street   | 330/054.0-0010-0000.0 | Tax Possession Sale<br>Committee                    | 0.100                   |                           |
|                | Crescent St. Tax Title Parcel - West                                | Crescent Street   | 330/053.0-0069-0000.0 | Tax Possession Sale<br>Committee                    | 0.146                   |                           |
|                | Crest Haven Parcel  | Acton Road        | 330/013.0-0071-0000.0 | Selectmen   | 0.750                   |                           |
|                | Dana Drive Conservation Land 1                                      | Dana Drive        | 330/027.0-0206-0000.0 | Conservation Commission                             | 0.420                   |                           |
|                | Dana Drive Conservation Land 2                                      | Dana Drive        | 330/027.0-0206-0002.0 | Conservation Commission                             | 2.540                   |                           |
|                | Dana Drive Conservation Land 3                                      | Dana Drive        | 330/027.0-0228-0010.0 | Conservation Commission                             | 22.000                  |                           |
|                | Day Agricultural and Conservation Land (a.k.a. "The Pumpkin Field") | Graniteville Road | 330/026.0-0037-0000.0 | Conservation Commission                             | 17.610                  |                           |
|                | Depot St Well Parcel 2  | Depot Street      | 330/065.0-0003-0000.0 | Water Department                                    | 5.300                   |                           |
|                | Depot St. Well - Parcel 1   | Depot Street      | 330/065.0-0002-0000.0 | Water Department                                    | 8.330                   |                           |
|                | Drew Boston Road Land   | Boston Road       | 330/022.0-0117-0002.0 | Selectmen   | 2.480                   |                           |
|                | Drew Boston Road Land Access ROW                                    | Boston Road       | 330/022.0-0117-0016.0 | Selectmen   | 0.620                   |                           |
|                | Drew Court Road Parcel 1  | Crown Road        | 330/022.0-0084-0000.0 | Conservation Commission                             | 5.600                   |                           |
|                | Drew Court Road Parcel 2  | Court Road        | 330/022.0-0083-0000.0 | Conservation Commission                             | 20.680                  |                           |
|                | Drew Crossing Conservation Land                                     | Drew Crossing     | 330/022.0-0117-0004.0 | Conservation Commission                             | 9.250                   |                           |
|                | Drew Ramp Parcel  | Boston Road       | 330/022.0-0003-0003.0 | Conservation Commission                             | 12.210                  |                           |
|                | Duffy and Doucette Conservation Land                                | Keyes Road        | 330/040.0-0058-0001.0 | Conservation Commission                             | 2.300                   |                           |
|                | Edward and Louise Dean Conservation land                            | Dean Drive        | 330/066.0-0101-0003.0 | Conservation Commission                             | 0.440                   |                           |
|                | Edwards Parcel  | Tyngsboro Road    | 330/045.0-0099-0000.0 | Conservation Commission                             | 40.000                  |                           |

**Inventory of Municipal Facilities**

| <b>Map No.</b> | <b>Name</b>   | <b>Address</b> | <b>Parcel</b>         | <b>Responsible Board/<br/>Commission/Department</b> | <b>Size<br/>(acres)</b> | <b>Building<br/>(Y/N)</b> |
|----------------|---|----------------|-----------------------|---|-------------------------|---------------------------|
|                | Emmet Conservation Land - Durkee Rd. Eminent Domain Taking        | Durkee Road    | 330/002.0-0011-0000.0 | Conservation Commission                             | 8.950                   |                           |
|                | Emmet Conservation Land - Gage Parcel (Haggood and Tuttle Lots 2) | Texas Road     | 330/002.0-0023-0000.0 | Conservation Commission                             | 10.000                  |                           |
|                | Emmet Conservation Land - Gage Parcel (Haggood and Tuttle Lots)   | Durkee Road    | 330/002.0-0007-0000.0 | Conservation Commission                             | 28.250                  |                           |
|                | Emmet Conservation Land - Gage Parcel (Sheperd Lot Part 1)        | Texas Road     | 330/002.0-0005-0000.0 | Conservation Commission                             | 41.400                  |                           |
|                | Emmet Conservation Land - Gage Parcel (Sheperd Lot Part 2)        | Texas Road     | 330/002.0-0006-0000.0 | Conservation Commission                             | 41.110                  |                           |
|                | Emmet Conservation Land - Gage Parcel (White Lot 1)               | Durkee Road    | 330/002.0-0003-0000.0 | Conservation Commission                             | 16.500                  |                           |
|                | Emmet Conservation Land - Gage Parcel (White Lot 2)               | Texas Road     | 330/002.0-0024-0000.0 | Conservation Commission                             | 5.000                   |                           |
|                | Emmet Conservation Land - Gage/Kennedy Parcels 1                  | Powers Road    | 330/006.0-0002-0000.0 | Conservation Commission                             | 23.830                  |                           |
|                | Emmet Conservation Land - Gage/Kennedy Parcels 2                  | Powers Road    | 330/006.0-0003-0000.0 | Conservation Commission                             | 2.500                   |                           |
|                | Emmet Conservation Land - Gage/Kennedy Parcels 3                  | Concord Road   | 330/006.0-0005-0000.0 | Conservation Commission                             | 11.140                  |                           |
|                | Emmet Conservation Land - Guidoboni/Masse Parcel                  | Powers Road    | 330/006.0-0008-0000.0 | Conservation Commission                             | 5.540                   |                           |
|                | Emmet Conservation Land - Harriet Hill Tax Title Parcel 1         | Durkee Road    | 330/002.0-0002-0000.0 | Conservation Commission                             | 16.000                  |                           |
|                | Emmet Conservation Land - Harriet Hill Tax Title Parcel 2         | Durkee Road    | 330/002.0-0008-0000.0 | Conservation Commission                             | 7.000                   |                           |
|                | Emmet Conservation Land - J. F. White Parcel 1                    | Texas Road     | 330/002.0-0025-0000.0 | Conservation Commission                             | 36.050                  |                           |
|                | Emmet Conservation Land - J.F. White Parcel 2                     | Texas Road     | 330/002.0-0027-0000.0 | Conservation Commission                             | 12.000                  |                           |
|                | Emmet Conservation Land - J.F. White Parcel 3                     | Texas Road     | 330/002.0-0028-0000.0 | Conservation Commission                             | 12.520                  |                           |
|                | Emmet Conservation Land - Kennedy Parcel 1                        | Texas Road     | 330/002.0-0026-0000.0 | Conservation Commission                             | 15.620                  |                           |
|                | Emmet Conservation Land - Kennedy Parcel 2                        | Texas Road     | 330/006.0-0047-0000.0 | Conservation Commission                             | 5.000                   |                           |
|                | Emmet Conservation Land - Mahoney and Jansky Parcel 1             | Powers Road    | 330/005.0-0020-0000.0 | Conservation Commission                             | 1.200                   |                           |
|                | Emmet Conservation Land - Mahoney and Jansky Parcel 2             | Powers Road    | 330/005.0-0020-0001.0 | Conservation Commission                             | 5.760                   |                           |
|                | Emmet Conservation Land - Martin and Mitchell Parcel              | Powers Road    | 330/002.0-0004-0000.0 | Conservation Commission                             | 6.000                   |                           |

**Inventory of Municipal Facilities**

| <b>Map No.</b> | <b>Name</b>  | <b>Address</b>     | <b>Parcel</b>         | <b>Responsible Board/<br/>Commission/Department</b> | <b>Size<br/>(acres)</b> | <b>Building<br/>(Y/N)</b> |
|----------------|--|--------------------|-----------------------|---|-------------------------|---------------------------|
|                | Emmet Conservation Land - R.S. Realty Trust Parcel         | Powers Road        | 330/006.0-0007-0000.0 | Conservation Commission                             | 26.490                  |                           |
|                | Endmoor Road Tax Title Land                                | Endmoor Road       | 330/073.0-0013-0000.0 | Tax Possession Sale Committee                       | 0.096                   |                           |
|                | Ennion Tyngsboro Rd. Tax Title Parcel                      | Tyngsboro Road     | 330/047.0-0029-0000.0 | Tax Possession Sale Committee                       | 2.868                   |                           |
|                | Fieldstone Drive Conservation Land 1                       | Fieldstone Drive   | 330/017.0-0025-0000.0 | Conservation Commission                             | 8.470                   |                           |
|                | Fieldstone Drive Conservation Land 2                       | Fieldstone Drive   | 330/017.0-0038-0000.0 | Conservation Commission                             | 14.520                  |                           |
|                | Flagg Road Conservation Land                               | Flagg Road         | 330/021.0-0014-0000.0 | Conservation Commission                             | 1.380                   |                           |
|                | Fletcher Well Land 1                                       | Concord Road       | 330/020.0-0007-0000.0 | Water Department                                    | 1.010                   |                           |
|                | Fletcher Well Land 2                                       | Concord Road       | 330/020.0-0009-0000.0 | Water Department                                    | 2.080                   |                           |
|                | Fletcher Well Land 3                                       | Concord Road       | 330/020.0-0012-0000.0 | Water Department                                    | 9.990                   |                           |
|                | Forge Village Rd. Conservation Area                        | Forge Village Road | 330/025.0-0224-0000.0 | Conservation Commission                             | 14.620                  |                           |
|                | Forrest Road Land  | Forrest Road       | 330/046.0-0001-0006.0 | Status unclear                                      | 0.080                   |                           |
|                | Genova Conservation Land                                   | Stony Brook Road   | 330/067.0-0049-0000.0 | Conservation Commission                             | 10.800                  |                           |
|                | Georges Tadmuck Ln Conservation Land 1                     | 5 Tadmuck Lane     | 330/027.0-0187-0000.0 | Status Unclear                                      | 0.459                   |                           |
|                | Georges Tadmuck Ln Conservation Land 2                     | Tadmuck Lane       | 330/027.0-0196-0000.0 | Conservation Commission                             | 14.800                  |                           |
|                | Gifford Drive Tax Title Parcel                             | Gifford Drive      | 330/037.0-0003-0006.0 | Tax Possession Sale Committee                       | 0.420                   |                           |
|                | Granite Hill Est. Conservation Parcel 1                    | Cowdry Hill Road   | 330/029.0-0070-0000.0 | Conservation Commission                             | 26.922                  |                           |
|                | Granite Hill Est. Conservation Parcel 2                    | Cowdry Hill Road   | 330/029.0-0084-0000.0 | Conservation Commission                             | 44.844                  |                           |
|                | Grassy Pond Conservation Area                              | Depot Street       | 330/065.0-0054-0000.0 | Conservation Commission                             | 62.140                  |                           |
|                | Great Elm Parcel   | Carlisle Road      | 330/007.0-0019-0001.0 | Conservation Commission                             | 10.850                  |                           |
|                | Grey Fox Lane Conservation Land                            | Grey Fox Lane      | 330/032.0-0027-0000   | Conservation Commission                             | 12.900                  |                           |
|                | Greystone Groton Rd Land (Lot A)                           | Groton Road        | 330/046.0-0011-0227.0 | Selectmen   | 0.920                   |                           |
|                | Greystone Lot B Conservation Land                          | Russell's Way      | 330/046.0-0011-0228.0 | Conservation Commission                             | 52.810                  |                           |
|                | Greystone Lot C Conservation Land                          | Russell's Way      | 330/046.0-0011-0229.0 | Conservation Commission                             | 4.850                   |                           |
|                | Greystone Lot D Municipal Land (Drainage Basin)            | Curren Drive       | 330/048.0-0011-0230.0 | Selectmen   | 0.460                   |                           |
|                | Greystone Lot E Municipal Land (Water Tower Road Entrance) | Russell's Way      | 330/048.0-0011-0231.0 | Selectmen   | 0.960                   |                           |
|                | Greystone Lot G Conservation Land                          | Caldwell Drive     | 330/048.0-0011-0233.0 | Conservation Commission                             | 13.380                  |                           |
|                | Greystone Lot H Conservation Land                          | Russell's Way      | 330/048.0-0011-0247.0 | Conservation Commission                             | 130.130                 |                           |
|                | Greystone Lot J Municipal Land                             | Russell's Way      | 330/048.0-0011-0235.0 | Selectmen   | 4.240                   |                           |
|                | Greystone Lot K Conservation Land                          | Russell's Way      | 330/048.0-0011-0236.0 | Conservation Commission                             | 0.380                   |                           |
|                | Greystone Lot L Conservation Land                          | Chandler Road      | 330/049.0-0011-0237.0 | Conservation Commission                             | 31.470                  |                           |
|                | Greystone Lot M Conservation Land                          | Morrison Lane      | 330/048.0-0011-0238.0 | Conservation Commission                             | 0.080                   |                           |
|                | Greystone Lot P Conservation Land                          | Morrison Lane      | 330/048.0-0011-0240.0 | Conservation Commission                             | 0.370                   |                           |
|                | Groton Rd Gage Land  | Groton Road        | 330/076.0-0054-0001.0 | Town Forest Committee                               | 8.370                   |                           |
|                | Hassan Conservation Land                                   | Littleton Road     | 330/023.0-0041-0000.0 | Conservation Commission                             | 4.500                   |                           |
|                | Hildreth St. Tax Title Parcel                              | Hildreth Street    | 330/021.0-0103-0000.0 | Tax Possession Sale Committee                       | 2.950                   |                           |

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| <b>Map No.</b> | <b>Name</b>                              | <b>Address</b>     | <b>Parcel</b>         | <b>Responsible Board/<br/>Commission/Department</b> | <b>Size<br/>(acres)</b> | <b>Building<br/>(Y/N)</b> |
|----------------|--|--------------------|-----------------------|---|-------------------------|---------------------------|
|                | Horsehead Conservation Land 1            | Beaver Brook Road  | 330/014.0-0034-0016.0 | Conservation Commission                             | 26.330                  |                           |
|                | Horsehead Conservation Land 2            | Southwick Circle   | 330/015.0-0002-0026.0 | Conservation Commission                             | 18.000                  |                           |
|                | Horsehead Conservation Land 3            | True Bean Way      | 330/014.0-0023-0003.0 | Conservation Commission                             | 4.580                   |                           |
|                | Howard Rd. Well Site 1                   | Howard Road        | 330/015.0-0003-0000.0 | Water Department                                    | 17.920                  |                           |
|                | Howard Rd. Well Site 2                   | Howard Road        | 330/015.0-0004-0000.0 | Water Department                                    | 5.650                   |                           |
|                | Howard Rd. Well Site 3                   | Howard Road        | 330/015.0-0098-0000.0 | Water Department                                    | 2.810                   |                           |
|                | Indian Meeting Ground                    | Bradford Street    | 330/052.0-0002-0000.0 | Conservation Commission                             | 0.562                   |                           |
|                | Irwin Conservation Land                  | Howard Road        | 330/015.0-0097-0000.0 | Conservation Commission                             | 2.550                   |                           |
|                | J.P. McKenna Conservation Land           | Hyacinth Drive     | 330/031.0-0034-0000.0 | Conservation Commission                             | 0.739                   |                           |
|                | Kate Rose Way Conservation Land          | Kate Rose Way      | 330/016.0-0020-0002.0 | Conservation Commission                             | 1.160                   |                           |
|                | Keyes Pond Conservation Land             | Keyes Road         | 330/040.0-0044-0000.0 | Conservation Commission                             | 0.256                   |                           |
|                | Keyes Road Tax Title Parcel 1            | Keyes Road         | 330/040.0-0060-0000.0 | Tax Possession Sale<br>Committee                    | 0.100                   |                           |
|                | Keyes Road Tax Title Parcel 2            | Keyes Road         | 330/040.0-0059-0000.0 | Tax Possession Sale<br>Committee                    | 0.100                   |                           |
|                | Kiberd Conservation Land                 | Monadnock Drive    | 330/016.0-0042-0000.0 | Conservation Commission                             | 2.910                   |                           |
|                | Kloppenburch Conservation Land           | Hartford Road      | 330/020.0-0074-0010.0 | Conservation Commission                             | 12.860                  |                           |
|                | Knoll Rd Tax Title Parcel                | 1 Knoll Road       | 330/074.0-0153-0000.0 | Tax Possession Sale<br>Committee                    | 0.098                   |                           |
|                | Lakeview St. Tax Title Parcel 1          | Lakeview Street    | 330/050.0-0017-0000.0 | Tax Possession Sale<br>Committee                    | 0.123                   |                           |
|                | Lakeview St. Tax Title Parcel 2          | Lakeview Street    | 330/050.0-0018-0000.0 | Tax Possession Sale<br>Committee                    | 0.108                   |                           |
|                | Lakeview St. Tax Title Parcel 3          | Lakeview Street    | 330/050.0-0019-0000.0 | Tax Possession Sale<br>Committee                    | 0.108                   |                           |
|                | Lakeview St. Tax Title Parcel 4          | Lakeview Street    | 330/050.0-0020-0000.0 | Tax Possession Sale<br>Committee                    | 0.095                   |                           |
|                | Lakeview St. Tax Title Parcel 5          | Lakeview Street    | 330/050.0-0021-0000.0 | Tax Possession Sale<br>Committee                    | 0.071                   |                           |
|                | LaSalette Rd. Land                       | Lasalleette Road   | 330/018.0-0103-0000.0 | Selectmen   | 3.900                   |                           |
|                | LaSalette Rd. Land                       | Lasalleette Road   | 330/018.0-0110-0000.0 | Selectmen   | 1.050                   |                           |
|                | LaSalette Rd. land                       | Lasalleette Road   | 330/018.0-0111-0000.0 | Selectmen   | 1.230                   |                           |
|                | LaSalette Rd. Land                       | Lasalleette Road   | 330/018.0-0112-0000.0 | Selectmen   | 2.090                   |                           |
|                | Lawton Ave. Conservation Land 1          | Lawton Avenue      | 330/027.0-0063-0004.0 | Conservation Commission                             | 0.960                   |                           |
|                | Lawton Ave. Conservation Land 2          | Lawton Avenue      | 330/027.0-0063-0002.0 | Conservation Commission                             | 1.020                   |                           |
|                | Leighton Way Conservation Parcel 1       | Leighton Way       | 330/032.0-0022-0002.0 | Conservation Commission                             | 1.880                   |                           |
|                | Leighton Way Conservation Parcel 2       | Leighton Way       | 330/032.0-0022-0005.0 | Conservation Commission                             | 0.150                   |                           |
|                | LePage Conservation Land                 | Forge Village Road | 330/025.0-0037-0000.0 | Conservation Commission                             | 0.060                   |                           |
|                | Littleton Road Conservation Parcel       | Littleton Road     | 330/012.0-0009-0000.0 | Conservation Commission                             | 4.440                   |                           |
|                | Lorain Realty Trust Conservation Land    | Rome Drive Ext.    | 330/016.0-0076-0000   | Conservation Commission                             | 22.500                  |                           |
|                | MacDonald Sawmill Rd Tax Title Parcel    | Sawmill Road       | 330/045.0-0040-0000.0 | Conservation Commission                             | 11.360                  |                           |
|                | MacDonald Tyngsboro Rd. Tax Title Parcel | Tyngsboro Road     | 330/045.0-0002-0000.0 | Tax Possession Sale<br>Committee                    | 2.250                   |                           |

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| <b>Map No.</b> | <b>Name</b>   | <b>Address</b>      | <b>Parcel</b>         | <b>Responsible Board/<br/>Commission/Department</b> | <b>Size<br/>(acres)</b> | <b>Building<br/>(Y/N)</b> |
|----------------|---|---------------------|-----------------------|---|-------------------------|---------------------------|
|                | Mark Vincent Drive Tax Title Land                     | Mark Vincent Drive  | 330/013.0-0082-0000.0 | Tax Possession Sale<br>Committee                    | 0.920                   |                           |
|                | Martina Gage Town Forest                              | Gage Road           | 330/018.0-0066-0000.0 | Town Forest Committee                               | 74.880                  |                           |
|                | Mass. Electric Conservation Land                      | Rome Drive          | 330/016.0-0078-0000.0 | Conservation Commission                             | 11.000                  |                           |
|                | Michael Joseph "Joe" and Yvonne Rose<br>Sullivan Land | Blakes Hill Road    | 330/021.0-0094-0000.0 | Selectmen   | 1.450                   |                           |
|                | Mill Pond/Charles G. Sargent Playground               | North Main Street   | 330/061.0-0041-0000.0 | Selectmen   | 8.000                   | N                         |
|                | Milot Conservation Land                               | Milot Road          | 330/025.0-0084-0000.0 | Conservation Commission                             | 3.640                   |                           |
|                | Minot's Corner Parcel                                 | Littleton Road      | 330/017.0-0027-0001   | Selectmen   | 0.027                   |                           |
|                | Moulton Conservation Land 1                           | Cold Spring Road    | 330/025.0-0129-0000.0 | Conservation Commission                             | 0.961                   |                           |
|                | Moulton Conservation Land 2                           | Old Homestead Road  | 330/025.0-0149-0000.0 | Conservation Commission                             | 0.690                   |                           |
|                | Moulton Conservation Land 3                           | Longmeadow Road     | 330/025.0-0148-0000.0 | Conservation Commission                             | 0.920                   |                           |
|                | Mystery Spring Woods Conservation Land                | Tadmuck Road        | 330/022.0-0030-0017.0 | Conservation Commission                             | 4.620                   |                           |
|                | Nabnasset St. Water Dept. Land 1                      | Nabnasset Street    | 330/043.0-0011-0000.0 | Water Department                                    | 6.680                   |                           |
|                | Nabnasset St. Water Dept. Land 2                      | 25 Nabnasset Street | 330/043.0-0041-0000.0 | Water Department                                    | 1.320                   |                           |
|                | Nabnasset St. Water Dept. Land 3                      | Nabnasset Street    | 330/043.0-0013-0000.0 | Water Department                                    | 1.280                   |                           |
|                | Nutting Rd Well Parcel 1                              | Nutting Road        | 330/068.0-0001-0000.0 | Water Department                                    | 7.750                   |                           |
|                | Nutting Rd Well Parcel 2                              | Nutting Road        | 330/068.0-0002-0000.0 | Water Department                                    | 9.200                   |                           |
|                | Odell W. Prescott St. Land Donation                   | W Prescott Street   | 330/053.0-0013-0000.0 | Selectmen   | 0.092                   |                           |
|                | Original Academy Site-Boston Rd                       | Boston Road         | 330/059.0-0002-0000.0 | Selectmen   | 0.155                   |                           |
|                | O'Soro Conservation Land                              | Moore Avenue        | 330/074.0-0183-0000.0 | Conservation Commission                             | 0.178                   |                           |
|                | Parcel Z, Lakeside Meadows                            | Muriel Drive        | 330/041.0-0002-0017.0 | Selectmen   | 0.390                   |                           |
|                | Patten Road Tax Title Parcel                          | Patten Road         | 330/054.0-0030-0002.0 | Tax Possession Sale<br>Committee                    | 0.195                   |                           |
|                | Picking Conservation Land - East                      | Gould Road          | 330/035.0-0004-0001.0 | Conservation Commission                             | 27.380                  |                           |
|                | Picking Conservation Land - West                      | Gould Road          | 330/035.0-0002-0007.0 | Conservation Commission                             | 21.850                  |                           |
|                | Picking Selectmen Land - East                         | Groton Road         | 330/035.0-0004-0002.0 | Selectmen   | 4.730                   |                           |
|                | Picking Selectmen Land - West                         | Gould Road          | 330/035.0-0002-0006.0 | Selectmen   | 6.090                   |                           |
|                | Pine Tree Trail Tax Title Parcel 1                    | 20 Pine Tree Trail  | 330/078.0-0075-0000.0 | Tax Possession Sale<br>Committee                    | < 0.100                 |                           |
|                | Pine Tree Trail Tax Title Parcel 2                    | 1 Pine Tree Trail   | 330/074.0-0055-0000.0 | Tax Possession Sale<br>Committee                    | 0.103                   |                           |
|                | Pond St. Conservation Land - Freedom Park             | 8 Pond Street       | 330/053.0-0095-0000.0 | Conservation Commission                             | 0.941                   |                           |
|                | Randolph Circle Tax Title Parcel                      | Randolph Circle     | 330/059.0-0007-0004.0 | Tax Possession Sale<br>Committee                    | 1.410                   |                           |
|                | Red Line North Parcel                                 | West Street         | 330/029.0-0001-0000.0 | School Department                                   | 5.360                   |                           |
|                | Red Line South Parcel                                 | Forge Village Road  | 330/025.0-0011-0000.0 | Selectmen   | 6.100                   |                           |
|                | River St. Canoe Ramp                                  | River Street        | 330/030.0-0065-0000.0 | Conservation Commission                             | 6.260                   |                           |
|                | Rolling Meadows Conservation Land                     | Rolling Meadow Lane | 330/046.0-0031-0009.0 | Conservation Commission                             | 10.080                  |                           |
|                | Rome Drive Tax Title Parcel 1                         | Rome Drive          | 330/021.0-0003-0026.0 | Tax Possession Sale<br>Committee                    | 0.690                   |                           |
|                | Rome Drive Tax Title Parcel 2                         | Rome Drive          | 330/022.0-0003-0011.0 | Tax Possession Sale<br>Committee                    | 0.415                   |                           |

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| <b>Map No.</b> | <b>Name</b>   | <b>Address</b>        | <b>Parcel</b>         | <b>Responsible Board/<br/>Commission/Department</b> | <b>Size<br/>(acres)</b> | <b>Building<br/>(Y/N)</b> |
|----------------|---|-----------------------|-----------------------|---|-------------------------|---------------------------|
|                | Russell Bird Sanctuary  | 65 Forge Village Road | 330/025.0-0010-0001.0 | Conservation Commission                             | 20.740                  |                           |
|                | Sargent's Town Forest Gift  | Groton Road           | 330/034.0-0026-0000.0 | Town Forest Committee                               | 25.000                  |                           |
|                | Schlusemeyer Lake Shore Dr S Land                                   | Lake Shore Drive S    | 330/074.0-0246-0000.0 | Selectmen   | 0.953                   |                           |
|                | Schlusemeyer Sycamore Rd Parcel 1                                   | Sycamore Road         | 330/069.0-0049-0000.0 | Conservation Commission                             | 0.254                   |                           |
|                | Schlusemeyer Sycamore Rd Parcel 2                                   | Sycamore Road         | 330/069.0-0050-0000.0 | Conservation Commission                             | 0.050                   |                           |
|                | Schwab Conservation Parcel 1  | Rome Drive Ext.       | 330/016.0-0074-0000   | Conservation Commission                             | 22.500                  |                           |
|                | Schwab Conservation Parcel 2  | Rome Drive Ext.       | 330/016.0-0075-0000   | Conservation Commission                             | 20.000                  |                           |
|                | Scott Conservation Land   | Cold Spring Road      | 330/025.0-0202-0001.0 | Conservation Commission                             | 14.600                  |                           |
|                | Shelly Lane Conservation Land                                       | Shelly Lane           | 330/007.0-0033-0000.0 | Conservation Commission                             | 1.710                   |                           |
|                | Shipley Swamp Conservation Area                                     | Nutting Road          | 330/068.0-0003-0000.0 | Conservation Commission                             | 25.500                  |                           |
|                | Skating Pond Conservation Land                                      | Hearthstone Road      | 330/028.0-0020-0000.0 | Conservation Commission                             | 4.570                   |                           |
|                | Slifer Conservation Land  | Keyes Road            | 330/040.0-0063-0002.0 | Conservation Commission                             | 20.530                  |                           |
|                | Snake Meadow Hill Conservation Parcel 1                             | Groton Road           | 330/030.0-0014-0000.0 | Conservation Commission                             | 7.000                   |                           |
|                | Snake Meadow Hill Conservation Parcel 2                             | Groton Road           | 330/030.0-0015-0000.0 | Conservation Commission                             | 0.400                   |                           |
|                | So. Chelmsford Rd 1   | S Chelmsford Road     | 330/023.0-0079-0000.0 | Town Forest Committee                               | 20.320                  |                           |
|                | So. Chelmsford Rd 2   | S Chelmsford Road     | 330/023.0-0078-0000.0 | Town Forest Committee                               | 9.150                   |                           |
|                | Socha Shore   | Pleasant Street       | 330/052.0-0001-0000.0 | Conservation Commission                             | 1.200                   |                           |
|                | Spalding Town Forest 1  | Cold Spring Road      | 330/025.0-0012-0000.0 | Town Forest Committee                               | 5.030                   |                           |
|                | Spalding Town Forest 2  | Forge Village Road    | 330/025.0-0013-0000.0 | Town Forest Committee                               | 7.530                   |                           |
|                | Stony Brook Conservation Land -<br>Conservation Commission Parcel 2 | Depot Road            | 330/035.0-0032-0004.0 | Conservation Commission                             | 19.750                  |                           |
|                | Stony Brook Conservation Land -<br>Conservation Commission Parcel 3 | River Street          | 330/031.0-0035-0000.0 | Conservation Commission                             | 65.100                  |                           |
|                | Stony Brook Conservation Land -<br>Recreation Commission Parcel 2   | River Street          | 330/031.0-0035-0101.0 | Recreation Commission                               | 15.000                  |                           |
|                | Stony Brook Conservation Land - Water<br>Dept. Parcel               | River Street          | 330/031.0-0035-0102.0 | Water Department                                    | 30.700                  |                           |
|                | Stony Brook Road Conservation Land                                  | Stony Brook Road      | 330/066.0-0018-0000.0 | Conservation Commission                             | 7.170                   |                           |
|                | Sullivan Conservation Land  | Rome Drive            | 330/016.0-0077-0000.0 | Conservation Commission                             | 65.690                  |                           |
|                | Swanson Conservation Land   | 14 Hunt Road          | 330/033.0-0015-0000.0 | Conservation Commission                             | 0.919                   |                           |
|                | Switzer Conservation Land   | Lowell Road           | 330/032.0-0079-0001.0 | Conservation Commission                             | 1.320                   |                           |
|                | Tadmuck Swamp North 1   | Tadmuck Road          | 330/027.0-0229-0000.0 | Selectmen   | 100.800                 |                           |
|                | Tadmuck Swamp North 2   | Chippewa Road         | 330/028.0-0005-0000.0 | Selectmen   | 4.740                   |                           |
|                | Tadmuck Swamp South   | Littleton Road        | 330/023.0-0046-0000.0 | Selectmen   | 24.000                  |                           |
|                | TBG Conservation Land 1   | 43 Almeria Circle     | 330/063.0-0032-0000.0 | Conservation Commission                             | 0.420                   |                           |
|                | TBG Conservation Land 2   | Almeria Circle        | 330/064.0-0027-0000.0 | Conservation Commission                             | 0.150                   |                           |
|                | TBG Conservation Land 3   | Almeria Circle        | 330/064.0-0028-0000.0 | Conservation Commission                             | 5.210                   |                           |
|                | Tenney Road Conservation Land (Avalon<br>Real Estate Land)          | Tenney Road           | 330/044.0-0028-0006.0 | Conservation Commission                             | 15.305                  |                           |
|                | Tenney Road Conservation Parcel 1                                   | Tenney Road           | 330/044.0-0046-0000.0 | Conservation Commission                             | 1.520                   |                           |
|                | Tenney Road Conservation Parcel 2                                   | Tenney Road           | 330/044.0-0047-0000.0 | Conservation Commission                             | 1.350                   |                           |
|                | Texas Rd Conservation Land  | Texas Road            | 330/006.0-0031-0000.0 | Conservation Commission                             | 6.960                   |                           |
|                | Town Farm Rd. Water Dept. Land                                      | Town Farm Road        | 330/024.0-0024-0000.0 | Water Department                                    | 7.380                   |                           |
|                | Trailside Way Parcel A Conservation Land                            | Trailside Way         | 330/005.0-0074-0020.0 | Conservation Commission                             | 0.160                   |                           |

**Inventory of Municipal Facilities**

| <b>Map No.</b> | <b>Name</b>                                     | <b>Address</b>     | <b>Parcel</b>         | <b>Responsible Board/<br/>Commission/Department</b> | <b>Size<br/>(acres)</b> | <b>Building<br/>(Y/N)</b> |
|----------------|---|--------------------|-----------------------|---|-------------------------|---------------------------|
|                | Trailside Way Parcel B Conservation Land        | Trailside Way      | 330/005.0-0074-0017.0 | Conservation Commission                             | 7.900                   |                           |
|                | Trailside Way Parcel C Conservation Land        | Trailside Way      | 330/005.0-0074-0019.0 | Conservation Commission                             | 1.400                   |                           |
|                | Trailside Way Parcel D Conservation Land        | Trailside Way      | 330/005.0-0074-0021.0 | Conservation Commission                             | 0.770                   |                           |
|                | Trailside Way Parcel E Conservation Land        | Trailside Way      | 330/005.0-0074-0018.0 | Conservation Commission                             | 0.050                   |                           |
|                | Twin Peaks                                      | Tyngsboro Road     | 330/047.0-0043-0000.0 | Town Forest Committee                               | 23.290                  |                           |
|                | Twin Peaks Water Tower Land                     | Russell's Way      | 330/047.0-0043-0001.0 | Water Department                                    | 2.430                   |                           |
|                | Tyngsboro Town Line Gage Parcel-East            | Sawmill Road       | 330/047.0-0001-0000.0 | Town Forest Committee                               | 22.900                  |                           |
|                | Tyngsboro Town Line Gage Parcel-West            | Tenney Road        | 330/044.0-0002-0000.0 | Town Forest Committee                               | 22.700                  |                           |
|                | Uncompleted Tax Taking - Cold Spring Road       | Cols Spring Lane   | 330/025.0-0202-0000.0 | Status Unclear                                      | 2.520                   |                           |
|                | Varnum Conservation Land                        | Forge Village Road | 330/025.0-0036-0000.0 | Conservation Commission                             | 1.050                   |                           |
|                | Verna Williamson Parcel                         | Acton Road         | 330/013.0-0035-0000.0 | Selectmen   | 0.480                   |                           |
|                | Veterans Memorial Complex Conservation Land 1   | Farmer Way         | 330/035.0-0111-0000.0 | Conservation Commission                             | 2.670                   |                           |
|                | Veterans Memorial Complex Conservation Land 2   | Nutting Road       | 330/035.0-0109-0000.0 | Conservation Commission                             | 8.900                   |                           |
|                | Veterans Memorial Complex Conservation Land 3   | Farmer Way         | 330/030.0-0032-0000.0 | Conservation Commission                             | 7.940                   |                           |
|                | Veterans Memorial Complex Water Department Land | Beacon Street      | 330/030.0-0032-0002.0 | Water Department                                    | 45.250                  | N                         |
|                | Village View Parcel A-2                         | Village View Road  | 330/056.0-0054-0000.0 | Selectmen   | 8.150                   |                           |
|                | Vine Brook Road Conservation Parcel             | Vine Brook Road    | 330/006.0-0006-0000.0 | Conservation Commission                             | 8.340                   |                           |
|                | Vineyard Rd Ext School Land - North             | Vineyard Road Ext  | 330/048.0-0005-0001.0 | School Committee                                    | 3.760                   |                           |
|                | Vineyard Rd Ext School Land - South 1           | Vineyard Road Ext  | 330/048.0-0005-0000.0 | School Committee                                    | 8.020                   |                           |
|                | Vineyard Rd Ext School Land - South 2           | Vineyard Road Ext  | 330/048.0-0011-0245.0 | School Committee                                    | 1.270                   |                           |
|                | Vineyard Road Conservation Land                 | Vineyard Road      | 330/047.0-0045-0015.0 | Conservation Commission                             | 15.320                  |                           |
|                | William C. O'Connell Wildlife Sanctuary         | Timberlee Lane     | 330/036.0-0002-0000.0 | Conservation Commission                             | 6.900                   |                           |
|                | Williams Ave Conservation Land                  | Williams Avenue    | 330/070.0-0046-0001.0 | Conservation Commission                             | 2.060                   |                           |
|                | Wilson Parcel                                   | Boston Road        | 330/022.0-0119-0000.0 | Conservation Commission                             | 1.000                   |                           |
|                | Winnek Water Dept Land 1                        | 17 Main Street     | 330/021.0-0042-0000.0 | Water Department                                    | 22.330                  |                           |
|                | Winnek Water Dept. Land 2                       | Main Street        | 330/055.0-0003-0000.0 | Water Department                                    | 10.370                  |                           |