Horsley Witten Group
Sustainable Environmental Solutions
90 Route 6A • Sandwich, MA • 02563
Phone - 508-833-6600 • Fax - 508-833-3150 • *www.horsleywitten.com*

Final Report

Sustainable Stormwater Funding Evaluation
for the Upper Charles River Communities of Bellingham, Franklin, and Milford, MA

September 30, 2011



Submitted to:
U.S. Environmental Protection Agency (EPA)- Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Submitted by:
Horsley Witten Group, Inc.

in partnership with:
AMEC Earth & Environmental, Inc.
2 Robbins Road
Westford, MA 01886

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List of Acronyms

BMP	Best Management Practice
CBIP	Catch Basin Inventory Plan
CIP	Capital Improvement Project
CMPP	Certified Municipal Phosphorus Program
CRPCD	Charles River Pollution Control District
CRW	Charles River Watershed
CRWA	Charles River Watershed Association
CWA	Clean Water Act
DCIA	Directly Connected Impervious Area
DD(s)	Designated Discharge(s)
DEM	Massachusetts Department of Environmental Management
DIMS	Does It Make Sense
DO	Dissolved Oxygen
EPA	Environmental Protection Agency
ERU	Equivalent Residential Unit
ESC	Erosion Sediment Control
FTE	Full time employee
GP	General Permit
HSG	Hydrologic Soil Group
IA	Impervious Area
IDDE	Illicit Discharge Detection and Elimination
LOE	Level of Effort
MassGIS	Massachusetts Geographic Information System
MADEP	Massachusetts Department of Environmental Protection
MAPC	Metropolitan Area Planning Council
MOA	Memorandum of Agreement
MS4	Municipal Separate Storm Sewer System
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
PCP	Phosphorus Control Plan
RDA	Residual Designation Authority
SJC	Massachusetts Supreme Judicial Court
SSO	Sanitary Sewer Overflow
SWMP	Stormwater Management Plan
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
WLA	Waste Load Allocation

Executive Summary

The Clean Water Act (CWA) requires, among other things, states to identify waters within their boundaries that fail to meet applicable surface water quality standards, and develop limits for each pollutant contributing to their impairment. These limits are expressed as "total maximum daily loads" (TMDLs). TMDL calculations determine the amount of a particular pollutant that a water body can receive while still meeting water quality standards. The TMDL calculation also estimates the degree to which a pollutant load must be reduced for that water body to achieve water quality standards.

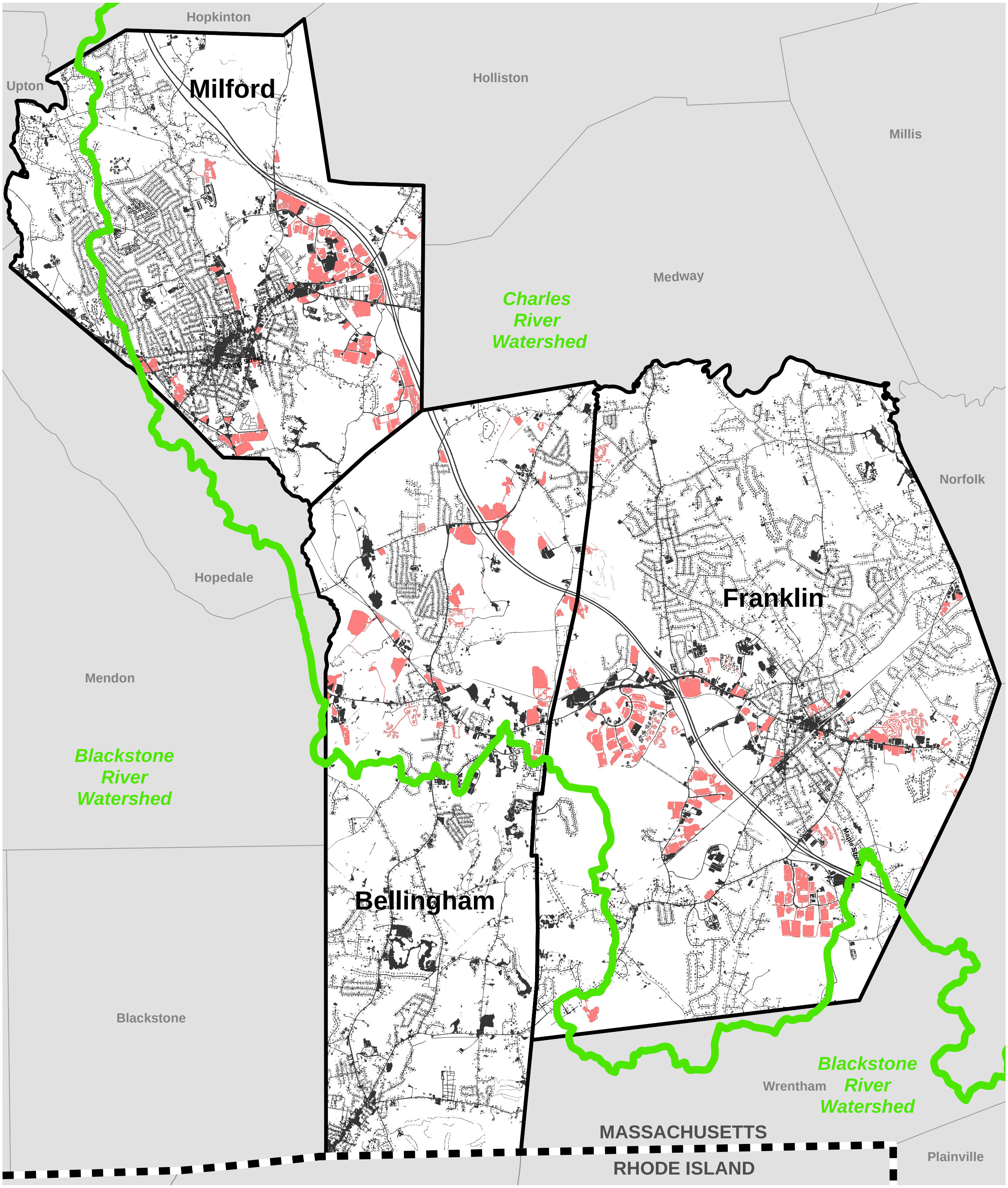
The Charles River runs approximately 80 miles from its source at Echo Lake in Hopkinton to its mouth in Boston and drains a 308 square mile watershed containing all, or part, of 35 Massachusetts' municipalities and a range of land uses and activities. The Charles River is not currently meeting Massachusetts Surface Water Quality Standards for a number of parameters, including most notably, phosphorus. In the fall of 2007, US Environmental Protection Agency (EPA), Region 1 approved a TMDL for phosphorus for the Lower Charles River that established the total allowable phosphorus loads from the contributing watershed. The lower Charles River TMDL established the required stormwater derived phosphorus load reductions for watershed areas upstream of the Watertown Dam.

The TMDL sets phosphorus limits for stormwater runoff based on various land-use categories. It also establishes annual phosphorus load reduction targets for stormwater runoff from individual municipalities and from larger private property owners throughout the Upper Watershed. Total phosphorus (TP) reduction targets of 57.0%, 51.8%, 52.1% were established for the towns of Milford, Bellingham and Franklin, respectively.

These targets were incorporated by EPA into two draft general permits under the National Pollution Discharge Elimination System (NPDES) requiring enhancement of stormwater discharges from "Small Municipal Storm Sewer Systems in the Massachusetts North Coastal Watersheds" (hereafter the MS4 GP) and under the Residual Designation Authority (RDA) from "Designated Discharges in the Charles River Watershed within the Municipalities of Milford, Bellingham, and Franklin, Massachusetts" (hereafter the RDA GP).

Watershed Context and Regulatory Drivers

Table E.1 summarizes some of the basic characteristics of the three towns, including population and watershed impervious areas (IA). Figure E.1 illustrates the impervious cover distribution across the three towns. These characteristics and other supporting data, such as land use and distribution of soil types, are key variables relating to overall phosphorus loading and management.



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Legend

- Focus Communities
- State Boundaries
- Impervious Area (from 2005 Aerial)
- Impervious Area in Draft Designated Discharge (DD)/Residual Designation Authority (RDA) Parcels*
- Neighboring Towns
- Major Basins

Source - Data from MassGIS 2011 except the following:
**Derived from Vorhees, 2011*

N

Feet
7,500

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Impervious Cover in Bellingham, Franklin, and Milford

Date: 8/17/2011

Figure E.1

Table E.1: Key Town Statistics Relating to Phosphorus Loading

Town	2009 Population	Area (acres)	Within Charles River Watershed			Designated Discharges*		
			Area (acres)	Impervious Area (IA) (acres)	% IA	#	Total Area (acres)	Total IA (acres)
Bellingham	15,845	11,840	6,293	924	14.7%	40	1,022.1	281.3
Franklin	32,065	17,112	15,669	2,315	14.8%	110	1,416.3	539.9
Milford	27,588	9,536	8,250	1,721	20.9%	113	809.9	401.6

*Based on data from Voorhees (2011), which may vary based on aggregation interpretation.

The draft 2010 MS4 GP requires communities to continue implementation of stormwater program elements already in place per the 2003 MS4 permit, as well as to more effectively manage their stormwater discharges by improving existing control measures or implementing new measures. For communities subject to TMDLs (including all those within the Charles River watershed), the MS4 GP requires additional measures to achieve specific pollutant reduction targets and meet State Water Quality Standards. In the Charles River Watershed, the major additional requirements include the development of a Phosphorus Control Plan (PCP); additional infrastructure and PCP mapping; increased operation and maintenance; capital projects to meet TP removal requirements; public education and outreach addressing phosphorus reduction; and fertilizer and waterfowl management plans.

The RDA GP calls for individual Designated Discharges (DDs) located in the three communities to reduce TP loads by 65% from existing conditions. Under the RDA GP, DDs can implement the 65% TP reduction on their own using structural and non-structural practices. Alternatively, DDs can join a Certified Municipal Phosphorus Program (CMPP) administered either by their municipality or by an upstream municipality. By joining a CMPP, DDs participate cooperatively with the municipality, which in turn becomes responsible for the optimized implementation of phosphorus control measures for the participating DDs.

EPA, Region 1 retained the Horsley Witten Group, Inc. (HW) and AMEC Earth and Environmental, Inc. (AMEC) to assess the feasibility of developing and maintaining a sustainable stormwater management funding source for the Upper Charles River communities in consultation with a project Steering Committee appointed by EPA, Region 1.

Alternatives for Program Implementation

The draft MS4 and RDA GPs do not specify how municipalities might structure a stormwater management program or fund permit requirements. Instead, the draft GPs set out compliance options, such as the CMPP, and only requires that municipalities state how they intend to fund permit compliance. Consequently, this report evaluates four scenarios for stormwater program implementation that seem to be the most likely candidates for permitee adoption (Table E.2).

The elements of each scenario differ based on timeframe for implementation, choice of funding mechanism, and municipal management approach as follows:

- **Implementation Timeframe**: This analysis contemplates timeframes for implementing stormwater control measures that extend from a minimum of 10 years from the effective date of the GP to a maximum of 25 years.
- **Funding Mechanisms:** The municipalities may choose to fund their programs through a user fee/enterprise fund under a Stormwater Utility structure, or through other sources such as the municipality's general fund, permit fees, and grants.
- **Management Approach:** A municipal stormwater management program may be implemented individually or cooperatively.
    - Town-by-Town: This involves implementation through a cooperative agreement between the municipality and regulated DD property owners, or the municipalities might work to manage runoff without the participation of the DD properties; or
    - Regional: The municipalities might elect to work together to cooperatively implement program elements. Doing so could be more cost-effective than if each municipality implemented these elements on their own.

Table E.2: Stormwater Management Implementation Scenarios Evaluated in this Feasibility Report

<table>
<tr><td colspan="3">Each Town Manages Stormwater Program Individually</td><td rowspan="3">Scenario 4
Regional Stormwater Management Program – DDs fully participate</td></tr>
<tr><td colspan="2">No Stormwater Utility</td><td rowspan="2">Scenario 3
Town enacts Stormwater Utility – DDs fully participate in the program</td></tr>
<tr><td>Scenario 1
DDs on their own</td><td>Scenario 2
DDs participate in a CMPP</td></tr>
</table>

Existing and Future Program Costs

Cost estimates for stormwater program services for the three municipalities have been developed for the existing program, as well as for projected future services. Existing costs encompass expenditures related to the administration and implementation of the current stormwater program for each town (Table E.3). Future costs assume adding new services to the existing program costs as necessary to fulfill conditions of the draft MS4 GP and to meet phosphorus load reduction targets. Future services are divided into operational costs (Table E.4) and capital expenditures (retrofitting with structural best management practices (BMPs) for phosphorus reductions, Table E.5).

Both current and future operational costs were evaluated within five major cost centers as listed in the tables. The cost centers and activities included in this analysis are comprehensive in order to accommodate future program requirements and to help communities redefine the scope of their stormwater programs; therefore, current stormwater services (e.g., catch basin cleaning and storm sewer maintenance), as well as required future services that the towns may not currently account for (e.g., code development and zoning support or leaf pickup) are included.

Table E.3: Summary of Existing Estimated Annual Stormwater Program Costs (FY 2010)

Major Cost Centers	Existing Stormwater Program Annual Costs		
	Bellingham	**Franklin**	**Milford**
Administration	$18,000	$59,000	$18,000
Regulation/Enforcement	$2,000	$51,000	$26,000
Engineering and Master Planning	$17,000	$153,000	$13,000
Operations and Implementation	$195,000	$760,000	$488,000
Monitoring	-	-	-
Total Cost	$232,000	$1,023,000	$546,000
Costs are rounded to the nearest $1,000 (totals may not add up due to round-off error) and include staff labor and direct costs for equipment, materials, disposal, supplies, etc. Current monitoring costs are assumed to be $0, but future costs are assigned.			

Table E.4: Summary of Future Annual Stormwater Program Operational Costs

Town	Existing	Future Operational Costs (2011 Dollars)				
		Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Bellingham	$232,000	$872,000	$1,029,000	$879,000	$799,000	$879,000
Franklin	$1,023,000	$1,652,000	$2,080,000	$1,888,000	$1,695,000	$1,763,000
Milford	$546,000	$1,098,000	$1,274,000	$997,000	$912,000	$905,000
Total cost estimates are rounded to the nearest $1,000 and include staff labor and direct costs for equipment, materials, disposal, supplies, etc.						

Three alternative approaches were used to estimate and compare the potential capital costs for each municipality to comply with the TP reduction targets specified in the TMDL, including: 1) scaling-up costs derived from the recently completed watershed plan for the Spruce Pond Brook in Franklin, MA; 2) applying cost data drawn from a GIS-based spreadsheet model to estimate size and costs of hypothetical structural BMPs as a function of watershed land cover and treatment volume; and 3) comparing stormwater retrofit implementation costs per impervious acre treated using results from studies completed in other New England and Mid-Atlantic watersheds. The analysis assumes that 15% of the TMDL target values will be achieved through non-structural control measures, and that the costs for these non-structural controls are already included in the operational costs presented in Table E.4 or are cost neutral. The value of 15% TP reduction from non-structural controls was derived assuming:

- 2% TP load reduction from enhanced street sweeping;
- 2% TP load reduction from semi-annual catch basin cleaning;
- 1% TP load reduction from collection of organic wastes and leaf litter; and
- 10% TP load reduction from a ban on phosphorus in fertilizers.

The assumed value of 15% TP reduction from non-structural measures is believed to be a conservative assumption and the actual TP reduction from these control strategies is likely to be higher as additional research is completed and evaluated. The estimated capital costs presented in Table E.5 include construction costs, design, permitting, construction administration, and land acquisition costs.

Table E.5: Recommended Capital Cost for Implementation of Structural Stormwater Controls to Achieve Compliance with Phosphorus Load Reductions (2011 Dollars)

Town	% Phosphorus Removal from Structural Controls[1]	Total Cost of Structural BMPs (Charles River Watershed)[2]
Bellingham	37%	$29,700,000
Franklin	37%	$74,600,000
Milford	42%	$75,800,000

[1]Assumes 15% TP reductions in each community via non-structural controls
[2]Estimated costs are based on a calibration against Spruce Pond Brook subwatershed and rounded to the nearest $100,000

Funding Options and Revenue Alternatives

Various funding options are presented in four major categories of municipal revenue generation: taxes, service charges, exactions, and assessments.

- Taxes are primarily used to generate revenue. No particular relationship is necessary between tax revenues and the activities or improvements that they fund. These include property tax, income tax, sales tax, etc.
- Service charges must be tied to the cost of providing specific services and/or facilities. The charge to each rate payer must relate to that ratepayer's impact, or "use" of the service.
- Exactions are related to the extension of an approval or privilege to use. Licenses, tap fees, fees in lieu of detention, and capital recovery charges are also forms of exactions.
- Assessments are geographically or otherwise limited fees levied by municipalities to pay for improvements or activities of direct and special benefit to those who are being charged.

Stormwater utilities are user-fee service charge systems based on the premise that stormwater drainage systems are public, similar to municipally-operated wastewater or water supply systems. This project evaluated the preliminary framework for a Stormwater Utility as an option to fund the future stormwater programs for Bellingham, Franklin and Milford.

Stormwater Utility billing rates are often based on units of imperviousness calculated to reflect the total coverage of impervious surface of a typical residential property. These units of impervious are called an Equivalent Residential Unit (ERU). The value of one ERU is then used as a multiplier for non-residential properties. The ERU values in the Upper Charles were computed by taking the median of the impervious areas for the residentially designated parcels in each municipality. Using satellite-derived impervious polygons, as adjusted to reflect data variability, the value and total number of ERUs were calculated for each town (Table E.6).

Table E.6: Equivalent Residential Unit (ERU) Data Town-Wide

Town	ERU Value (sq ft)	Number of ERUs
Bellingham	3,260	21,189
Franklin	3,252	33,769
Milford	3,029	28,523

The total number of ERUs presented in Table E.6 includes all properties in each municipality whether located in the Charles River watershed, or not. If only parcels within the Charles River watershed are used as a basis to generate revenue, the numbers of ERUs are 12,055, 31,724, and 25,633 in Bellingham, Franklin and Milford, respectively. A smaller number of ERUs means that a higher fee per ERU is needed to generate the same level of revenue. The municipalities will need to further evaluate and decide on the area of service in establishing a Stormwater Utility.

The sources of the revenue from ERUs can be classified based on different land use categories as (1) DDs, (2) all other impervious area, (3) local roads, and (4) state and federal roads. This allows the municipalities to evaluate each source and its potential to generate revenue. Total revenue capacity is calculated by multiplying the number of ERUs for each category by the monthly fee per ERU, and then by a factor of 12 to calculate an annual fee. Table E.7 lists the number of ERUs available for each of the three towns and the total for all towns combined (includes town area beyond the Charles River Watershed).

Table E.7: Basic Revenue Capacity Information – ERUs within Each Town and Total for 3 Towns

Town	DD ERU	Other IA ERU[1]	Local Road ERU	MDOT ERU	TOTAL ERU
Bellingham	3,594	11,205	5,642	748	21,189
Franklin	6,291	15,074	10,903	1,501	33,769
Milford	5,821	14,431	6,997	1,274	28,523
TOTALS	15,706	40,710	23,543	3,522	83,481

[1] Other IA includes all non-road and non-DD impervious area associated with all other parcels (residential, small commercial, institutional, etc.).

The number of ERUs (either in each town or across all three towns) is then used as the basis for calculating revenue potential per dollar charged per ERU as a monthly fee. Table E.8 shows the revenue potential for the three towns per dollar charged per ERU with all local state and federal roadways removed.

Table E.8: Basic Revenue Capacity Information within Each Town (with Roads Removed) –Annual Revenue for One Dollar/ERU/Mo (including DDs)

Town	DD $$	DD %	Other IA $$	Other IA %	TOTAL $$
Bellingham	$43,128	24%	$134,460	76%	$177,588
Franklin	$75,492	29%	$180,888	71%	$256,380
Milford	$69,852	29%	$173,172	71%	$243,024
TOTALS	$188,472	28%	$488,520	72%	$676,992

The town operational and the capital costs presented in Tables E.4 and E.5 provide estimates in 2011 dollars. To evaluate revenue potential over time, it was necessary to calculate the change in program costs moving forward. To do this, the following assumptions were made as a percentage of current capital costs:

- Inflation rate: 2.5%;
- Bond interest rate: 4.0% for a bond maturation life of 20 years;
- Operations and maintenance cost on new construction beginning in the year after construction: 3.5% annually;
- Stormwater Utility billing and administrative cost: $0.65/account billed quarterly;
- Capital costs were inflated to 2017 to begin construction; and
- One-time bonding costs are included in the bonded capital interest rate.

Table E.9 summarizes the estimated operational costs as well as the capital implementation costs for construction of structural stormwater controls for both the municipalities and the DDs, in 2011 dollars. Table E.9 presents estimated total capital costs plus annual operational costs, but does not present Stormwater Utility billing costs and annual maintenance costs on capital projects.

Table E.9: Estimated Operational and Capital Costs – Charles River Watershed (2011 dollars)

Town	DD CIP	Town CIP	Total CIP	Operating Costs[1]
Bellingham	$2,600,000[2]	$27,100,000	$29,700,000	$891,000
Franklin	$10,900,000	$63,700,000	$74,600,000	$1,815,000
Milford	$11,100,000	$64,700,000	$75,800,000	$1,037,000
TOTALS	$24,600,000	$155,500,000	$180,100,000	$3,744,000

[1] Annual Average for first five years
[2] Bellingham DD implementation costs per impervious acre are estimated to be significantly lower due to the presence of higher infiltration capacity soils underlying subject properties and the lower ratio of impervious to pervious surfaces compared to DD properties in the other two municipalities.
Costs are rounded to the nearest $1,000 (totals may not add up due to round-off error).

Total implementation costs include capital expenditures, operational costs, billing, BMP maintenance costs, as well as interest costs on bonds used to fund capital projects and inflation over time. As stated in E.2, implementation of structural controls was evaluated over four different time periods. Each time period evaluation assumed that initial construction would begin in Year 6 of the permit and continue for another 5, 10, 15, or 20 years thereafter. Total program costs to be paid by the Stormwater Utility for each year includes: interest on capital bonds + operations and maintenance cost on accumulated capital construction + general program operating costs + billing and administration costs.

Each year's inflated cost totals were based on the assumed inflation rate. Loan interest, and operations and maintenance costs on accumulated capital construction varied according to the construction program chosen. Payment of the interest on bonded capital construction continues for twenty years from the last date of borrowing. For example, in the case of the 25-year program with construction beginning in 2017 and ending in 2037, bond interest payments extend to 2057. As a consequence total implementation costs vary significantly as a function of implementation timeframe. The sum of all estimated costs over a 25-year period, beginning in 2012 is presented for the four implementation time periods in Table E.10.

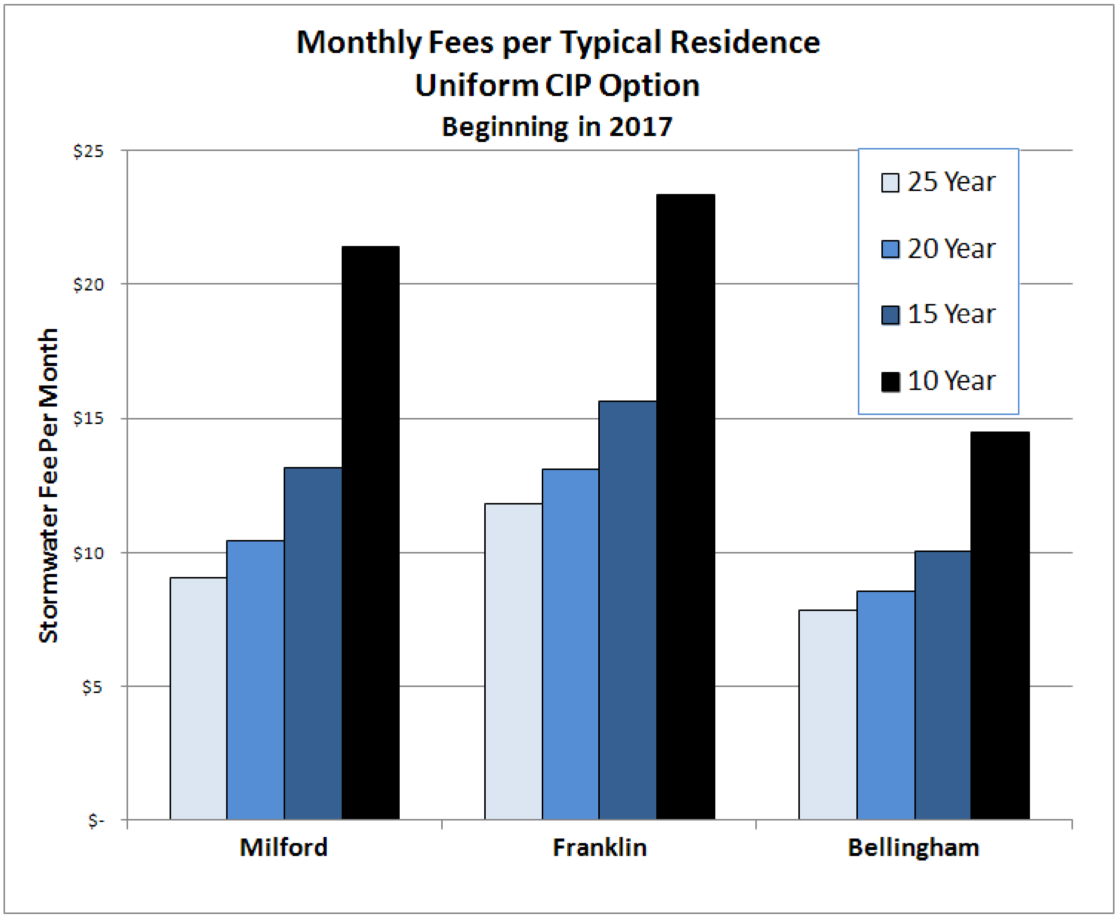
Table E.10: Estimated Total Implementation Costs over 25 Years Beginning in 2012 (2011 Dollars)

Town	10-Year Implementation	15-Year Implementation	20-Year Implementation	25-Year Implementation
Bellingham	$70,800,000	$65,900,000	$60,700,000	$55,000,000
Franklin	$165,900,000	$153,400,000	$140,400,000	$127,000,000
Milford	$146,000,000	$133,400,000	$120,200,000	$107,000,000
TOTALS	$382,700,000	$352,700,000	$321,300,000	$289,000,000
Costs are rounded to the nearest $100,000.				

The revenue capacity assessment (Table E.8) is used to evaluate the ERU fee amount necessary to meet the costs presented in Tables E.9 and E.10. Figure E.2 illustrates the monthly fee per household for the four different time periods of implementation beginning in the first year of construction of structural BMPs (assumed 2017). The Uniform Cost Allocation Approach presented in Figure E.2 assumes constant expenditures of capital investments over the term of construction.

If a stormwater utility was immediately formed in each of the three towns to cover just initial annual operational cost from 2012-2016, the monthly ERU fee in Bellingham, Franklin, and Milford, would be approximately $5.10, $7.20 and $4.40 respectively.

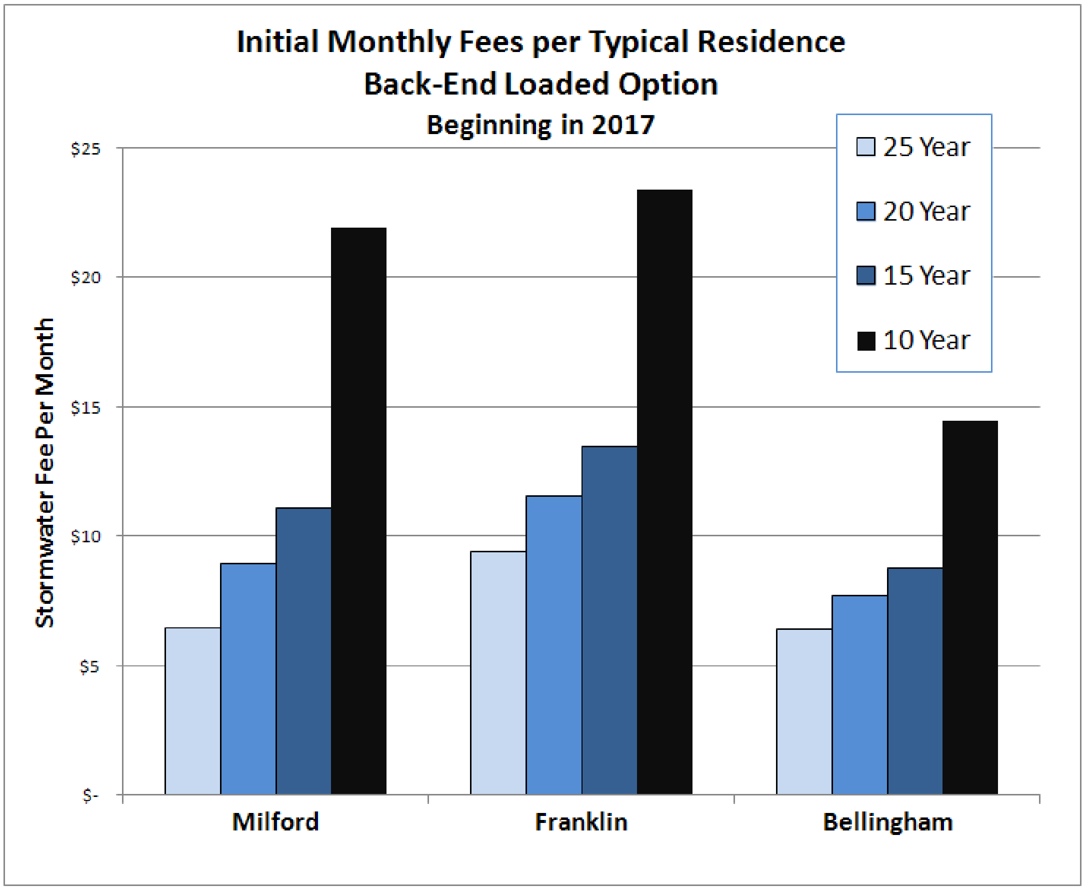
Figure E.2: Monthly Stormwater Utility Fee for Typical Residence for Four Different Capital Construction Implementation Periods Using a Uniform Cost Allocation Approach



There are several ways to evaluate implementation costs beyond just the timeframe. One option explored was the idea of "back-end loading" the capital construction costs (i.e., paying a larger amount later in the implementation process). There are many good reasons to do this including: (1) the value of starting implementation slowly to gain experience in efficiently managing multiple construction projects; (2) the possibility that better or changed data or other unforeseen factors will become available to reduce future control requirements; and (3) the possibility that better technologies or more effective non-structural phosphorous reduction approaches would become available prior to irreversible brick & mortar investments.

A back-end loading approach must balance the desire to delay initial capital investment against the challenge of having to accelerate required construction projects to meet implementation timeframes. For example, in the 25-year implementation program plan, multipliers (to the uniform approach) of 0.5, 0.75, 1.25 and 1.75 were applied in four, five-year increments. The resulting initial monthly fees for each of the four implementation time periods are illustrated in Figure E.3.

Figure E.3: Monthly Stormwater Utility Fee for Typical Residence for Four Different Capital Construction Implementation Periods Using a "Back-End Loaded" Approach



Recommendations

Based on the data and information evaluated in this project, the weight of evidence indicates that: 1) the costs for the future stormwater management programs for the three municipalities will be significantly higher than their current expenditures; 2) compliance with phosphorus reduction requirements will require a combination of non-structural and structural controls implemented over time through a comprehensive strategy; and 3) the likelihood that each community's general fund can continue to fully support implementation is low.

The recommendations provided herein offer suggestions on the next steps that the municipalities, EPA and other stakeholders may choose to pursue. These recommendations are based on the terms and conditions of the draft MS4 and RDA GPs, and thus, are subject to revision depending on the requirements of the final permits. The following list of general recommendations is offered for consideration:

1. Implement the following non-structural control measures to the maximum extent practicable:

- Pursue a phosphorus ban on fertilizers at the state level (and locally if deemed within the authority of home rule);
- Conduct enhanced street sweeping with vacuum-assisted street sweeping equipment and, where possible, using high-efficiently regenerative-air street sweeper technologies. Evaluate enhanced street sweeping effectiveness from current and future studies such as the current research being conducted by the U.S. Geological Survey in Cambridge, MA (Sorenson, 2011);
- Conduct and/or enhance an organic waste/leaf litter collection program and evaluate its effectiveness based on current and future research documenting phosphorus removal rates;
- Continue and/or enhance catch basin cleaning and evaluate its effectiveness based on current and future research documenting phosphorus removal rates;
- Identify un-needed or under-utilized impervious surfaces and eliminate them; calculate the load reduction potential; and
- Identify un-used or under-utilized turf areas that could be converted to forest or other minimally maintained vegetative cover; calculate the load reduction potential.

2. Periodically petition EPA to review and update presumed TP reduction values for non-structural controls based on data collected by the municipalities and on the results of published current and future research.
3. Implement structural control measures in the context of a watershed management plan. Periodically petition EPA to review and update TP removal efficiencies for structural controls based on data collected by the municipalities and the results of published current and future research.
4. The communities should seek EPA approval for, and EPA should consider, a longer implementation period than proposed in the draft GPs based on the data in this report that demonstrates greater flexibility associated with an extended construction period.
5. The communities should seek EPA approval for, and EPA should consider, revising the draft GPs to allow for the implementation of structural controls using a "back-end-loaded" approach. Under this approach initial funding is lessened to allow for better quantification of benefits from non-structural measures and early implementation of the most cost effective structural practices. This approach should also reduce initial expenditures as practitioners gain expertise and will likely lead to long-term savings over time.
6. Pursue the implementation of a stormwater utility at the individual municipal level initially, but structure it to allow other municipalities to join it through inter-municipal agreements in the future.

The following list of specific short-term recommendations is offered for consideration by the municipalities, EPA, and interested stakeholders:

1. Review this report's cost estimates and implementation analyses as each community decides on their next steps – refine estimates as appropriate; (refer to Sections 8.3 and 8.4).

2. Convene an inter-municipal working committee to document areas of agreement and areas of divergent positions on implementation of a comprehensive regional stormwater management program. Decide whether to move forward regionally or individually (refer to Section 8.3);
3. The DD property owners should be polled on their likely participation in a CMPP and/or stormwater utility;
4. Develop of a regional watershed management plan, or at a minimum, develop separate watershed plans for each municipality; and
5. Implement a public education and engagement project explaining the benefits of a comprehensive stormwater program. The public will need to understand why stormwater management is important, how stormwater management affects daily activities and the range of broad-scale potential benefits of a comprehensive stormwater program. Public support will be a critical and necessary component for future stormwater programs throughout the watershed.

The long-term costs of this program will be borne by the residents and businesses of the towns. As such, the most equitable, adequate, flexible, and stable source of funding to support the phosphorous reduction program and the rest of the surface water/stormwater programs is a Stormwater Utility/user fee approach. The feasibility of a Stormwater Utility for the Upper Charles was evaluated both on a town-by-town basis and as one single entity and will involve a series of assessments and key decisions by the municipalities prior to implementation.

The timeframe for development and implementation of a **single municipal utility** will likely take 12 to 18 months, assuming the town has political and public support to move forward, and that funding for full implementation is available with a modest public education and involvement campaign. The implementation costs are likely to be in the range of $200,000 to $300,000. The timeframe for development and implementation of a **multi-municipal utility** for all three communities will likely take 18 to 24 months, assuming all three towns have political and public support to move forward, and that funding for full implementation is available with an aggressive public education and involvement campaign. The implementation costs are likely to be in the range of $700,000 to $1,000,000. Based on the past experience from other municipalities, the cost to implement a Stormwater Utility is less than the first year's revenue and can be paid back over time through the utility.

Because of the similarity of the eventual programs and charges among the three towns, it also makes sense to avoid duplication of efforts and mistakes. Assuming there is consistently good political and public support across the three municipalities, significant savings can result if a joint effort is undertaken.

1.0 Introduction

The Charles River runs approximately 80 miles from its source at Echo Lake in Hopkinton to its mouth in Boston. The 308 square mile watershed drains land area containing all or part of 35 Massachusetts' municipalities and a range of land uses and activities. Unfortunately, the Charles River is not currently meeting Massachusetts Surface Water Quality Standards for a number of parameters, including excessive phosphorus loading from stormwater runoff draining to the river. In the fall of 2007, EPA Region 1 approved a Total Maximum Daily Load (TMDL) for phosphorus for the Lower Charles River that established the total allowable phosphorus loads to the River from the contributing watershed. The TMDL analysis was used to establish annual phosphorus load reduction targets for stormwater runoff from individual municipalities (who operate municipal separate storm sewer systems), as well as from larger commercial and industrial properties throughout the watershed. Total phosphorus reduction targets of 57.0%, 51.8%, 52.1% were established for the towns of Milford, Bellingham and Franklin, respectively.

These targets were incorporated by EPA into two draft general permits under the National Pollution Discharge Elimination System (NPDES) requiring better management of stormwater discharges from "Small Municipal Storm Sewer Systems in the Massachusetts North Coastal Watersheds" (hereafter the MS4 GP) and under the Residual Designation Authority (RDA) from "Designated Discharges in the Charles River Watershed within the Municipalities of Milford, Bellingham, and Franklin, Massachusetts" (hereafter the RDA GP). These two permits require, among other things, the development of a Phosphorus Control Plan (PCP) to manage stormwater runoff to control phosphorus loadings to the Charles River to meet the allowable limits prescribed in the TMDL. The specifics of the approved TMDL and the MS4/RDA GPs phosphorus control requirements for communities in the Charles River watershed can be found at the Massachusetts Department of Environmental Protection's and EPA Region 1 websites at: www.mass.gov/dep/water/resources/charlesp.pdf and www.epa.gov/region1/npdes/stormwater/index.html, respectively.

This report presents the results of a study to assess: 1) the potential cost of meeting phosphorus reduction targets through public and private sector stormwater management, and 2) the feasibility of establishing a sustainable stormwater management funding source to serve the Charles River watershed communities of Bellingham, Franklin, and Milford, Massachusetts. The Horsley Witten Group, Inc. (HW) and AMEC Earth and Environmental (AMEC), Inc. hereafter collectively referred to as the project team, under contract with the Environmental Protection Agency (EPA), Region 1 and in cooperation with a project Steering Committee, have compiled data and information on the cost of services and potential revenues to fund future stormwater management programs within each of the three municipalities.

The findings and recommendations contained in this feasibility assessment report are based on the terms and conditions outlined in the draft general permits, which include very specific schedules for conducting certain actions. In undertaking this project, EPA, Region 1 directed the project team to base the analysis on the specific requirements outlined in the draft general permits, with a caveat that the implementation schedules contemplated in the draft general permits could be extended over a longer timeframe as a means to evaluate the impact of schedule on annual costs and revenues. The final general permits may contain revisions to specific requirements, in addition to changes in the implementation schedule, which would also affect our findings and recommendations.

1.1 Purpose

The purpose of this sustainable stormwater funding feasibility assessment is to develop recommendations for integrated funding options to manage stormwater runoff in the context of the proposed requirements set forth in the draft MS4 and RDA GPs. In order to evaluate these funding options for the three communities, it is necessary to understand the specific requirements of the MS4 and RDA GPs and how the potential cost of permit compliance affects each of the three municipalities. In addition to an evaluation of potential future costs and revenues, this feasibility assessment is intended to provide key information about current municipal stormwater management program elements, potential future program elements, data and information gaps, and likely steps that each municipality may want to follow in developing a comprehensive and cost-effective stormwater management program for the future.

1.2 Benefits of this Feasibility Assessment

This feasibility assessment will likely provide the reader with the following benefits:

- An in-depth understanding of the likely permit requirements for both the MS4 and RDA GPs and how these might affect local programs;
- An initial estimate of the likely costs to develop and implement a stormwater management program for each of the three Upper Charles River watershed municipalities;
- An understanding of likely new and/or enhanced stormwater program elements that will be necessary for permit compliance and identification of the current program status within each of the communities;
- A better understanding of a range of program implementation options for the affected municipalities as well as the potentially regulated Designated Dischargers (DDs);
- An understanding of potential municipal funding options and rate structures to generate a sustainable funding source for different implementation scenarios;
- Illustration of potential cost savings and efficiencies of cooperation among municipalities and private property owners;
- A better understanding of the potential benefits of the Certified Municipal Phosphorus Program (CMPP), as well as a potential implementation process; and
- An outline of potential next steps in developing a sustainable stormwater management and funding program.

1.3 Feasibility Assessment Process and Steering Committee Representation

This project was initiated by EPA, Region 1 to provide data and information to the regulated municipalities, property owners and other interested parties about the specific activities that are anticipated as a consequence of the final adoption of the MS4 and RDA GPs. EPA, Region 1 retained HW and AMEC to undertake a scope of work to assess the feasibility of developing and maintaining a sustainable stormwater management funding source for the Upper Charles River communities in consultation with a project Steering Committee appointed by EPA, Region 1. The Steering Committee includes the following representatives from each municipality, as well as state agency staff and regional planning entities:

<u>Sustainable Stormwater Funding for the Upper Charles River Watershed – Steering Committee Members</u>

Town of Bellingham:	Denis Fraine, Administrator; Donald DiMartino, DPW Director
Town of Milford:	Louis Celozzi, Town Administrator; Michael Santora, Town Engineer; Rosalie Starvish, GZA GeoEnvironmental, Inc.
Town of Franklin:	Jeffrey Nutting, Town Administrator, Brutus Cantoreggi, DPW Director; James Esterbrook, DPW
495/MetroWest Partnership:	Jessica Strunkin
MADEP:	Fred Civian
MAPC:	Martin Pillsbury
EPA, Region 1	Ray Cody; Ken Moraff; Gina Snyder; Bill Walsh-Rogalski; Mark Voorhees; Josh Secunda; Michael Ochs

In addition to the regular membership of the Steering Committee, representatives from the private sector who had a stake in the data and information developed as part of this project attended three of the Steering Committee meetings and participated in the discussions. These individuals are listed below:

Tom Barnes	Congressman Richard Neal's Office
Arthur Barrett	Barrett Distribution
Ned Bartlett	Bowditch and Dewey, LLC
Brian Bass	Congressman Richard Neal's Office
Steve Brazeau	Hallkeen Management
Charles Degnim	Dunkin Donuts
David Dorrer	Scandia Kitchens
Bethany Eisenberg	Vanasse Hangen Brustlin
Kerri Furtack	SC Management, Oakwood Apartments
Barry Feingold	Milford Chamber of Commerce
Steve Gordon	DoubleTree Hotel
Hamilton Hackney	NAIOP/Greenberg Traurig
Steve Hardy	Hallkeen Management
Paul Hogan	Woodard & Curran

Rick Kaplan	Bellingham Plaza
Brian Kelly	Dean College
Jack Lank	United Regional Chamber of Commerce
Rick Morton	DoubleTree Hotel
Lisa Nelson	Congressman James McGovern's Office
Chris Parker	Clarke Corporation
Erika Paulhus	Senator Scott Brown's Office
George Preble	Beals and Thomas
Virginia Purcell	Congressman Richard Neal's Office
Todd Schively	Cedar Shopping Centers
Tamara Small	NAIOP
Kevin Testa	Barrett Distribution

The project team met with the Steering Committee four times during the assessment and data development stage of the project, between October 2010 and June 2011. Each meeting had a specific agenda and focused on the following topics:

- Project objectives and timeframe;
- Data collection and characterization;
- Cost projections for existing and future services; and
- Revenue options and rate structure alternatives.

The major topics, discussion points and specific action items of each meeting are contained in document summaries and posted to a project website for wider dissemination. The project website can be accessed at: http://www.epa.gov/region1/npdes/charlesriver/index.html. Other relevant information and supporting studies are also posted to the project website.

In addition, project team members met separately with representatives from each town to review available existing data and to understand the different aspects of each town's current stormwater management program. These meetings occurred in the fall of 2010 with follow-up correspondence and meetings in the spring and summer of 2011. Town personnel received copies of assessment spreadsheets with cost accounting assumptions for both existing program costs and projected future operational costs, and provided feedback on these documents, as well as other aspects of the project. Comment documents and other relevant correspondence are contained in Appendix A.

2.0 The Stormwater Context in the Upper Charles River Watershed

This section describes the context for anticipated stormwater management requirements for the Towns of Bellingham, Franklin, and Milford of the Upper Charles River Watershed, as well as some of the local factors that will influence their stormwater program capacity and, ultimately, compliance feasibility. Specifically, this section outlines Total Phosphorus (TP) load reduction requirements of the Charles River Watershed TMDLs, the new NPDES General Permits intended to position local stormwater programs to achieve these reductions, and key characteristics of each of the three towns that will influence implementation and funding potential.

2.1 Water Quality in the Charles River

The approximately 80-mile long Charles River drains over 300 square miles across 35 separate municipalities (Figure 2.1) and a variety of land uses. The watershed is divided into three main sections—the Lower (43 square miles below the Watertown Dam), Middle (86 square miles), and Upper Charles River (182 square miles above the USGS Dover Gauge). Many segments of the Charles River have been consistently listed as impaired in annual Massachusetts Integrated Waters Reports for a range of water quality parameters including, but not limited to, nutrients, organics, metals, low dissolved oxygen (DO), pathogens, oil and grease, and turbidity (MADEP, 2010). Starting with Milford Pond and moving downstream, evidence of excessive nutrient loading has been documented in almost all segments of the Charles River, particularly in mainstream impoundments such as Milford and Populatic Ponds (CRWA, 2011). Phosphorus, the nutrient of concern in the Charles, is found naturally in soils and vegetation throughout the watershed; however, additional inputs from human activities and hydrologic alterations, such as municipal wastewater discharges and stormwater runoff, can lead to excessive aquatic plant and/or algal growth, algal blooms, low dissolved oxygen, and other eutrophic conditions. Phosphorus sources in stormwater runoff are typically derived from fertilizers, organic debris, detergents, vehicle exhaust, pet waste, and atmospheric deposition.

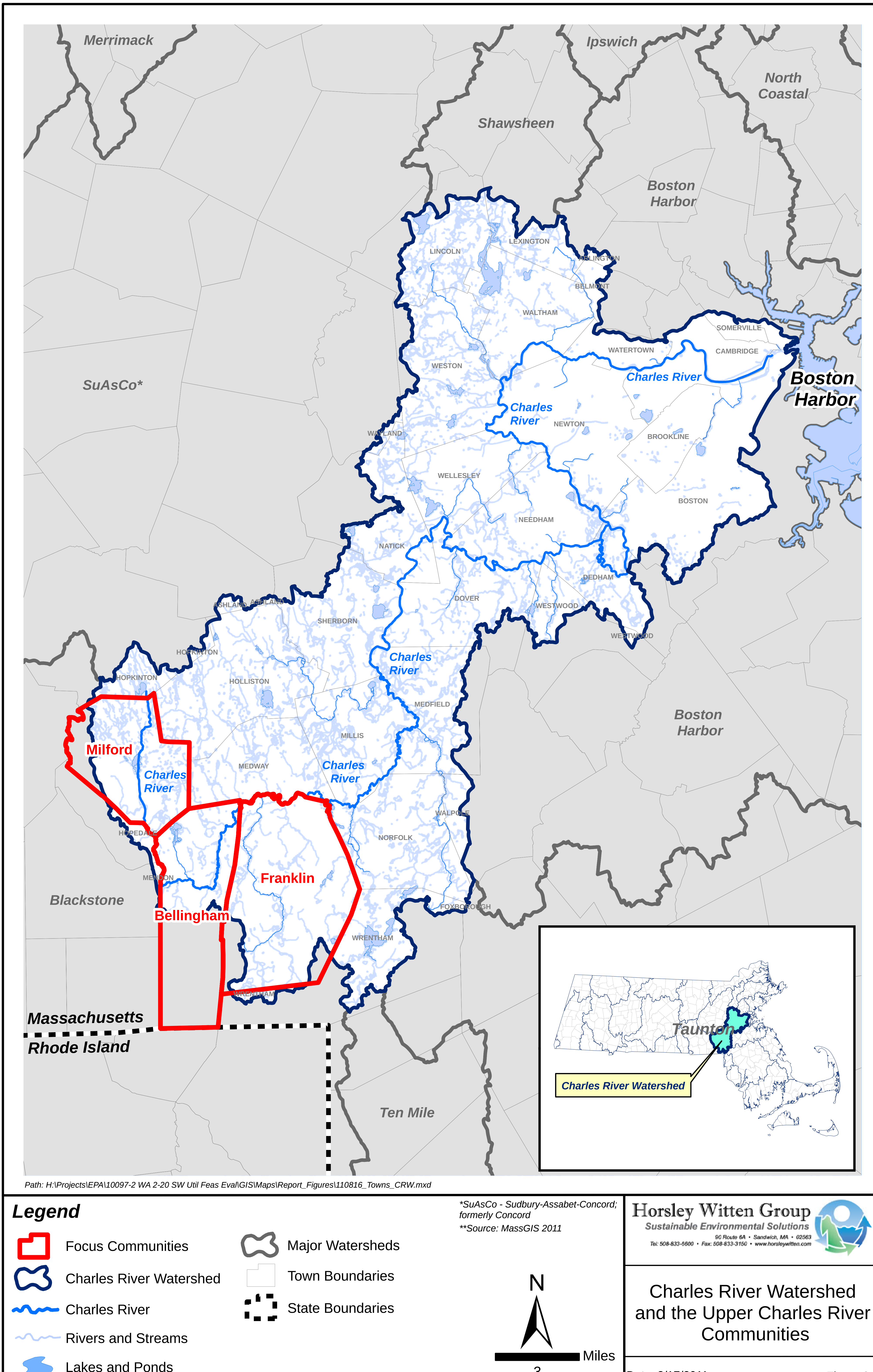
Milford, Franklin, and Bellingham drain to the Upper Charles River and are the first places where significant signs of excessive aquatic plant and algal growth are evidenced. Table 2.1 summarizes MADEP's 2010 list of impaired waters within each of the three towns for both the Charles and Blackstone River Watersheds. Figure 2.2 shows impaired water locations based on MassGIS (2002).

Table 2.1: Summary of 2010 Impaired Waters in Bellingham, Franklin, and Milford (MADEP, 2010)

Jurisdiction	Section	Cat*	Impairment	Area
Charles River Watershed				
Milford	MA72-01 Charles River (outlet Echo Lake, Hopkinton to Dilla St., Milford. Miles 78.9-76.5)	5	Low and other flow alterations; Dissolved Oxygen	2.5 mi
	MA72-02 Charles River (Dilla St. to Milford WWTP, Hopedale. Miles 76.5-73.4)	5	Metals, Nutrients; Organic enrichment/Low DO; Other habitat alterations; Pathogens;	3.0 mi

Jurisdiction	Section	Cat*	Impairment	Area
			Noxious aquatic plants	
	MA72-33 (formerly part of MA72-02) (Outlet Cedar Swamp Pond/Milford to the Milford WWTF discharge)	5	E. coli; Nutrient/ eutrophication Biological Indicators; substrate habitat alterations	2.0 mi
	MA72016 Cedar Swamp Pond/Milford Pond	5	Non-Native Aquatic Plants; Dissolved Oxygen; Mercury in Fish Tissue	99.0 ac
	MA72035 Echo Lake	4a-	Mercury in Fish Tissue	72.3 ac
	MA72068 Louisa Lake	3	*Not included*	7.8 ac
Milford/ Bellingham	MA72-03/MA72008 Charles River (Milford WWTP discharge, Hopedale to outlet Box Pond, Bellingham)	5	DDT; Dissolved oxygen; E. coli; Excess Algal Growth; Organic Enrichment (Sewage); Biological Indicators; Phosphorus (Total)	3.4 mi
	MA72004 Beaver Pond	5	Mercury in Fish Tissue	86.7 ac
Bellingham	MA72-12 Beaver Brook (Outlet Beaver Pond north of Route 126 (Hartford Avenue) to confluence with Charles River. Miles 1.7-0.0)	5	E. coli	1.4
Bellingham/ Franklin	MA72-04 Charles River (Outlet Box Pond, Bellingham to outlet Populatic Pond, Norfolk/Medway. Miles 70.3-58.9)	5	E. coli; Fishes Bioassessments; Other flow regime alterations; Mercury in Fish Tissue; Other; Chlordane; DDT	11.4 mi
	MA72-14/MA72077 Mine Brook (Headwaters in Franklin State Forest, Franklin to the Charles River)	5	Habitat Assessment (Streams); Temperature, water	8.9 mi
Franklin	MA72006 Beaver Pond**	4c	Non-Native Aquatic Plants	31.8 ac
	MA72032 Franklin Reservoir SW	5	Turbidity; Aquatic Plants (Macro)	13.1 ac
	MA72095 Franklin Reservoir NE	5	Turbidity; Aquatic Plants (Macro)	21.0 ac
	MA72122 Uncas Pond	5	Non-Native Aquatic Plants; Dissolved Oxygen	17.3 ac
Blackstone River Watershed				
Milford	MA51049 Fiske Millpond	5	Noxious plants; Exotic species	19.0 ac
	MA51102 Mill Pond	3	*Not included*	19.6 ac
	MA51112 North Pond	4c	Exotic species	213 ac
	MA51149 Silver Hill Pond	3	*Not included*	5.7 ac
	MA51-10 Mill River (Outlet North Pond, Milford/Upton to MA/RI border. Miles 11.0-0.0)	5	Priority organics; Metals	16.1 mi
Bellingham	MA51-18 Peters River (Outlet Curtis Pond to Rhode Island state line)	5	Metals; Pathogens	5.7 mi
	MA51062 Lake Hiawatha	3	*Not included*	58.1 ac
	MA51075 Jenks Reservoir	4c	Exotic species	26.1 ac
	MA51150 Silver Lake	3	*Not included*	42.3 ac

* Category 5 waters require a TMDL; Cat 4 indicates waters that are threatened or impaired for one or more uses, but not requiring a TMDL; and Cat 3 indicates waters that do not have defined uses.
**MA72006 not shown on Figure 2.1 because it is not included in the MassGIS data for 2002 Impaired Waters.


Merrimack
Ipswich
North Coastal
Shawsheen
Boston Harbor
SuAsCo*
Blackstone
Ten Mile
Massachusetts
Rhode Island
Charles River
Milford
Bellingham
Franklin
LINCOLN
LEXINGTON
ARLINGTON
BELMONT
WALTHAM
SOMERVILLE
WATERTOWN
CAMBRIDGE
WESTON
NEWTON
BROOKLINE
WAYLAND
WELLESLEY
BOSTON
NEEDHAM
NATICK
DEDHAM
DOVER
ASHLAND
SHERBORN
WESTWOOD
HOPKINTON
HOLLISTON
MEDFIELD
MILLIS
MEDWAY
WALPOLE
HOPEDALE
NORFOLK
MENDON
FOXBOROUGH
WRENTHAM
Taunton
Charles River Watershed
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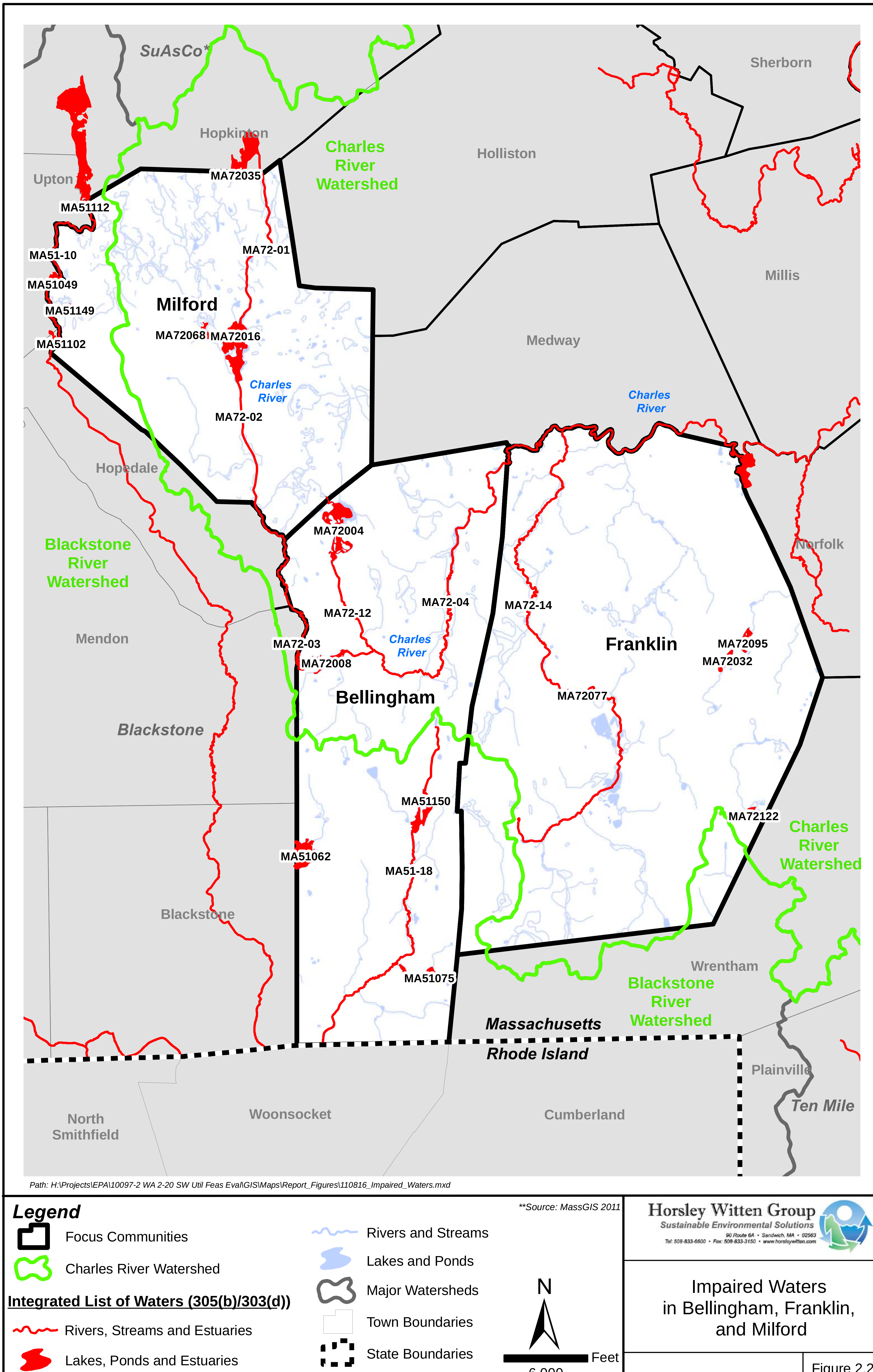
Legend
Focus Communities
Charles River Watershed
Charles River
Rivers and Streams
Lakes and Ponds
Major Watersheds
Town Boundaries
State Boundaries
*SuAsCo - Sudbury-Assabet-Concord; formerly Concord
**Source: MassGIS 2011
N
Miles
3
Horsley Witten Group
Sustainable Environmental Solutions
90 Route 6A • Sandwich, MA • 02563
Tel: 508-833-6600 • Fax: 508-833-3150 • www.horsleywitten.com
Charles River Watershed and the Upper Charles River Communities
Date: 8/17/2011
Figure 2.1



Impaired Waters in Bellingham, Franklin, and Milford

Figure 2.2

Date: 8/16/2011

Draft Report – Sustainable Stormwater Funding Evaluation, Upper Charles River Communities, August 2011

2.2 Regulatory Drivers

2.2.1 Charles River Phosphorus Total Maximum Daily Loads (TMDLs)

Section 303(d) of the Clean Water Act and the EPA's Water Quality Planning and Management Regulations (Title 40 of the *Code of Federal Regulations* Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for impaired waterbodies. DEP has determined that phosphorus in stormwater runoff is a significant cause of the water quality impairments in the Charles River, and as a result, final TMDLs for Total Phosphorus (TP) have been approved by EPA for the Lower Charles River, as well as the Upper/Middle Charles River (MADEP, 2007 and CRWA 2011, respectively). These TMDLs can be accessed at www.mass.gov/dep/water/resources/ucharles.pdf and www.mass.gov/dep/water/resources/charlesp.pdf. The TMDLs estimate the total TP load that can be discharged from point and non-point sources to the Charles River without violating water quality and designated use standards, allocate loads between wastewater, stormwater, and other sources, and establish load reduction targets to meet the TMDL target from existing conditions. The TMDLs sets phosphorus limits for stormwater runoff by land use category.

The Lower Charles River TMDL establishes a maximum annual TP load discharge from above the Watertown Dam of 15,109 kg/yr (MADEP, 2007). To meet these conditions, the communities within the Upper/Middle Charles River cannot collectively discharge more than 14,968 kg/yr, which includes a 141 kg/yr Margin of Safety (Figure 2.3). Currently, total annual phosphorus load to the Upper/Middle Charles River is estimated at 29,872 kg/yr while the TMDL load is set for 14,968 kg/yr. Collectively, this equates to a 50% reduction in annual phosphorus loads (a 51% reduction in stormwater loads alone) from existing conditions that will be required for communities upstream of the Watertown Dam.

Figure 2.3: Annual TP Loads for Upper/Middle and Lower Charles River TMDL (from CRWA, 2011)

Source	Current Load (kg/yr)	Reduction (%)	TMDL Load (kg/yr)
Wastewater	9,611	66	3,296
Stormwater	30,808	51	15,086
Nonpoint & Background	2,801	21	2,211
Other Losses*	-13,348	58	-5,625
TOTAL ALLOCATION (Upper/Middle Charles Model)	**29,872**	**50**	**14,968**
MOS (Upper/Middle Charles Model)			**141**
TOTAL ALLOCATION (Lower Charles TMDL)			**15,109**
MOS (Additional Designated from Lower Charles TMDL)			**757**

The TMDL TP reduction requirements are assumed to be achievable through the disconnection of impervious areas from the storm drain network, and/or through implementation of structural and non-structural BMPs to reduce loads from existing development. As such, these measures have been integrated into the requirements of the anticipated NPDES Small MS4 and RDA GPs.

2.2.2 The Anticipated Small MS4 General Permit

In the Charles River Watershed, stormwater runoff discharged to waters of the United States is regulated under the NPDES Phase I and Phase II permitting programs. Bellingham, Franklin, and Milford are subject to the Phase II permit conditions and will be regulated under the final NPDES Small MS4 General Permit for Massachusetts North Coastal Watersheds once effective (draft issued by EPA in February of 2010). The draft permit can be accessed directly from: www.epa.gov/region1/npdes/stormwater/draft_manc_sms4gp.html. MS4s consist of piped and open stormwater conveyance systems that are considered part of the municipal stormwater infrastructure, as well as stormwater water quality and storage BMPs (e.g., infiltration basins, bioretention systems, etc.).

Appendix G of the Draft North Coastal MS4 GP summarizes TP reduction targets assigned to each of the municipalities in the Charles River Watershed based on land use. Table 2.2 summarizes reduction targets for Bellingham, Franklin, and Milford, as well as the impairment listings and relevant permit sections that specifically address load reductions.

Table 2.2. Required % Total Phosphorus Reduction from Stormwater Runoff in the Three Upper Charles River Communities of Interest (from 2010 MS4 GP, Appendix G)

Town	Required % TP Reduction	Pollutant causing impairment	Relevant Sections of Draft Small MS4 Permit
Bellingham	52%	Priority organics, metals, nutrients, organic enrichment, low dissolved oxygen (DO), pathogens, oil and grease, taste, odor, and color, noxious aquatic plants, turbidity	2.2.1(c) & (d)(i-x); 2.4.2.1(c)(i)(ii)&(iv); 2.4.4.6(d)(i-iv) 2.4.4.8(d)(vi); 2.4.7.1(a)(i)&(ii) and (d)(iii)
Franklin	52%		
Milford	57%		

Municipalities operating regulated MS4s must develop and implement stormwater programs that address the following six minimum control measures:

1. Public education and outreach;
2. Public participation/involvement;
3. Illicit discharge detection and elimination;
4. Construction site runoff control;
5. Post construction runoff control; and
6. Pollution prevention/good housekeeping.

The draft 2010 MS4 permit requires communities to continue implementation of program elements already in place per the 2003 MS4 permit, as well as enhance or implement new control measures to more effectively manage stormwater. New requirements (e.g., comprehensive mapping, junction manhole investigations, enhanced street sweeping, annual impervious cover tracking, retrofit inventories, outfall monitoring) are described in more detail in Section 4.2 and Appendix B of this report.

For communities subject to TMDLs, the MS4 GP requires additional measures to achieve specific pollutant reduction targets and meet State Water Quality Standards. In the Charles River Watershed, the major additional requirements include the development of a Phosphorus Control Plan (PCP); additional infrastructure and PCP mapping; increased operation and maintenance; capital projects to meet TP removal requirements; education and outreach for phosphorus reduction; and fertilizer and waterfowl management plans. **As stated previously, Bellingham, Franklin, and Milford must develop a PCP that will reduce TP loads by 52%, 52%, and 57%, respectively, to be in compliance with the MS4 GP.**

2.2.3 The Proposed Residual Designation Authority (RDA) General Permit

The phosphorus reduction required by the RDA GP will also help municipalities meet their community-wide reduction targets that are specified in the MS4 GP. The RDA GP can be downloaded at http://www.epa.gov/region1/npdes/charlesriver/index.html. Under the revised draft RDA GP, DDs are defined as "two or more acres of impervious surfaces located: (1) in the Charles River watershed; (2) in whole or in part in the municipalities of Milford, Bellingham and Franklin Massachusetts; and (3) on a single lot or two or more contiguous lots." To be included, contiguous lots must either be owned by the same person, or share structures (e.g., buildings, parking lots, infrastructure) if owned by different people. Land uses that are excluded from the RDA include sporting and recreational camps; recreational vehicle parks and campsites; manufactured housing communities; detached single-family homes located on individual lots; and stand-alone multi-family houses with four or fewer units. All government-owned properties that are already covered under the MS4 GP are also excluded from RDA provisions.

The RDA GP calls for individual DDs in the three communities to reduce TP loads 65% from existing conditions. Appendix B provides a summary table of RDA GP requirements and implementation schedules. Under the RDA GP administered by EPA, DDs can implement the 65% TP reduction on their own using structural and non-structural BMPs. Alternatively, they can join a Certified Municipal Phosphorus Program (CMPP) administered either by their municipality or by an upstream municipality. By joining a CMPP, the DD participates cooperatively with the municipality, which in turn becomes responsible for the optimized implementation of phosphorus control measures across the DDs. The timeframe for implementation is twice as long for DD's participating in a CMPP than opting to go alone. A more detailed discussion of the potential mechanics of a CMPP is provided in Appendix C. Sections 3, 4.2 and 6.0 of this report elaborate on the potential costs, advantages, and disadvantages of DDs managing stormwater either on their own, as part of a CMPP, or as part of a broader stormwater utility.

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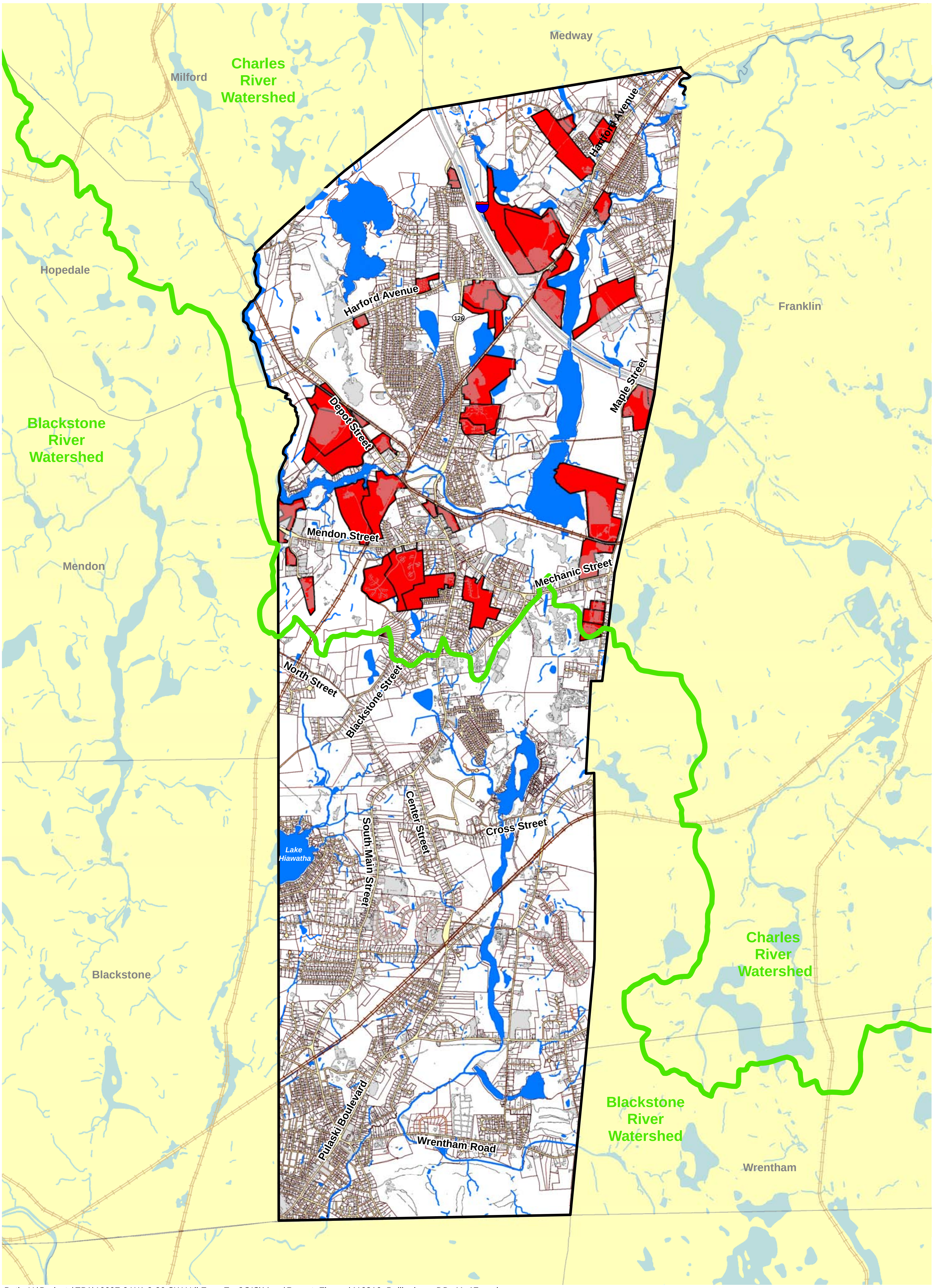

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Legend

- Town of Bellingham
- Parcels*
- Parcel Data Provided by Town **
- Impervious Area (from 2005 Aerial)
- Draft Designated Discharge (DD)/Residual Designation Authority (RDA) Parcels***
- Streams
- Neighboring Towns
- Railroads
- Open Water
- Major Basins

Source - Data from MassGIS 2011 except the following:
**Optimal Stormwater Management Plan Alternatives Project, 2009*
***Town of Bellingham GIS Data, 2008*
****Vorhees, 2011*

N

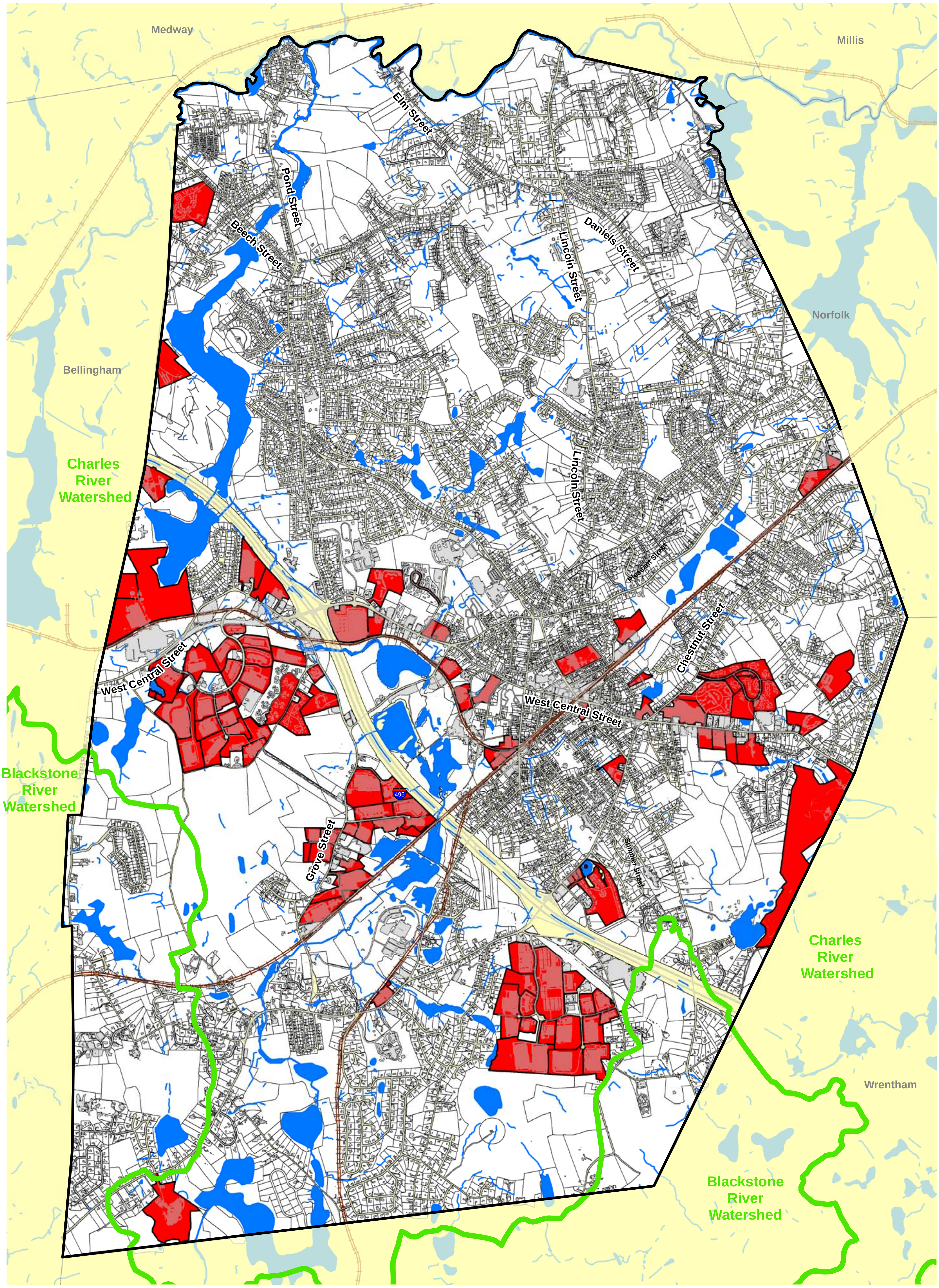
3,500 Feet

Horsley Witten Group
Sustainable Environmental Solutions

Designated Discharge (DD) Parcels in Town of Bellingham

Date: 8/17/2011

Figure 2.4



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Legend

- Town of Franklin
- Major Basins
- Parcels*
- Impervious Area (from 2005 Aerial)
- Streams
- Open Water
- Railroads
- Neighboring Towns
- Draft Designated Discharge (DD)/Residual Designation Authority (RDA) Parcels**

Source - Data from MassGIS 2011 except the following:
**Optimal Stormwater Management Plan Alternatives Project – 2009*
***Vorhees, 2011*

N

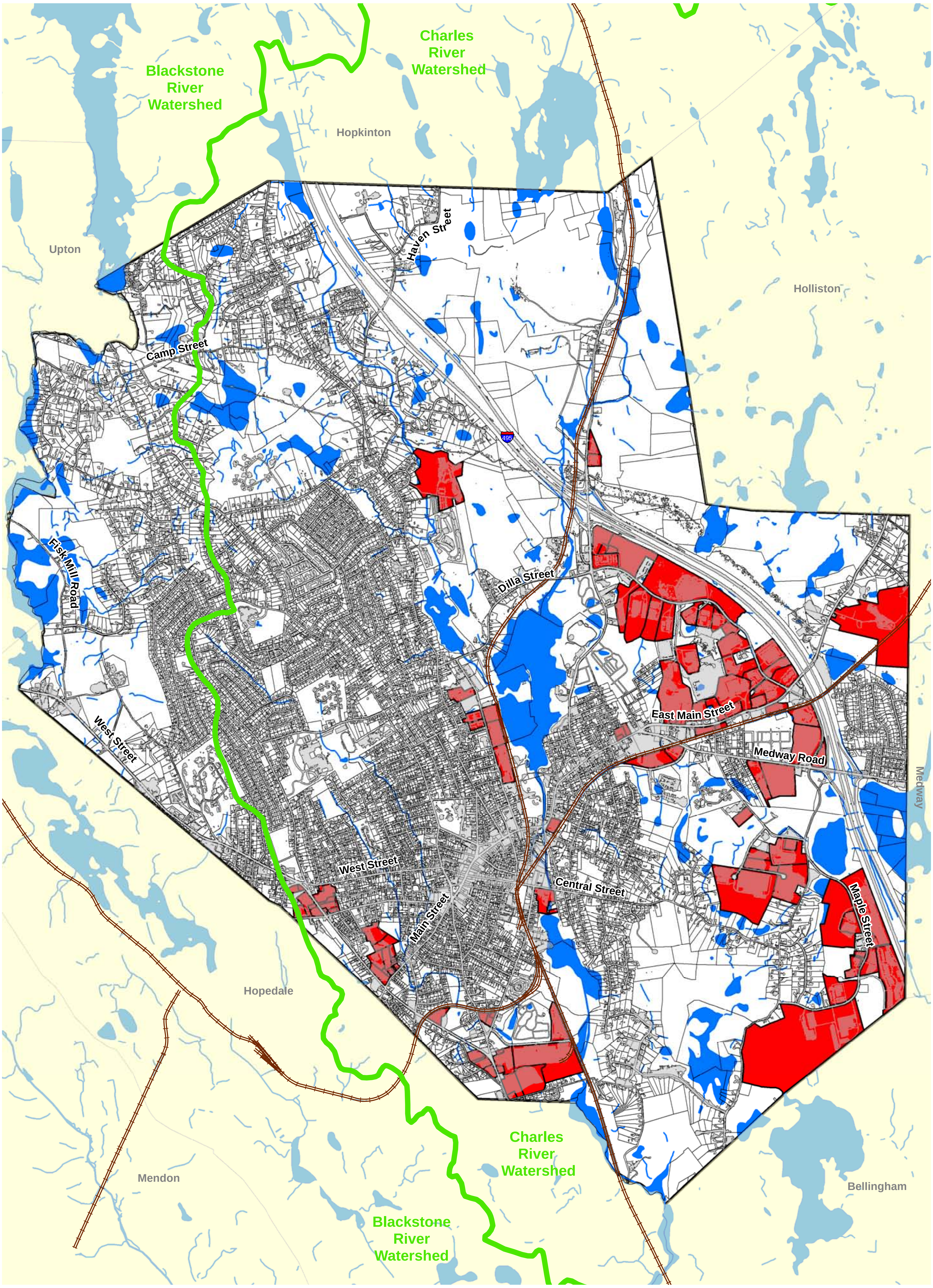
Feet
3,000

Horsley Witten Group
Sustainable Environmental Solutions
90 Route 6A • Sandwich, MA • 02563
Tel: 508-833-6600 • Fax: 508-833-3150 • www.horsleywitten.com

Designated Discharge (DD) Parcels in Town of Franklin

Date: 8/17/2011

Figure 2.5



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Legend

- Town of Milford
- Parcels*
- Impervious Area (from 2005 Aerial)
- Draft Designated Discharge (DD)/Residual Designation Authority (RDA) Parcels**
- Streams
- Open Water
- Neighboring Towns
- Major Basins
- Railroads

Source - Data from MassGIS 2011 except the following:
**Optimal Stormwater Management Plan Alternatives Project – 2009*
***Vorhees, 2011*

N

2,500 Feet

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Sustainable Environmental Solutions
90 Route 6A • Sandwich, MA • 02563
Tel: 508-833-6600 • Fax: 508-833-3150 • www.horsleywitten.com

Designated Discharge (DD) Parcels in Town of Milford

Date: 8/17/2011

Figure 2.6

2.3 Local Factors Influencing Stormwater Program Implementation

Portions of Bellingham, Franklin, and Milford (52%, 31%, and 85%, respectively) are within the Charles River Watershed; thus the towns are subject to the same regulatory drivers discussed above. Unique local characteristics (e.g., physical and environmental factors, infrastructure, and governance structures) will result in varied stormwater program approaches and costs for each community.

2.3.1 Land Use and Environmental Features

The type and density of land use, extent of impervious cover, average annual rainfall conditions, and soil characteristics will influence the amount of stormwater runoff generated in an area, associated pollutant loadings, and even the potential for pollutant removal. Impervious surfaces in urbanized areas affect the natural stormwater hydrology of the watershed by limiting the amount of onsite recharge, degrading water quality, altering the natural drainage flow paths, and increasing the flow and intensity of runoff during storm events. As described previously, the Charles River Watershed TMDL assigns pollutant loads based on the type of land use activity (e.g., some land uses typically generate higher pollutant loads). Figures 2.7-2.9 illustrate the distribution of land uses in the three communities. Densely urbanized areas, particularly those developed prior to adequate stormwater management standards, can be difficult (and expensive) to retrofit with conventionally sized controls given the lack of space and compacted soils.

Table 2.3 summarizes some of the basic characteristics of the three towns, including population and watershed impervious areas, which relate to overall phosphorus loading to the Charles River. Table 2.4 summarizes the land use breakdown for the portion of each town within the Charles River Watershed. It should be noted that population growth in Bellingham, Franklin, and Milford was estimated at 6%, 31%, and 15%, respectively, between 1990 and 2009. During this period, extensive commercial development (e.g., shopping plazas and national retail chains, such as Home Depot, Lowes, Wal-mart, and Target) along the I-495 corridor occurred in each of the communities, adding to overall watershed imperviousness. Figure 2.10 shows the distribution of impervious cover across the three towns.

Table 2.3. Town Impervious Cover Characteristics

Town	2009 Population	Area (acres)	Within Charles River Watershed			Designated Discharges*		
			Area (acres)	Watershed IA (acres)	% IA	#	Total Area (acres)	Total IA (acres)
Bellingham	15,845	11,840	6,293	924	14.7%	40	1,022.1	281.3
Franklin	32,065	17,112	15,669	2,315	14.8%	110	1,416.3	539.9
Milford	27,588	9,536	8,250	1,721	20.9%	113	809.9	401.6

*Based on data from Voorhees (2011), which may vary based on aggregation interpretation.

Table 2.4: Percent Land Use within the Charles River Watershed in Each Town

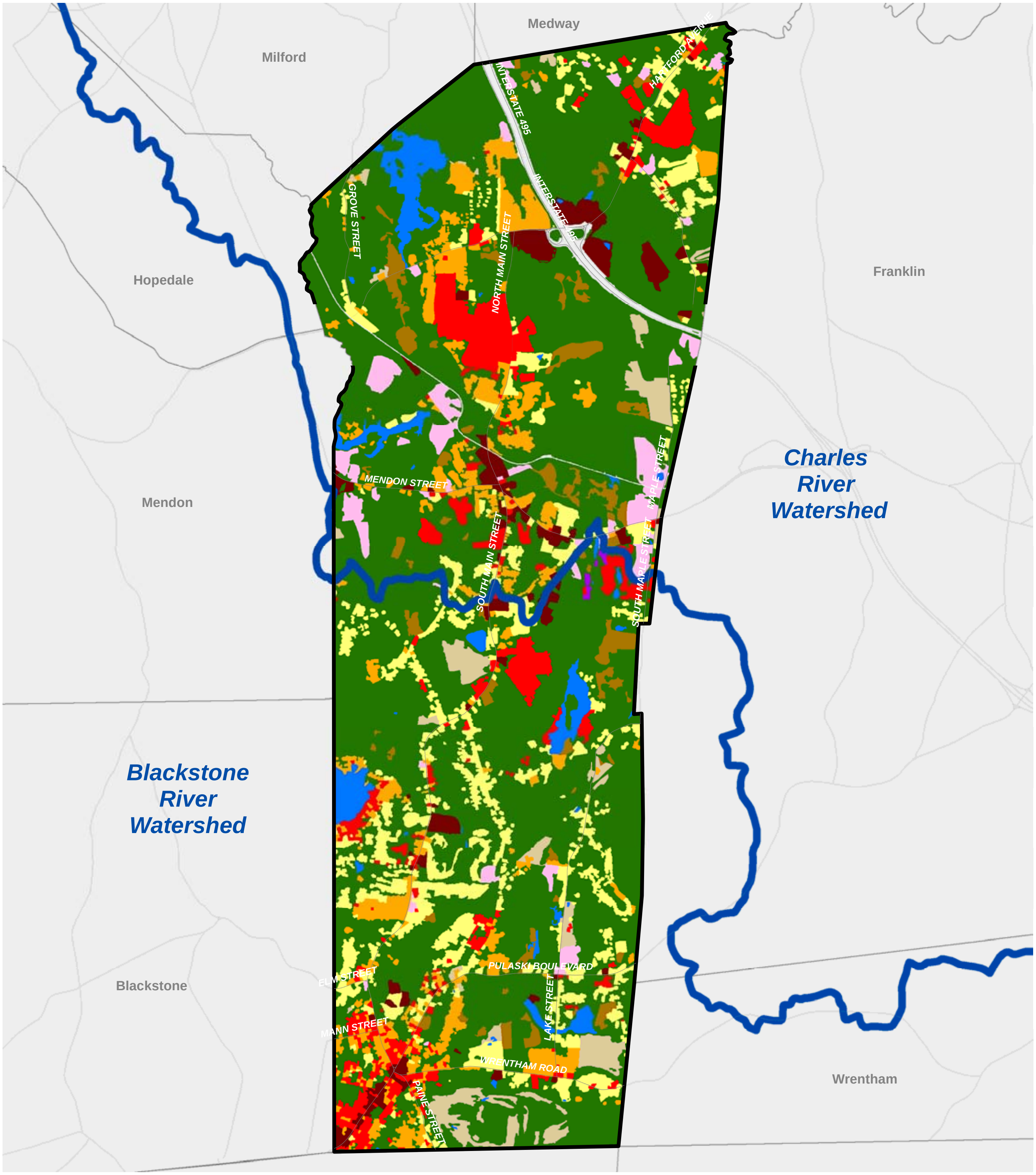
Land Use Category	Bellingham	Franklin	Milford
Forest	63.5%	56.4%	50.9%
Open Land	3.1%	1.2%	0.5%
Agriculture	1.5%	2.6%	0.2%
Low Density Residential	5.9%	9.5%	6.4%
Medium Density Residential	7.3%	18.8%	19.0%
High Density Residential	5.9%	1.8%	7.4%
Multi-Family Residential	0.0%	0.2%	0.2%
Commercial	3.8%	2.8%	6.6%
Industrial	4.4%	4.3%	4.1%
Freeway	2.0%	1.7%	2.9%
Water	2.7%	0.8%	1.7%
Land use data derived from MassGIS, 2005			

All three towns have similar annual rainfall averages ranging from approximately 46 to 48 inches (SCAS, 2000).

Soils are also a key factor in determining the appropriate and most effective stormwater BMPs that can be used to reduce phosphorus loading in each town. Soils can be classified by their hydrologic soil group (HSG). In general, HSG A soils have high permeability (i.e., water easily infiltrates down into the soil), while HSG D soils have very low permeability (i.e., water tends to pond on the surface and create runoff). HSG A and B soils are considered appropriate for stormwater infiltration practices, which help in providing recharge to groundwater, but also tend to have high pollutant removal capabilities and lower unit costs. The percentage breakdown of HSG soils for each of the three towns in the watershed is shown in Table 2.5.

Table 2.5: Percent Coverage of Hydrologic Soil Groups within the Charles River Watershed in Each Town

HSG	Bellingham	Franklin	Milford
A	40%	25%	11%
B	19%	28%	35%
C	18%	29%	35%
C/D*	2%	3%	0%
D	18%	13%	18%
U	0.4%	2%	0%
Open Water	3%	1%	1%
Soils data derived from the latest MassGIS * Subsequent analysis assumes this grouping to be C type soils.			



Path: H:\Projects\EPA\10097-2 WA 2-20 SW Util Feas Eval\GIS\Maps\Report_Figures\110816_Bellinghamlanduse_8-5x11.mxd

Legend

Source - Optimal Stormwater Management Plan Alternatives Project – 2009

Land Use*

- Agriculture
- Commercial
- Forest
- Freeway
- Industrial
- Low_D_Res
- Medium_D_Res
- High_D_Res
- Multi_Family_Res
- Open
- Water

N

Mile

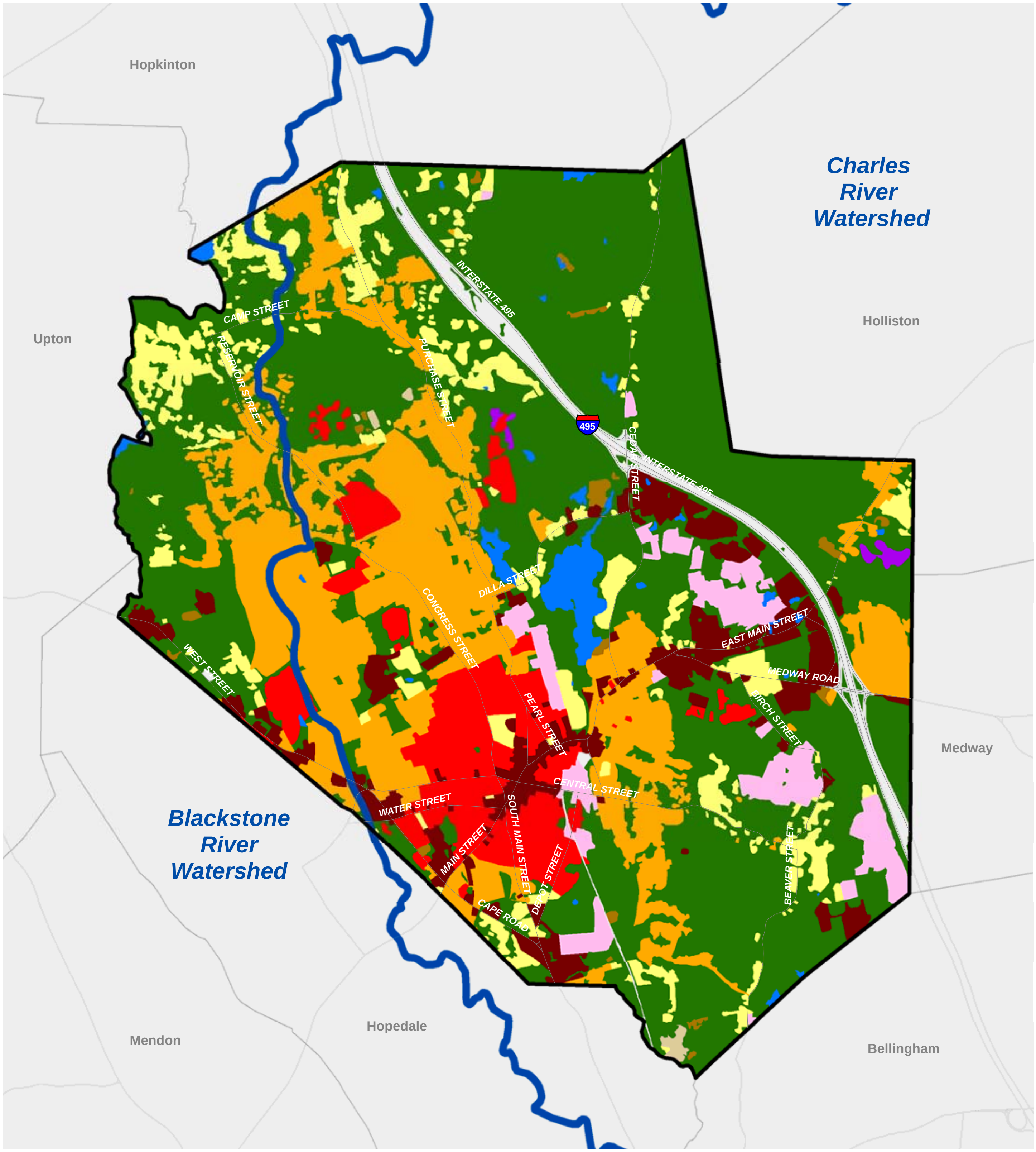
1

Horsley Witten Group
Sustainable Environmental Solutions
90 Route 6A • Sandwich, MA • 02563
Tel: 508-833-6600 • Fax: 508-833-3150 • www.horsleywitten.com

Land Use Distribution in the Town of Bellingham

Date: 8/17/2011

Figure 2.7



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Legend

Land Use*

- Agriculture
- Commercial
- Forest
- Freeway
- Industrial
- Low_D_Res
- Medium_D_Res
- High_D_Res
- Multi_Family_Res
- Open
- Water

*Source - Optimal Stormwater Management Plan Alternatives Project – 2009

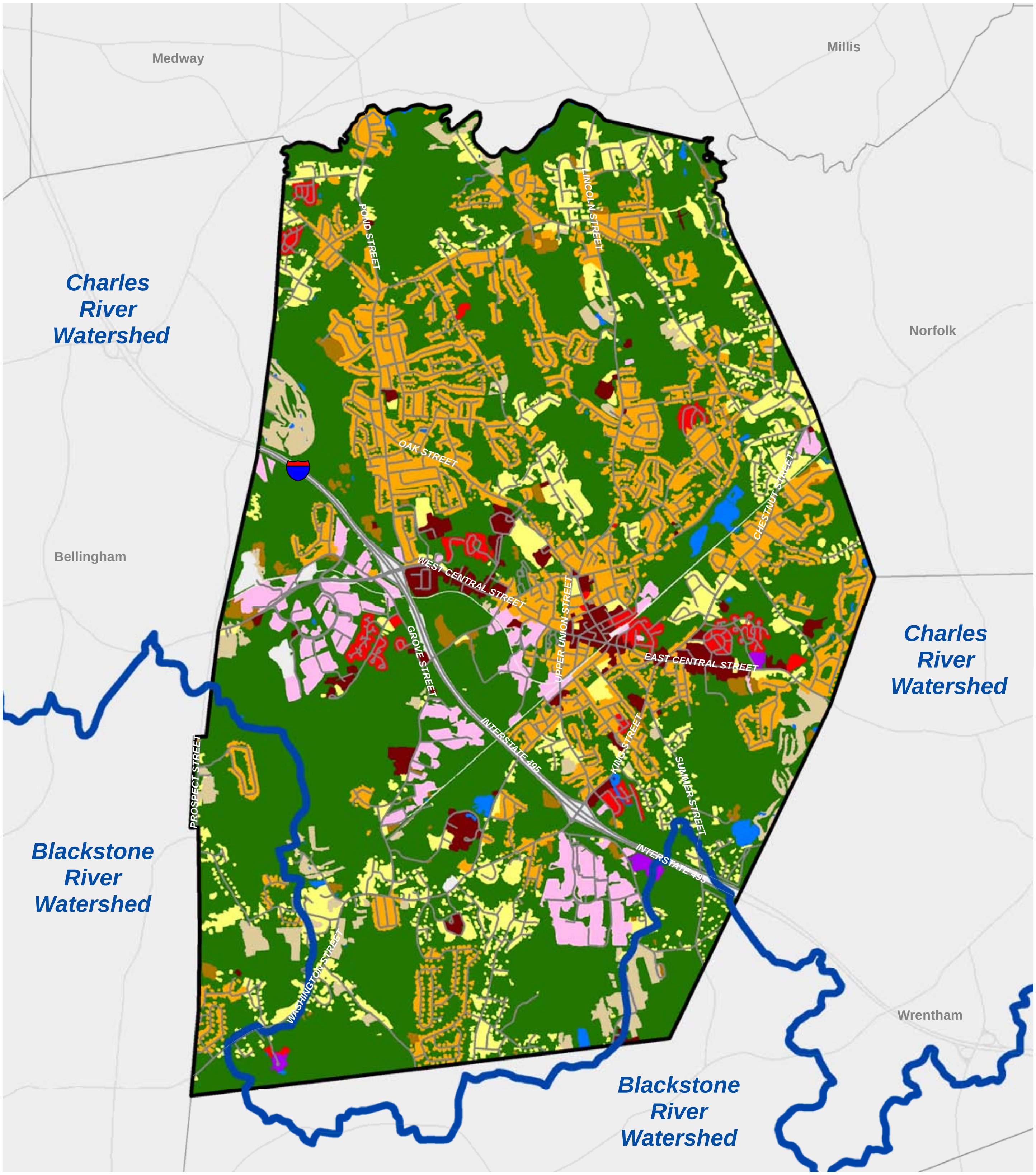
N

Feet
4,000

Horsley Witten Group
Sustainable Environmental Solutions

Land Use Distribution in the Town of Milford

Date: 8/17/2011 Figure 2.9



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Legend

Land Use*

- Agriculture
- Commercial
- Forest
- Freeway
- Industrial
- Low_D_Res
- Medium_D_Res
- High_D_Res
- Multi_Family_Res
- Open
- Water

Source - Optimal Stormwater Management Plan Alternatives Project – 2009

N

Miles

1

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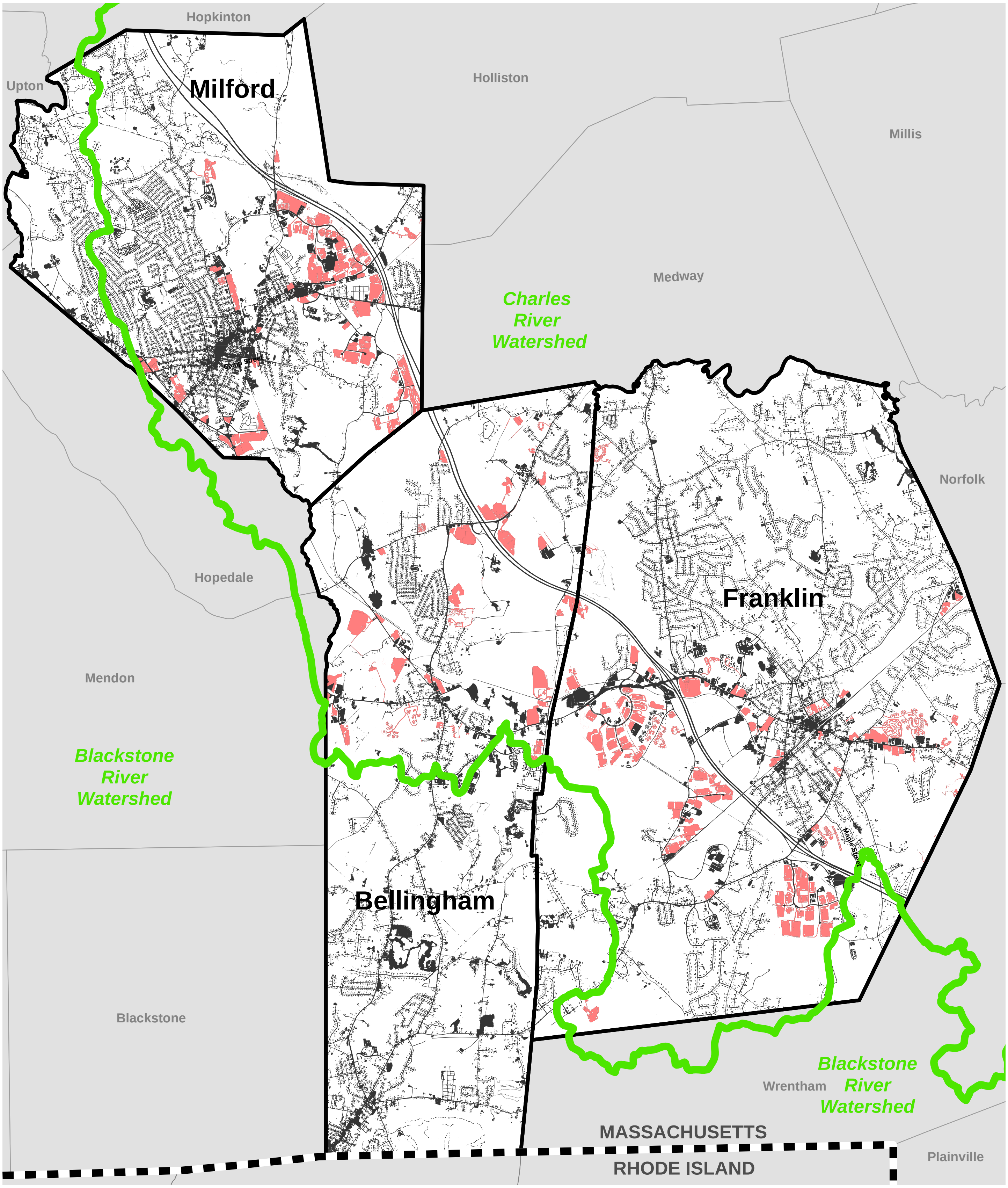
Sustainable Environmental Solutions
90 Route 6A • Sandwich, MA • 02563
Tel: 508-833-6600 • Fax: 508-833-3150 • www.horsleywitten.com

Land Use Distribution in the Town of Franklin

Date: 8/17/2011

Figure 2.8



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Legend

Focus Communities

State Boundaries

Impervious Area (from 2005 Aerial)

Impervious Area in Draft Designated Discharge (DD)/Residual Designation Authority (RDA) Parcels*

Neighboring Towns

Major Basins

Source - Data from MassGIS 2011 except the following:
**Derived from Vorhees, 2011*

N

Feet
7,500

Horsley Witten Group
Sustainable Environmental Solutions

Impervious Cover in Bellingham, Franklin, and Milford

Date: 8/17/2011

Figure 2.10

2.3.2 Existing Stormwater Capacity

The stormwater programs in Bellingham and Franklin are run by Departments of Public Works and the program in Milford is run by the Highway Department. Stormwater discharges in Bellingham, Franklin, and Milford are permitted for 2011 by the continuation of the NPDES Phase II Small MS4 GP issued in 2003. The extent of stormwater services varies from town to town; these services are currently funded primarily out of general taxpayer funds and grants. Estimates of existing program costs are provided in Section 4.1 of this report.

Bellingham reports that due to the condition of the present economy, they have been under considerable pressure to cut their budget. This has had the effect of reducing some stormwater services provided by the Town. In Milford, according to their 2011 annual report, the stormwater management program is currently meeting goals as specified in the 2003 permit. Franklin has begun to implement measures and capital improvement projects for water quality improvement. Projects include impervious pavement reduction, installation of bioretention and other structural BMPs to improve water quality in areas where runoff was previously untreated.

Tables 2.6 and 2.7 summarize existing infrastructure data and program activities as provided in the 2010 NPDES annual report (Yr 2009), in discussions with the towns, or from town GIS. Franklin has established an extensive GIS with detailed mapping of stormwater infrastructure. Bellingham is also in the process of digitizing their stormwater infrastructure into their GIS as information becomes available.

Table 2.6: Existing Stormwater Infrastructure (as reported by towns)

Jurisdiction	# Catch Basins	# Outfalls	Existing Detention Basins	# municipal-owned properties*		Town Roads (Miles)**
				w/ buildings	w/o buildings	
Bellingham	2,050	240	23	26	69	96
Franklin	3,000	501	185	57	244	170
Milford	3,368	303	70	22	188	123

**per Bellingham and Franklin GIS, Milford assessors database*
***MassDOT Commonwealth of Massachusetts 2010 Road Inventory Year End Report*

Table 2.7: Existing Stormwater Control Program Activities (from Yr 2009 NPDES Annual Report)

Bellingham	Franklin	Milford
Public Education and Outreach		
- Youth summer water awareness program - Distribution of written information - SmartStorm roof runoff recharge/reuse information posting	- Recycling education for home owners - Education information on website - Education on waste disposal and water conservation - Water resource information and protection signs - Public education with CRWA - Establish a "Green Team'" at High School - Open data sharing for stormwater infrastructure - Classroom stormwater education - Stormwater newspaper articles	- Brochures to educate public - Brochures to educate business/industry - Outreach program for local students, civic groups - Education materials in Library and Town Hall
Public Involvement and Participation		
-Water Resource Committee Meetings (formerly Stormwater Management Committee) - Open and advertise WRC Meetings	- Storm drain stenciling - Outreach efforts with CRWA - Public meetings to encourage volunteers - Community assistance program - Establish a stormwater telephone hotline	- Community cleanup - Scrap metal and used motor oil recycling - Hazardous waste drop off days - Public meetings
Illicit Discharge Detection and Elimination (IDDE)		
- Complete GIS mapping of 2000 urbanized area - Distribute written information to residents on illicit discharges - Illicit discharge bylaw to town meeting - Train DPW staff to identify illicit discharges	- Stormwater map development - Develop non-stormwater discharge ordinance - Perform dry weather outfall assessments - Develop procedures for removing illicit connections - Setup and advertise hotline for illicit discharges - I/I and Sewer Rehab Program	- Storm sewer map - IDDE program development, identification of problem areas, correction of issues - IDDE program documentation - Storm drain stenciling - Regulation prohibiting non-stormwater discharges to municipal system
Post Construction Stormwater Management in New Development and Redevelopment		
- Review and suggest modifications to by-laws and regulations - Annual review of post construction runoff procedures	- Procedures for long term O&M - Review procedures for post construction impacts - Best Management Handbook for Developers - Establish procedure for receipt of info submitted by public	- Regulations for BMPs - Regulatory mechanism for BMP O&M

Bellingham	Franklin	Milford
Construction Site Stormwater Runoff Control		
- Review existing by-laws - Suggest modification to bylaws and regulations -Procedures for Town's site inspectors	- Ordinance development for waste control - Formalization of Site Plan Review procedures - Revised ordinance to address stormwater pollution - BMPs Manual for developers - Formalization of inspection procedures - Establish procedure for receipt of information submitted by public	- Regulation for erosion/sediment control, BMPs, construction controls - Mechanism for site plan review, inspections, review procedures
Pollution Prevention and Good Housekeeping in Municipal Operations		
- Continuous street sweeping and catch basin cleaning and record keeping - DPW and Parks Dept. Facilities Master Plan - All Town Facilities Stormwater Review and Master Plan - Construct recharge and treatment at Plymouth Road BMPs	- Standard operating procedures - Employee training - Parking lot and road sweeping - Spill response and prevention - Catch basin cleaning - Municipal facilities and operations evaluation - Low impact design for DPW roadways and drainage projects - BMP evaluation and identification of needed retrofits - Stormwater BMP maintenance and drainage system upgrades - Annual household hazardous waste collection	- Street sweeping - Catch basin cleanouts - Record keeping/ schedule of maintenance - Recycling waste disposal program - Waste disposal/ housekeeping training and practices - Identification, inspection, maintenance of municipal BMPs
BMPs for Meeting TMDL Waste Load Allocations		
None	Additions: - Evaluate Data and TMDL for the Charles River and Develop a Plan to improve TMDL Waters - Implement Water Quality Improvement Plan for Discharges to 303(d) waters	None

2.3.3 Water and Sewer Management

The structure of water and sanitary sewer system management is also an important factor that can affect how stormwater is managed. Towns that have implemented a utility fee structure to fund stormwater programs have successfully argued that stormwater is the "third arm" of municipal water resource service, and fees are typically linked to drinking water supply and sanitary sewer utility bills. The link between drinking water and stormwater programs can also be profound, not just for surface intakes, but also in areas where aquifers provide a significant portion of the drinking water supply and, thus, recharge of uncontaminated stormwater is critical to maintaining the groundwater supplies.

In Bellingham, 95% of the population is connected to the Town water supply, while only 25% is on the Town's sanitary sewer system. The sources of the water supply are 14 groundwater wells, four of which are located in the Charles River Watershed. The DPW manages the water system, and customers pay a service charge in addition to metered consumption per gallon using a three-step increasing block system. Sewer system utility billing is also managed by DPW. Billing is based on the facility water meter size with a single rate applied for all usage volumes.

The Town of Franklin also has a centralized town water supply that provides service to 80% of the Town. The water system draws from 12 groundwater wells and consists of six water storage tanks, 2,000 hydrants, 157 miles of water main, and 9,000 water service connections. The sanitary sewer system is comprised of 137 miles of sewer pipe, more than 3,400 manholes and 23 pump stations. The DPW Sewer and Water Division manages both the water and sewer systems and associated billing. Billing for both the water and sewer services is done quarterly based on water consumption using a three-step increasing block system.

In the Town of Milford, 95% of the town utilizes the public water supply, and 80% use the town sewer system. The water supply is from wells in the Charles River Basin, the Echo Lake reservoir, and an intake on the Charles River. Water service is provided and managed by the Milford Water Company; customers pay a service charge by meter size as well as a volumetric charge based on specific rates per hundred cubic feet. The sewer system includes 60 miles of pipeline and ten pump stations managed by the Milford Sewer Department. Users pay a volumetric charge based on winter water use and the applicable service charge rate (rates vary depending on facility type). Wastewater treatment occurs at the Milford Wastewater treatment plant in Hopedale, MA.

Like water and sewer service, the maintenance of stormwater infrastructure across an MS4 is a real expense. Table 2.8 summarizes results of the 2010 utility rate survey in Massachusetts, showing average annual household costs for water and sewer for each of the three Towns.

Table 2.8: 2010 Average Cost per Household for Sewer and Water

Towns	Annual Water Utility Bill	Annual Sewer Utility Bill
Bellingham	$422 (billed bi-annually)	$619 (billed bi-annually)
Franklin	$665 (billed quarterly)	$524
Milford	$310 (billed quarterly)	$426 (billed bi-annually)
Source: Tighe & Bond 2010 Sewer Rate Survey and Water Rate Survey; Assumes 90,000 gallons/yr (not based on actual consumption in each town and does not necessarily reflect actual costs per household).		

2.3.4 Governance Structure

The political structure of a town can influence the feasibility of adopting stormwater management by-laws or ordinances and determine the source and timing of potential revenue to fund a stormwater program. Bellingham and Milford both operate under a Board of Selectmen; Bellingham holds open town meetings, while Milford has representative town meetings. The Town of Franklin operates under a Town Council.

With the exception of Franklin, each Town has adopted appropriate by-laws and regulations pertaining to stormwater management, illicit discharges, and erosion and sediment control as required under the 2003 permit and in accordance with State and Federal standards. Franklin has not formally adopted an illicit discharge regulation. In addition, the Town of Milford's Comprehensive Plan identifies the protection of water resources in Charles River and non-point source pollution control to protect the drinking water supply as two important goals.

2.4 Implications for Stormwater Implementation and Funding

Given local conditions, the following implications for meeting stormwater management regulatory requirements should be considered:

- Reducing TP loads from highly urban areas can be challenging and expensive, particularly given soil conditions and limited space available for placement of stormwater BMPs. This will be relatively challenging for parts of down town Franklin and Milford where there are fewer opportunities for retrofitting urban areas due to the high density of development. In addition, Milford has the highest percentage of HSG C and D soils of the three towns, which constrains implementation for retrofitting with the more cost-effective infiltration practices. Bellingham has more soils where infiltration is feasible, which provides more opportunities for implementing stormwater practices with higher TP reduction efficiencies and, thus, a potentially lower overall treatment cost.
- The DDs offer significant potential to help the towns meet their TP control requirements. Cumulatively, the DD properties contribute a significant amount of TP loading in each of the towns. Many of these facilities have existing stormwater BMPs that will be among the most cost-effective practices to retrofit. In addition, the 65% TP reduction requirement will help the towns meet their own TP reduction targets. Having the DDs as implementation partners will likely have significant benefits for the towns.

- A fairly large number of existing BMPs have been constructed in each of the towns over the years. When BMPs were constructed, how they perform, and ultimately how EPA credits their phosphorus reduction could significantly affect the implementation costs in each community. Future assessment of these facilities would be a critical component of any future watershed plans that are developed for the region.
- Assuming the required activities outlined in the draft MS4 GP are carried forward to the final permit, future municipal stormwater program operational costs could more than double over current expenditures, depending on the level of sophistication of existing programs (see Section 4.2 and Appendix B). A significant increase in capacity will be required for all three municipalities.
- Two of the three municipalities have a form of local government that requires Town Meeting approval of new by-laws. The implementation of new stormwater programs for the Upper Charles communities will likely involve the need for new or amended by-laws. The passage of new by-laws at Town Meeting can be highly uncertain, depending on a number of factors and conditions. In recent years, new by-laws that have a perceived increased financial burden have been more difficult to pass at Town Meeting, and if they do pass, often require more than one attempt and a substantial effort in educating the voters and justifying the value and need for the by-law.

3.0 Stormwater Management Implementation Alternatives

This section presents the implementation alternatives that are evaluated from a cost and revenue perspective and sets the stage for the funding evaluation presented in subsequent sections. As defined in the draft RDA GP, DDs have the option to participate in a CMPP to achieve part or all of their phosphorus reduction requirements. When the draft RDA GP was issued, EPA envisioned that the optional CMPP approach would be a cooperative implementation strategy to meet permit requirements, but not necessarily in the context of a stormwater utility or enterprise fund. The following analysis and assessment assumes that the only difference between a CMPP and a Stormwater Utility is in the funding approach. Both a CMPP and a Stormwater Utility involve a cooperative approach among the DDs with the municipalities. Therefore, while a Stormwater Utility is not specifically identified in the draft RDA GP, it is assumed that the same requirements defined in the RDA GP for a CMPP would apply to a Stormwater Utility.

3.1 Context for Analysis

There are probably a dozen or more alternative management and funding approaches that the municipalities and affected property owners could pursue to implement a stormwater management program and move towards the goal of compliance with the permit requirements of the MS4 and RDA GPs. Some of the alternatives may be more feasible or favorable than others, thus this report is directed at the feasibility of the implementation of four scenarios that seem to be the most likely candidates for moving forward. Scenarios differ based on timeframe for implementation, funding mechanism, and the municipal management approach, as follows:

- **Implementation Timeframe**: This analysis contemplates a timeframe for implementing stormwater control measures to extend over a period of years from a minimum of 10 years from the effective date of the GP to a maximum of 25 years. Since the current draft MS4 GP includes a 10 year implementation term, this is assumed to be the minimum timeframe. The longer implementation periods are presented as possible terms to be defined in the final GPs. Timeframes are analyzed for 10, 15, 20 and 25 year implementation terms. The maximum timeframe for implementation ultimately will be defined in the final MS4 and RDA GPs.
- **Funding Mechanisms:** The municipalities may choose to fund the program through a user fee/enterprise fund under a Stormwater Utility structure, or through other sources such as the municipality's general fund, permit fees, and grants.
- **Management Approach:** The municipal stormwater management program may be implemented individually or cooperatively.
    - Town-by-Town: This involves implementation through a cooperative agreement between the municipality and regulated property owners (both those permittees who are governed by the RDA GP and those whose discharges are covered by the MS4 GP), or the municipalities might work to manage runoff without the participation of properties governed by the RDA; or

- Regional: The municipalities might elect to work together cooperatively to share program elements that would otherwise be duplicative or less cost effective when implemented alone.

This feasibility report evaluates the financial (cost and required revenue) and programmatic/logistical considerations for four main scenarios (each with variable implementation timeframes) based on the management and funding options presented above. These scenarios are summarized in Table 3.1 and described in more detail below. Advantages and disadvantages to the municipalities are discussed for each option.

It should be noted that sufficient information is provided herein for affected and interested parties to evaluate a wider range of possible scenarios, beyond those analyzed here. Additional permutations that could be evaluated, include: 1) partial participation by some DD properties in a cooperative program and some on their own; 2) creation of a stormwater utility that covers the entire town versus a utility that covers the Charles River watershed-only; or 3) cooperation between only two of the three Upper Charles River watershed towns.

Table 3.1: Stormwater Management Implementation Scenarios Evaluated in this Feasibility Report

<table>
<tr><td colspan="3">Each Town Manages Stormwater Program Individually</td><td rowspan="3">Scenario 4
Regional Stormwater Management Program – DDs fully participate</td></tr>
<tr><td colspan="2">No Stormwater Utility</td><td rowspan="2">Scenario 3
Town enacts Stormwater Utility – DDs fully participate in the program</td></tr>
<tr><td>Scenario 1
DDs on their own</td><td>Scenario 2
DDs participate in a CMPP</td></tr>
</table>

3.2 No Stormwater Utility (Scenarios 1 and 2)

Under this management structure, the municipalities do not pursue the adoption of a stormwater utility, rather, funding for the planning and implementation of a stormwater management program is assumed to be through a combination of general funds, fees and grants. The municipalities may either elect to develop a CMPP to help facilitate implementation of more cost effective stormwater control measures for the regulated DD properties under the RDA, or they may elect to allow the DD properties to implement control measures on their own.

3.2.1 DD's on Their Own (Scenario 1)

The first scenario assumes that no stormwater utility will be established, and that the DD properties implement controls on their individual sites. Municipalities will first have to refine their current stormwater program to meet requirements of the MS4 GP. This will include all control measures required by the MS4 GP as defined in the municipality's Stormwater Management Program (SWMP). Most notably, each municipality within the Charles River watershed will need to develop and implement a PCP. The PCP describes the measures necessary to reduce the amount of phosphorus discharged from the municipal storm sewer system to the Charles River and its tributaries to achieve consistency with the phosphorus waste load allocation (WLA) published in the final TMDL.

The process will involve refining and updating the municipality's stormwater program and developing annual budget estimates for the cost of the program, similar to any other municipal program. The budget allocation from general funds may be reduced through the adoption of fees, such as permit fees, grants, and/or very low interest loans (e.g., State Revolving Fund (SRF) loan program).

The advantages to the municipalities of DDs implementing stormwater measures on their own are as follows:

- It does not require setting up an additional entity and the MS4 GP obligations can be administered within existing departments. The municipality will not have to develop, administer, or enforce a new program to control phosphorus loading from the DD properties.
- Revenues from general funds are typically raised through property taxes, so residential property owners may be able to receive a tax deduction on their state and federal tax returns.
- The town's stormwater program priorities will be completely within the municipality's control, with no required coordination with DDs or other municipalities.

Alternatively, the disadvantages to the municipalities of this type of approach may include:

- Required revenues for the updated SWMP may exceed general fund budgets and may require a Proposition 2½ Override each year through a vote from the legislative branch of municipal government (e.g., Town Meeting or Town Council). Other municipal priorities may impact the program's revenue.
- It lacks equity among property owners within the municipality. Property taxes are based on assessed value of property, not the contribution of stormwater runoff.
- DD property owners will most likely have a shorter timeframe to implement stormwater control measures (currently half the time in the draft RDA GP, since no planning or coordination among DD property owners is required) and will likely have to incur higher costs for site-by-site implementation, which may impact municipal tax revenues.
- No cost savings can be achieved through the elimination of duplicative services provided by each municipality (e.g., public education), increased efficiencies for volume discounts (e.g., catchbasin cleanout and disposal), or enhanced stormwater controls on the most cost-effective sites across municipal boundaries.
- No opportunity to use fiscal incentives to enhance program implementation (behavior modification and/or installation of on-site controls, such as rain gardens).
- Compliance with MS4 GP will be less certain.

3.2.2 DDs participate in CMPP (Scenario 2)

Scenario 2 also assumes that the municipalities will not adopt a stormwater utility but will undertake the development of a CMPP with cooperation and input from the DD property owners. This scenario will involve an initiative by the municipalities to set up, manage and enforce a program to reduce phosphorus loads from the DD parcels by 65% from current levels. The potential logistics and a proposed process for developing and managing a CMPP are described in Appendix C. The RDA GP allows DD property owners to participate in a CMPP either within the municipality where the property is located or within an upstream municipality. Participation in a CMPP allows DD property owners additional time to achieve phosphorus load reductions (currently twice the timeframe for implementation and assumes that the first half of the timeframe will be used to plan for and set up the CMPP) and allows for a phosphorus load trading program between sites based on cost-effectiveness of control measures.

The advantages to the municipality of instituting a CMPP within a municipality include:

- The longer timeframe for DD property owners to plan for and implement phosphorus control measures allows the municipality to better assess and quantify how the remaining MS4 load reductions can be achieved.
- A CMPP allows for phosphorus trading to maximize load reductions on the most cost-effective sites, thus reducing the overall cost of management for all DD sites collectively (an estimate of the cost savings for DD properties operating within a CMPP is presented in Section 4).
- A centralized entity at the municipal level allows for a more structured approach, presumably with more resources to optimize site selection and ensure consultant and contractor expertise at prescribed levels.
- More likely to have less impact on fiscal resources and business disruptions of DD property owners, and thus less potential to impact municipal revenues.

The disadvantages of establishing a CMPP from a municipal perspective include:

- There can be significant initial time and expense in setting up a CMPP, as well as time and labor to manage the entity over the long term. Presumably fees would cover municipal expenses over the long term, so there would be no increased cost to the municipality.
- The management of a CMPP might divert resources from other municipal activities and thus potentially impact other programs.

3.3 Stormwater Utility on a Town-by-Town Basis (Scenario 3)

Scenario 3 involves each town establishing and operating a stormwater utility established through a local bylaw or ordinance in accordance with the enabling legislation of MGL 83 Section 1A and 16 or other legal mechanism or basis. Each town would pursue the establishment and maintenance of a stormwater utility by generally undertaking the tasks outlined in later sections of this report. Under this scenario, each municipality would include all parcels within their jurisdiction together with the DDs within the Charles River watershed in a utility designed to meet stormwater management programs as outlined in the SWMP. The stormwater utility would be established in such a way so it could serve the CMPP function, thus allowing DD property owners the longer timeframe for implementation and potential cost savings of a phosphorus trading program.

This scenario assumes that each town would establish a stormwater utility across the limits of the entire town; both within the Charles River watershed and beyond. At the implementation stage, each municipality may wish to revisit this assumption and consider a Charles-only Stormwater Utility with a tiered fee structure as a function of watershed location. This is a valid issue, as many elements of the municipal stormwater program will be driven by the new MS4 GP requirements that are independent of discharge location, but also has potential significant fee implications for requirements that are dependent on discharge location. Bellingham, in particular has a significant portion of the town that drains to the Blackstone River and would not be subject to the immediate requirements as outlined in the draft MS4 permit for the North Coastal Watershed that includes the Charles River. The most equitable approach would be to establish a rate structure that reflects the requirements of each watershed. As currently written, those properties draining to the Charles River will be subject to phosphorus load reductions that have a higher cost than those properties draining to the Blackstone River.

The advantages to the municipality of establishing and maintaining a stormwater utility within each town include:

- The cost of the stormwater program matches with the revenue in an equitable manner. Property owners' rates are based on the amount of "impact" as measured by impervious cover (more detailed description is presented in later section of this report).
- Establishes a consistent and independent funding source that does not compete for other programs for resources. Rates are established in accordance with program services and costs and are not subject to annual debate and vote by the municipality's legislative branch of government (e.g., Town Meeting).
- DD property owners will most likely have a longer timeframe for planning and implementation of stormwater control measures.
- Phosphorus trading is allowed in order to maximize load reductions on the most cost-effective sites and, thus, overall program costs for achieving required phosphorus load reductions are reduced.
- An opportunity is created to use fiscal incentives to enhance program implementation (behavior modification and/or installation of on-site controls, such as rain gardens).
- Compliance with the MS4 GP will be more certain.

The disadvantages of establishing and maintaining three separate stormwater utilities in each town include:

- Each utility will have an initial set-up cost and a long term cost associated with billing and administration of the utility.

- No cost savings will be achieved through the elimination of duplicative services provided by each municipality (e.g., public education), increased efficiencies for volume discounts (e.g., catch-basin cleanout and disposal), or enhanced stormwater controls on the most cost effective sites across municipal boundaries.
- The payment of fees by residents and businesses will establish expectations of service for a range of issues, which will require the municipality to be responsive and diligent in areas where they may have been less attentive in the past.
- Fees paid into enterprise funds are typically not deductable expenses like property taxes are, thus residential property owners may not be able to receive a tax deduction on their state and federal tax returns.

3.4 Regional Stormwater Management Program (Scenario 4)

Under Scenario 4, the three municipalities would enter into an inter-municipal agreement to participate in a regional stormwater management utility that would share certain program elements and allow for the implementation of stormwater control measures across municipal boundaries. The exact nature of the shared elements would be established in the implementation phase of a regional utility, as described in more detail in later sections of this report.

Likely shared elements of a regional program might include:

- Shared billing and administrative functions, with possibly a separate rate structure for each municipality developed as a function of their respective parcel impervious cover data and estimated costs for program services.
- A shared single public education, outreach and involvement program.
- Coordinated implementation of non-structural control measures, such as enhanced street sweeping, catch basin cleaning, and fall leaf pick-up and disposal using shared equipment.
- Completion of a watershed management plan for the three communities within the Upper Charles River watershed to identify the location and type of the most cost effective control measures.
- Management of the CMPP and PCP components of the RDA and MS4 GPs, respectively.
- Design, permitting, bidding, and construction of phosphorus load reduction structural controls and performance of long-term facility maintenance.

The potential advantages of a regional stormwater utility program include:

- Cost savings for administrative and programmatic elements that eliminate duplicative efforts and spread costs over a larger base (such as billing, data management, and public education).
- Cost savings associated with implementation of phosphorus control measures across municipal boundaries to maximize loading reductions in the most cost effective locations and using the most cost effective practices.

- Establishment of a regional entity eliminates the need to have separate municipal programs and avoid conflicts with other municipal programs (e.g., snow removal, highway maintenance, etc).
- Sets up the opportunity for other municipalities to join the entity in the future and further share resources to potentially reduce individual expenses.

Possible disadvantages of a regional stormwater utility program include:

- The perception that one municipality might have to “bail out” another municipality where stormwater management costs might be higher due to past practices or neglected maintenance.
- The possibility that elected officials and citizens might lose local control over certain program elements.
- The possibility that creating a new bureaucracy might lead to program elements that are unnecessary or unwanted and that, possibly, may result in higher rates.
- The possibility that the program may result in inconsistent services across municipalities.
- Concerns related to the regional entity’s responsiveness and concerns over who controls priorities.

4.0 Cost Estimates for Existing and Future Stormwater Services

This section provides cost estimates for stormwater program services for the municipalities of Bellingham, Franklin, and Milford that include provisions of the existing NPDES permit, as well as the projected cost of future services as outlined in the draft MS4 and RDA GPs. Existing costs encompass expenditures related to the administration and implementation of the current stormwater program for each town (see Section 4.1). Future costs assume adding new services to the existing program costs as necessary to fulfill conditions of the draft NPDES MS4 permit and to meet phosphorus load reductions (see Section 4.2). Future services are divided into operational costs (running the program, Section 4.2.1) and capital expenditures (retrofitting with structural practices for phosphorus reductions, Section 4.2.2). Estimates of both existing and future program costs were reviewed by each of the towns and revised as needed.

To facilitate the analysis, both current and future services were evaluated within five major cost centers. Brief descriptions of the type of activities allocated to each cost center are summarized in Table 4.1. Because the existing stormwater program capacity varies across the three towns, some towns may not have current expenditures for all activities listed under these major cost centers. The cost centers and activities included in this analysis are comprehensive in order to accommodate future program requirements and to help communities redefine the scope of their stormwater program; therefore, traditional stormwater services (e.g., catch basin cleaning and storm sewer maintenance), as well as services that the Towns may not currently account for within their stormwater program budgets (e.g., code development and zoning support or leaf pickup) are included here.

Itemized budget spreadsheets for operational costs for each town are located in Appendix D. These spreadsheets provide detailed descriptions, cost assumptions, level of effort, and annual costs assigned for specific activities within each cost center. General information on the budgetary assumptions used to generate existing and future program costs for each town are described in the remainder of this Section.

Table 4.1: Summary of Key Stormwater Program Cost Centers and Activities

Cost Centers	Stormwater Program Activity Subcategories
Administration	Stormwater program and CMPP* administration; Legal support services; Inter-agency & inter-municipal coordination; Emergency management coordination; NOI and SWMP development; Annual reporting; Public education/involvement programs & staff training; and Grants administration
Regulation/ Enforcement	MS4 Permit compliance; Stormwater/drainage system inspections; Illicit discharge and elimination (IDDE); ESC inspections; and RDA/CMPP Compliance*
Engineering and Master Planning	Stormwater Master Planning; IDDE plan*; Catch Basin Inventory Plan (CBIP) and street sweeping optimization*; Waterfowl & Pet Waste Plans*; Pesticide/herbicide/ fertilizer program*; Spill response & cleanup program; Capital improvement project (CIP) design/engineering/ permitting assistance; Stormwater pollution prevention plan (SWPPPs); Maintenance and field engineering support; Data collection, management, and mapping for drainage and sewer infrastructure; Technical services/public assistance (hotlines); Code development and zoning support; and

Cost Centers	Stormwater Program Activity Subcategories
	Hazard mitigation planning and flood insurance updates
Operations and Implementation	Operations and maintenance management; CIP/infrastructure implementation; PCP implementation; CMPP/RDA implementation (where applicable); IDDE; Storm sewer and culvert maintenance/repair; Inlet, catch basin, and manhole cleaning; Stormwater BMP maintenance; Street sweeping; Organic and leaf pickup and composting; maintenance of BMPs; Stream Restoration; Ditch and channel maintenance; Waterfowl & pet waste pickup; Hazardous materials collection; Emergency repairs
Monitoring*	Catchment assessment; Dry and wet weather outfall monitoring
*These activities apply to future costs only	

4.1 Existing Stormwater Program Costs

Existing annual program costs are based on multiple sources including the activities and expenses for 2009 as documented in the 2010 NPDES MS4 report (permit year seven), as well as supplemental information on 2010 labor and other direct costs reported and reviewed by each town (specifically, by the DPW in the Towns of Bellingham and Franklin, as well as by the Milford Town Engineer, Highway Surveyor, Board of Health, and Milford's Consulting Engineer GZA Geoenvironmental, Inc.). Table 4.2 summarizes expenses within each major cost center and the overall annual cost (rounded to the nearest $1,000) of the Stormwater Programs estimated for each town. Total costs include labor and direct costs (e.g., equipment, materials, disposal fees, etc). Figure 4.1 shows existing program costs graphically for all three towns.

Table 4.2: Summary of Estimated Existing Annual Stormwater Program Costs (FY 2010)

Major Cost Centers	Existing Stormwater Program Annual Costs		
	Bellingham	Franklin	Milford
Administration	$18,421	$58,670	$18,335
Regulation/Enforcement	$1,800	$51,396	$26,250
Engineering and Master Planning	$17,000	$152,671	$13,100
Operations and Implementation	$194,918	$759,978	$487,966
Monitoring	-	-	-
Total Cost	$232,139	$1,022,715	$545,651
Costs include staff labor and direct costs for equipment, materials, disposal, supplies, etc.			

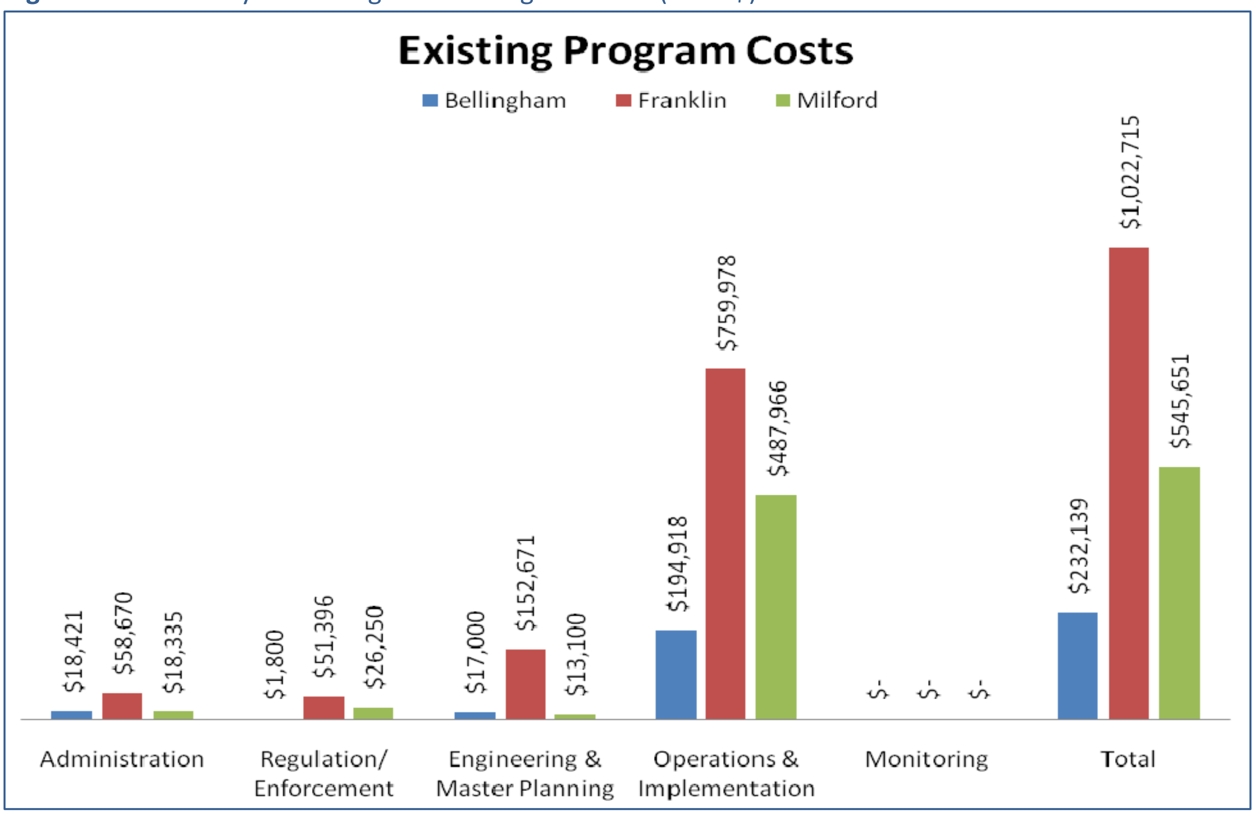
The following assumptions have been used in establishing the existing stormwater program annual costs presented herein:

- Estimates for staff level of effort (LOE) are based on feedback from each Town since there are no detailed tracking systems reported for labor by stormwater program category.
- Cost estimates based on LOE of personnel utilize current salaries provided by the towns, which were then increased by 50% to represent the burdened personnel costs. This is

to account for the estimated true cost to the town for providing employees with standard benefits (e.g. health insurance and vacation time) on top of the personnel base salary. LOE is the percentage of time estimated for one full time employee (FTE) to perform a task.

- The annual cost of sanitary sewer improvements (i.e., inflow and infiltration and sump pump disconnection programs) are not included since these are associated with the sanitary system rather than the storm sewer system. However, programs to identify and remove illicit discharges to the storm sewer system are included.
- Equipment costs were provided by the town either as an approximate annual lump sum cost estimate, or as an initial purchase price. When the initial purchase price was used, an equivalent uniform annual cost was calculated assuming a 10-year service life of the equipment. Calculations for equipment depreciation were not included.
- The estimated cost for Milford and Bellingham does not reflect capital improvement projects for infrastructure repair funded through grants or projects implemented by the Milford Highway Department or Bellingham DPW as part of the road repair budget.
- Franklin includes capital improvement projects performed as part of the stormwater program; examples are pavement reduction projects and stormwater infrastructure repairs.

Figure 4.1: Summary of Existing Annual Program Costs (2010 $)



Administration: The administration category is for tracking and estimating program costs resulting from programmatic administrative support. The cost analysis includes the cost for town personnel support based on estimated effort for staff oversight, participation, and coordination of all aspects of the stormwater program. In addition, the towns utilize services of outside engineering consultants to varying degrees for activities such as the preparation of the NPDES MS4 Annual Reports, staff training, and public education programs. Table 4.3 describes these activities, LOE, and consultant fees used to estimate program administrative costs.

Table 4.3: Key Administration Assumptions by Town

Bellingham	Franklin	Milford
• DPW Director at 5% LOE for program administration, NPDES MS4 annual reporting, public involvement and inter-agency/ municipal coordination, and training; • DPW Assistant Director and Administrative Assistant each at 4% LOE for supportive administrative tasks; • Participation of six DPW staff in annual pollution prevention training ; and • Outsource annual public education and involvement programs $6,000.	• DPW Director at 10% for review and tracking of tasks and subcontractors, inter-agency coordination including attending workshops and sharing information, review of NPDES annual report, public education, public involvement, and grant programs; • DPW Office Manager and Clerk at 5% and 4% LOE, respectively, for tracking of tasks and subcontractors and inter-agency coordination; • GIS Technician at 25% LOE for involvement in tracking of tasks and subcontractors, NPDES annual report, public education displays, and grant programs; • Town Administrator at 2% LOE for review of program tasks and inter-agency coordination, workshops and information sharing; • Town Attorney at 1% LOE for periodic review of regulatory changes; • DPW Director at 2% LOE for coordination and attendance for public involvement programs; and • Lump sum cost of $5,500 for engineering consultant involvement in NPDES MS4 annual report and DPW staff training.	• Highway Surveyor at 3% LOE for periodic review of program tasks and tracking of subcontractors, inter-agency coordination and sharing of information, NPDES annual report review, and grant review; • Highway Surveyor Assistant at 3% LOE for periodic review of program tasks and tracking of subcontractors, and facility cleanup program; • Administrative Assistant at 7% LOE for assistance with administrative tasks and NPDES annual report; and • Lump sum cost of $7,800 for engineering consultant involvement in NPDES annual report, public education, and Highway Department staff training.

Regulation and Enforcement: This category estimates the cost associated with project permit plan review, inspection, and enforcement of town's post-construction stormwater, ESC, and IDDE ordinances. Based on input from the three towns, the cost of regulation and enforcement of private projects is assumed to be borne by the developer. Table 4.4 summarizes other key assumptions.

Table 4.4. Key Regulation and Enforcement Assumptions by Town

Bellingham	Franklin	Milford
• Assistant DPW Director at 2% LOE for inspection of stormwater systems and ESC at town projects.	• Town Engineer at 7% LOE or 0.07 FTE for inspection of stormwater system and ESC; • Highway Superintendent at 5% LOE for inspections; • Staff Engineer/Inspector at 43% LOE for inspection of all stormwater system and erosion and sediment controls; • GIS Technician at 2% LOE for GIS system updating to include stormwater systems; and • DPW Clerk and Office Manager each at 2% LOE for IDDE.	• Town Engineer at 15% LOE for permit review/ enforcement, inspection of BMPs, connections with MS4, and ESC compliance; and • $6,000 Illicit Discharge.

Engineering and Master Planning: This cost category includes estimates for stormwater planning, mapping, engineering planning and assistance, and regulatory code updates. As previously mentioned, the programs currently performed by each of the towns vary from one another on the level of service provided. One variation is existing expenditures for GIS mapping. For example, Franklin has an ongoing town-wide GIS mapping effort that is continually updated as infrastructure is verified in the field. Bellingham has mapped outfalls and updates some stormwater infrastructure annually. Milford has mapped outfalls, but does not have a comprehensive GIS mapping system established. All three towns have ordinances in place for ESC and post-construction stormwater management (developed under 2003 permit), with no additional cost for permit year 7. Both Bellingham and Milford also have by-laws in place for illicit discharge detection and elimination (IDDE), but Franklin has not formally adopted their drafted IDDE by-law. All three towns have either installed or repaired stormwater infrastructure components; the cost for design, permitting, and field maintenance is included either as a personnel expense when performed by the Town Engineer or as a sub-contractor fee when a consulting engineering performed design activities. Other assumptions are summarized in Table 4.5.

Table 4.5: Key Engineering and Master Planning Assumptions by Town

Bellingham	Franklin
• Lump sum cost of $10,000 for consultant engineering assistance to DPW for maintenance and field engineering support; • Lump sum cost of $7,000 for field data collection and GIS updates.	• Town Administrator at 2% LOE for stormwater planning; • DPW Director at 12% LOE for stormwater planning, pesticide/herbicide/ fertilizer program, engineering design and permitting assistance, municipal facility inventory, data collection and GIS updating, public assistance for flooding and illicit discharge concerns; • Town Engineer at 21% LOE for stormwater planning efforts, engineering design for stormwater improvement retrofits, on call engineering assistance to DPW for field engineering and maintenance, permitting assistance, field data collection and GIS updating, and code development and zoning support services (compliance with stormwater requirements); • Highway Superintendent at 12% LOE for tasks including engineering design for stormwater improvement retrofits, municipal facility inventory, and on call engineering assistance to DPW for field engineering and maintenance support;

Milford	Franklin (cont.)
• Town Engineer at 6% LOE for engineering design, permitting assistance, and Highway Department support for field engineering and maintenance; and • Lump sum cost of $5,000 for hazard mitigation planning	• Staff Engineer/ Inspector at 70% LOE for tasks including DPW project design engineering and permitting assistance, maintenance and field engineering support, field data collection and GIS update assistance, and code development and zoning support services (compliance with stormwater requirements); • GIS Technician at 26% LOE for tasks including stormwater planning, update GIS system to include outfalls identified as part of IDDE plan and sanitary sewer investigations and improvements, assistance with toxic and hazardous waste collection program, design engineering and permitting assistance, involvement in inventory of municipal facilities, maintenance and field engineering support, and GIS system maintenance including data collection, database management, and mapping updates; • DPW Office Manager at 5% LOE for tasks including pesticide/herbicide/ fertilizer program, assistance with toxic and hazardous waste collection program, design engineering and permitting assistance, and public assistance for flooding and illicit discharge concerns; • Conservation Agent at 10% LOE for code development and zoning support services (compliance with stormwater requirements); and • DPW Clerk at 3% LOE for assistance with permitting assistance, and public assistance for flooding and illicit discharge concerns.

Operations and Implementation: This cost category is for tracking costs associated with managing and implementing construction, maintenance, repair, good housekeeping operations, and public assistance services. Specifically, this category includes the following expenses: construction, maintenance, and repair of stormwater infrastructure; ESC measures; stream restoration and stabilization projects; ditch and channel maintenance projects; public assistance programs to address flooding concerns, removal of illicit discharges, and collection programs for toxic and hazardous materials; and good housekeeping maintenance operations such as inlet, catch basin, and manhole cleaning, BMP facility maintenance, street sweeping, organic waste and leaf litter pick up, and waterfowl and pet waste management. General assumptions that have been used in estimating the cost of activities included in this category are as follows and Table 4.6 summarizes town-specific assumptions:

- This task includes time associated with project bidding, and coordination of work schedules, equipment needs, and sub-contractors;
- All three towns reported costs for storm sewer and culvert repairs; the values vary greatly. Bellingham's cost for this task includes cleaning in one culvert, while both Franklin and Milford performed culvert, headwall, and catch basin repairs;
- All three towns perform some form of catch basin inspection and cleaning. The cost for Bellingham is considerably less than Franklin and Milford. This has been an area in the existing Bellingham DPW budget that has been cut over the last year, leading to catch basins being cleaned on an as needed basis. A total of 158 of the estimated 2,050 total basins were cleaned. Milford, on the other hand, sources out the inspection and cleaning of basins to a sub-contractor that addresses the needs of 3,368 basins on an annual basis. Catch basins that need additional attention during the year are cleaned by Milford Highway Department staff as needed. Franklin DPW reported performing annual catch basin inspection and cleaning for 1,800 of their estimated 3,000 basins.

- Street sweeping is performed in all of the towns by either the DPW or the Highway Department. Franklin, with 170 miles of road, and Bellingham, with 96 miles of road, reported cleaning all roads at least once per year; in addition, Franklin reported sweeping downtown streets and municipal parking areas a second time. Milford reported sweeping all streets (123 miles) and municipal parking areas twice per year and sidewalks once per year; the cost provided by Milford included the initial purchase price of equipment, labor, fuel, and disposal costs. Bellingham provided sweeping costs broken out by labor, annual equipment expense, and disposal costs; in addition to the cost provided, an equipment replacement cost for a regenerative air sweeper is assumed to be $197,000 and factored in as an annual expense.
- BMP maintenance was performed in the towns; Bellingham reported addressing vegetation maintenance at 24 BMPs and inspecting 7 inline proprietary water quality devices. Franklin performed vegetation maintenance and debris removal where issues were reported. Milford performed vegetation and trash removal in ~ 70 BMPs.
- Hazardous and toxic materials collection programs are run annually in all of the towns.
- Allowances of $0 in Bellingham, $35,000 in Franklin, and $12,000 in Milford for unexpected stormwater infrastructure repairs have been included.
- Franklin has reported capital improvement projects performed by the Highway and Water Departments that include impervious surface reduction in roadways and cul-de-sacs. These projects are a result of the stormwater program and have been included.
- Milford and Franklin provided leaf collection programs during this permit cycle. Milford reported providing leaf collection for 123 miles of streets once during the year, and establishing a composting area for disposal of leaves collected through the program. Franklin reported providing leaf collection a total of six times, three times each in the spring and fall.
- Milford has annual costs associated with cleaning stormwater infrastructure per the Highway Department facility SWPPP.

Monitoring: This category includes the cost of establishing and running a stormwater outfall monitoring program, as well as performing detailed inspection and monitoring of contributing drainage catchments. The towns have completed their inventories of outfalls required as part of the 2003 permit in prior years. Bellingham reported 240 outfalls, Franklin reported 501 outfalls, and Milford reported 303 outfalls. The three towns have also performed dry weather screening of outfalls to varying degrees of completion during previous permit years. Bellingham and Franklin reported completing dry weather screening of 65% and 10% of their outfalls respectively, while Milford has reported dry weather screening of 100% of outfalls. Estimated cost of these monitoring programs have not been included as they were performed during previous permit years.

Table 4.6: Key Operations and Implementation Assumptions by Town

<table>
<tr><th>Bellingham</th><th>Franklin</th></tr>
<tr><td>• DPW Director at 6% LOE, Assistant Director and Forman at 5% LOE for construction/maintenance oversight;
• Lump sum cost of $1,000 for drain/culvert maintenance;
• DPW costs for stormwater BMP facility maintenance (31 BMPs), catch basin cleaning at 12% LOE each for two laborers (clean 158 of estimated 2050), and street sweeping (once annually), based on equipment, labor at 70% LOE each for two laborers, and disposal.</td>
<td rowspan="3">• DPW Director at 7% LOE for operations and maintenance oversight, infrastructure improvements and impervious surface reduction, unexpected stormwater system repairs, operation oversight of toxic and hazardous materials collection program, and oversight of goose egg addling and beaver control activities;
• Town Engineer at 5% LOE and Staff Engineer/ Inspector at 20% LOE for involvement in infrastructure improvements and impervious surface reduction program;
• Highway Superintendent at 51% LOE for operations and maintenance management, infrastructure improvements and impervious surface reduction, coordination of catch basin cleaning and repair, stormwater BMP facility maintenance and inventory, management of street sweeping, erosion repair, unexpected stormwater system repairs, and oversight of goose beaver control activities;
• GIS technician at 5% LOE for tracking of toxic and hazardous materials control program;
• DPW Office Manager at 9% LOE for involvement in oversight of operations and implementation and in infrastructure improvements and impervious surface reduction program, and toxic and hazardous materials collection program;
• DPW Clerk at 22% LOE for involvement in oversight of operations and implementation, catch basin repairs, toxic and hazardous materials collection program, and infrastructure improvements and impervious surface reduction program;
• Mechanic at 15% LOE for maintenance/repair of catch basin cleaning & street sweeping equipment;
• Highway Working Foreman at 90% LOE for operations and implementation scheduling, infrastructure improvements and impervious surface reduction, catch basin repair, stormwater BMP facility maintenance and inventory, street sweeping, erosion repair, unexpected stormwater system repairs, and disconnection of inflow to the sanitary sewer system;
• Heavy Equipment Operators at 175% (1.75 full time employees) LOE for infrastructure improvements and impervious surface reduction, catch basin cleaning and repair, stormwater BMP facility maintenance, street sweeping, erosion repair, unexpected stormwater system repairs, and disconnection of inflow to the sanitary sewer system;
• Highway Maintenance Craftsman at 55% LOE for infrastructure improvements and impervious reduction program, repair of storm sewers/culverts, and disconnection of sanitary sewer inflow;
• Seasonal labor at 50% LOE for stormwater BMP facility maintenance;
• Annual average cost of $12,000 for contractor for goose egg addling & beaver control activities;
• In addition to the cost of personnel, expenses for equipment, disposal, supplies, and fuel have been included in the cost estimates for infrastructure improvements and impervious surface reduction, catch basin cleaning and repair, stormwater BMP facility maintenance, street sweeping, erosion repair, and unexpected stormwater system repairs.</td></tr>
<tr><th>Milford</th></tr>
<tr><td>• Highway Surveyor and Assistant Highway Surveyor at 7% LOE for construction, operations management, and maintenance oversight;
• Lump sum costs totaling $104,000 for culvert repairs, drain pipe and catch basin installations, toxic and hazardous waste collection program, disposal costs resulting from facility maintenance, and unexpected stormwater system repairs;
• Lump sum cost of $42,000 for subcontractor to provide annual catch basin cleaning services;
• Highway Dept. seasonal labor of five employees at 100% LOE for maintenance of stormwater BMP facilities;
• Highway Dept. cost for the street /sidewalk sweeping program and the leaf collection program are based on expenses for equipment, fuel, labor, and material disposal. Equipment expenses include replacement cost annualized based on provided initial purchase prices; cost of the compost area based on the cost of area installation; compost maintenance costs include labor and materials.
• Highway Dept. cost for on-call catch basin cleaning services is based on provided equipment, material, and disposal costs. The equipment cost includes replacement value based on equipment purchase price.
• $10,000 for illicit discharge removal.</td></tr>
</table>

4.2 Future Stormwater Program Costs

Future stormwater costs build upon existing costs and are evaluated using the same cost centers described above. In addition to existing program expenses, the future stormwater expenditures will include new services required by the draft MS4 GP and, perhaps, the optional provisions for municipal involvement in RDA GPs. Table 4.7 summarizes a number of the key requirements of the draft GPs that are beyond the current 2003 MS4 permit requirements. A more detailed list of permit requirements can be found in Appendix B, or on the EPA Region 1 website at: www.epa.gov/region1/npdes/stormwater/ma/SummaryPermitRequirements.pdf. A summary table of the major changes between the 2003 and draft 2010 permit can be found at: www.epa.gov/region1/npdes/stormwater/ma/SummaryMajorChanges2003-2010SmallMS4Permit.pdf.

Table 4.7: Major New Requirements of the 2010 Draft Massachusetts North Coastal Small MS4 General Permit for Communities in the Upper Charles River

- Update written Stormwater Management Plan;
- Increased reporting/record keeping on annual reports;
- Targeted public education (2 messages to 4 audiences) and report results;
- Illicit discharge priority catchment assessments (including SSO's);
- Detailed outfall monitoring for both dry and wet weather;
- Written IDDE program with mapping and prioritization of problem catchments;
- Complete stormwater system mapping (all pipes/manholes/inlets/structures). Catch basin inspection/cleaning/inspection data;
- Track the number of site plan reviews, inspections, enforcement actions;
- Identify/rank retrofit opportunities for municipally owned facilities;
- Develop a SWPPP for municipally owned facilities;
- Complete a code review and report;
- Conduct impervious cover/DCIA tracking;
- Street sweeping optimization;
- Written O&M procedures for municipal activities for trash, pet wastes, leaf litter control, fertilizer use & yard wastes;
- Pet waste & waterfowl management plans;
- Phosphorus Load Reduction to comply with TMDL targets, which includes
  - Development of a Phosphorus Control Plan (PCP);
  - Phosphorus control mapping of priority areas;
  - Off-site phosphorus management plan (CMPP);
  - Increased/targeted public education/ involvement related to phosphorus control
  - Public and private sector stormwater retrofits

To facilitate comparisons between current and proposed expenditures over a multi-year implementation horizon, future cost estimates were evaluated separately by operational (see Section 4.2.1) and new capital expenditures (see Section 4.2.2). Operational costs include the basic services required to fulfill the programmatic aspects of the new GPs (e.g., program administration, developing the CMPP, implementing new IDDE requirements, code review, operating the pet waste program, and street sweeping). Capital costs are specific costs associated with design, construction, and maintenance of structural stormwater retrofits to reduce phosphorus loads through implementation of parts of the PCP. Methodologies and assumptions used to derive future services costs are described below.

4.2.1 Operational Program Costs

Future program costs vary between the municipalities of Bellingham, Franklin, and Milford based on watershed size, extent of infrastructure, completeness of mapping, and level of service currently provided. The future operational costs do not reflect capital improvement projects (CIP) resulting from implementation of the PCP plan. Operational costs for future stormwater programs include:

- Ongoing services that were initiated prior to the draft GPs, already meet future requirements, and are accounted for in the current budget (e.g., semi-annual street sweeping and leaf pickup in Milford). Costs for ongoing services, are estimated to be the same as current expenditures with accrued inflation and, in some cases, with additional recordkeeping and reporting effort. It is important to note that stormwater activities that were not conducted during 2009 (Permit Yr 7) were not included in existing costs; this could have significant implications. For example, Milford and Bellingham reported no CIPs in 2009; therefore, existing and future operational costs carry no CIP expenditures other than those developed to control Phosphorus under the PCP.
- Enhanced effort above and beyond the required activities that were initiated under the 2003 MS4 permit (e.g., additional educational messages and additional stormwater infrastructure mapping). The future cost of providing enhanced services are estimated based on current expenditures plus the additional level of effort and assumed equipment/materials required to meet the new GP requirements. As an example, the 2003 MS4 permit required distribution of educational materials to the public on the impact of stormwater discharges to water bodies and actions the public can take to reduce pollutants. The draft MS4 GP expands this by requiring education and outreach on two separate occasions to four different audiences that include specific targeted messages regarding water quality and pollutants of concern. Future costs would include: expenditures to develop targeted messages and measure message effectiveness on the audience; increased LOE of personnel for administrative support; and message distribution expenses such as printing, mailing, newspaper space, or radio/television airtime.
- Completely new services presented under the draft MS4/RDA GPs (e.g., PCP, retrofitting, outfall catchment assessment and wet weather monitoring, and mapping and tracking of directly connected impervious area).

The following general assumptions were used in analysis of the future stormwater program costs across all three communities:

- Future costs are addressed individually for each of the five permit years to reflect the implementation schedules specified in the GPs.
- Year 10 cost is based on Year 5 estimated cost (in today's dollars) projected out 5 years at a 2.5% rate of inflation.
- Annual costs are shown in today's dollars and assume a 2.5% inflation rate.

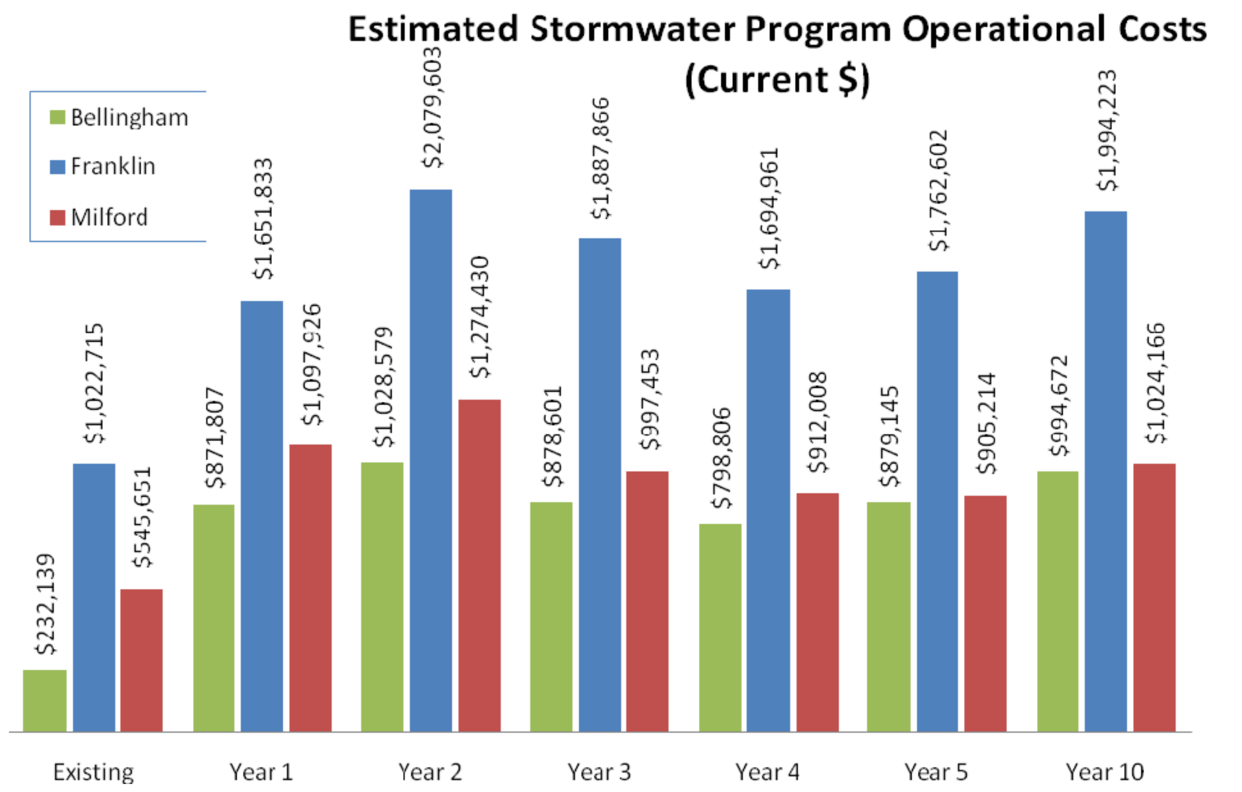
- Cost estimates based on LOE of personnel utilize current salaries provided by the towns, which were then increased by 50% to represent the burdened personnel costs. This is to account for the estimated true cost to the town for providing employees with standard benefits (e.g. health insurance and vacation time) on top of the personnel base salary. LOE is the percentage of time estimated for one full time employee (FTE) to perform a task.
- Future cost for many permitting, planning, code review, mapping (other than standard map updates), reporting, and educational program activities include the cost of an engineering or GIS consultant at $100/hr and $70/hr, respectively.
- Equipment costs were provided by the towns either as an approximate annual lump sum cost estimate, or as an initial purchase price. When the initial purchase price was used, an equivalent uniform annual cost was calculated assuming a 10-year equipment service life, which includes replacement costs. Calculations for equipment depreciation were not included.
- The annual cost of sanitary sewer improvements (i.e., inflow and infiltration and sump pump disconnection programs) are not included under the stormwater budget; however, the identification and elimination of illicit discharges to the storm sewer system are included, as is the cost for performing infrastructure improvements resulting from removal of illicit connections.
- Maintenance costs for existing BMPs and infrastructure repair are considered to be ongoing costs. Maintenance associated with new BMPs constructed under PCP are accounted for in the cost/ revenue projections provided in Section 5.
- Land acquisition costs, where applicable, are included within the estimate of capital costs for PCP implementation.
- Billing costs for possible stormwater utilities are accounted for in the cost/ revenue projections presented in Section 5.

Table 4.8 summarizes the overall annual cost of the Stormwater Programs estimated for each Town, which are illustrated in Figure 4.3.

Table 4.8: Summary of Future Annual Stormwater Program Operational Costs

Town	Future Operational Costs (2011 Dollars)				
	Year 1	Year 2	Year 3	Year 4	Year 5
Bellingham	$871,807	$1,028,579	$878,601	$798,806	$879,145
Franklin	$1,651,833	$2,079,603	$1,887,866	$1,694,961	$1,762,602
Milford	$1,097,926	$1,274,430	$997,453	$912,008	$905,214

Figure 4.2: Estimated Program Operational Costs for Each of the Three Towns



Bellingham Program Operational Costs

Cost Center	Existing	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10
Administration	$18,421	$69,373	$48,185	$34,343	$56,558	$54,785	$61,984
Regulation/ Enforcement	$1,800	$3,750	$13,500	$13,500	$13,500	$24,375	$27,578
Engineering & Master Planning	$17,000	$311,007	$419,892	$259,470	$179,245	$171,275	$193,782
Operations & Implementation	$194,918	$470,028	$469,028	$493,313	$471,528	$550,736	$623,107
Monitoring	$0	$17,650	$77,975	$77,975	$77,975	$77,975	$88,222
Total	**$232,139**	**$871,807**	**$1,028,579**	**$878,601**	**$798,806**	**$879,145**	**$994,672**

Milford Program Operational Costs

Cost Center	Existing	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10
Administration	$ 18,335	$ 75,178	$ 50,661	$ 35,498	$ 56,963	$ 57,726	$ 65,311
Regulation/ Enforcement	$ 26,250	$ 37,050	$ 42,570	$ 42,570	$ 42,570	$ 53,870	$ 60,949
Engineering & Master Planning	$ 13,100	$ 427,481	$ 546,551	$ 251,878	$ 175,328	$ 154,940	$ 175,300
Operations & Implementation	$ 487,966	$ 540,477	$ 538,847	$ 571,707	$ 541,347	$ 542,877	$ 614,216
Monitoring	$ -	$ 17,740	$ 95,801	$ 95,801	$ 95,801	$ 95,801	$ 108,390
Total	**$ 545,651**	**$1,097,926**	**$ 1,274,430**	**$ 997,453**	**$ 912,008**	**$ 905,214**	**$ 1,024,166**

Franklin Program Operational Costs

Cost Center	Existing	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10
Administration	$ 58,670	$ 136,707	$ 90,596	$ 78,502	$ 101,867	$ 99,686	$ 112,786
Regulation/ Enforcement	$ 51,396	$ 77,333	$ 97,523	$ 97,523	$ 97,523	$ 110,648	$ 125,188
Engineering & Master Planning	$ 152,671	$ 367,649	$ 687,381	$ 447,246	$ 264,996	$ 334,683	$ 378,663
Operations & Implementation	$ 759,978	$1,043,747	$ 1,047,202	$ 1,082,267	$1,048,247	$1,060,685	$ 1,200,068
Monitoring	$ -	$ 26,398	$ 156,900	$ 182,328	$ 182,328	$ 156,900	$ 177,518
Total	**$ 1,022,715**	**$1,651,833**	**$ 2,079,603**	**$ 1,887,866**	**$1,694,961**	**$1,762,602**	**$ 1,994,223**

Detailed budget spreadsheets located in Appendix D provide itemized descriptions of future activities for each town, cost assumptions, and estimates of LOE and annual costs. Table 4.9 summarizes the uniform cost assumptions (i.e., unit costs and implementation timeframe) applied across all three towns as new and enhanced services under each of the five major cost centers. Town-specific assumptions used to derive future program costs include:

<u>Administration</u>

- Milford and Franklin will continue to utilize the services of an outside engineering consultant for preparation of the NPDES MS4 Annual reports, staff training, and public education programs. Bellingham will continue to produce the NPDES MS4 annual report in-house.
- All three towns will enlist consulting engineering services for submittal of the NOI and SWMP, and for development of public education messaging, program evaluation, and staff training. Costs for each town will vary based on number of residents and extent of commercial/industrial districts, and based on best outreach methods described by each town. Consultant services will also be utilized in all towns starting in Year 5 for recordkeeping and tracking of CMPP program progress updating.

<u>Regulations and Enforcement</u>

- The cost of plan review for private development and redevelopment projects is assumed to be borne by the developer. Bellingham and Milford require all inspection costs also to be borne by the developer. The cost for reviewing town projects in Bellingham and Milford is included in this category. Similar to Bellingham and Milford, Franklin only performs plan reviews and ESC inspections for town projects, however, the town performs inspections of all stormwater systems regardless of whether the projects are private or public.
- IDDE and dry-weather monitoring costs are based on number of outfalls within each town: Bellingham has 240, Franklin has 501, and Milford has 303. It is assumed that 10% of outfalls are found to have dry-weather flow (sampling cost included in monitoring category) caused by an illicit discharge. Costs include the identification of the discharge source from the outfall to manhole to the illicit connection as performed by municipal staff using smoke/dye testing when the connection is not visually obvious. When these methods are not effective, outside consultants are hired to conduct more advanced identification procedures. Costs for actually eliminating the discharge are assumed to be borne by the property owner or sanitary authority.

Table 4.9. Cost Assumptions and Implementation Timeframe for New and Enhanced Services

Major Cost Centers	Key Cost Assumptions for New or Enhanced Services
Administration	• 50% annual increase from existing LOE for annual stormwater program administration to account for costs resulting from permit administration, recordkeeping, and reporting; • $5,000 more for legal review of regulatory changes in Yr 2 and 5; • 50% increase from existing for annual inter-agency coordination and participation in meetings; • 50% increase from existing LOE to meet twice a year for inter-municipal and emergency response coordination; • Range of $36,000 to $55,000 depending on complexity of municipality to prepare NOI and SWMP in Yr 1, Yr 4 incorporate PCP plan into SWMP at cost of $16,000 to $25,000. Generally, cost estimates are based on size of MS4, with higher costs resulting from greater amount of infrastructure and area for management activities; • 100% increase in LOE from existing for draft MS4 GP annual reporting; • At least 200% increase from existing program; annual educational program estimates include cost for printing and mailing materials to targeted audiences (cost varies between town based on number of residential and commercial properties), and cost for newspaper and television advertisement; distribute at least two messages to four different audiences, measure & report message effectiveness; • 200% to 300% increase from existing cost based on level of existing effort reported for annual public involvement (i.e., 2 public meetings, update website w/annual report & events, river clean-up day, storm drain stencil, rain barrel workshop); • $4,000 increase from existing for MS4 and SPCC annual training of staff on stormwater management plan, IDDE awareness and protocol, and facility good housekeeping measures; and • $9,000 annual CMPP recordkeeping, data tracking and correspondence with regulated entities for updating program progress under "Water Quality" starting in Yr 5 for municipality program.
Regulation/ Enforcement	• 2% additional LOE for MS4 Stormwater permitting/oversight of estimated 3 new project permits annually; • $11,000 annually starting in Yr 5 for RDA/CMPP compliance inspections of retrofit facilities, GIS consultant to update mapping;* • 25% increase in LOE for inspection of new or improved drainage systems; • Identification of IDDE sources, assume 10% of outfalls have illicit discharge (sampling included in dry-weather monitoring category). Estimate cost to identify source at $1200 per illicit; Assume removal costs are borne by property owner or sewer authority; cost includes coordination/ oversight of enforcement activity;* • 50% increase in ESC Inspections for permit compliance due to increased maintenance and construction projects; and • 5% LOE each for field inspection and recordkeeping, $5,000 for coordination/ update of GIS mapping for CMPP facility compliance begin in Yr 5, occurs annually.*

Major Cost Centers	Key Cost Assumptions for New or Enhanced Services
Engineering and Master Planning	• PCP development cost range $310,000 to $356,000 total to develop PCP through year four (range based on existing watershed planning efforts and estimate of future watershed planning needs), year five development of CIP based on PCP and existing infrastructure needs, GIS update of new BMPs and resulting TP reductions begin YR 5 cost $1,500;* • Update IDDE plan in Yr 1, $17,000 to $34,000, $60/catchment for delineation and prioritization as required by draft MS4 GP for IDDE program and update of written plan; Yr 2 update mapping based on mapping changes additional $5,000, Yr 5 consultant cost for detailed report of removals and 1% LOE for coordination and review; * • $5,000 to $10,000 in Yr 1 for preparation of Catch basin Inventory Plan (CBIP) and Street sweeping optimization, including GIS mapping exercise, and 2% LOE for review and coordination in years 1, 2 and 3 include additional field crew personnel to perform street sweeping and catch basin cleaning data collection and recordkeeping as well coordinate with GIS consultant or technician;* • Waterfowl and Pet Waste Management Program in Yr 1 is $11,000 for consultant services for written plan, assume 1% LOE and inter-department coordination in each town for program planning, oversight, and coordination occurring annually beginning Yr 2;* • 2% LOE annually for inter-department coordination to implement fertilizer optimization program begin Yr 1;* • $8,800 average cost for development of Spill Response and Cleanup Program Yr 2; 2% LOE for tracking/ recordkeeping annually beginning Yr 3, update every 3 years; • $4,700 technical Groundwater and Drinking Water Program Review and 2% LOE for review (Yr 1), 2% LOE annually for incorporation into SW program; • 25% increase in annual LOE Highway Dept./ DPW project design/engineering/permitting in Yr 1 (2 projects/yr), 50% increase in Yr 5 (implementation of PCP projects); • SWPPP development for Transfer Station &Highway Dept. facilities range from $11,600 to $17,500 (Yr 1), assume 25% of town facilities in Bellingham and Milford require SWPPP $2,500/ facility and two facilities in Franklin at $3,000/ facility; 2% LOE for annual site inspection begin (Yr 2); Yr 5 assume$2500/ facility SWPPP update; • 25% increase in annual LOE in maintenance and field engineering support in YR 1, 50% increase in projects for Yr 5; • Assumed range of $259,000 to $484,000 ($484,000 for Milford which is currently not already engaged in GIS mapping efforts) in comprehensive drainage mapping by Yr 2; $34,000 average cost for annual updates; $5,500 included as part of annual update cost for IC reduction/PCP implementation tracking in Yr 5;* • $44,000 to $84,000 included for mapping to incorporate sewer/ septic locations and attributes (based on number of miles of sewer main and estimated number of septic systems) into GIS system per draft MS4 GP IDDE program mapping in Yr 1. Annual cost in following Years to address mapping updates; • 1% LOE annually for administration and planning management for calls related to illicit discharge and flood complaints; • $32,000 average cost for code review/update and zoning support as needed by Yr 2, include report on local regulations affecting impervious areas by, $19,000 to report on feasibility of LID in Years 3, 4, and 5, assume consultant cost and town personnel LOE for code compliance support average $8,500;* • $27,000 average allowance in Yr 5 for specific areas of concern identified through Hazard Mitigation Planning and Flood Insurance Updates; and • $20,000 allowance in Years 2, 3, and 4, for planning and development of municipal CMPP program.

Major Cost Centers	Key Cost Assumptions for New or Enhanced Services
Operations and Implementation	• 50% increase in O&M management in Yr 1, LOE due to new projects and tracking of results (measurable goals) for each activity, Additional 1% increase of LOE in Yr 5 for oversight of implementation and construction of BMP's for PCP; • IDDE removal in Years 2 through 5 costs assume $19,000 for infrastructure repairs related to IDDE removals, the cost for removal of Illicit discharge/ connection is borne by owner; • Storm Sewer and Culvert Maintenance/Repair includes a 25% increase due to degraded infrastructure • Inlet, Catch Basin, and Manhole Cleaning Inspect all catch basins and manholes each year and clean as needed, clean basins when sump 50% full, document infrastructure status, increased cost to programs not inspecting all catch basins annually is assumed to be $55/ catch basin annually; • Stormwater BMP facility maintenance continue existing effort for cleaning and maintenance of BMP's, Yr 5 includes a 5% increase in maintenance LOE due to aging infrastructure; • Street , parking, and sidewalk Sweeping program to increase to sweep all streets and municipal directly connected impervious parking two times per year, assume cost is increased from existing by 0% in Milford, 75% in Franklin, and 100% in Bellingham to meet requirement; • Organic waste and leaf litter collection program begins in Yr 5, Continue leaf collection program in Milford and Franklin (an existing activity), Yr 5 cost in Bellingham is approximately $400/ curb mile based on current operations in Milford* • Maintenance/Repair/ Installation of ESC practices , allowance of $7,000 in Bellingham and Milford, Franklin continue existing activity; • Stream Restoration/Stabilization Allowance to address one stream project every 3 years, occurs in Yr 3, allowance of $20,000 to $35,000; • Waterfowl and Pet Waste Management Programs include installation of waterfowl education signs at congregation areas by Yr 2; install pet waste stations at key areas of concern by Yr 3, maintain programs after Yr 4; implement waterfowl deterrents by Yr 4. Assume allowance in Bellingham and Milford for costs during Years 1 through 3 is $12,500 annually, and $6,500 annually to maintain programs beginning in Yr 4. Franklin's management programs costs are based on the existing program, the projected future program costs in Years 1 through 3 average $18,500 annually and $22,000 beginning in Yr 4;* • Public Assistance Program Continue creating public awareness, encourage disconnection of impervious areas, and awareness of illicit discharges 2% LOE each for program coordination and implementation; • Hazardous/toxic materials collection program continue existing activity and report annually; and • Annual emergency drainage repairs allowance continue existing practices Years 1-5 cost range $12,000 to $63,000, a 50% increase from existing based increased inspection frequency and age of infrastructure.
Monitoring	• Average cost of $610/ outfall for dry weather monitoring and catchment assessment by consultant field crew including LOE for coordination and oversight Years 2 through 5; Assess 50% of catchments include key junction manhole inspections by Yr 3, 100% by Yr 5;* • Cost of $830/outfall for wet weather monitoring including LOE for program oversight, coordination, and recordkeeping Years 2 through 5. • Develop Monitoring Plan in Yr 1 estimated average plan cost $17,000 prepared by consultant (Bellingham and Milford); sample 25% of outfalls each year beginning in Yr 2, assume 20% of outfalls excluded per monitoring plan.
* New requirement per draft MS4 GP	

Engineering and Master Planning

- A large portion of stormwater master planning costs are associated with the development of the PCP that involves developing a watershed management plan and development of a CIP, which is estimated based on the size of the watershed within each jurisdiction.
- Stormwater infrastructure mapping effort cost estimates vary greatly between the towns. Franklin has an ongoing stormwater infrastructure mapping effort with a town GIS system in place that is continually updated; the estimated cost for updating stormwater infrastructure mapping to meet the draft MS4 GP is $279,000. Bellingham has mapped outfalls and updates some stormwater infrastructure annually in an established town GIS system; the estimated cost for mapping in the first two years to meet the draft MS4 GP is $255,000. Milford has only mapped outfalls and does not have a GIS mapping system established; the estimated cost in the first two years for Milford to meet the draft MS4 GP mapping requirements is $484,000, including expanding a mapping program as part of the master planning and IDDE planning program. Costs provided for meeting program data collection and mapping requirements per the draft MS4 GP are based on estimated engineering consultant and GIS consultant mapping costs. Completion of this task has been assumed to occur within the first two permit years to facilitate the use of the mapping in work required as part of the IDDE program planning (catchment delineation and outfall prioritization) and the PCP plan (town watershed planning). Additional costs are included after the first two years for mapping updates based on field verification and new projects. The LOE for planning and coordination with subcontractors is also included in this sub-category.
- CBIP and street sweeping optimization tasks are based on the number of catch basins and the length of streets. For each town, these were determined from the MS4 GP and existing GIS data (see Table 2.7).
- The future cost for IDDE plan updates includes time for a consultant engineer to review the existing plan and update it with a written IDDE plan per the draft MS4 GP by the end of Year 1. Consultant time is included in Years 1 and 2 for delineation of outfall catchments and prioritization of outfalls based on illicit discharge potential. The assumed cost for a GIS consultant to delineate and prioritize outfall catchments is derived from the assumption that 20% of the catchment can be excluded per the exclusion criteria specified in the draft MS4 GP. Catchments from the remaining 80% of the outfalls are to be delineated by the GIS consultant at a rate of approximately 20 outfalls per eight hour day.
- Bellingham and Milford include time to coordinate with groundwater and drinking water programs; Franklin considers these costs under the Water Department.
- All three towns will continue to install or repair stormwater infrastructure components as part of the future program. The cost of consulting engineers assisting with design, permitting, and field maintenance costs have been included for Bellingham, while engineering services for Franklin and Milford are included based on the LOE of each of the Towns' Engineering Departments. Estimates include an increase in existing workload of 25% during Years 1 through 4 for DPW for project design and permitting

assistance. Year 5 includes a 50% increase in cost due to increased needs, projects resulting from increased infrastructure inspection and age. Maintenance and field engineering support for infrastructure repair is assumed to increase from existing cost by 25% in Years 1- 4 and 100% after Year 5 as infrastructure already in place continues to age.

- SWPPP development is required for municipal facilities in Year 1. To establish an estimate for this cost, it is assumed that 25% of town owned facilities require a SWPPP; the cost for a consultant to prepare a SWPPP is $2,500. The number of facilities has been estimated from the town assessor records for both Bellingham and Milford. The following is assumed: Bellingham has seven and Milford has five potential sites requiring a SWPPP. Franklin has two facilities that will require SWPPPs. SWPPP facilities are required to be inspected annually with inspection results included in the NPDES annual report. The cost for Years 2 through 5 assumes that the inspection is performed by the facility manager and results will be reported to the stormwater program director for inclusion in the annual report. Costs for this are based on a LOE by town personnel to perform inspections and stormwater program director to perform recordkeeping of results and reporting in annual report.
- Sewer/ septic system mapping efforts are included beginning in Year 2. Estimates are based on the reported number of miles of sewer main and the percent of the population utilizing septic systems. Cost is estimated based on the assumption that it will take a GIS consultant eight hours to map one mile of sewer main. Milford reports 60 miles and Franklin reports 137 miles of sewer main in town. Bellingham reports that 75% of the community utilizes on-site septic systems, and the cost to update mapping with on-site septic system information includes consultant time for data collection and insertion into the map. All estimates also include LOE for coordination with the sewer department or board of health, and consultant time to address data gaps.
- Groundwater and drinking water program planning is assumed to be performed by the Water Department in Franklin; the cost of similar programs in Bellingham and Milford are included in this cost estimate.
- Public assistance future program costs have been assumed in Franklin based on existing program costs and the assumption of a 50% increase in calls beginning in Year 1. This is a new program cost for both Bellingham and Milford, and the estimated cost includes LOE for responding to calls related to flooding and illicit discharges.

<u>Operations and Maintenance</u>

- Operations and maintenance includes costs associated with personnel in the Department of Public Works (in Bellingham and Franklin) or Highway department (in Milford) and the LOE required for overseeing the completion of annual operations and maintenance programs for the stormwater program and construction projects for infrastructure improvement and repair.
- Inlet catch basin and manhole cleaning future costs for Franklin and Bellingham are estimated based on the existing cost reported by Franklin to perform this service utilizing town staff and equipment. The existing cost reported by Franklin for labor,

equipment, fuel, and disposal is $55 per catch basin. Bellingham has approximately 2,050 catch basins that will need to be cleaned to meet the draft MS4 GP requirements. To date Bellingham cleans 158 of its 2,050 total catch basins. The cost currently reported by Bellingham results in a higher estimated cost per catch basin than that of Franklin to have this service performed by the town DPW staff and equipment. Because Bellingham is currently addressing catch basin cleaning on an as needed basis, an assumption has been made that when the municipality addresses cleaning all basins each year as required by the permit, they will use a more economical method similar to Franklin and Milford that will bring the unit cost down. Therefore, Bellingham future costs are estimated utilizing a per catch basin value equivalent to Franklin. Milford reports that all basins (3,368) are inspected and cleaned annually by a subcontractor and catch basins or manholes that need additional attention during the year are cleaned by Milford Highway Department staff as needed. Future cost of catch basin inspection and cleaning in Milford will remain the same, as this effort meets future permit requirements. Additional management costs are included for the three towns for Highway Department and DPW coordination and annual reporting.

- Under the SWPPPs for the Transfer Station & Highway Department Facility, existing activities will continue in Milford. The existing cost for this activity is unknown in both Bellingham and Franklin; therefore, it is not included as a future cost.
- BMP maintenance costs are assumed to remain the same as existing costs for Years 1-4. In Year 5, maintenance costs are projected to increase by 5% as a result of increased inspections and aged infrastructure of existing facilities. It has been assumed that BMPs requiring major maintenance will be retrofitted as part of the PCP CIP.
- Street sweeping programs are performed annually in all of the towns by either the DPW or the Highway Department. Mass DOT reported that Bellingham, Franklin, and Milford each have 96, 170, and 123 centerline road miles, respectively. Bellingham reported cleaning all roads at least once per year and Franklin reported sweeping all streets once, downtown streets a second time, and parking areas annually. Milford reported sweeping all streets and municipal parking areas twice per year and sidewalks once per year. The cost for future street sweeping programs meeting the draft MS4 GP are based on the existing cost per mile adjusted to reflect the increased sweeping requirements of the draft MS4 GP (sweep streets and directly connected municipal impervious parking areas two times per year). The cost for sweeping in Bellingham and Franklin will increase to meet the draft MS4 GP requirements; the resulting increase is 100% in Bellingham and 75% in Franklin. Estimation of the cost to sweep the additional directly connected parking areas in Bellingham is based on the assumption that 80% of municipal parking areas need sweeping at a cost of $400 per parking area annually.
- Leaf collection in Bellingham will begin in Year 5 as part of the PCP implementation program. Milford and Franklin both provide leaf collection services as part of their existing stormwater program. It has been assumed that both Franklin and Milford will continue to provide this service. Cost assumptions for providing this service in Bellingham are based on the cost reported by Milford at $400 per curb-mile for equipment, fuel, labor, and composting.

- The waterfowl and pet waste management subcategory includes additional cost for the continuation of beaver control and goose egg addling programs in Franklin.

<u>Monitoring</u>

- It is assumed that the following number of outfalls (as reported in 2010 MS4 NPDES annual report) are located in each town: 240 outfalls in Bellingham, 501 outfalls in Franklin, and 303 outfalls in Milford.
- Dry-weather monitoring and outfall inspections for the IDDE program are performed simultaneously beginning in Year 2 with 25% of outfalls and catchments assessed during that Year, and each Year after until 100% of outfalls have been monitored. Dry-weather flow is assumed to be found and sampled at 20% of outfalls by a consultant engineer/ sub-contractor, and 50% of samples are assumed to be positive for illicit discharge markers.
- It is assumed that 10% of catch basins result in a key junction manhole that requires inspection as part of the dry-weather monitoring program and catchment assessment. Inlet pipes of key junction manholes requiring inspection are inspected and dammed in advance by town personnel, and follow up inspection (on two occasions 48 hours apart) and sampling (as needed) is performed by a consultant field crew at a rate of eight sites per day. The cost of police road detail to facilitate inspections is $400 per day. A consultant engineer will review and report on the results of sampling.
- Wet-weather outfall monitoring is performed by an engineering consultant field crew at a rate of five outfalls per qualifying storm event; sample results are reviewed and reported on by a consultant engineer.
- It is assumed that 20% of outfalls meet exemption criteria in the draft permit and can be excluded from wet-weather monitoring program. The remaining 80% of outfalls are monitored 25% at a time beginning Year 2 with completion of the monitoring program in Year 5.
- The Town of Franklin wet-weather monitoring plan development is included in the stormwater master planning cost category. In addition, the Town of Franklin requested that an allowance be included for surface water monitoring as they anticipate that this will be part of the monitoring plan. An allowance of $25,000 has been included in Years 3 and 4 for monitoring of waterbodies at seven key locations on four occasions.

4.2.2 Phosphorus Control Capital Costs for Implementation of Structural BMPs

This section presents planning-level estimated costs for the design, permitting, and construction of structural control measures to achieve TMDL total phosphorus reduction targets in each of the three towns. According to the TMDL WLA requirements, each municipality must achieve a significant reduction in total phosphorus loading, which ranges across the three communities as a function of existing loading. Table 4.10 lists the required load reduction percentage for each municipality. This analysis assumes that 15% of the TMDL target values are achieved through non-structural control measures; therefore, the capital costs presented here are for the implementation of stormwater BMPs to meet total phosphorus reductions of 37% in both Bellingham and Franklin, and 42% in Milford. Costs for long-term BMP maintenance as well as non-structural measures are accounted for elsewhere (see Sections 6 and 4.2.3, respectively).

A number of alternative approaches were used to estimate and compare the potential capital costs for each municipality to comply with the total phosphorus reduction targets specified in the TMDL, including: 1) scaling-up of costs from a recently completed watershed plan for the Spruce Pond Brook in Franklin, MA; 2) the application of results from a GIS-based spreadsheet model to size and cost-out hypothetical, structural BMPs as a function of watershed land cover and treatment volume; and 3) a comparison of stormwater retrofit implementation costs per impervious acre treated from a number of other studies from New England and the Mid-Atlantic. This section provides supporting information and documentation on the results of each of these assessments and the recommended capital costs to use as a basis for evaluating the utility rate structure presented in Section 6 of this report.

Table 4.10: Phosphorus Load Reductions Required (Charles River Watershed)

Town	Area (ac)	IA (ac)	Existing load (lbs/yr)	TMDL Allowable Load (lbs/yr)	TMDL Required Load Reduction (lbs/yr)	% Load Reduction		
						Total Required	Assumed met with Non-structural BMPs	Assumed met with Structural BMPs
Bellingham	6,122	922	2,132	1,028	1,104	**51.8**	**15**	**36.8**
Franklin	15,546	2,401	5,428	2,600	2,828	**52.1**	**15**	**37.1**
Milford	8,112	1,741	3,851	1,656	2,195	**57.0**	**15**	**42**
Sources: Impervious areas and loads from EPA spreadsheet derived from TMDL (Voorhees, 2011); areas for each town are from MassGIS shapefile for Charles River Watershed (2011)								

4.2.2.1 Derived Capital Costs Using the Spruce Pond Brook Subwatershed, Franklin, MA

The primary approach used to estimate capital costs involved the scaling-up of results from a detailed assessment in 2010 by the Charles River Watershed Association (CRWA) of the costs and feasibility to implement structural stormwater controls to achieve comparable phosphorus reductions in the Spruce Pond Brook subwatershed, a 1.1 square mile subwatershed to the Charles River in Franklin, MA. In CRWA's analysis, field investigations were used to identify potential sites by evaluating 51 catchments, size a range of treatment practices in accordance with the MA Stormwater Management Standards, estimate phosphorus removal loads (based on Tetra Tech, 2008, revised 2010), and estimate capital construction costs. Capital construction costs were estimated as the product of water quality treatment volume multiplied by the unit costs for treatment. Unit costs were derived from a range of sources, including published data from Tetra Tech (2009), the Center for Watershed Protection (CWP, 2009), and average construction bid results for more than a dozen capital projects recently constructed in eastern MA. CRWA applied cost multipliers to account for the nature of the project (i.e. whether the retrofit required a simple outlet modification to an existing detention basin, installation of a new facility in a relatively undeveloped area, or construction of a new facility in a partially or completely developed area). CRWA's assessment included the costs of land acquisition where a facility was proposed on private lands, but did not include costs associated with design, permitting, construction administration, or maintenance. Land acquisition costs were derived based on review of local real estate assessment values under the assumption that the municipality would have pay fair market value for either an easement on the property or outright fee simple acquisition. Because design, permitting and construction administration was not included in the CRWA assessment, a 35% adjustment factor was added to the cost estimates for the Spruce Pond Brook subwatershed.

CRWA completed two separate evaluations to derive the estimated cost of implementation of control measures. The first evaluation involved an on-the-ground retrofit inventory and site assessment where control practices were selected in 28 of the 51 catchments and sized based on the physical constraints of the project site (see Figure 4.4). The second evaluation involved the application of a cost optimization model that was set to minimize cost by varying the size of the treatment storm and application of practices across more than 40 of the 51 catchments. This second "optimization" method resulted in a significant hypothetical savings of over 35% in comparison with the on-the-ground retrofit inventory method if all the 40 catchments proved to be viable locations for construction and maintenance of structural controls. However, since the feasibility of these hypothetical practices was not field verified, the team elected to use the more conservative results from the initial cost evaluation in the upper Charles River watershed-wide assessment. CRWA concluded that the cost to remove **43.1%** of the phosphorus in the Spruce Pond Brook subwatershed would cost **$ 4.92M** at a unit cost of approximately **$31,700/lb TP** removed, or **$28,070/impervious acre**.

Using the results of Spruce Pond Brook assessment to estimate costs for application in the three Upper Charles River communities, the following analysis was conducted:

Step 1: The Spruce Pond Brook implementation costs were adjusted to match the required target removals (using $31,700/lb removed) for each town (i.e., 37% and 42% P reduction). The 35% contingency was added to the estimated capital costs to account for design, permitting, and construction administration. The resulting values are:

- Bellingham and Franklin: Cost to remove 37% P = $5.73M (each)
- Milford: Cost to remove 42% P = $6.48M

Step 2: Management units were created based on the distribution of land use and soil types within the Spruce Pond Brook subwatershed. Each was assigned a unit costs per impervious acre (IA), which were then calibrated against the total treatment costs of $5.73M and $6.48M for target TP removal in the three towns of 37% and 42%, respectively (see Table 4.11). To evaluate the validity of this scaling, the land use distribution from the Spruce Pond Brook subwatershed was then compared with that of total watershed area of the three municipalities, and unit treatment costs were compared with unit costs for stormwater treatment/impervious acre from other studies, assessments, and actual retrofit implementation projects (Table 4.12).

The land use distribution of Spruce Pond Brook is similar to that of the Upper Charles River as a whole, with the exception of the relative amount of medium density residential and forest cover. The amount of medium density residential land use is significantly higher in Spruce Pond

Brook than in the Upper Charles River as a whole and contains reasonably high unit costs; forest cover on the other hand has a significantly higher area in the Upper Charles River and contains no implementation costs. Consequently, the application of the unit costs from Table 4.11 should be viewed as containing some potential variability. Because unit costs were calibrated against the total estimated cost of implementation, the higher medium density residential land use area in Spruce Pond would mean these unit cost values are potentially overemphasized and other land use unit costs deemphasized, thus introducing some potential error. This being said, the method provides a reasonable estimate for the capital costs for implementation of structural stormwater control measures and offers, in our opinion, the best estimate of probable costs for implementation of structural controls.

Table 4.11: Management Unit Treatment Costs for Target Phosphorus Removal

Management Unit (Land Use and Soil Type)	Cost per IA for 37% TP Removal	Cost per IA for 42% TP Removal
Agriculture A/B[1]	$11,000	$14,000
Agriculture C/U[1]	$19,000	$22,000
Commercial A/B	$49,000	$56,000
Commercial C/U	$74,000	$81,000
Freeway A/B	$20,000	$24,000
Freeway C/U	$30,000	$36,000
Industrial A/B	$34,000	$41,000
Industrial C/U	$54,000	$60,000
High Density Res A/B	$74,000	$80,000
High Density Res C/U	$128,000	$135,000
Medium Density Res A/B	$24,000	$30,000
Medium Density Res C/U	$46,000	$51,000
Low Density Res A/B	$20,000	$24,000
Low Density Res C/U	$30,000	$36,000

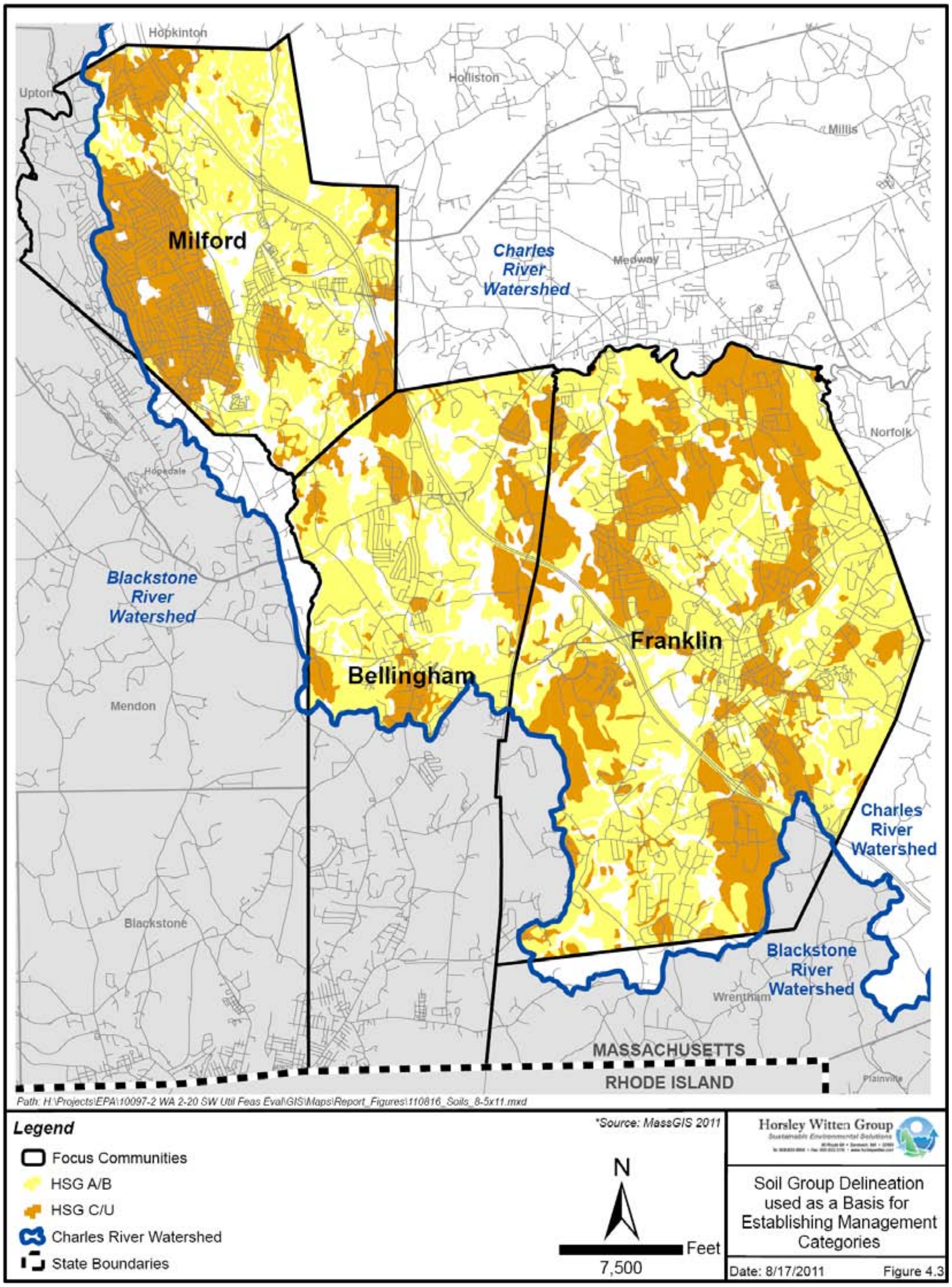
[1] Unit price for Ag lands reflects management of impervious surfaces and not phosphorus loading to crop lands.

Table 4.12: Comparison of Land Use Distribution between Spruce Pond Brook and Three Upper Charles River Municipalities

Land Use	Spruce Pond Brook	Upper Charles River Towns (3 Municipalities)
Agriculture	0.8%	1.7%
Forest	36.9%	56.4%
Open Land	8.8%	1.4%
Commercial	6.1%	4.1%
Freeway	2.4%	2.1%
Industrial	3.0%	4.2%
High Density Res	7.0%	4.2%
Medium Density Res	32.1%	16.5%
Low Density Res	10.9%	7.9%

Step 3. MassGIS land use and soil data for the total area of each town was used to generate management units for the three Upper Charles River watershed communities. The same unit costs derived in Table 4.11 were applied as initial estimates of probable future costs to implement structural controls within each community. The distribution of land use and soil types across the three municipalities is illustrated in Figures 2.7-2.9 and 4.3. Table 4.13 lists the areas of each Management Unit for each municipality and the resulting initial estimate of the implementation cost, in current dollars.

Figure 4.3: Soil Group Delineation Used as Basis for Establishing Management Categories



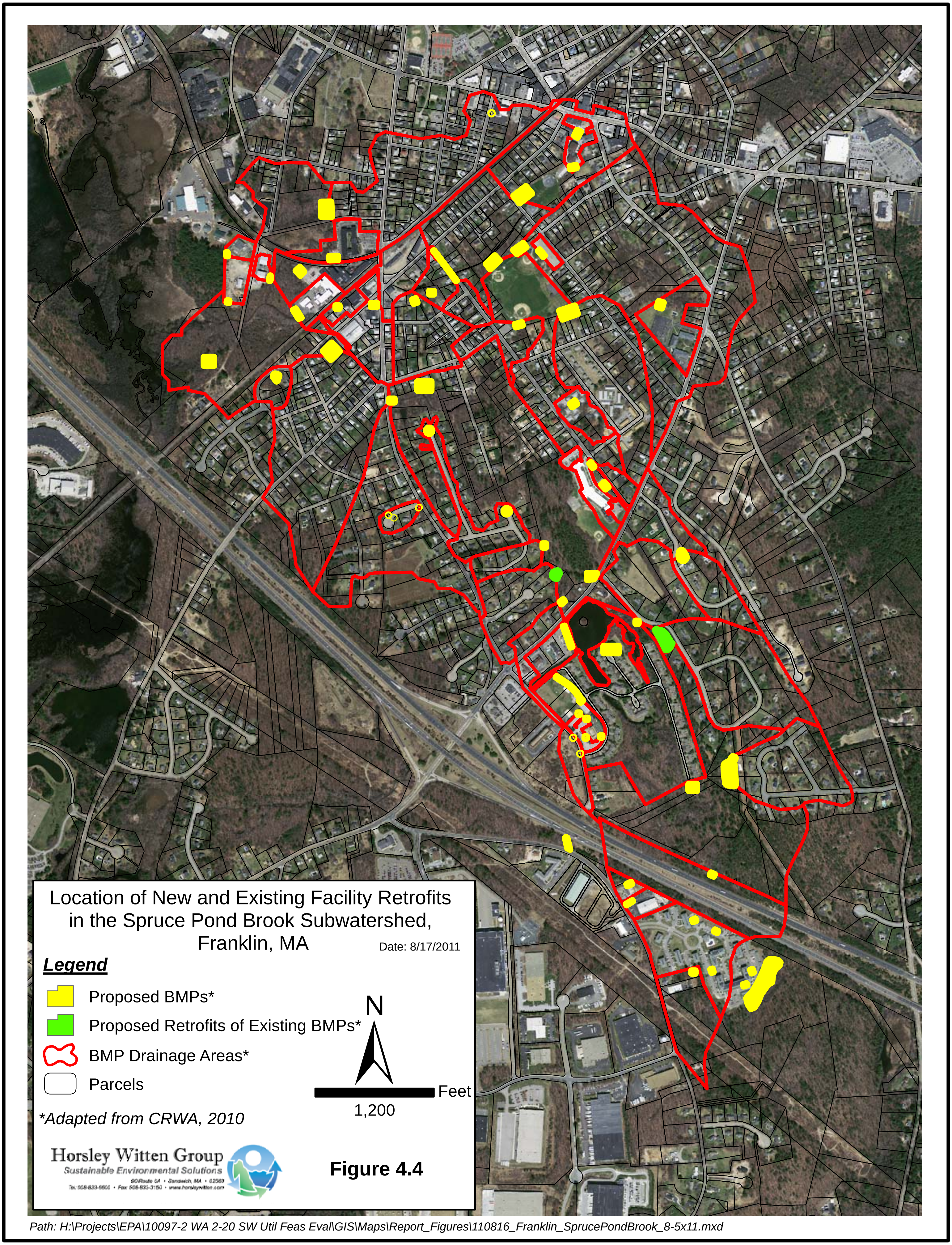


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Table 4.13: Distribution of Management Unit Area and Structural BMP Initial Implementation Costs (in current $) for Bellingham, Franklin and Milford, MA

Mgmt Unit	Bellingham			Franklin			Milford		
	Unit Cost 37% TP Red. (x1,000)	**IA** (acres)	**Cost to Implement** (x1,000)	**Unit Cost 37% TP Red.** (x1,000)	**IA** (acres)	**Cost to Implement** (x1,000)	**Unit Cost 42% TP Red.** (x1,000)	**IA** (acres)	**Cost to Implement** (x1,000)
Ag A/B	$11	2.4	$26	$11	15.3	$168	$14	0.2	$3
Ag C/U	$19	1.4	$28	$19	9.2	$176	$22	0.9	$20
Com A/B	$49	137.3	$6,729	$49	162.2	$7,948	$56	238.8	$13,372
Com C/U	$74	25.9	$1,915	$74	128.1	$9,476	$81	129.7	$10,503
Freeway A/B	$20	53.5	$1,070	$20	119.6	$2,392	$24	68.5	$1,644
Freeway C/U	$30	1.8	$55	$30	23.3	$700	$36	13.9	$502
Ind A/B	$34	150.6	$5,122	$34	183.9	$6,252	$41	186.3	$7,638
Ind C/U	$54	39.8	$2,147	$54	259.4	$14,006	$60	46.8	$2,807
High Density Res A/B	$74	91.3	$6,758	$74	66.7	$4,938	$80	40.2	$3,214
High Density Res C/U	$128	25.2	$3,290	$128	60.4	$7,729	$135	210.6	$28,427
Medium Density Res A/B	$24	91.8	$2,202	$24	479.6	$11,510	$30	143.5	$4,304
Medium Density Res C/U	$46	22.1	$1,018	$46	279.6	$12,860	$51	308.3	$15,722
Low Density Res A/B	$20	61.1	$1,222	$20	259.3	$5,187	$24	70.0	$1,680
Low Density Res C/U	$30	24.4	$731	$30	79.5	$2,384	$36	41.7	$1,500
Totals		729.2	**$32,313**		2,126.0	**$85,726**		1,499.2	**$91,336**

Step 4. Next, implementation costs were adjusted as a function of the number of existing stormwater management practices. Prior studies have clearly shown that retrofitting is more cost-effective for practices that manage larger drainage areas, and that the cost to retrofit an existing detention structure versus installing new facilities in existing developed areas is significantly cheaper. CRWA estimated that approximately 7% of proposed BMPs in Spruce Pond Brook involved the moderately-priced conversion of outlet controls within existing BMPs to achieve significant phosphorus reduction at 10% or less of the cost of new retrofit facilities. Thus, the ratio of existing storage BMPs to total area within a watershed provides a reasonable

mechanism to adjust estimated costs based on the presence of existing stormwater controls in the watershed. GIS data coupled with information provided by each municipality were used to estimate the total number of existing BMPs in the watershed. The relative savings associated with the existing stormwater practices estimated in the Spruce Pond Brook study were used to derive the potential cost savings in each community. Table 4.14 presents the results of this assessment and the corresponding estimated implementation costs for structural controls.

Table 4.14: Adjusted Capital Costs for Structural Stormwater Control Measures to Achieve Compliance with Phosphorus Load Reductions

Location	TP Load Red.	Area (ac)	# of Exist. BMPs	BMP/Total Area Ratio (R)	Cost Factor (C)	Initial Implementation Cost (Millions)	Cost Savings (Millions)	Final Implementation Cost (Millions)
Spruce Pond Brook	43.1%	692.9	2	2.9×10^{-3}	0	$4.9	$0	$4.9
Bellingham	37%	6,122	55	9.0×10^{-3}	0.08	$32.3	$2.6	**$29.7**
Franklin	37%	15,546	196	12.6×10^{-3}	0.13	$85.7	$11.1	**$74.6**
Milford	42%	8,112	125	15.4×10^{-3}	0.17	$91.3	$15.5	**$75.8**

Cost Savings is the product of the Cost Factor (C) times the Initial Implementation Cost as follows:
Cost Factor (C)= $c^* [(R_{Town}/R_{Spruce\ Pond}) - 1)]$

Where

c = 3.9% (the cost savings associated with 2 existing BMPs out of 28 retrofit sites in Spruce Pond Brook)

R = # of BMPs/Total Area (ac)

4.2.2.2 Derived Capital Costs Using a GIS-based Spreadsheet Model

The costs presented in Section 4.2.2.1 for the implementation of capital stormwater controls rely on the level of detail and analysis of the pilot subwatershed assessment of the Spruce Pond Brook. While this is viewed as a very good local example, a separate cost analysis was also conducted by EPA (with project team input and comment) as a gage for establishing the reasonableness of the costs for compliance with the TMDL. This second method built on the Optimization Study completed by Tetra Tech, Inc. in 2009. Similar to the Spruce Pond Brook evaluation, EPA looked at a range of treatment strategies where practices would be installed to manage varying levels of watershed impervious cover from 65% up to 100% within each municipality.

This method, described in more detail in Appendix E, uses MassGIS data for loading and constraint information (e.g., land use, soils, slopes, water table/bedrock depth), and a spreadsheet-based model to calculate the required treatment storage volumes for a range of structural controls sized to remove phosphorus levels to those required in the TMDL. The model calculates the required target load reductions from pervious and impervious areas as a function of treatment volume and practice type. The model then multiplies the required treatment volume by a unit cost for IA treatment to derive the total estimated costs. Unit treatment costs for each BMP were derived from literature sources and the project team's collective experience with implementation of structural stormwater controls as listed in Table 4.15.

Table 4.15: Unit Costs for Construction of Various Structural Stormwater Control Practices

Control Practice Type	Unit Construction Cost ($/ft^3)*
Infiltration Basin	10.80
Rain Garden	13.50
Surface Infiltration Trench	21.60
Subsurface Infiltration Chamber System	32.40
Bioretention	27.00
Gravel Based Wetland	21.60

*Unit construction costs are derived from new facility construction costs and include a multiplier of 2 to account for the fact that these will be retrofit projects with a 35% contingency for design, permitting and construction administration services (e.g., typical new construction cost for infiltration basin = $4.0/ft^3; thus retrofit cost = 4.0(2.0)(1.35) = $10.80/ft^3).

Under this approach the basic implementation scenarios presented in Section 3 were evaluated to understand the range of possible structural control capital costs to achieve phosphorus reduction as well as to help frame differing implementation approaches. Each of these implementation approaches involve differing assumptions in performing the calculations which are described briefly below and in further detail in Appendix E.

Scenario 1- Independent compliance of the DDs to achieve 65% and 50% phosphorus reduction respectively (i.e., each DD site on its own): Each DD site was evaluated separately and the most logical structural practice was chosen (given the on-site constraints) and then sized to achieve either the 65% or 50% phosphorus reduction.

Scenario 2 - Collective compliance by all the DDs within each town to achieve 65% and 50% phosphorus reduction, respectively (i.e., working within a CMPP within each town): All the DD sites within each town were grouped together and then, through an iterative process, practices were selected as a function of the ratio of pervious area to impervious area and other site constraints. Structural practices were selected based on a cost effective selection preference and sized to maximize phosphorus reduction on the most cost effective sites (i.e., those that treat a larger impervious area with larger pervious areas and more infiltrative soils). Sites with more severe constraints (e.g., small pervious areas and poor soils) were often assigned underground practices, but had smaller control volumes and thus smaller phosphorus reductions and lower costs. The process involved a balancing between sizing and practice selection until the target 65% or 50% phosphorus reduction was achieved.

An additional scenario (2B) was also evaluated that includes collective compliance by all the DDs within the three combined municipalities to achieve 65% and 50% phosphorus reduction, respectively (i.e., working in a regional CMPP or stormwater utility). The same approach was used as described above, except that all DDs within all three towns were grouped together.

Scenario 3 - Collective compliance across the watershed within each town to achieve phosphorus reduction of 57% and 42% (Milford), 51.8% and 36.8% (Bellingham), and 52.1% and 37.1% (Franklin) for varying amounts of impervious cover treated: All parcels, including the DDs, as well as municipal roads were evaluated. This approach grouped areas into management categories based on land use type, soil type, and preferred structural control practice. For example, commercial properties with HSG A soils and larger pervious to impervious area ratios would be assigned surface infiltration practices with a higher infiltration rate (i.e., the most cost effective practice). Medium density residential areas with HSG C soils would be assigned bioretention/swales as preferred practice types. This option initially sized practices at a target of managing 1-inch of runoff from enough impervious surface to achieve the target phosphorus removal for the range of implementation scenarios in each town (i.e., 51.8% and 36.8% in Bellingham, 52.1% and 3.7.1% in Franklin, and 57.0% and 42.0% in Milford). This yielded a single estimated implementation cost across the watershed. But because the cost varied significantly if both the treatment volume and the impervious cover capture area were varied, an additional step was undertaken to vary the required BMP sizes (i.e., change the depth of runoff and/or area of impervious area for which the practice was sized). In this analysis, implementation cost decreases as practices are sized for smaller volumes and as the amount of impervious cover treated increases.

Scenario 4 - Collective compliance across the Upper Charles River watershed of the three combined municipalities (i.e., working in a regional management district): The same approach was undertaken as in Scenario 3, except that all properties across the entire area of the watershed within the three municipalities were evaluated together.

The results from Scenarios 3 and 4 for target phosphorus reduction of 36.8%, 37.1% and 42.0% in Bellingham, Franklin, and Milford, respectively, are presented in Figures 4.5 through 4.8 for each municipality and for the three communities combined. The figures show declining cost as impervious area treated increases. Table 4.16 presents a summary of implementation costs for Scenarios 1 through 4. Note that in Figures 4.5 through 4.7, the corresponding cost estimate presented in Section 4.2.2.1 is shown for purposes of comparison and to help confirm the general range of likely implentation costs for structural controls.

Figure 4.5: Estimated Capital Costs for Structural Controls to Achieve 36.8% Phosphorus Reduction for Bellingham (Implementation Scenario 3)

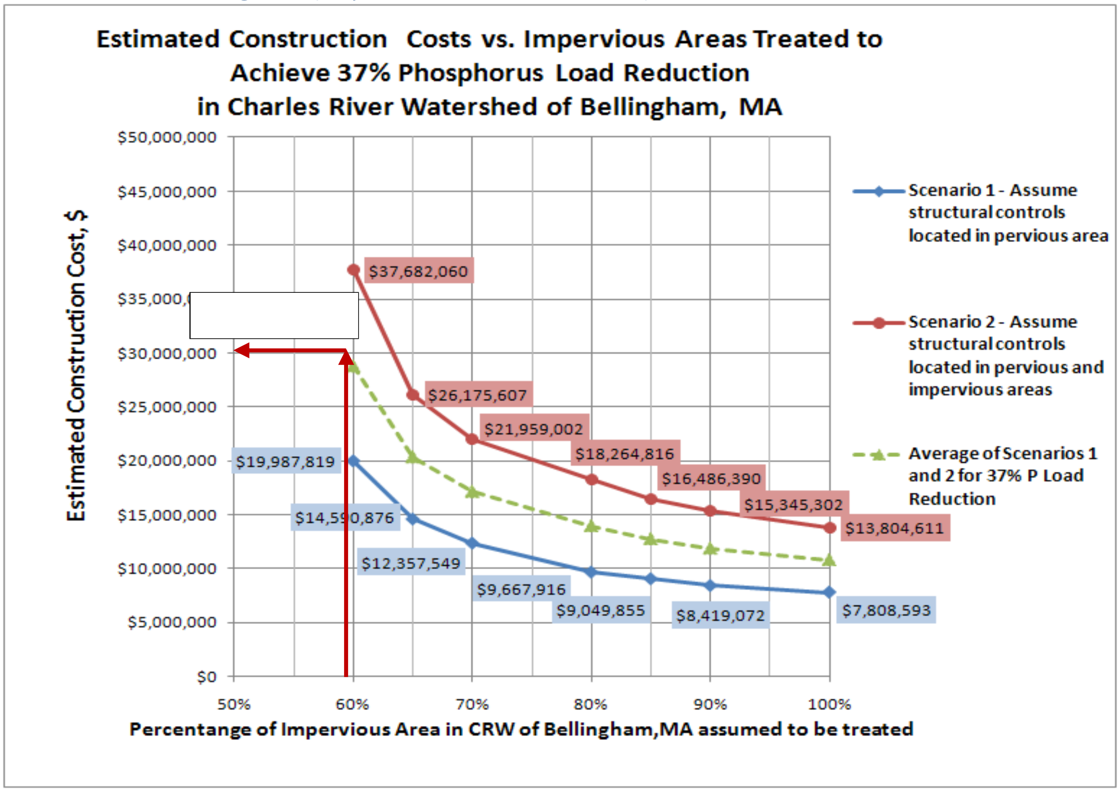


Figure 4.6: Estimated Capital Costs for Structural Controls to Achieve 37.1% Phosphorus Reduction for Franklin (Implementation Scenario 3)

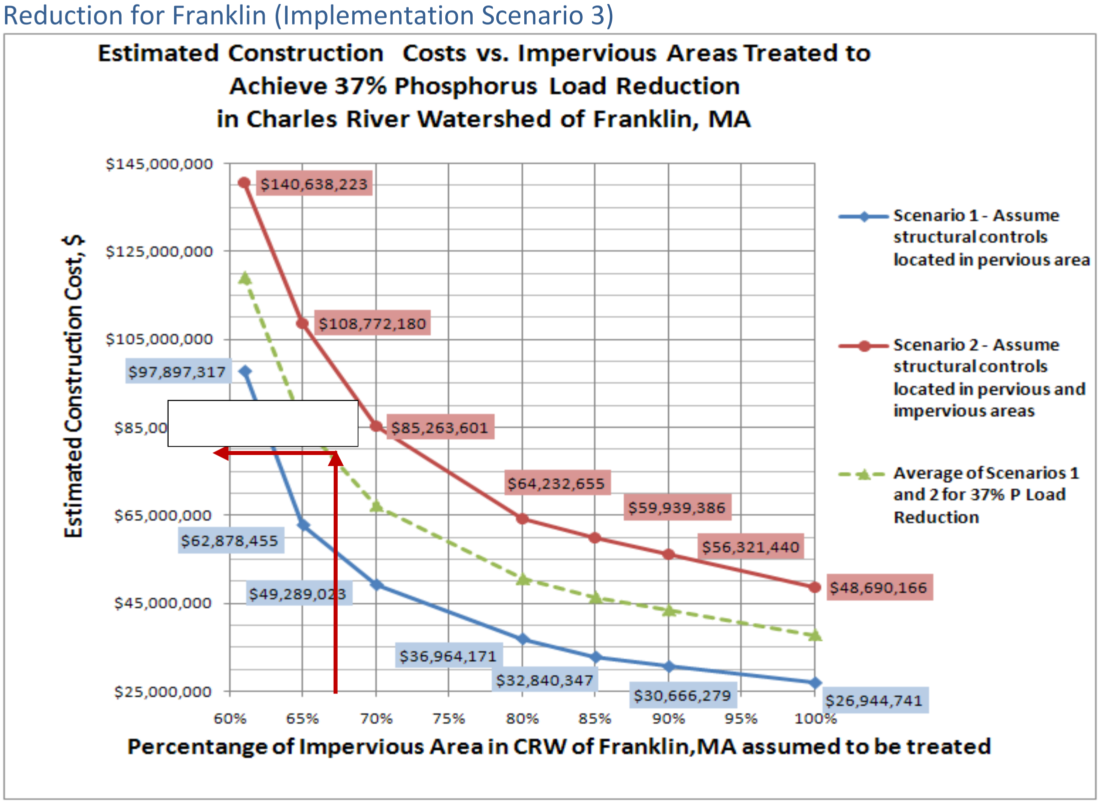


Figure 4.7: Estimated Capital Costs for Structural Controls to Achieve 42% Phosphorus Reduction for Milford (Implementation Scenario 3)

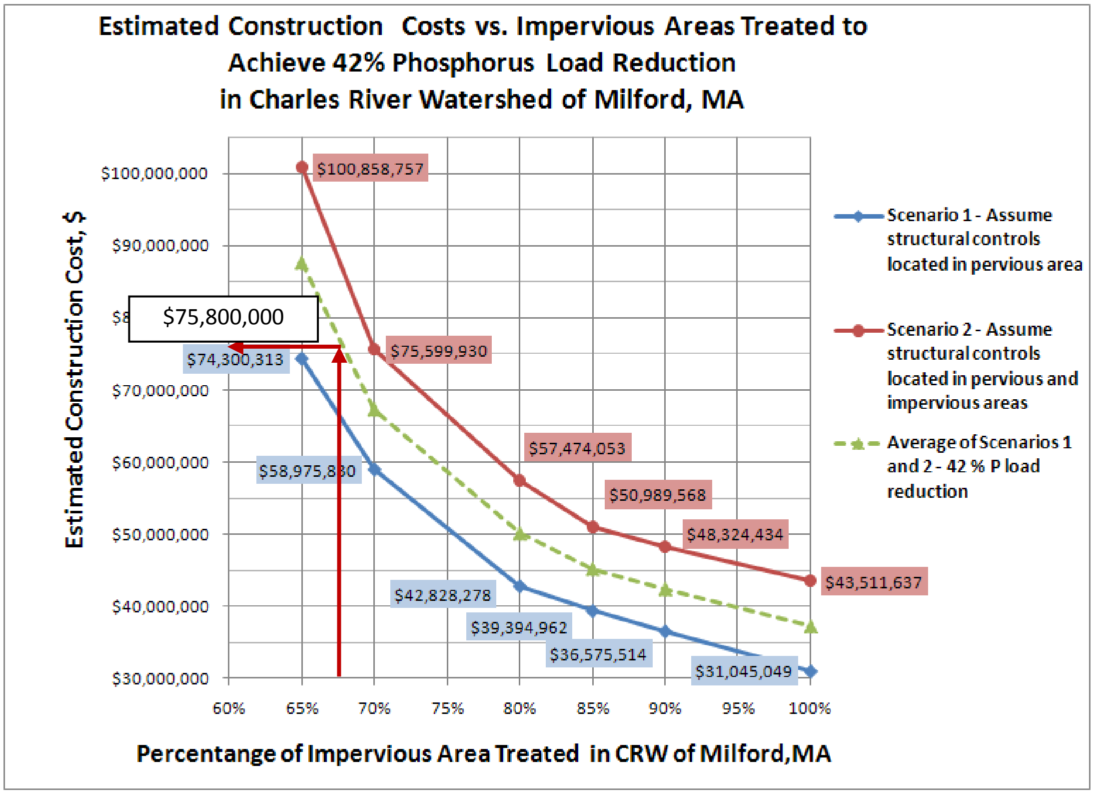


Figure 4.8: Estimated Capital Costs for Structural Controls to Achieve 38.7% Phosphorus Reduction in all Three Towns (Implementation Scenario 4)

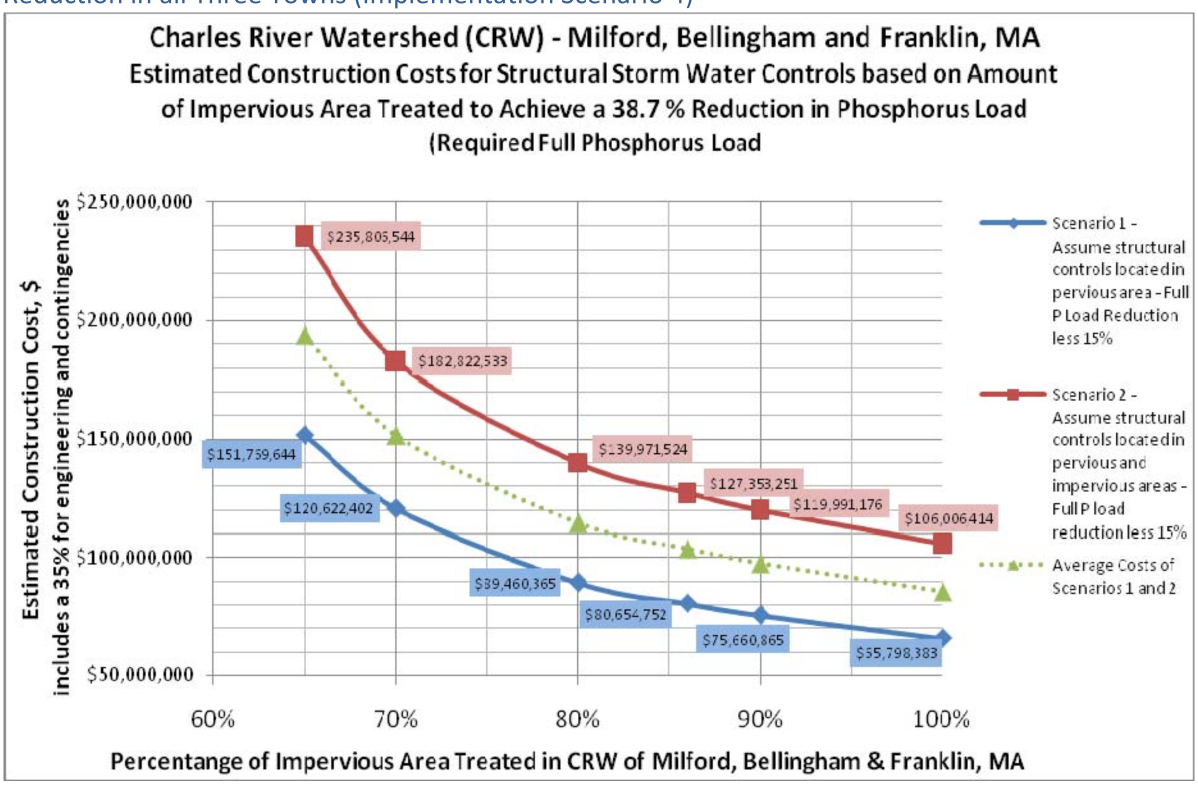


Table 4.16: Summary of Estimated Capital Cost for Structural Controls to Achieve Target Phosphorus Reductions For Five Implementation Options

Implementation Scenario	TP Reduction from Structural Controls	Bellingham Cost (Millions)	Franklin Cost (Millions)	Milford Cost (Millions)	Total Cost Area of Three Communities Combined (Millions)
Scenario 1 DD each site on its own	65%	$6.7[1]	$23.9	$22.7	$53.3
	50%*	$4.2[1]	$15.7	$14.3	$34.2
Scenario 2 DDs collective compliance working in CMPP or Utility within each town	65%	$4.6[1]	$19.8	$19.1	$43.5
	50%*	$2.6[1]	$10.9	$11.1	$24.6
Scenario 2B DD sites collective compliance working within a regional utility	65%	N/A			$41.6
	50%*	N/A			$22.9
Scenario 3 Town by town program to meet TMDL target P reduction with structural controls for full compliance (80-90% of IA treated) and 15% less reduction (assume 65% of IA treated)	52% in B & F; 57% in M	$54.1	$181.0	$143.0	$388.1
	37% in B & F; 42% in M*	$20.4	$79.0	$87.6	$187
Scenario 4 Combined program for all municipalities working together to meet TMDL target TP reduction (less 15%) with structural controls (assumed 65% IA treated) - DDs included	38.7% across the 3 towns*	N/A			$185.2
*15% less TP reduction assumes 15% reduction via non-structural practices					

[1] Bellingham DD implementation costs per impervious acre are estimated to be significantly lower due to the presence of higher infiltration capacity soils underlying subject properties and the lower ratio of impervious to pervious surfaces compared to DD properties in the other two municipalities.

4.2.2.3 Comparison to Other Studies and Detailed Investigations

The implementation of structural controls at the scale contemplated in the Charles River watershed will likely involve a wide distribution of actual costs associated with site specific constraints, owner preferences, engineer and contractor expertise, and timing, among other factors. In order to fully investigate reasonable sources for the cost of implementation, the project team also looked at what has been done elsewhere in terms of retrofitting at the watershed scale. The management approach of retrofitting existing development to reduce pollutant loading is not completely new. In the Chesapeake Bay watershed, retrofit projects have been designed and installed to reduce pollutant loadings since as early as the late 1980's, so data on implementation costs have been compiled for quite some time. The key objective of this current assessment is to derive current costs based on the local conditions in the upper Charles River watershed. This being said, other studies in other regions provide good context for the estimates developed here.

The cost of stormwater retrofit implementation has been tracked in various publications and by various groups. For example, cost numbers for retrofitting were published by the Center for Watershed Protection in Urban Stormwater Retrofit Practices (Schueler et. al, 2007) with median costs per impervious acre treated ranging from approximately $11,000 for retrofits of existing detention structures to $88,000 for on-site urban retrofits.

The Chesapeake Stormwater Network prepared a Technical Bulletin (No. 5), entitled "Stormwater Design for High Intensity Development Projects in the Chesapeake Bay Watershed" (Schueler, 2011). As indicated in Figure 4.9, retrofit implementation costs range from a low of approximately $32,500 to over $190,000 per impervious acre treated, depending on the type of retrofit practice and the land use intensity. Note the reference to cost to treat one acre of impervious cover in Maryland is "also equivalent to reducing one pound of total phosphorus." While this statement is generally true across a range of urban land uses in Maryland, it is also a fairly accurate statement for the upper Charles River watershed where phosphorus loading data and rainfall statistics are similar to those in suburban Maryland.

Figure 4.9: Capital Cost Range from Chesapeake Bay Watershed for Different Implementation Scenarios (from Schueler, 2011)

Cost to Treat One Acre of Impervious Cover in Maryland[1,2]		
Stormwater Management Scenario	**Sector**	**$** [3]
New Development Pre-ESD (MDE 2000 manual)	Private	$ 31,700
New Development, ESD to MEP (MDE, 2009)	Private	$ 46,500
Urban Redevelopment Using LID	Private	$ 191,000
Storage Retrofits in Urban Watershed	Public	$ 32,500
Green Street Retrofits, Highly Urban	Public	$ 167,100
Stream Restoration, Nutrient Equivalent	Public	$ 35,600

[1] also equivalent to reducing one pound of total phosphorus.
[2] Costs in other states will be slightly different, based on their sizing requirements in their stormwater regulations
[3] costs expressed in 2010 dollars

The Long Creek Watershed Management District in southern Maine has been designing and implementing stormwater retrofits at non-residential properties for the last few years. Recent cost data from this watershed indicate that storage retrofits for commercial properties (i.e., Maine Mall Plaza) are costing approximately $82,000 per impervious acre. So called "street level" retrofits are costing approximately $137,000 per impervious acre treated (Lee Pinard, 2011).

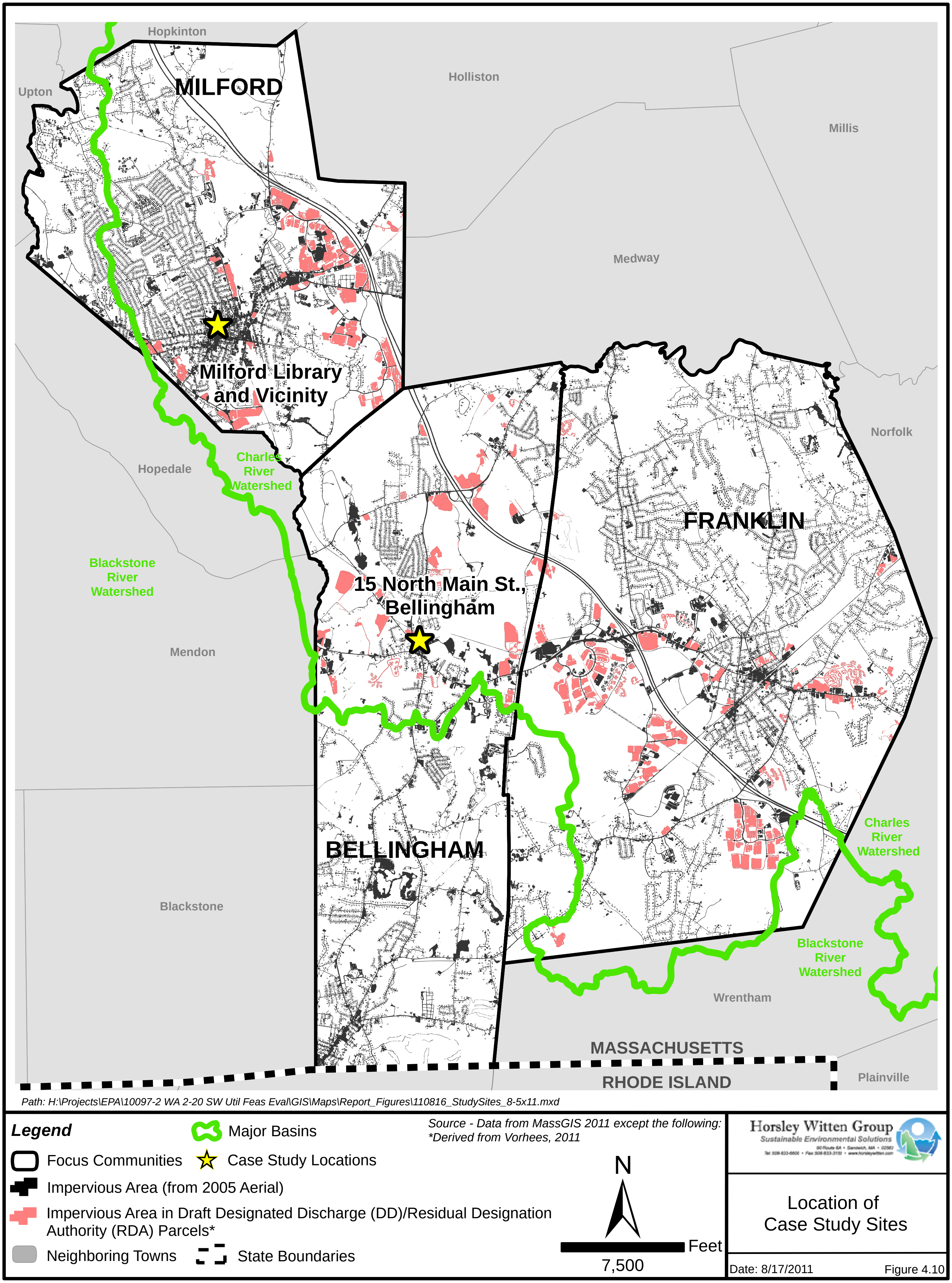
The project team itself has been involved in designing, permitting and providing construction administration services for the implementation of a number of structural stormwater retrofits in the region in recent years (e.g., Providence, RI, Newton, MA, Plymouth, MA, Oak Bluffs, MA, Peabody, MA and Harvard, MA). These facilities have included a range of retrofit projects from modest modifications to existing detention structures to entirely new facilities to manage high intensity parking lots with significant site contraints. Implementation costs per impervious area (based on actual construction bids and including design, permitting and construction administration) range from approximately $16,000 for the retrofits of existing detention structures to approximately $45,000 for larger storage retrofits, to a high of approximately $140,000 for high density street level retrofits.

Finally the project team undertook a detailed retrofit inventory in two site locations in the upper Charles River watershed (Figure 4.10). The first was an existing 8.6 acre commercial shopping center in Bellingham at 15 North Main Street, built long before any stormwater detention or treatment requirements, and the second was the Milford Public Library and vicinity, a 4.27 acre area in downtown Milford, also built without any existing stormwater treatment systems. These two case studies were chosen because they represented challenging implementation conditions. The 15 North Main Street property represents an older commercial shopping center containing minimal pervious open space and backing up against a railroad right-of-way and adjacent wetland area. The Milford Public Library is an example of a very dense urban area overlying relatively poor soils (from an infiltration standpoint) also with very little pervious open space. The thinking in the selection of these examples was that the implementation costs for these two sites should be among the highest of any location within the three municipalities.

This assessment generally followed the approach outlined in CWP's Urban Stormwater Retrofit Practices manual (Schueler, et. al, 2007), and included conducting a field reconnaissance, identifying and sizing likely retrofit practices, developing concept sketches for the projects, and estimating the implementation costs. The results of these two case study assessments are summarized in Table 4.17 and retrofit site plans are illustrated in Figures 4.11 and 4.12.

Table 4.17: Summary of Costs of Compliance with Phosphorus Reduction Targets for Two Case Study Sites in Charles River Watershed

Site Location	**Total Area** (acres)	**IA** (ac)	Target TP Removal	**TP Load Reduction** (lbs)	**Total Project Implementation Cost** ($)	$/lb TP Removed	$/IA acre Treated
15 North Main St., Bellingham	8.55	6.39	65%	14.57	$650,430	$68,683	$101,760
Milford Library and Vicinity	4.27	3.18	57%	4.21	$476,370	$113,152	$149,750


Hopkinton
Upton
MILFORD
Holliston
Millis
Medway
Milford Library and Vicinity
Norfolk
Hopedale
Charles River Watershed
FRANKLIN
Blackstone River Watershed
15 North Main St., Bellingham
Mendon
Charles River Watershed
BELLINGHAM
Blackstone
Blackstone River Watershed
Wrentham
MASSACHUSETTS
RHODE ISLAND
Plainville
Path: H:\Projects\EPA\10097-2 WA 2-20 SW Util Feas Eval\GIS\Maps\Report_Figures\110816_StudySites_8-5x11.mxd
Legend
Major Basins
Focus Communities
Case Study Locations
Impervious Area (from 2005 Aerial)
Impervious Area in Draft Designated Discharge (DD)/Residual Designation Authority (RDA) Parcels*
Neighboring Towns
State Boundaries
Source - Data from MassGIS 2011 except the following:
*Derived from Vorhees, 2011
N
Feet
7,500
Horsley Witten Group
Sustainable Environmental Solutions
Location of Case Study Sites
Date: 8/17/2011
Figure 4.10

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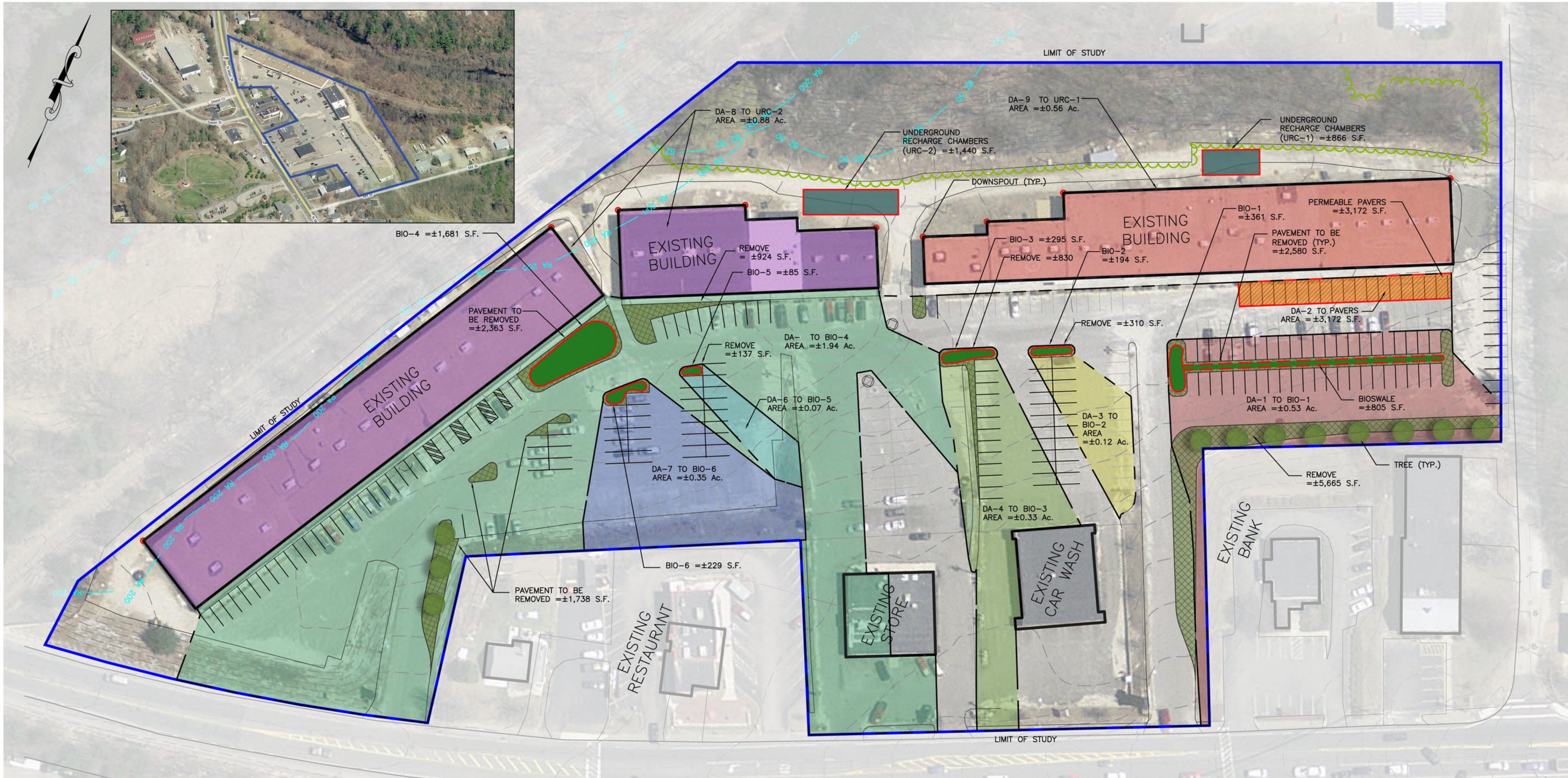

Bellingham Conceptual Phosphorus Reduction Retrofit Treatment and Cost Analysis

	IMPERVIOUS AREA (Ac.)	PERVIOUS AREA (Ac.)	TOTAL AREA (Ac.)	BMP AREA (S.F.)	TP REMOVAL (LB/YR)	BMP COST ($/CUF)	CONSTRUCTION COST ESTIMATE	REMOVAL COST ($/IMPERV. AC.)	REMOVAL COST ($/ac.)
UNDERGROUND RECHARGE CHAMBERS (URC-1)	0.56	0.00	0.56	866	1.22	$32.40	$66,422.74	$117,607.30	$117,607.30
UNDERGROUND RECHARGE CHAMBERS (URC-2)	0.88	0.00	0.88	1,440	1.93	$32.40	$103,667.75	$117,607.30	$117,607.30
REMOVE PAVEMENT	0.34	0.00	0.34	14,861	0.67	$10.00	$148,610.00	$435,600.00	$435,600.00
BIO-1/SWALE	0.31	0.22	0.53	1,166	0.73	$27.00	$30,571.78	$98,006.08	$57,480.43
BIO-2	0.12	0.00	0.12	194	0.25	$27.00	$11,458.79	$98,006.08	$94,912.52
BIO-3	0.28	0.05	0.33	295	0.55	$27.00	$27,748.14	$98,006.08	$83,112.77
BIO-4	1.58	0.37	1.95	1,681	3.33	$27.00	$154,872.55	$98,006.08	$79,590.48
BIO-5	0.05	0.02	0.07	85	0.12	$27.00	$4,927.30	$98,006.08	$70,141.61
BIO-6	0.23	0.12	0.35	209	0.51	$27.00	$22,854.59	$98,006.08	$65,376.00
PERMEABLE PAVERS	0.07	0.00	0.07	3,172	0.16	$25.00	$79,300.00	$1,089,000.00	$1,089,000.00
UNTREATED AREA	1.96	1.38	3.33						
PHOSPHORUS REDUCTION TREATMENT TOTAL	4.44	0.78	5.21	23,969	9.47		$650,433.65		
TOTAL	**6.39**	**2.15**	**8.55**	**23,969**	**9.47**		**$650,433.65**	**$101,761.30**	**$76,115.60**

GRAPHIC SCALE

(in feet)
1 INCH = 40 FEET

Revisions

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Prepared For: Town of Bellingham, 10 Mechanic Street, Bellingham, MA

Survey Provided By: Horsley Witten Group, Inc., 90 Route 6A, Sandwich, MA 02563, Phone: (508) 833-6600, Fax: (508) 833-3450

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Figure 4.11: Hypothetical Retrofit Site Plan for Commercial Center in Bellingham

Milford Conceptual Phosphorus Reduction Retrofit Treatment and Cost Analysis	IMPERVIOUS AREA (Ac.)	PERVIOUS AREA (Ac.)	TOTAL AREA (Ac.)	BMP AREA (S.F.)	TP REMOVAL (LB/YR)	BMP COST ($/CUF)	CONSTRUCTION COST ESTIMATE	REMOVAL COST ($ /IMPERV. Ac.)	REMOVAL COST ($ /Ac.)
BIO-1 (LIBRARY UPPER PARKING LOT)	0.17	0.09	0.26	262	0.30	$27.00	$16,222	$98,006	$62,572
PLANTER-1 (LIBRARY ROOF-PORTION NOT FLAT)	0.04	0.00	0.04	78	0.08	$27.00	$4,410	$98,006	$98,006
RAIN GARDENS (MEMORIAL BLDG) RG-1A	0.04	0.03	0.08	68	0.08	$13.50	$2,087	$49,003	$27,330
RAIN GARDENS (MEMORIAL BLDG) RG-1C	0.03	0.04	0.06	40	0.05	$13.50	$1,241	$49,003	$19,415
BIO-1B (LIBRARY LOWER/EMPLOYEE PARKING)	0.21	0.13	0.34	337	0.39	$27.00	$20,749	$98,006	$60,254
BIO-2A (TEMPLE-PARK)	0.04	0.02	0.06	73	0.08	$27.00	$4,221	$98,006	$69,224
BIO-2B (TEMPLE DW)	0.02	0.05	0.07	35	0.05	$27.00	$2,124	$98,006	$30,334
RG-2A1 - (TEMPLE SCHOOL ROOF)	0.04	0.02	0.05	58	0.07	$13.50	$1,824	$49,003	$33,787
RG-2A2(TEMPLE & SCHOOL ROOF)	0.03	0.05	0.08	58	0.07	$13.50	$1,650	$49,003	$20,891
BIO-3 (CHURCH)	0.37	0.10	0.47	580	0.65	$27.00	$36,127	$98,006	$77,198
RG-3 (CHURCH)	0.04	0.06	0.10	60	0.08	$13.50	$1,912	$49,003	$19,373
DA-4 POROUS PVMT-12"- (CHURCH MAIN & RES.)	0.32	0.05	0.37	8,676	0.55	$25.00	$216,900	$685,892	$585,933
DA-5 POROUS PVMT-12" -(CHURCH SIDE)	0.09	0.01	0.09	1,945	0.15	$25.00	$48,625	$570,149	$534,201
RG-6 (DUNKIN DONUTS & PART CHURCH)	0.07	0.06	0.13	106	0.13	$13.50	$3,261	$49,003	$25,726
BIO-6 (DUNKIN DONUTS)	0.14	0.01	0.14	215	0.23	$27.00	$13,477	$98,006	$93,332

	IMPERVIOUS AREA (Ac.)	PERVIOUS AREA (Ac.)	TOTAL AREA (Ac.)	BMP AREA (S.F.)	TP REMOVAL (LB/YR)	BMP COST ($/CUF)	CONSTRUCTION COST ESTIMATE	REMOVAL COST ($ /IMPERV. Ac.)	REMOVAL COST ($ /Ac.)
SAND FILTER-7A (GAS STATION)	0.10	0.00	0.10	145	0.17	$21.60	$7,714	$78,405	$78,405
BIO-7B (GAS STATION)	0.16	0.02	0.19	280	0.28	$27.00	$16,168	$98,006	$85,563
SAND FILTER-7C (GAS STATION)	0.10	0.00	0.10	145	0.16	$21.60	$7,594	$78,405	$78,405
BIO-8 (SCHOOL ST.)	0.30	0.03	0.33	477	0.52	$27.00	$29,586	$98,006	$88,327
PAVEMENT REMOVAL		0.08			0.16	$10.00	$34,630		$34,630
PAVEMENT ADDITIONS (BERMS)						$15.00	$5,850		
UNTREATED AREA	0.88	0.24	1.12						
PHOSPHORUS REDUCTION TREATMENT TOTAL	2.30	0.85	3.15	13,638	4.21		$476,372		
TOTAL	**3.18**	**1.09**	**4.27**	**13,638**	**4.21**		**$476,372**	**$149,752**	**$111,562**

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Figure 4.12: Hypothetical Retrofit Site Plan for Downtown Milford

4.2.2.4 Recommended Capital Costs for Structural Controls

As evidenced by the above information, there is a fairly significant range of costs for implementation of structural controls to achieve phosphorus reductions depending on land use intensity, specific site constraints, control objective, and which method or implementation option one chooses to focus on. One difficulty is that currently there is not a watershed management plan for the upper Charles River watershed that specifies where controls would be most cost effective and where these control measures might be located. The scaled-up assessment from Spruce Pond Brook likely provides the best possible estimate at this time. A careful look at the unit costs from Table 4.11 compared against the implementation costs from other studies and projects supports this conclusion. In addition, the scaled-up assessment from Spruce Pond Brook accounts for land acquisition costs. Consequently, the recommended planning level costs for implementation of capital project in the watershed are presented in Table 4.18.

Table 4.18: Recommended Capital Cost for Implementation of Structural Stormwater Controls to Achieve Compliance with Phosphorus Load Reductions

Town	% Phosphorus Removal from Structural Controls	Total Cost of Structural BMPs (Charles River Watershed)
Bellingham	37%	$29,700,000
Franklin	37%	$74,600,000
Milford	42%	$75,800,000
Costs are based on a calibration against Spruce Pond Brook Subwatershed and rounded to nearest $100,000		

4.2.3 Phosphorus Control Costs for Implementing Non-Structural Practices

As discussed in Section 4.2.2, the project team developed phosphorus reduction cost estimates for structural stormwater controls assuming 15% of the total required phosphorus reduction could be achieved by non-structural controls. This assumption was developed in consultation with EPA and following input and comment from the Steering Committee. As a consequence, the potential costs associated with non-structural controls were estimated as part of the overall cost of services associated with future stormwater management services. It is important to note that each town currently has some component of their stormwater program that is achieving some level of phosphorus control (e.g., existing street sweeping, catch basin cleaning and organic matter/leaf pick-up program). It will be important for the towns to document these programs and the benefits they provide in the future. In addition, the science on the benefits of non-structural controls is not well documented and the benefits are likely to be higher in the future as more data is compiled; thus, the 15% reduction estimate is likely conservative on what can be achieved with little or no additional expense.

In the draft RDA GP and accompanying fact sheets, EPA has identified four specific non-structural control measures that can receive phosphorus reduction credits. Each of these programs offers potential phosphorus credits based on current research and the level of effort. As currently proposed, the draft permit offers credits as follows:

- Enhanced street sweeping--3% and 8% credit as a function of the frequency of sweeping and the type of sweeper;
- Semi-annual catch basin cleaning--2% phosphorus credit;
- No application of fertilizers containing phosphorus-- a 10% phosphorus credit; and
- Organic waste and leaf litter collection program--up to a 5% phosphorus credit.

Section 4.2.1 described the operational costs for each municipality. Included in these costs are the costs for enhanced street sweeping, semi-annual catch basin cleaning and organic waste and leaf litter collection. Thus, the costs for implementation of these non-structural controls have already been accounted for and only the phosphorus reduction credit needs to be assessed.

The enhanced street sweeping program guidance presented in the draft RDA GP references monthly street sweeping with a mechanical broom sweeper to achieve a 3% phosphorus credit. The municipal operation costs presented in Section 4.2.1 assume a semi-annual street sweeping program of all streets and directly connected municipal parking lots with a regenerative air sweeper to comply with the requirements of the MS4 GP. The program costs for this activity are included in the operational costs for the future program and the likely phosphorus credit for this activity is assumed to exceed 2%. Note that the cost estimates for structural controls presented in Section 4.2.2 are town-wide and include municipal streets and directly connected parking lots. The presumption is that street sweeping does not have to occur on each DD property.

The semi-annual catch basin cleaning program guidance presented in the draft RDA permit references a potential phosphorus credit of 2% for this activity, assuming the impervious area is not up-gradient of a structural stormwater control measure. The municipal operation costs presented in Section 4.2.1 assume semi-annual catch basin cleaning and it is assumed that future structural BMPs installed below these areas will not restrict this credit, and thus a 2% credit is realistic.

The elimination of phosphorus from fertilizers would receive a 10% phosphorus credit according to the draft RDA permit. It is assumed that this ban will be enacted at the regional or municipal level, if not through state legislation, and therefore it is assumed that this credit can be achieved at no additional cost to the municipalities.

The organic waste and leaf litter control guidance offering in the draft RDA permit states that weekly clean-up of organic debris between April 1 and December 15 is needed to achieve a 5% phosphorus credit. The municipal operational costs presented in Section 4.2.1 assume the clean-up of this source of phosphorus at least seven times during the year, including weekly during the peak periods of leaf drop in the fall. The phosphorus credit for this level of program is likely to exceed 1%.

The sum of all potential non-structural credits from the above referenced activities that have either already been accounted for in operation costs or are assumed to have no cost is estimated to equal or exceed 15%.

4.3 Potential for Regional Implementation Cost Savings

As discussed in Section 3.4, the creation of a regional stormwater management program across the three towns has the potential to reduce overall program operating costs, depending on what elements of the program are defined as “regional.”

The creation of a Regional District or entity is an option for governance of a Regional Stormwater Management Program, and is discussed further in Section 5. Based on the current organizational structure of communities in New England, it is most likely that an initial regional program would be set up as an inter-municipal agreement with a lead municipality, and not one sole entity that is responsible for the program. Further evaluation is needed to identify the feasibility of and the most appropriate (and desirable) configuration of a regional program. However, each of the three towns will likely have several similar operating needs to implement a comprehensive stormwater management program and the need to meet the same regulatory objectives. Therefore, some elements of a Regional Stormwater Management Program could be shared across town borders, thus allowing for the cost of services to be spread across a larger group, thereby minimizing the duplication of efforts and maximizing the efficiency of resources.

Table 4.19 provides a list of the most likely shared activities where efficiencies could be realized using a regional approach to serve as a potential starting point for the discussion of a regional program. Depending upon the extent of coordination, the cost savings of a regional program might range from as little 1 to 2% of total program costs if just public education is shared, to maybe approaching 20% if all those measures identified in Table 4.19 are integrated into a regional program.

Table 4.19: Program Elements with Potential Savings through a Shared Regional Approach

Shared Program Activity	Description of Saving Potential	Potential Economies of Scale*
<u>Administrative Costs</u> *Billing, contracting and record keeping*	Municipal staff requirements reduced because a single entity performs tasks. Centralized system ensures consistent procurement and contracting procedures.	Yes
<u>Public Education</u> *Creation and dissemination of consistent educational messages for the four targeted audiences*	Development of a single set of messages will likely result in reduced fees for material development, program management and measurement of success. Reduction in municipal staff expenses by combining efforts for program oversight, production and delivery costs to be handled by one entity.	Yes
<u>Public Involvement</u> *Programs offered across all three municipalities*	Public involvement programs such as rain barrel installation, stream clean-up days, or steering committee participation could potentially result in cost savings for program oversight and coordination, as well as materials costs through bulk savings from vendors.	Likely but variable

Shared Program Activity	Description of Saving Potential	Potential Economies of Scale*
Municipal Operations *Activities such as catch basin cleaning, street sweeping, leaf collection & waterfowl/pet waste management*	A single program would establish standard procedures across all participating municipalities and optimize the efficiency of operations. Larger contracts with outside entities would likely result in more competitive pricing. Fleet vehicles and equipment purchase prices and maintenance costs likely reduced. Bulk disposal costs of likely to result in savings.	Yes
Capital Construction Project Implementation *Site selection, design and construction of structural stormwater BMPs*	Municipal staff savings in administration and oversight of contracts. Larger assessment and design contracts likely to attract more experience consultants with potential cost savings for design and permitting. Scale of construction contracts likely to result in reduced material and installation costs. Site selection flexibility and more options for most cost effective BMPs.	Yes
Structural BMP Maintenance *Inspection and maintenance of retrofit BMPs*	Municipal staff savings as a result of pooled resources for inspections or cost efficiencies resulting larger consultant contracts. Maintenance equipment and bulk material disposal savings.	Yes
Mapping, Record Keeping and Reporting *Tracking impervious cover changes, GIS data updates, BMP installations and phosphorus reduction reporting*	Municipal staff savings to administer, track and report data changes. Centralized data management system likely to reduce hardware and software costs. Larger contracts and single consultant likely to provide more competitive costs for data collection (e.g., field work), management and reporting.	Maybe
CMPP Administration *Compliance and tracking of DDs*	Savings in establishing one CMPP versus three. One entity with oversight, regulation and tracking of BMP installation and performance credit tracking likely resulting in reduced administration and operation costs.	Maybe
*Economies of scale include larger contracts, larger material quantities and greater negotiation capabilities for a range of professional services, construction contracts and disposal costs.		

5.0 Governance & Administration

As identified during this assessment, stormwater management in the Upper Charles is divided among several governmental organizations: the Towns of Bellingham, Franklin and Milford; various departments within those towns; contractual assistance; and intermittently, MADEP. The pending GPs will also require some private land owners to manage stormwater. This causes responsibility to be spread out with potential overlaps and gaps in the administration and implementation of the stormwater programs. A consideration of this study was to entertain the concept of developing an alternative approach to administering and governing the stormwater program going forward.

A presentation was given to the project Steering Committee on possible options and benefits of some sort of regional approach. Discussions on possible drivers for a regional approach were conducted but these were mostly focused on estimating future costs and the potential for economies of scale. The study did not include any in-depth discussions with the municipalities on what the governance options would entail, either legally or administratively. Nor were there any discussions of what types of organizational changes might take place at the town level. Organizational changes might be a consideration with or without a fee; and in an independent or regional approach.

Although there are many scenarios for a Sustainable Stormwater Management Program, Table 5.1 illustrates the range of governance/administration, and funding options.

Table 5.1: Stormwater Governance Options

Stormwater Governance Options	Independent Funding	Each Has Similar Fee Structure	Utility & Fee*
Independent Programs	Move ahead independently	Gain economies in fee development only	Create an organization to collect and disburse funds only
Cooperative Multi-Municipal Programs	Each decides how to pay for partially cooperative program	Cooperate on similar fee and shared program where it makes sense	One "look" to citizens with cooperation in parts of program
Regional Umbrella Program	Each decides how to pay share of one program	Avoid financial entanglement but gain economies of scale	Each gives program and authority to separate entity

*Fees still may be different among the participating municipalities

5.1 Governance Options

While there, are many nuances that might be incorporated into any of the governance options chosen; below is an overview of what the major distinctions are between the three primary governance categories: regional utility/umbrella, multi-municipal/shared, and independent/town levels.

5.1.1 Regional Utility Approach

Because water and stormwater have no political boundaries there may be advantages to taking a regional approach for more effective management and cost-effective implementation of best management practices. A regional approach generally can be defined as a:

- Regional program;
- Regional funding; and/or
- Regional organization

In defining what would be incorporated into a "region" the geographical coverage area needs to be determined. In Section 3.3 it was assumed that the entire geography of each town was included in the analyses. Under that assumption a regional utility, would be for the entire geographical area of each of the three towns, although the program and level of service may vary by watershed boundary for example.

For a Regional Utility the most likely governance approach would be to develop a standalone new entity. However, as indicated in Table 5.1 there are still various administrative options that could go along with a Regional Utility. The three most distinct administrative options for the Regional Utility are:

- Take over the entire responsibility for stormwater for the 3 towns;
- Be responsible for the billing, fee collection, and disbursal of funds, and the actual implementation of the stormwater programs would be done by each of the three towns; and
- Be responsible for only the billing, fee collection and management of any cooperative programs and agreed upon contracts. They may also be responsible for implementing certain programs if there is Utility staff for such services.

The most familiar example of a regional entity is the Charles River Pollution Control District (CRPCD) located in Medway, MA. The CRPCD treats wastewater and domestic septage from 8 communities: Bellingham, Dover, Franklin, Medway, Millis, Norfolk, Sherborn and Wrentham. The CRPCD was created by the Massachusetts Department of Environmental Management under Massachusetts General Law (MGL) Chapter 21, Section 28 "water pollution abatement districts; establishment; dissolution; enlargement or consolidation". Towns are assessed fees for capital and operating costs of the facility based on % capacity and metered flows. These fees are incorporated into the rate structure for each community based on specific needs and operation/maintenance costs for the collection system. This approach for management of wastewater by a regional entity is similar to one that could be used for stormwater; however, the management of stormwater is more complicated than management at a centralized facility with slightly different advantages and disadvantages due to the decentralized nature of stormwater management.

Advantages & Disadvantages of a Regional Utility Approach

In order for municipalities to achieve the efficiencies available through regional stormwater programs, each community must be willing to resign some local authority to the regional effort. This requires a degree of cooperation that, for legitimate reasons, may not be feasible. Municipalities may be reluctant to participate in a regional effort because of the perception that:

- Their constituents' money may be spent on projects outside their jurisdiction;
- Uncooperative regional members may threaten compliance with permits;
- Administrative costs may be too high to coordinate a regional effort and for creating a new organization;
- Concerns over creating a new "bureaucracy";
- Loss of local control on decision making and adequate response to local needs; and/or
- Loss of control on priority setting.

However, regional programs can be created with great flexibility, tailored to the participating municipalities' needs and the level of cooperation to which they are comfortable. As with all regional planning efforts, individual municipalities must sacrifice some control to the larger community in order to achieve long term gain.

Possible advantages may include:

- Economies of scale when performing services and pursuing contracts for services such as monitoring, street sweeping and specialized stormwater management expertise;
- Greater access to sources of specialized expertise;
- Ability to direct resources to projects watershed-wide that will have greater benefits to water quality;
- Spread costs across a larger rate payer base;
- Increased ability to gain outside funding;
- Consistency of programs at a watershed level – across jurisdictions;
- Ability to address larger problems;
- More stable organizational structure less influenced by politics and elections; and
- Consistency in services across watersheds.

5.1.2 Multi-Municipal Approach

In a multi-municipal approach the towns would cooperate and coordinate on stormwater management efforts that they choose. It may look a lot like a regional approach with multiple services being provided in a coordinated approach, but the most likely scenario would be that there would not be the creation of a new separate governance organization/utility. Shared services might be jointly funded or it might be that one town provides services to the other towns in a vendor-like capacity. Table 5.2 below highlights how this might look in the context members, to be appointed by the local appointing authority; and may appropriate for the expense of said committee such sum or sums as it may deem necessary.

- It shall be the duty of the regional water and sewer district commission planning board to study the advisability of establishing a regional water and sewer district commission, its organization, operation and control and of constructing, maintaining and operating such water and sewer facilities to serve the needs of such district; to estimate the construction and operating costs thereof; to investigate the methods of financing such facilities, and any other matters pertaining to the organization and operation of a regional water and sewer district commission; and to submit a report of its findings and recommendations to the selectmen of the several towns.

<u>Emerson Case & User Fees v. Taxes</u>

The notion of a stormwater utility in New England is quite often met with opposition that the fee is really a "rain" tax. Despite some of the key issues related to funding stormwater programs (e.g., lack of dedicated revenue), a stormwater user fee must meet specific legal criteria in order to not be a tax. The case of Emerson College v. City of Boston, 391 Mass. 415 (1984) resulted in a significant change in the evaluation of user fees versus taxes. The Massachusetts Supreme Judicial Court (SJC) outlined that municipalities may impose special assessments "for local improvements which enhance value of real property, provided that assessments are not in substantial excess of benefits received". Following the Emerson Case, the Massachusetts SJC adopted the three-prong test known as the EMERSON test.

The EMERSON test requires:

a. Receipt of a particularized municipal benefit;
b. A choice to avoid the fee by foregoing the service; and
c. A non-revenue raising purpose.

Since the Emerson Case, there have been numerous court cases that challenged municipal charges and more challenges can be expected with a stormwater user-fee. Another example of such challenges occurred in the Town of Franklin where a school impact fee was imposed on residential property owners seeking occupancy permits for the purpose of raising funds to build or improve public schools to accommodate increased demand attributable to new development (Greater Franklin Developers Association, Inc. v. Town of Franklin, 49 Mass. App. Ct. 500 (2000). The fee was declared invalid because the benefit of schools is not limited to fee payers and providing schools is therefore a general government cost.

These cases and other potential challenges emphasize the need to do a thorough legal review and perform the necessary level of "due diligence" when developing a stormwater user-fee system. This would be conducted at the Stormwater Utility implementation stage and discussed further in Section 8 of this report.

of the governance options presented previously, which is consistent with Massachusetts General Law (MGL) Ch. 40, Sec. 4A that allows a municipality to enter into an agreement with another municipality to perform joint services or activities. Existing legislation and legal considerations are discussed further in Section 5.3.

Table 5.2: Potential Multi-Municipal Approach

Stormwater Governance Options	Independent Funding	Each Has Similar Fee Structure	Utility & Fee*
Independent Programs	Move ahead independently	Gain economies in fee development only	Create an organization to collect and disburse funds only
Cooperative Multi-Municipal Programs	Each decides how to pay for partially cooperative program	Cooperate on similar fee and shared program where it makes sense	One "look" to citizens with cooperation in parts of program
Regional Umbrella Program	Each decides how to pay share of one program	Avoid financial entanglement but gain economies	Each gives program and authority to separate entity

*Fees still may be different among the participating municipalities

Based on the preliminary analysis to date, one stormwater service that appears to be a reasonable candidate for a shared approach is public education. Using this as an example there are still a number of ways that that service could be provided across the three towns:

- One of the towns could take the lead and provide public education to the other two towns for a fee;
- The towns could choose to pay another organizations, like a watershed group, to provide this service to them; and/or
- The towns could enter into a contractual arrangement with a consulting firm to provide these services.

Other stormwater services that could be implemented through a shared approach are public involvement activities, equipment contracting and water quality monitoring. Although these types of agreements have not yet been established by any of these 3 towns for stormwater-related services or activities, inter-municipal agreements are not uncommon and some local examples for a variety of services are provided below:

- Animal Control & Inspection Services (Bellingham & Franklin): these Towns have an agreement to share the services of an animal control officer employed by the Town of Bellingham and Franklin pays a share of the cost (based on hours).
- Library Administration & Maintenance Services (Franklin & Medway): these Towns previously had a joint agreement for the Library Director in Franklin to assist with the administrative and maintenance services in Medway. The agreement included an allocation of 14 hours to be paid by Medway.

- <u>Recreation Services (Franklin & Medway)</u>: these Towns have an agreement to share the services of the Franklin Recreation Department and compensation from Medway is agreed upon annually based upon need.
- <u>Nursing Services (Franklin & Medway)</u>: the Franklin and Medway Councils on Aging made a joint application for a private grant from the Metrowest Community Healthcare Foundation to fund a Senior Wellness Program to provide clinics and consultations at each municipality's Senior Center and home visitations. The program was implemented by a nursing professional employed by the Town of Medway and paid by grant funds.
- <u>Water Service (Franklin & Norfolk)</u>: the Town of Franklin sells water to the Town of Norfolk and charges on the basis of water consumption.
- <u>Norfolk County Agricultural High School (NCAHS)</u>: the NCAHS is a public high school located in Walpole, MA that offers academic and vocational training to students from the 29 communities in Norfolk County (including Bellingham & Franklin) and over 40 out of county (tuition) communities. The communities are assessed a fee or tuition to support the school.

A multi-municipal approach for stormwater management in the Upper Charles may include all three towns for some services or it might be just two towns for other services. There may also be advantages in entering into agreements with other neighboring smaller towns. However each of the towns is ultimately responsible for meeting their MS4 and RDA GPs so any shared approaches must be accompanied by a written agreement that will serve as a contractual arrangement between the parties. It is likely that a series of discussions will need to take place in order to reach agreement on such issues as:

- Who will provide the service?
- What measures will be taken if there is a breach of services or contract?
- Will a town member be allowed to leave the program? How long would the required notice period be?
- Which entity would hold any outside contracts?
- What is the process for amending the stormwater program or services?

While the technical (program or service level) discussions are likely best discussed at the staff level, because these are legal agreements, they will also need to have town legal counsel review as well as approval at Town Meeting or by Town Council, as applicable.

Another consideration in the multi-municipal approach is how programs will be funded. Any of the towns may choose to develop a sustainable stormwater fee – the financing of the program is a different issue than the program itself. Those towns who choose to move forward with a fee would want to include shared costs into the calculation of their fee. However with or without a stormwater fee; any or all of the municipalities could enter into a shared services set of agreements and finance them from whatever source of revenue they are currently using for stormwater.

5.1.3 Independent Municipality Approach

A single municipal approach to providing stormwater services and managing a stormwater fee is the most common approach; although the benefits of a shared approach for some services is gaining in popularity. Many of the disadvantages to a regional approach could be viewed as an advantage to the standalone approach.

- Money spent on projects will stay within the town;
- Town maintains control to assure compliance with permits;
- Additional administrative costs will be minimal because there will not be a need to create a new organization with start-up costs;
- Administered as a part of the local governmental structure rather than creating a new "bureaucracy";
- Maintain local control on decision making; and
- Maintain control on priority setting.

If an independent municipal approach is chosen as the governance option than it is often advantageous to look at what organizational options the town might have to improve or streamline its administration of stormwater services. If the independent municipal approach is chosen and the decision is also made to implement a stormwater fee there may be new additional administrative functions that will need to be added to the organization structure. This information is discussed further below, additionally, the existing and future stormwater program staff needs (represented by FTE units and/or percent LOE by town personnel) emphasize the need to further evaluate the future organizational structure.

5.2 Organizational Assessment Options

Currently, stormwater services are not always coordinated nor are there always the same priorities between departments. It is recommended that if either the single or multi-municipal approach is chosen, that an organizational assessment be conducted to identify options for increasing efficiency within the town. Three common results from an analysis are: 1) the organizational structure is modified to reduce the number of departments that are involved in providing stormwater services; 2) a new integrated stormwater department is created; and 3) departments and staffing assignments remain as they are, but a stormwater coordinator position is created to manage the stormwater activities across departments.

<u>Preliminary Assessment of Governance & Administration</u>

Based on the information gathered during the study a preliminary illustration of those departments, or other organizations, currently providing some type of stormwater services in each of the towns is presented in Table 5.2. During the consideration of future stormwater needs, additional FTEs were identified based on an increase in future LOE by staff to perform services (refer to Section 4.2).

Table 5.3: Current Organizational Structure for Stormwater Management

Cost Category	Bellingham	Franklin	Milford
Administration	DPW	DPW	DPW
Regulation/Enforcement	DPW, Town Engineer, Conservation Commission	DPW, Building Inspector, Town Engineer, Conservation Commission	Highway Dept., Town Engineer, Conservation Commission
Engineering & Master Planning	DPW, Consultant Services	DPW, Town Engineer, Consultant Services	Town Engineer, Consultant Services
Operations & Implementation	DPW	DPW	Highway Dept., Town Engineer
Monitoring	N/A	N/A	N/A
Existing FTEs	2.07	7.75	3.60
Future Estimated FTEs*	4.92	12.12	5.40

Note: *Future estimated FTEs represent the 5 year average level of effort for staff performing stormwater management activities based on estimated program requirements and are not specific to a particular Town department of staff position.

Organizational Assessment & Gap Analysis

Table 5.2 also illustrates that there may be overlaps in services provided; however, gaps in service were not discussed. By conducting an organizational assessment and a gap analysis, each town will better understand what is **currently** being done and by whom, what is **legally required** to be done, and what **might not be getting done** or **could be done better**.

An organization analysis generally consists of a series of interviews with key staff and a review of regulatory permit requirements and Federal and local legislation, and planning documents to define: the area, extent, and the level of service that currently is and should be provided by the town's various departments across all of the stormwater services to be provided.

Service Area

The service area is the physical area where the town provides services. It is common to find that within the same municipality that a determination of service may be interpreted differently by different crews, for example in street right-of-ways.

Extent of Service

The extent of service addresses the application of specific stormwater responsibilities and activities pertaining to the physical system. It defines the program boundaries for which a department takes responsibility. It is not uncommon to find that when stormwater services are provided by multiple departments that each thinks the other has the responsibility to implement, resulting in gaps in service. By analyzing the Extent of Service, a town would then be able to evaluate what the appropriate response is and who should be responsible. This might then be reflected in either an organizational modification, if needed, or may require a separate agreement (e.g., Memorandum of Agreement or MOA) with another entity.

<u>Level of Service</u>
The level of service defines the system performance capability objectives and the condition that should exist. It provides the guidance on how system performance conditions should be judged and measured. By analyzing the Level of Service, a town will be able to identify if the correct number of staff exist and if they are allocated correctly between departments.

These three questions (service area, extent of service, and level of service) should be considered when reviewing all of the stormwater services provided. Table 5.3 provides a list of services to be considered in the organizational and administrative analysis. Any organizations, other than the three towns, should also be identified if they currently provide any of these services.

Table 5.4: Services to be Considered in the Organizational and Administrative Analysis

1. Administration & Finance
- General Administration
- General Program Development
- Inter-local Coordination
- Billing Operations
- Customer Service
- Enforcement
- Reporting
- Financial Management

2. Public Involvement & Education
- Public Outreach
- Community meetings/Public Involvement
- Coordination with Homeowner Associations

3. GIS and Technology Support
- Geographic Information
- Systems Mapping

4. Operations and Maintenance
- General Maintenance Management
- General Routine Maintenance
- General Remedial Maintenance
- Emergency Response Maintenance
- Complaints Response

5. Capital Construction
- Major Capital Improvements
- Minor Capital Improvements
- Land, Easement, and Right-of-Way

6. Engineering & Planning
- Design Criteria and Standards
- Structural and Non-Structural BMPs
- Design, Field and Ops Engineering
- Zoning Support
- Retrofitting Program Planning Support

7. Regulatory Compliance & Enforcement
- Code Development and Enforcement
- General Permit Administration
- System Inspection & Regulation
- Zoning and Land Use Regulations
- Construction Management
- Erosion Control Program
- Monitoring Program
- Pesticide, Herbicide, and Fertilizer Program
- Used Oil & Toxic Materials Program
- Program for Public Education & Reporting
- Leakage and Cross Connections to Stormwater
- Industrial Program for Stormwater
- Illicit Connection & Illegal Dumping - IDD&E
- Watershed TMDL Support

Whatever ultimate governance or organizational decision is made, in addition to any responsibility given, it is necessary to make sure that clear authority is granted to those that will oversee stormwater activities, including those responsible for enforcement, collecting user fees and disbursing funds.

5.3 Existing Legislation & Legal Considerations

This study did not include a comprehensive legal analysis for the implementation of a user-fee or other funding mechanism for stormwater management and there are multiple legal considerations. However, existing legislation was reviewed to identify what options appear to exist in Massachusetts to implement a regional or multi-municipal governance structure and/or options for fees and financing. Below are the results of our policy review and interpretation of those statutes that appear to be most germane. This is not intended to be a distinctive study nor is it a legal review. These, and other, legal considerations will require further review as part of a comprehensive legal analysis. The legislation identified below is only provided for informational purposes to be considered by the towns as they continue to evaluate funding options for their stormwater program. The towns should perform "due diligence" throughout the process of developing a new governance structure or funding mechanism for stormwater (see also Section 8.4) to insure that they are allowed and can be defended under Massachusetts law.

Enabling Legislation for Establishing a Stormwater User-Fee (MGL Ch. 83, Sec. 16)

Chapter 83 Section 16 was originally established to allow municipalities to charge for the use of the sanitary sewer system. This section was revised in 2004 (effective July 1st) to incorporate language specific to "main drains and related stormwater facilities"; thereby enabling municipalities to charge a fee for stormwater services.

Chapter 83, Section 16 specifically discusses that any city (and we assume town) or sewer commission can develop an equitable fee for providing stormwater services as well as allow for a system of credits. Considerations and policy interpretation for MGL Ch. 83, Sec. 16 are as follows:

- It states that the fee is to "supplement" other available funds; however the determination or definition of what should be considered available is not provided.
- It specifically stipulates that charges must be either quarterly or annual, which will influence the billing options that are considered.
- It outlines that fees must be charged uniformly across residential properties and a uniform fee established for non-residential properties. This would seem to indicate that a multi-tiered residential approach would not be allowed. The alternative option given is that a uniform fee be established for all properties – this would allow for the ERU approach.
- The current language seems to allow for policy decisions, other than those specifically mandated, to be made on how properties are charged as long as it is fair, equitable, and uniform.

- Because the language states that such a fee shall be paid for “by every person” this language would seem to contradict the additional language that the fee is property based. Therefore, we interpret the intent of the meaning is that all properties would be required to pay said stormwater fee. This interpretation is further substantiated by the discussion of credits as an option to reduce a fee – a credit system is not required by this legislation.

Although MGL Ch. 83, Sec. 16 allows for the establishment of a stormwater user-fee, the question of supporting legislation for a regional utility or district requires further review of additional Massachusetts Law. It appears that the following laws are relevant in the discussion and further review of a regional utility or district: MGL Ch. 21, Sec. 28; MGL Ch. 40, Sec. 4A; MGL Ch. 40N, Sec. 4; and MGL Ch. 40N Sec. 25.

Water Pollution Abatement Districts (MGL Ch. 21, Sec. 28)
According to MGL Ch. 21, Sec. 28, the Massachusetts Department of Environmental Management (DEM) is authorized to propose that a special district be created to manage water pollution, if deemed necessary to adequately manage the pollution. It also outlines the following:

- An abatement district can be a part of one town, all of a town, more than one town or parts of various towns. The borders of the abatement district will be determined by the DEM.
- There are different requirements for cities versus towns. With respect to towns: if an abatement district is proposed then notice will be given to the town and action must take place in 90 days. In the case of a town a special election (with paper ballots) must be advertised and called, unless it coincides with annual meeting during that 90 day period.
- If the geographical area to be included is only a part of a town than only registered voters in that part may vote. If the vote passes then the abatement district shall be deemed established. If the vote fails then the DEM may hold a hearing and if the Director finds that an abatement district is necessary then it may be so declared.
- Once an abatement district is created it can only be dissolved by an act of the general court.

MGL Ch. 21, Sec. 28 is the authority that was used to establish the Charles River Pollution Control District, which was discussed in Section 5.1.1. It appears that this approach significantly limits the ability of the towns to control the decision making process for a stormwater management district and it would be difficult to make changes or dissolve the district. This may provide more incentive for the towns to pursue alternative options such as inter-municipal agreements or the formation of a Regional Water and Sewer District Commission, as outlined below.

Inter-Municipal Agreements (MGL Ch. 40, Sec. 4A)
Chapter 40 Section 4A allows for a governmental unit to enter into a contractual relationship with another governmental unit to perform services on its behalf. It also states:

- The contract will need to be ratified using the established approval methods of each of the government's elected body; as they would with any other contract.
- The details of services to be performed, the financial arrangements, record keeping, length of contract, and any other required and desired stipulations or considerations would need to be negotiated and agreed upon and stipulated in this agreement.
- Chapter 40 Section 4A also appears to provide enabling legislation for a governmental unit to raise money (manner not defined) to meet their legal obligation of the agreement.

This appears to be consistent with the approach for stormwater management using a multi-municipal agreement between 2 or 3 of the towns.

Creation of Municipal Water & Sewer Commissions (MGL Ch. 40N, Sec. 4)
MGL Ch. 40N, Sec. 4 specifically outlines the requirements for the development of a water or sewer **commission**; which is also referred to as a district. It states:

> *"In any city or town which accepts the provisions of this chapter, there is hereby created a body politic and corporate and political subdivision of the commonwealth to be known as the water and sewer commission of the municipality. The commission is hereby constituted an independent public instrumentality and the exercise by the commission of the powers conferred by this chapter shall be deemed and held to be the performance of an essential public function. The commission shall not be subject to the supervision of the municipality or of any department, commission, board, bureau or agency of the municipality except to the extent and in the manner provided in this chapter. "*

Section 4 does not allow a commission to cross political boundaries but would likely allow for a stormwater commission to be developed (in conjunction with the allowances in MGL Ch. 40, Sec. 4A) as a standalone body within a single town, should that option be desired.

Formation of Regional Water & Sewer District Commissions (MGL Ch. 40N, Sec. 25)
MGL Ch. 40N, Sec. 25 appears to contain the most applicable enabling legislation if a Regional Entity is identified as a preferred governance option. Although an amendment to incorporate stormwater may be necessary, Section 25 allows for Municipalities to join together to form a **regional** water and sewer **district** commission. It states the following:

- Regional water and sewer district planning committees from any two or more cities or towns may join together to form a regional water and sewer commission district planning board or boards.
- A regional water and sewer district commission established under the provisions of this section shall be a body politic and corporate and political subdivision of the commonwealth with all the powers and duties conferred by law upon such water and sewer commission, as outlined in sections seven and eight.
- Any town by vote in town meeting duly called therefore or city by a vote of the city council and approved by the mayor . . . may create a special unpaid committee to be known as the district water and sewer planning committee, to consist of three

6.0 Funding Options/Revenue Source Alternatives

This section is intended to provide a general understanding of the typical funding options for stormwater programs and background information related to how existing stormwater programs are funded in Bellingham, Franklin and Milford. A general overview of funding options is presented in Section 6.1. Sections 6.2 and 6.3 focus specifically on the option of a Stormwater Utility to fund the future stormwater programs for each town. A preliminary estimate of rates is provided, and specific funding scenarios were evaluated based on varying approaches for capital projects, implementation timelines, and the potential organizational framework of the future Stormwater Program(s) as initially presented in Section 3.

6.1 Funding Overview & Potential Sources

Municipalities employ a variety of "funding" methods to meet the services provided to their citizens, including service charges, several types of taxes, franchises, and other fees, fines, and penalties. With regard to stormwater services, it is important to understand the three main ways of providing support to stormwater programs: resources, money, and revenue. These are described below:

- Resources include all the non-cash ways that a local stormwater program can be supported, including: free resources available from the internet, shared costs with neighbors, transformation of current programs to better support stormwater needs, volunteer programs, etc. Resources are **not free** in that they often require significant staff time to find, coordinate, and manage.
- Money includes all one-time infusions of funds. This includes Federal and state grants, loans, penalties, bonds, special sales taxes, one-time development related fees and payments, penalties, etc. Money is often targeted to a specific need or program activity. It may, or may not, be sufficient to cover that program, but its key characteristic is that it is **one-time**.
- Revenue includes all ongoing flows of funds. For local governments, this includes property and other ad valorem taxes, sales or gasoline taxes, franchise fees, user fees, etc. The key characteristic of this type of support is that it is **ongoing**.

Each of these basic types of support has advantages and disadvantages and can be targeted toward different aspects of the stormwater program. Municipal stormwater management consists of a number of functions, both operational and administrative. As these elements are considered, it is clear that the bulk of the cost of stormwater programs are on-going and therefore, must be borne by revenue producing support sources not "resources" or "money." Since stormwater cannot compete effectively for general fund tax dollars, most local governments find that only legally dedicated revenue will last the test of time and competing priorities.

The various funding methods also have distinctive characteristics that separate them legally, technically, and in terms of public perceptions. Four major categories of municipal revenue generation methods are taxes, service charges, exactions, and assessments.

- Taxes are intended primarily as revenue generators, and with some exceptions (such as special local option sales or earmarked taxes), without any particular association with the activities or improvements that they fund (i.e., they can be used for the general purposes of local government). These include property tax, income tax, sales tax, etc.
- Service charges are not established simply to generate revenue but must be tied to the objectives of a specific program to which they are associated. For example, water and sewer service charges are structured to cover the cost of those programs, not to simply generate revenue that is used for other purposes as well. Thus, the total revenue generated must be tied to the cost of providing services and facilities, and the amount each rate payer is charged must be related to the impact or "use" of the system (i.e., contains a rational nexus between the charge and service provided).
- Exactions are related to the extension of an approval or privilege to use. Franchise fees for the privilege of using the right-of-way for cable and phone companies limited to a certain percentage of revenue by Federal or state laws are an exaction. Licenses, tap fees, fees in lieu of detention, capital recovery charges of all kinds, and the mandatory dedication of infrastructure during development are also exactions.
- Assessments are geographically or otherwise limited fees levied for improvements or activities of direct and special benefit to those who are being charged. The benefit must be direct, tied to a specific and measurable or estimable property improvement; and it must be special, a benefit which is not generally realized in the community or area.

6.1.1 Identified Funding Sources and Structure

Within the context of the four legal categories identified above, the Towns of Bellingham, Franklin, and Milford identified one or more of the sources of revenue outlined in Figure 6.1 that currently fund their stormwater program activities (or a portion thereof). Within each of the three towns, the primary source of revenue for year-to-year stormwater activities was identified as "General Funds" under the DPW (Bellingham and Franklin) and the Highway Department (Milford). Typical budgets for some of these revenue sources are outlined in Table 6.1. Although these functions or services vary by town, it is clear that the majority of the existing stormwater program costs presented in Section 4.1 are funded through a portion of "General Funds" and "Chapter 90 Funds."

It is worth noting that most of the existing funding sources, other than "General Funds," are project specific and often limit the town's ability to pay for administration and operations costs. Additionally, these funding sources are not guaranteed or dedicated to stormwater and vary from year to year. With the exception of permit fees and public/private partnerships, the majority of funding sources are managed and administered through the DPW or Highway Department, as applicable. Funds under the DPW/Highway are approved by the Board of Selectmen or Town Council, as in the case of Franklin.

Figure 6.1: Existing Revenue Sources for Stormwater Programs

Table 6.1: Typical Budgets by Existing Revenue Source

Revenue Source	Annual Budgets
General Funds (taxes)	• Bellingham DPW - $4.9M total budget (FY2010) • Franklin DPW - $14.6M total budget (FY2011) • Milford Highway Dept. - $4.6M total budget (FY2010)
Loans & Grants (e.g., SRF Loan, s319, CZM, MET, FEMA/MEMA HMGP)	• Grant typical range - $30K to $100K or greater depending on match % • Loan typical range - $100K to multiple $M
Permit Fees (e.g., independent inspection, enforcement)	• Fees vary greatly by project, but do not incorporate town staff time
Chapter 90 Funds (administered by MassDOT, FY 2012	• Bellingham - $509,535 • Franklin - $923,479 • Milford - $811,566
Bonds (for construction)	Varies greatly by project, up to multiple $M
Cost Sharing (e.g., water & sewer funds)	% of a project (e.g., water line construction pays for paving)
Public/Private Partnerships	Perceived value generally exceeds actual value

6.1.2 Stormwater Utility (User Fee) Advantages

A Stormwater Utility (or user-fee system) is seen as an umbrella under which a community or communities address their own specific needs in a manner consistent with local problems, priorities, and practices. It is based on the premise that the stormwater drainage system is a public system, similar to a wastewater or water supply system. When a demand is placed on either of these two later systems, the user pays a service charge. When a natural area is paved, a greater flow of water is placed on the drainage system; thus, creating an increased demand. The greater the demand (i.e., the more the parcel of land is paved), the greater the user fee should be.

<u>A Stormwater Utility is Typically Understood in Three Ways</u>:

- A means of generating revenue;
- A program concept; and
- An organizational entity.

It is important when considering and/or establishing a stormwater utility to determine in which of these three categories the "utility" actually falls. If the only reason for the establishment of a utility is to generate revenue and to free up additional tax revenues, the test for fee for service is not met. Citizens who thought they were getting stormwater services for free and now see a line item on a bill will pick up the phone and expect better service than before. Therefore, it is important to offer a better level of service (program concept) and provide a clear understanding of the program needs if a utility is to be formed.

<u>A Stormwater Utility Provides a Vehicle for</u>:

- Consolidating or coordinating responsibilities that were previously dispersed among several departments and divisions;
- Generating funding that is adequate, stable, equitable, and dedicated solely to the stormwater function; and
- Developing programs that are comprehensive, cohesive, and consistent year-to-year.

<u>Key Advantages of a Stormwater Utility are</u>:

- **It is Equitable** because the cost is borne by the user on the basis of demand placed on the drainage system.
- **It is Stable** because it is not as dependent on the vagaries of the annual budgetary process as taxes are.
- **It is adequate** because a typical stormwater fee is based on a well thought out stormwater program to meet the needs and demands of the community, as well as other program drivers (e.g., water quality, regulations).

<u>Stakeholder Feedback on a Stormwater Utility Funding Approach</u>:
During the course of the Steering Committee Meetings, the Project Team received some feedback related to a Stormwater Utility as a funding option. Although many of the members did not always agree with the "Stormwater Program" and regulatory requirements as they were defined by the Project Team and EPA, some members did feel that a Stormwater Utility was a fair method for funding a program of such magnitude based on their situation (e.g., developed site with limited stormwater controls, poor soils, other site constraints). Additionally, some members expressed that it may not make sense to fund the stormwater program strictly using general funds once the program shifts heavily towards the mitigation of pollutant loads and

costs increase as a consequence. One business stakeholder commented at the June 29, 2011 Steering Committee Meeting that a municipal Stormwater Utility (incorporating DDs) was the only way he could afford to meet the phosphorus reduction requirements under the RDA Permit. Therefore, a Stormwater Utility offers the advantage of a more reasonable fee that may be based on a watershed program to address phosphorus loadings.

Stormwater Utility Evaluation Completed for the Three Municipalities:
This analysis evaluated the preliminary framework for a potential Stormwater Utility as an option to fund the future stormwater programs for Bellingham, Franklin, and Milford. Prior to adoption of a stormwater utility, the three communities will need to further evaluate their desired stormwater program and work out the details of a funding approach; however, the analysis in Sections 6.2 and 6.3 provides the basis for evaluating the rough order of magnitude costs to Single-Family Residential (SFR) and Non-Single-Family Residential (NSFR) properties in each of the towns under specific Stormwater Utility funding options and scenarios.

6.2 Rate Structure Evaluation

When we bill for stormwater services, we are recognizing a property's or a person's use of the stormwater system to discharge the runoff from their property. The stormwater system is a public system that carries runoff from both public and private properties – everyone pays because everyone contributes to runoff. The framework that describes how much each property pays is called the "rate structure."

The rate structure developed for a particular utility is divided into three modules:

1) The basic rate methodology;
2) Modification factors, which can be applied to any of the rate concepts to enhance equity, reduce costs, increase simplicity, and meet other objectives; and
3) Secondary funding methods that can be adopted in concert with the service charges to enhance equity or increase revenue.

Typical modification factors might include: flat rates or tiers for single-family residences, fixed costs per account, and a crediting mechanism. Secondary funding methods might include plan review fees, inspection fees, and fees in lieu of detention. There are potentially a large number of decisions that must be made within each of these three areas, though experienced practitioners can narrow down the universe of options fairly quickly to those that will best support the program concept in an effective and equitable manner.

We will not be fully defining modification factors or discussing secondary funding methods at this point; though upon implementation, these subjects will be important to fully define. However, the basic rate methodology needs to be defined on a preliminary basis in order to make fee estimates.

6.2.1 Basic Rate Methodology

The basic rate methodology defines what makes up the rate that users will be paying. The three main impacts of urban development are increases in peak flow, volume of discharge, and amount of pollution; all other impacts can fit into these three basic categories. When we look at each of these major impacts in an urban setting (versus an agricultural one, for example), the primary cause is the conversion of forests and fields to impervious area (e.g., pavement, roof tops, etc.). It is this conversion to impervious area that causes a town to invest in the public drainage system – and the costs are roughly proportional.

Therefore, nearly all stormwater utilities use some surrogate of impervious area in their rate methodologies. A 2010 survey found that 55 percent of all stormwater utilities responding used impervious area as the only factor that went into the rate calculation, and 94 percent included some measure of impervious area in their calculation (Black &Veatch, 2010).

However, there are other factors or ways to configure the rate methodology to emphasize specific impacts or encourage certain kinds of development. Many of these considerations are handled with a stormwater crediting or secondary funding system. Some factors can best be handled in the makeup of the basic rate methodology itself.

Two in particular are commonly considered – though there are many variations:

1) Some communities charge for gross parcel area in addition to impervious area, reasoning that stormwater runs off all parcels; and thus, all should pay. In this concept, the idea is that management of the total stormwater system is of concern, not simply handling the increases due to urban development.
2) Other utilities want to encourage green space and set up charges based on an intensity of development factor – so that the same amount imperviousness would be charged less if it were located on a larger lot with more green space.

These latter two approaches are almost opposites of each other. They are ordinarily seen as mutually exclusive, although a rate methodology could be conceived that would incorporate both of these additional considerations. The 2010 survey, cited above, also found that of the remaining stormwater utilities that did not base charges solely on impervious area had:

- 29% that charge based on gross area plus impervious area;
- 10% that recognize the benefits of green space through an intensity of development factor; and
- 6% that used an “other” basis for fees.

Other factors can cause towns to spend stormwater-related money even though a property has little impervious area. For example, agricultural or golf course uses might generate a lot of nutrients and related costs unrelated to impervious area. Rate structures can be made flexible enough to accommodate key factors as appropriate, although it is important to remember that simplicity is best.

6.2.2 Rate Modifier or Class Exemptions

Rate modifiers or class exemptions are the second component of the rate structure and are policies that change the user fee charged to certain classes or types of properties. They are designed to appropriately increase simplicity or enhance equity. Nearly all utilities adopt one or more rate modifiers. There are significant pros and cons that need to be discussed as part of utility development. Rate modifiers and class exemptions that might be considered are described below:

Residential Charges

Compared to non-SFR properties, the variability of measured imperviousness is small. Most SFR properties are similar. Cost of service analyses conducted in Cincinnati, Tulsa, and Louisville all indicate that the cost of stormwater management services and facilities does not change appreciably based on the size of the parcel.

Because of this, the majority of cities and counties that have stormwater service fees employ a simplified charge for single-family residences. The principal motivation for using a simplified residential rate is to reduce costs, without sacrificing equity. The details of simplified residential rates vary from community to community. Many use just one rate for all developed SFR properties, but several other approaches have been adopted:

- Some use a single, flat rate while others have two or more flat rate tiers or classes of residential properties.
- Several communities have a flat rate or two tiers but have a cutoff number above which all residences are charged as if they were commercial properties. This captures the imperviousness of the few very large properties in a more equitable way.

Fixed Cost per Account

Fixed costs per account are uniform charges to each account for those costs that might be better allocated on a per account basis than on a per Equivalent Residential Unit (ERU – see Section 6.2.3) basis. Things such as billing and administrative costs might fit into this category. The net impact of having a fixed cost per account is to shift costs to residential customers away from commercial customers.

Variable Service Area Charges

Some stormwater utilities vary the fee based on location. In this case, there needs to be something about the location that is essentially different, in terms of cost causation or level of service, about the location. So in our case, this might include a differing charge for those within and outside the Charles River Watershed. The matter gets complex when those residing outside one particular area make use of that area, the roads in that area, or in some other way benefit from activities within that area.

Variable Charges Based on Property Class

Some stormwater utilities charge differently or exempt certain classes of ratepayers such as:

(1) publicly owned property; (2) roads – public or private; (3) non-profits; (4) income disadvantaged; (5) elderly; and (6) parkland or others. There are a variety of reasons to do so, only a few of which have to do with the basis of the rate and cost causation. For example, the elderly do not cause less cost on the basis of being elderly, nor do public schools have less runoff than an equally sized business establishment. However, there are other ways to address some of these property classes, such as the income disadvantaged or elderly customers, that may include a rebate of fees apart from the utility rate process. In this case, general fund allocations would be used to support the rebate program and it then becomes a policy decision based on non-technical merit and not a part of the utility rate structure itself.

Discussions related to the treatment of roads, public properties and parkland will be important because the total loading of phosphorous includes loadings from these properties; especially roads, which make up almost one-third of the total impervious area. Such discussions would take place in the context of other policy decisions to insure an adequate balance of equity and sufficient revenue.

Stormwater Credits

Often variable charges are accounted for in the form of credits to effectively reduce the fee for a particular property. Generally, stormwater credits are granted both to increase equity and to provide incentives to implement an overall community stormwater management plan.

Credits are important in several ways:

- Credits typically do not significantly reduce the utility's total revenue potential (often less than 2 to 5%), but may have a large potential to reduce resistance to the utility concept from large fee payers or others who would qualify for a credit. It is worth noting that a much larger revenue impact may occur if the DDs in the three Towns are granted full credit against the capital construction portion of the fee.
- One way a fee differs from a tax is that the customer must be able to refuse service and that the provision of service must be largely voluntary in nature. Credits may help to satisfy this requirement of a fee versus a tax.
- Credits are also one of only a few ways stormwater utilities have to encourage better on-site stormwater management using a "carrot" rather than a "stick." As such they carry an importance far beyond their actual revenue significance.

It is important to note the difference between the term "credit" and the term "offset," "incentive," or "exemption" to avoid confusion.

- A "credit" is a permanent reduction in the user fee as long as the recipient applies for and continues to maintain its reduced impact on the system or program.
- The term "offset" refers to a one-time reduction in an overall fee.
- An "incentive" is typically a one-time monetary or other inducement to support a community objective.

- An "exemption" is the waiving of part, or all, of the fee in recognition of some extraordinary circumstance peculiar to an individual or parcel for which the local government determines an exemption is warranted.

Ideally, credits should be derived and applied on the same basis as rates. They are earned. In this case, there are really only two main reasons for a stormwater credit that pass this rate-paralleling muster:

1. **Reduced Impact** – I obtain a stormwater credit because I take some (normally privately funded) ongoing action on my property that reduces its actual use of, or impact on, the downstream stormwater system to a level below that which would be reflected in the physical parcel measurement that determines my user fee.
2. **Reduced Cost of Service** – I do some (normally privately funded) activity, operate some program, or perform some function that, in an ongoing way, reduces the overall cost of the stormwater program for the local government, and thus obtain some, or all, of my cost of such performance back in the form of a credit.

The typical basic guiding principle in developing and granting stormwater credits based on impact and cost reduction can be stated as: ***"Credit should be given for approved private investments or actions commensurate with reduced public cost, or which produce a stormwater related public good which is ongoing."*** Under this guiding principle, there are a number of ways to look at how credits could theoretically be justified and applied. Table 6.2 gives some more common examples. In the case of the three towns subject to the RDA GP, the recognition of the DDs individual investments in phosphorous control could be efficiently handled with a crediting mechanism against the portion of the fee that reflects their portion of phosphorous reduction. This might avoid all the complexities of a rate structure reflecting the various combinations of location and town costs.

Stormwater programs vary considerably in the amount of the user fees that they make eligible for crediting. **The amount of a fee that is eligible for credits might be seen as the relative "generosity" of the credit.** Although the generosity of credits can be a bit subjective, there are rational reasons supporting a broad range of considerations, as well as good reasons for a cap on the amount of credit. For example, roads make up almost one-third of the impervious area and the cost of treating phosphorous from the roads is a shared community cost. If a property were credited 100% of their user fee that would mean their share of the road costs would be spread to others; a seemingly inequitable outcome. Other reasons for capping the amount of user fee available for credits includes recognition that parts of the stormwater program are fixed and therefore irreducible by private actions, and that all property even with advanced on-site treatment will have some adverse impact on the public drainage system.

Table 6.2: Examples of Credits on Two Bases – Reduced Impact and Reduced Cost of Service

Credits Based on Individual Parcel Reduction of Use or Impact	**Credits Based on Private Actions Leading to a Potential Reduction of Overall Local Program Cost**
• Peak flow credit for detention • Volume reduction credit for infiltration • Pollution (i.e., phosphorous) credit for approved BMP designs • Regular sweeping that reduces phosphorous loading • Runoff reduction credit for the provision of infiltration areas with disconnected imperviousness • Site design credit for designing properties with embedded runoff reduction principles and approaches • Oversize credit for provision of additional storage volume above design standards	• Stormwater education credit for schools and/or others • Stormwater activity credit for sponsoring stream cleanups • Area maintenance credits for performing maintenance on large urban areas or roadways • Industrial NPDES credit for complying with an individual NPDES stormwater industrial permit

Lastly, it is important to consider the downside to credits too. They can be: (1) complex and costly to initially determine, (2) hard to administer and police, (3) not large enough to actually encourage modified stormwater behavior, and (4) can be mismatched in the new development process in that it is the developer who most often must make the decision to build something credit-worthy into the site but it is not the developer who benefits from the ongoing credit – it is the owner.

6.2.3 Available Data & ERU Analysis for Towns

Equivalent Residential Unit

Stormwater billing is often based on a unit of imperviousness that reflects a typical residence – called the Equivalent Residential Unit (ERU). This is an intuitively understood concept acceptable to most ratepayers. Thus, if a property has ten times the ERU measurement, they would pay ten times the fee.

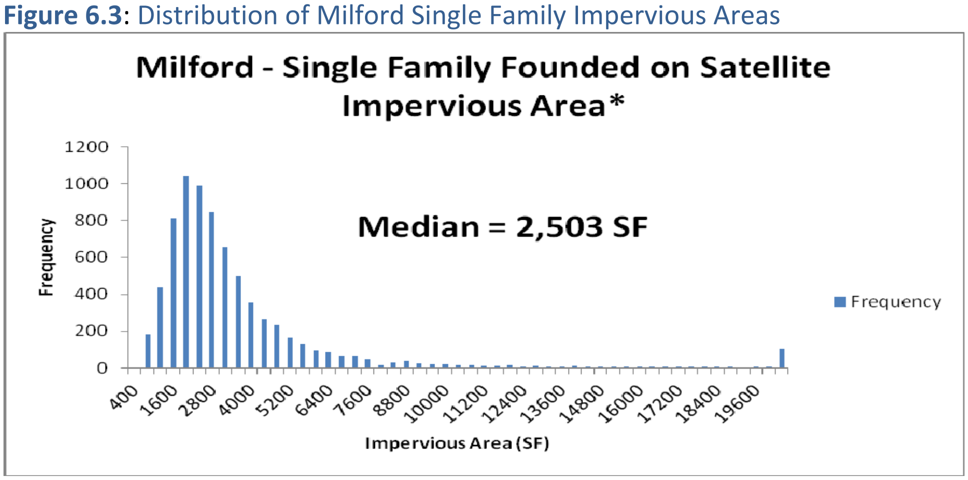
Figure 6.2 shows an example of the impervious coverage on a non-residential parcel in Franklin that has 18,943 square feet of impervious area. If the ERU is about 3,250 square feet, then this parcel contains 5.8 ERUs. Most municipalities typically charge on the basis of "ERUs or part thereof," which would make this parcel 6 ERUs. Thus, if the charge per ERU were $6.00, the fee for this property would be $36 per month.

Figure 6.2: Example of Non-Residential Parcel Impervious Area

<u>Calculation of ERU Values</u>

To develop an estimate of the ERU, each parcel was classified using land use and impervious area data as “residential,” “non-residential,” or “non-billable” for each of the three towns. Non-billable parcels are called “other” or “vacant” in the analysis, and are either a non-parcel (such as street right of way), or have less than 400 square feet of satellite derived impervious area on them. Using satellite-derived impervious polygons, the value and number of ERUs were calculated for each town. The ERU value was computed by taking the median of the impervious areas for the residential parcels, excluding those with impervious area less than 400 square feet or more than 20,000 square feet. The range and median of impervious areas for residential parcels in Milford is illustrated in Figure 6.3 below.

Figure 6.3: Distribution of Milford Single Family Impervious Areas



*Note: the data analysis revealed that numerous parcels were assigned a “residential” land use classification in the GIS data layer but some impervious areas were as high as 3-5 acres. These parcels will require further review to verify that they are residential. This may ultimately impact the total number of ERUs and fee per ERU if these parcels are determined to be non-residential. Very large impervious areas on residential parcels are typically classified as non-residential parcels and charged on the basis of actual impervious area and total ERUs.

Although the land use data (i.e., land use code in the parcel GIS data layer) is imperfect, visually the boundaries of imperviousness were observed to be appropriate for this level of analysis. Based on satellite-derived data, the ERU value was computed for each of the three towns (see Table 6.3).

The impervious area for each residential parcel in Franklin was also computed using manually developed impervious area polygons, from which the ERU was then computed. The Franklin ERU value, based on measured data, was calculated as 3,252.3 square feet, which was 21% larger than that computed from satellite-derived sources. This is a common deviation as the satellite method often "misses" impervious area hidden by tree canopy, and thus, underestimates areas that are actually impervious. When the project team then compared the impervious areas from satellite-derived sources to those from the measured source for the non-residential parcels in Franklin, it was found that the measured impervious areas for these parcels were LESS than the impervious areas derived from satellite (17% less overall). This is because the satellite derivation method overestimates in areas of disturbed soil, and also because some impervious features were apparently not digitized in the manually-collected feature layer.

The project team did not have any manually collected impervious area data for Bellingham and Milford; however, the assumption was made that if careful measurements were performed in those two towns, a similar translation would occur between satellite-derived and manually measured values for residential and nonresidential parcels. In other words, the true impervious area on residential parcels in these two towns is probably 21% larger than that derived from satellite, and the true impervious area on the non-residential parcels in these two towns is probably somewhere in between that derived from satellite and that derived from a translation equation derivable from the Franklin data. Based on these assumptions, the project team computed the ERU values presented in Table 6.3. Because of the incompleteness of the data, these estimates should be considered as "initial estimates," and there will be a need for updating and correcting the data for each of the towns in any subsequent implementation stage. In the end, these figures will be rounded for simplicity.

Table 6.3: Equivalent Residential Unit (ERU) Values for Each of the Three Towns

Towns & ERU Values in SF	Satellite ERU Value	Manual ERU Value*	Calculated ERU Value
Bellingham	2,693.6	-	3,260
Franklin	2,687.6	3,252.3	-
Milford	2,503.4	-	3,029
*The manually derived ERU for Franklin was used to reconcile discrepancies in the satellite ERU computations for Bellingham and Milford.			

The resulting "calculated" ERU values serve as a more conservative value in this study, as outlined below:

- A higher ERU value results in fewer total ERUs for non-residential properties; and

- The same program cost is now spread over fewer ERUs; therefore,
- The cost/ERU is slightly higher for both residential and non-residential properties.

Calculation of Total ERUs

Using the ERU values for each of the Towns, the total number of ERUs was calculated based on residential and non-residential properties. Table 6.4 shows the breakdown of properties in each town and the resulting number of ERUs.

Table 6.4: Total ERUs by Major Property Type within Each Town

Town	Residential	Non-Residential	Roads (local & state)	TOTAL ERUs
Bellingham	4,662	10,137	6,390	21,189
Franklin	7,799	13,566	12,404	33,769
Milford	7,382	12,870	8,271	28,523
TOTALS				83,481

*Note: properties with less than 400 square feet of impervious area were assigned 0 ERUs.

As noted previously, the initial data analysis revealed numerous residential parcels with very large impervious areas (3-5 acres). Regardless of whether these parcels are classified as residential, they would typically be treated as non-residential in the rate structure and charged on the basis of total impervious area versus only one (1) ERU. This would increase the total number of ERUs and consequently decrease the cost/ERU.

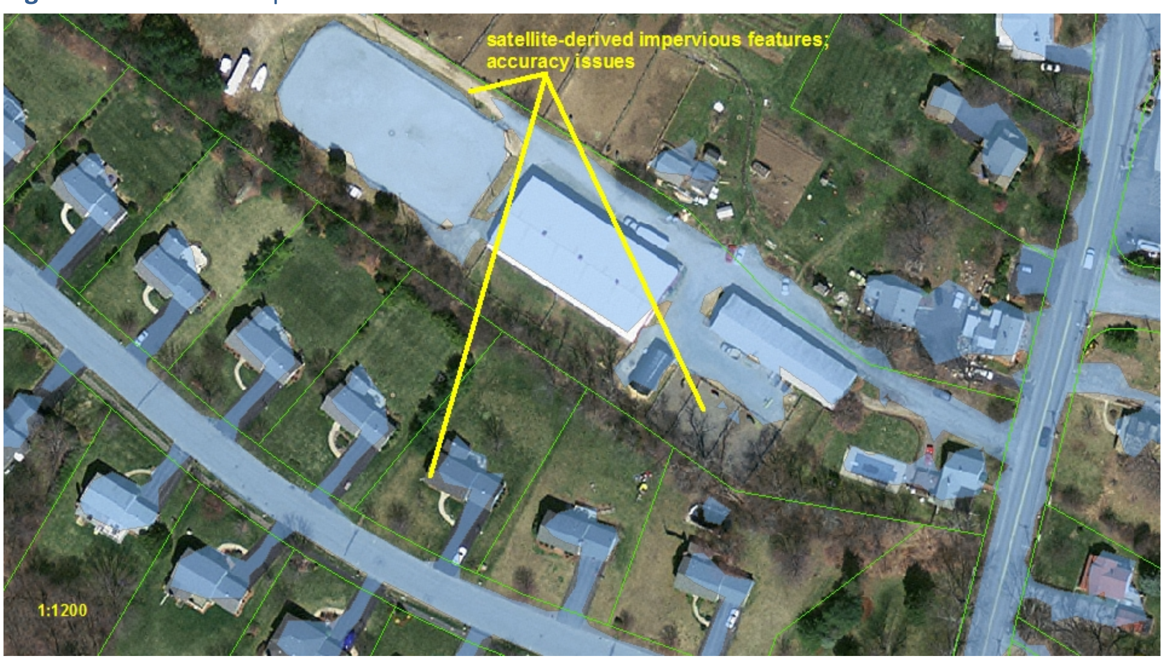
Other Data Issues

In addition to the ERU calculation issues identified above, other examples of data issues include how condominium ownership is modeled on a parcel. In the example below (Figure 6.4), 32 owners on a condo parcel are depicted as 32 stacked parcels with the same parcel ID. Depending on data and billing policy ultimately adopted by the applicable town, the handling of stacked parcels would create extra steps in the translation from geographic data to stormwater bills.

As discussed above, there are inherent accuracy challenges when using satellite imagery and automated processing to develop the impervious layer. As can be seen in this example (Figure 6.5), portions of impervious features are incomplete or missing. Future costs include improved GIS data development, and have been incorporated into the annual operating costs for each town (refer to Appendix D).

Figure 6.4: Example of Condominiums

Figure 6.5: Satellite Impervious Issues



6.3 Program Funding Options

Section 3 of this report outlined several typical organizational options, which included an incrementally greater involvement of the various parties in a joint or cooperative program. As mentioned in that section, the options differ in terms of: (1) time frame for implementation, (2) funding mechanism, and (3) municipal management approach.

This section discusses the impacts of independent actions with and without the inclusion of DDs across several implementation time frames. In this analysis, it has been assumed that a Stormwater Utility (user fee) is employed to fund the total of all program components, though other sources of funding (such as development fee, grants, general taxes, public-private cost share, or even paying some of the cost through sewer fees) could also be employed, lowering the stormwater utility rate estimates accordingly.

6.3.1 Overview of Analysis

A series of studies was done to investigate the impacts of: <u>timing of program implementation</u>, <u>inclusion of DDs</u> in the user fee, and <u>delay of capital construction</u> towards the back end of an implementation timeframe, as a so-called "back-end-loaded approach." Only independent community analysis was used (i.e., the project team did not look at the revenues required for the three municipalities combined as one entity). It was felt that this would provide sufficient information to assist in final decision making. In the case of a collaborative approach, the costs would be the summation of the three separate programs but with the probable efficiencies recognized as discussed in Sections 3 and 4.3.

Three financial options were defined, each with a program implementation time of 10, 15, 20, and 25 years. In each case, construction of the capital projects was assumed to begin in 2017, which is assumed to be five years after the effective date of the MS4 and RDA GPs. That is, no bonding for construction begins until 2017, the intervening years being used to plan for construction and to implement other aspects of the program.

The three financial assessment options each evaluated at the four time frames are:

1) Uniform capital construction program with the DDs on board (i.e., projects expenditures are implemented at a constant rate over the prescribed timeframe, and DDs participate fully in the program);
2) Uniform capital construction program without the DDs on board (same as above but DD properties implement projects independent of the municipalities); and
3) A back-end loaded construction program with the DDs on board.

6.3.2 Revenue Capacity

Revenue capacity is the size of the rate base – how much revenue will be generated by a certain charge. Basic information was developed on the ability of each town to generate revenue through a stormwater user fee. For this analysis, the fee is assumed to come from impervious area only (e.g., rooftops, pavement, etc.) and to be measured in increments of the size of the typical residential property in each town – i.e. an ERU. Table 6.5 gives this basic information for the totality of each town. ERU values were developed as described above and reviewing all the residential impervious areas and taking the median value.

Table 6.5: Basic Revenue Capacity Information – ERUs within Each Town and Total for 3 Towns

Town	DD ERUs	Other IA ERUs	Local Road ERUs	State/Fed Roadway ERUs	TOTAL ERUs
Bellingham	3,594	11,205	5,642	748	21,189
Franklin	6,291	15,074	10,903	1,501	33,769
Milford	5,821	14,431	6,997	1,274	28,523
TOTALS	15,706	40,710	23,543	3,522	83,481

Note that in this table, the sources of the revenue are identified and classified as: (1) DDs, (2) all local impervious area, (3) local roads, and (4) state and Federal roads. Not all of these categories of impervious area might be available to the towns for revenue calculations.

If one were going to include only the portion of the towns that is within the Charles River Watershed, then Table 6.6 would be applicable. From these two tables, it can be seen that the DD ERUs plus the Other IA ERUs for the Charles River Watershed (i.e., road ERUs not counted) only are 59%, 96% and 92% of the total town ERUs for Bellingham, Franklin, and Milford, respectively. That is, Bellingham's stormwater fee would nearly double if it charged only those properties within the Charles River Watershed the stormwater fee for the phosphorus reduction portion of the program.

Table 6.6: Basic Revenue Capacity Information – ERUs (Charles River Watershed Only)

Town	DD ERUs	Other IA ERUs	Local Road ERUs	State/Fed Roadway ERUs	TOTAL ERU
Bellingham	3,594	5,139	2,934	389	12,055
Franklin	6,291	14,182	9,889	1,361	31,724
Milford	5,821	12,715	6,004	1,093	25,633
TOTALS	15,706	32,036	18,827	2,843	69,412

Total revenue capacity is simply the number of ERUs for each category multiplied by the monthly fee per ERU, and by 12 to make it an annual fee. Using Table 6.5 data, Table 6.7 shows percentages of total revenue, while Table 6.8 shows annual revenue generated per one dollar per ERU per month charge (i.e., the revenue a charge of $1.00 would generate). As noted previously these values include the totality of each town without regard to location within or outside of the Charles River Watershed. The differences are less than 15% for Milford and

Franklin but would be far more substantial for Bellingham. Refer to Appendix F for the quantification and assessment of the impacts on ERU rates assuming only parcels within the Charles River Watershed are used to generate revenue for a Stormwater Utility.

Table 6.7: Basic Revenue Capacity Information – Percent of Total Revenue

Town	DD %	Other IA %	Local Road %	MDOT %	TOTAL %
Bellingham	17.0%	52.9%	26.6%	3.5%	100%
Franklin	18.6%	44.6%	32.3%	4.4%	100%
Milford	20.4%	50.6%	24.5%	4.5%	100%
TOTALS	18.8%	48.8%	28.2%	4.2%	100%

Table 6.8: Basic Revenue Capacity Information (Roads Included) – Annual Revenue for One Dollar/ERU/Month

Town	DD $$	Other IA $$	Local Road $$	MDOT $$	TOTAL $$
Bellingham	$43,128	$134,460	$67,706	$8,971	$254,265
Franklin	$75,492	$180,888	$130,837	$18,011	$405,227
Milford	$69,852	$173,172	$83,969	$15,285	$342,279
TOTALS	$188,472	$488,520	$282,512	$42,267	$1,001,771

6.3.3 Treatment of Public Roads

It should be noted that local and state roadway ERUs comprise 32% of the total. For this analysis, it was assumed that the towns choose not to bill themselves for roadways – both local and other. This assumption is significant for several reasons:

- Roadway impervious surfaces generate 32% of the total revenue. If they were included, such inclusion would lower the charge per ERU by 32% but would also require each town to make up that payment from its own funds – because the roads are then considered like all other impervious area and are town owned. Based on total program cost projections, each town's general fund support of the program through the road charge would quickly surpass current stormwater funding requiring either tax increases to cover the roads portion or budget cuts from elsewhere. This was seen as an unattractive initial option. There is the option of the municipalities to pay some portion of the stormwater fee from its general fund to reduce stormwater fee amounts, though this option was not explored in this analysis.
- State and Federal roadways make up 4.2% of the total. This potential revenue is lost if roads are not included – though actual collection of state and Federal roadway charges is sometimes problematic. For Milford alone, this total averages about $70,000 per year for the first ten years and increases from there, so this is a significant source of revenue that should be retained.
- The costs of the phosphorus reduction program are proportional to the amount of impervious area. Thus, roadways contribute 32% of the total capital and associated

maintenance program cost. This cost is logically spread across all other parcels on the basis of their impervious area – that being the best measure reflective of a rational nexus between the use of the roadways or benefit from the roadways. For example, a large non-residential parking lot reflects large roadway use for customers/members to safely arrive at the business or other facility. The result of this is that these program costs will be allocated across all parcels regardless of participation in the town stormwater program. So DDs will be allocated their fair share of these costs along with their fair share of other non-capital stormwater program costs.

Table 6.9 shows the revenue with all local, state and Federal roadways removed. These numbers were used in all further analyses.

Table 6.9: Basic Revenue Capacity Information within Each Town (with Roads Removed) – Annual Revenue for One Dollar/ERU/Mo Including DDs

Town	DD $$	DD %	Other IA $$	Other IA %	TOTAL $$
Bellingham	$43,128	24%	$134,460	76%	$177,588
Franklin	$75,492	29%	$180,888	71%	$256,380
Milford	$69,852	29%	$173,172	71%	$243,024
TOTALS	$188,472	28%	$488,520	72%	$676,992

6.3.4 Cost Calculations

Section 4.2.2 detailed the capital costs in current dollars, while Section 4.2.3 detailed other non-structural costs. For the purposes of this analysis, it was necessary to calculate the change in program cost over time. To do so, the following assumptions were made as a percentage of current capital costs:

- Inflation rate: 2.5%;
- Bond interest rate: 4.0% for a bond maturation life of 20 years;
- Operations and maintenance cost on new construction beginning in the year after construction: 3.5% annually;
- Billing and administrative cost: $0.65/account billed quarterly;
- Capital costs were inflated to 2017 to begin construction; and
- One-time bonding costs are included in the bonded capital interest rate.

Table 6.10 summarizes the estimated operational costs as well as the capital implementation costs for construction of structural stormwater controls for both the municipalities and the DDs, in 2011 dollars. Table 6.10 presents estimated total capital costs plus annual operational costs, but does not include Stormwater Utility billing costs and annual maintenance costs on capital projects.

Table 6.10: Estimated Operational and Capital Costs – Charles River Watershed (2011 dollars)

Town	DD CIP	Town CIP	Total CIP	Operating Costs[1]
Bellingham	$2,600,000[2]	$27,100,000	$29,700,000	$891,000
Franklin	$10,900,000	$63,700,000	$74,600,000	$1,815,000
Milford	$11,100,000	$64,700,000	$75,800,000	$1,037,000
TOTALS	$24,600,000	$155,500,000	$180,100,000	$3,744,000

[1] Annual Average for first five years
[2] Bellingham DD implementation costs per impervious acre are estimated to be significantly lower due to the presence of higher infiltration capacity soils underlying subject properties and the lower ratio of impervious to pervious surfaces compared to DD properties in the other two municipalities.
Costs are rounded to the nearest $1,000 (totals may not add up due to round-off error).

Total implementation costs include capital expenditures, operational costs, billing, BMP maintenance costs, as well as interest costs on bonds used to fund capital projects and inflation over time. As previously stated, implementation of structural controls was evaluated over four different time periods. Each time period evaluation assumed that initial construction would begin in Year 6 of the permit and continue for another 5, 10, 15, or 20 years thereafter. Total program costs to be paid by the Stormwater Utility for each year includes: interest on capital bonds + operations and maintenance cost on accumulated capital construction + general program operating costs + billing and administration costs.

Total program cost to be paid by the Stormwater Utility for each year includes: interest on capital bonds + operations and maintenance cost on accumulated capital construction + general program operating costs + billing and administration costs. In every year, the inflated cost totals were used based on the assumed inflation rate. The loan interest and operations and maintenance cost on accumulated capital construction varied according to the construction program chosen as follows:

- In the 25-year program, plan construction is completed in the last 20 years;
- In the 20-year program, plan construction is completed in the last 15 years;
- In the 15-year program, plan construction is completed in the last 10 years; and
- In the 10-year program, plan construction is completed in the last 5 years.

Payment of the interest on the bonded capital construction continues for twenty years from the last date of borrowing. So in the case of the 25-year program with construction beginning in 2017 and ending in 2037, bond interest payments extend to 2057. In the case of the 10-year program, construction begins in 2017 and ends in 2021 with bond interest payments continuing until 2041.

The timeframe for implementation will have a significant effect on the total implementation costs as well as the required ERU rates to cover the total costs. The sum of all estimated costs (including billing and BMP maintenance) over a 25-year period, beginning in 2012 is presented for the four implementation time periods in Table 6.11.

Table 6.11: Estimated Total Implementation Costs over 25 Years Beginning in 2012 (2011 Dollars)

Town	10-Year Implementation	15-Year Implementation	20-Year Implementation	25-Year Implementation
Bellingham	$70,819,000	$65,836,000	$60,661,000	$55,310,000
Franklin	$165,893,000	$153,401,000	$140,403,000	$126,926,000
Milford	$146,123,000	$133,405,000	$120,198,000	$106,505,000
TOTALS	$382,835,000	$352,643,000	$321,262,000	$288,741,000
Costs are rounded to the nearest $1,000 (totals may not add up due to round-off error).				

6.3.5 Back-End Loading

One option explored was the idea of back-end loading the capital construction. There are many good reasons to do this including: (1) the value of starting slowly at first to gain experience in efficiently handling multiple construction projects; (2) the potential for better or changed data or some other unforeseen factor to reduce control requirements; and (3) the potential that better technology or more effective non-structural phosphorus reduction approaches would become available prior to irreversible brick and mortar investments.

Back-end loading balances the desire to delay capital investment with the problem of having to make up too much construction in the end of an implementation timeframe. A prudent set of ratios of the uniform construction amounts were derived for each program length:

- In the 25-year program, plan construction ratios are 0.5, 0.75, 1.25 and 1.75 in four five-year increments;
- In the 20-year program, plan construction ratios are 0.75, 1.0 and 1.30 in three five-year increments;
- In the 15-year program, plan construction ratios are 0.75, and 1.30 in two five-year increments; and
- In the 10-year program, plan construction no delay is calculated and costs equal the uniform investment program.

6.3.6 Non-Participation of Direct Dischargers

Table 6.10 shows the portion of the total capital investment belonging to DDs. One option is that DDs construct their own phosphorus reducing structures and do not participate in the town phosphorus reduction plan. This has two main impacts: the revenue in support of the local town capital program is partially removed, and the corresponding capital demands of the DDs are also removed.

Non-participation of the DDs in the phosphorus reduction program does not exempt them from the shared costs of the program, which are allocated across all impervious area. As discussed previously, because phosphorus costs are related to impervious area, the roadway impervious area (32%, on average) of the phosphorus reduction costs must be allocated to all properties. Allocation of that cost on the basis of impervious area is equitable for reasons explained in Section 6.3.3. For example, in Milford, DDs make up 28.7% of the ERUs and, therefore, 28.7% of the roadway-related capital cost (32% of the total capital program) must be borne by the DDs. This amounts to about $6M of the total estimated $64.7M.

In addition, other program costs not associated with the capital program related to phosphorus reduction are also allocated across all parcels on the basis of impervious area using the same proportions.

In this case, these DDs will receive a bill from the town but at a reduced amount due to their non-participation in the program. This can be handled through individual crediting or through the rate methodology itself.

6.3.7 Analysis Results – Program Length Variations

The following set of three figures (Figures 6.6 through 6.8) illustrates the impact of changing the program length on the monthly user fee per ERU for each of the towns. As stated above, four different scenarios were modeled: 25-year, 20-year, 15-year, and 10-year. In each case, construction was assumed to begin in 2017 (after the first five-year period) and then be completed throughout the remainder of the plan life. So, for example, for the 25-year plan, construction begins in year 6 and continues for 20 years until year 25. **If a stormwater utility was immediately formed in each of the three towns to cover just operational fees, the monthly ERU fee in Bellingham, Franklin, and Milford, would be approximately $5.10, $7.20 and $4.40 respectively.**

In each of the figures, costs escalate throughout the construction period because additional bonded capital is invested, and interest payments on the 20-year bonds are added to the ongoing interest payments from the previous years. At the end of the 20-year bond period for each year's construction, those interest payments would cease, and the annual program cost, for that portion, would go down. So for the 10-year plan, construction takes place over a five-year period with bonded capital costs accruing throughout that period. All values shown are in 2011 dollars for comparison purposes. As can be seen from these figures, the shorter and far more aggressive construction periods greatly accelerate the fee increases. There are several potential disadvantages to such an aggressive approach, including:

- The rapid fee increases would potentially create a hardship for businesses who cannot adjust. For example, in Milford, the average annual increase for the 25-year plan in the first ten years of capital expenditures is about 17% while that for the 10-year plan is approximately 26%.
- The fees for the shorter period are themselves very different averaging $16.86 for the 25-year plan but $23.13 for the 10-year plan in Milford, potentially causing significant hardship for larger properties.
- An aggressive program would also require the towns to accomplish a great deal of construction in a relatively short time period leading to potential inefficiencies as experience is gained.

Figure 6.6: Milford Fee Estimates for Four Program Lengths

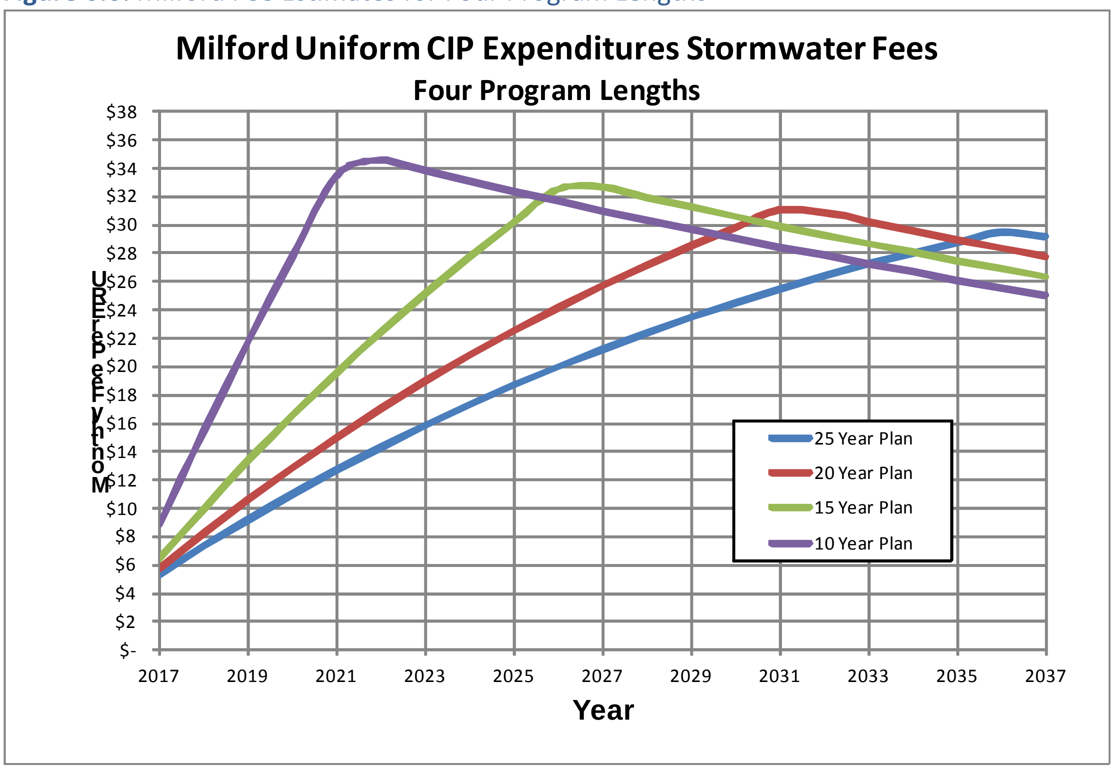


Figure 6.7: Franklin Fee Estimates for Four Program Lengths

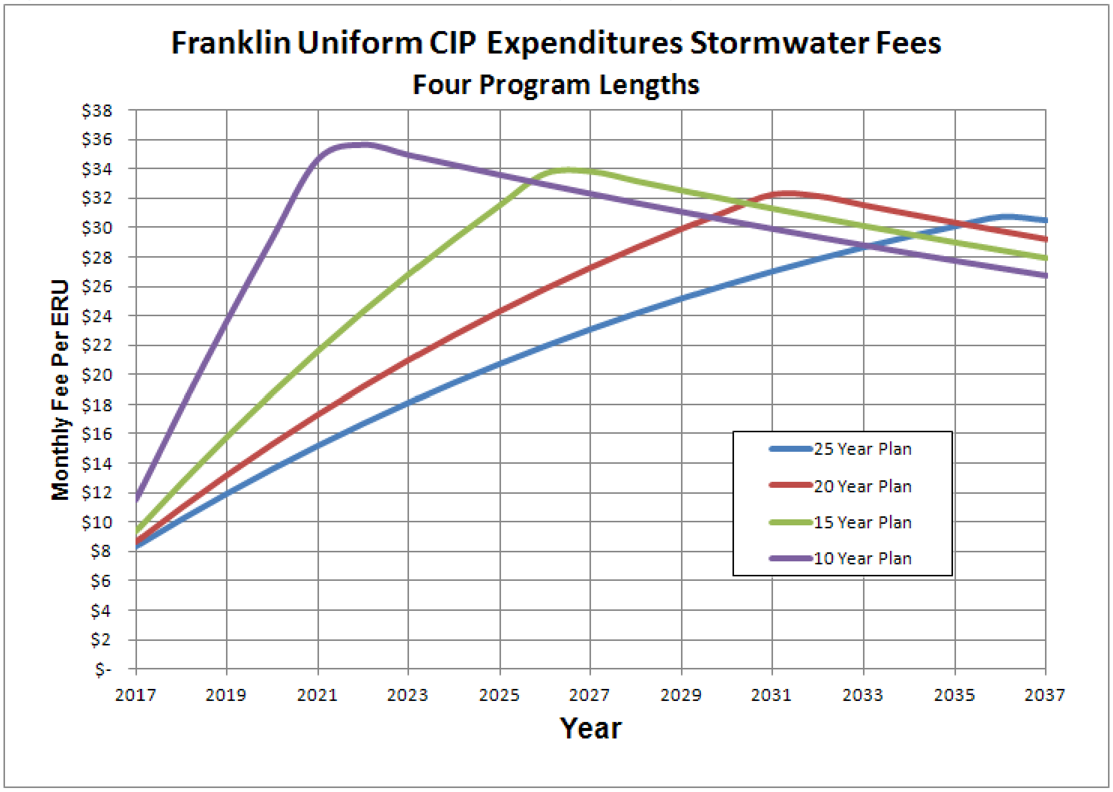
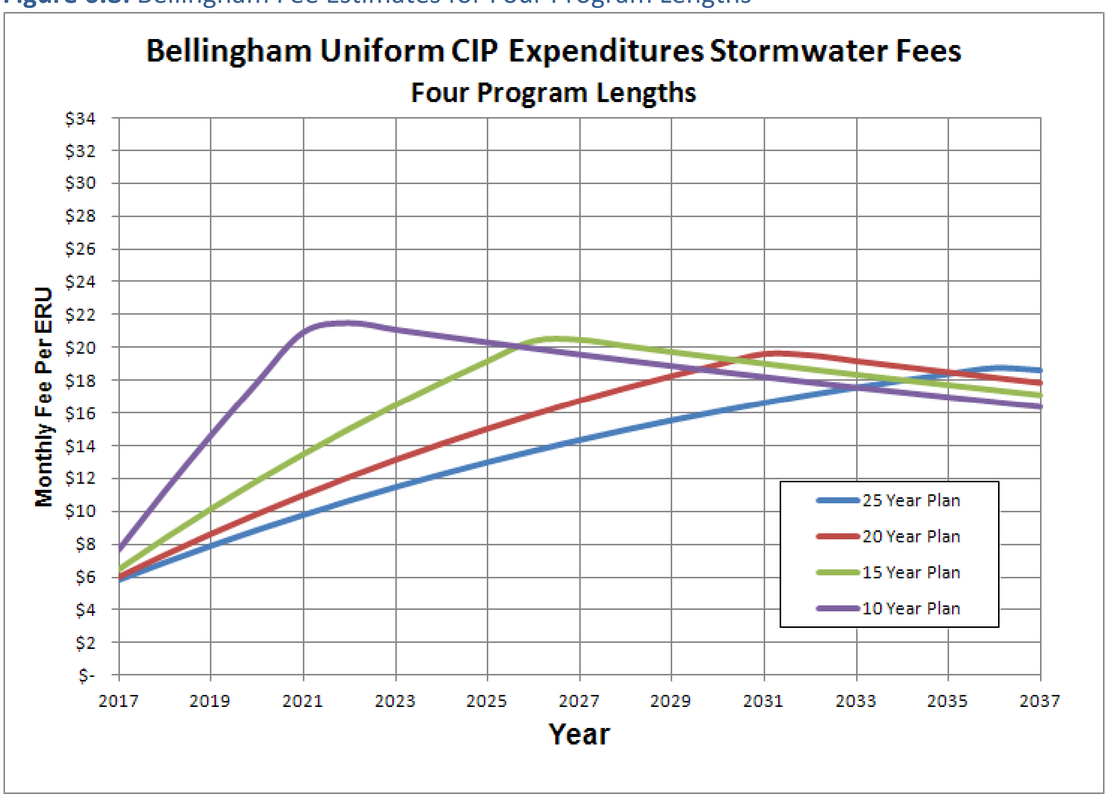


Figure 6.8: Bellingham Fee Estimates for Four Program Lengths



6.3.8 Analysis Results – Three Program Options

Figures 6.9 through 6.11 illustrate the impacts of the three potential program options modeled: (1) uniform capital expenditures throughout the construction program life with the DDs included with the towns (after the initial five-year period); (2) a back end-loaded construction program where the bulk of the construction is delayed until later in the construction program life with the DDs included; and (3) a uniform construction period as in Option 1 but without the DDs included.

It should be noted that all these figures assume that the whole of the town is paying for the program in a uniform fashion and that there is no distinction between properties located within and outside the Charles River Watershed. The eventual allocation of phosphorus reduction program costs will be a policy decision.

Note that the option with the DDs removed increases the user fee by a small amount. This is because, even with the allocation to all properties discussed above, the DDs remove slightly more revenue capacity than they remove capital costs. However, the difference is slight, and the ability to gain efficiencies through cooperative arrangements is anticipated to typically make membership in the town plan attractive to DDs given suitable administrative agreements can be reached.

The back-end loaded option shows a significant decrease in the initial monthly user fee per ERU through approximately 2030, then rising to "catch-up with the charges of the other options in approximately 2036. Beyond this time frame, it remains level for a longer period than the other two program options that begin to fall off in terms of bonded capital interest payments. That is, it delays both construction and the payments on borrowing for that construction.

Figures 6.12 through 6.14 illustrate the average fees for the first five-year construction period for each of the program lengths and the three program options.

Note again, as mentioned above, that Bellingham's fees are significantly less than the other two towns. This is an artifact of the decision to include all town area as a revenue source. If only the 52% of Bellingham that is within the Charles River Watershed is included, Bellingham's fees would be very similar to the other two. Refer to Appendix F for an assessment of the fee structure if only the parcels within the Charles River Watershed are used to generate revenue.

Thus, depending on the policy decisions regarding the extent of the area supporting the phosphorus reduction charges, there may be little difference on a fee structure per-acre in the Charles River Watershed among the three towns. This has the potential advantage of making a cooperative program easier to develop.

Figure 6.9: Milford Fee Estimates for Three Program Options

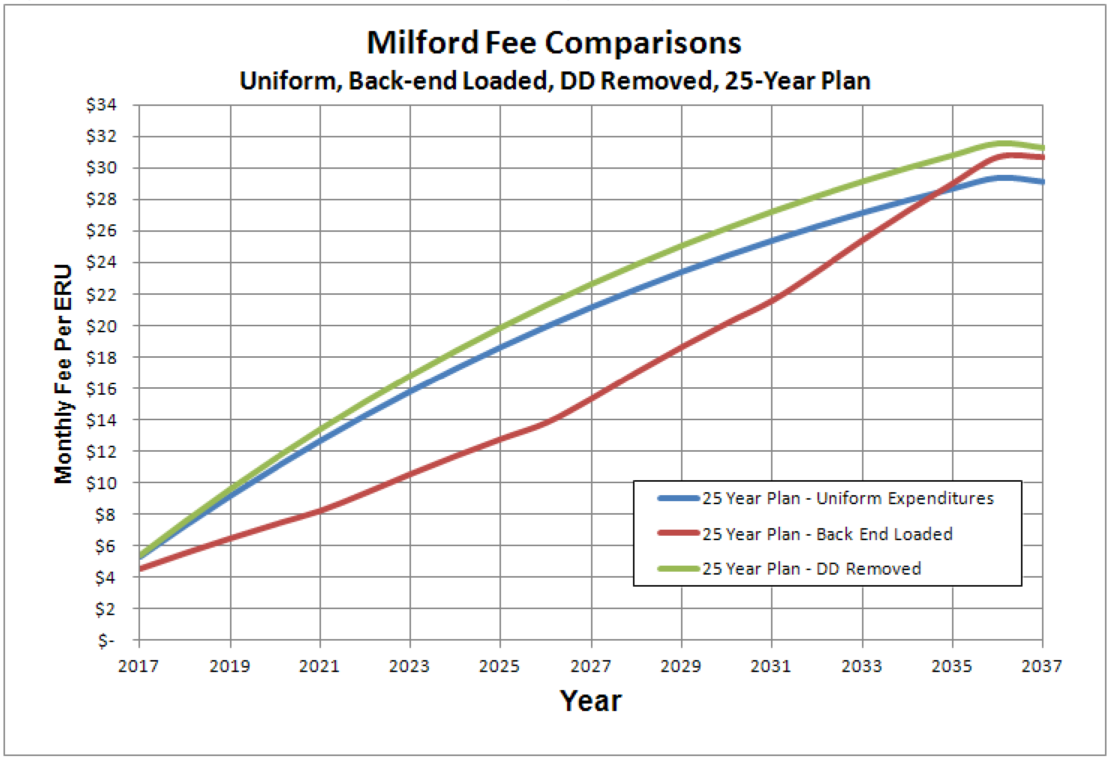


Figure 6.10: Franklin Fee Estimates for Three Program Options

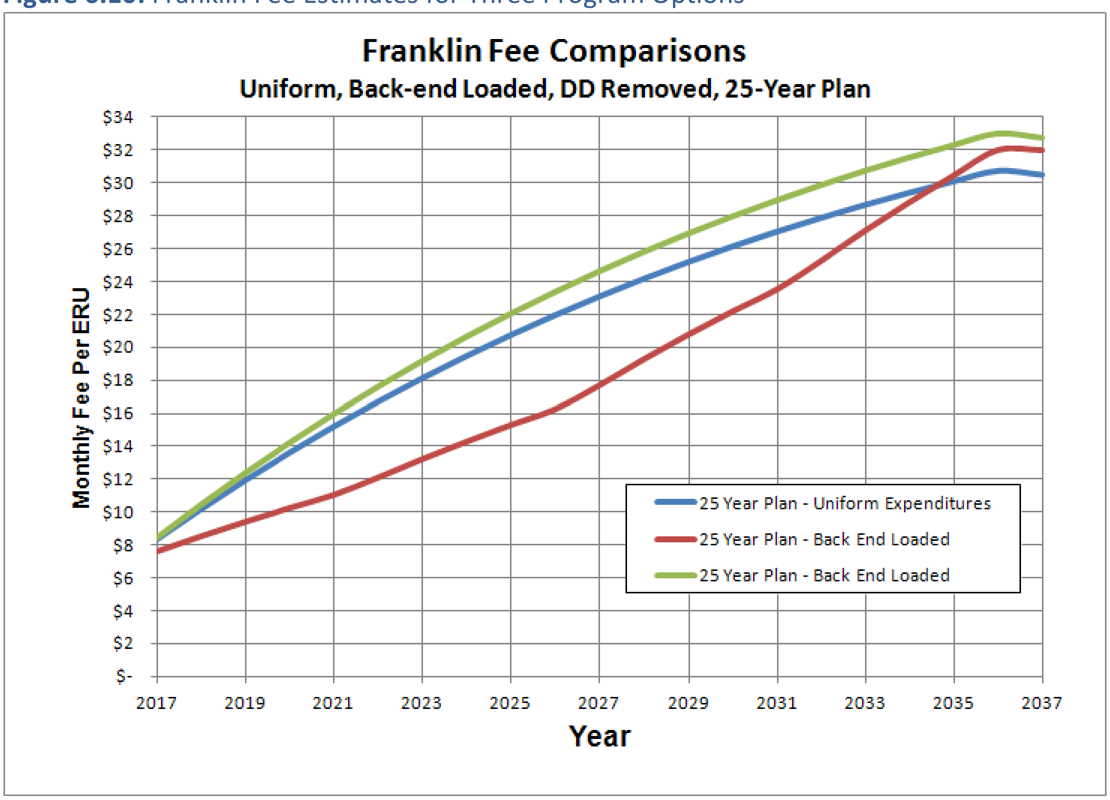


Figure 6.11: Bellingham Fee Estimates for Three Program Options

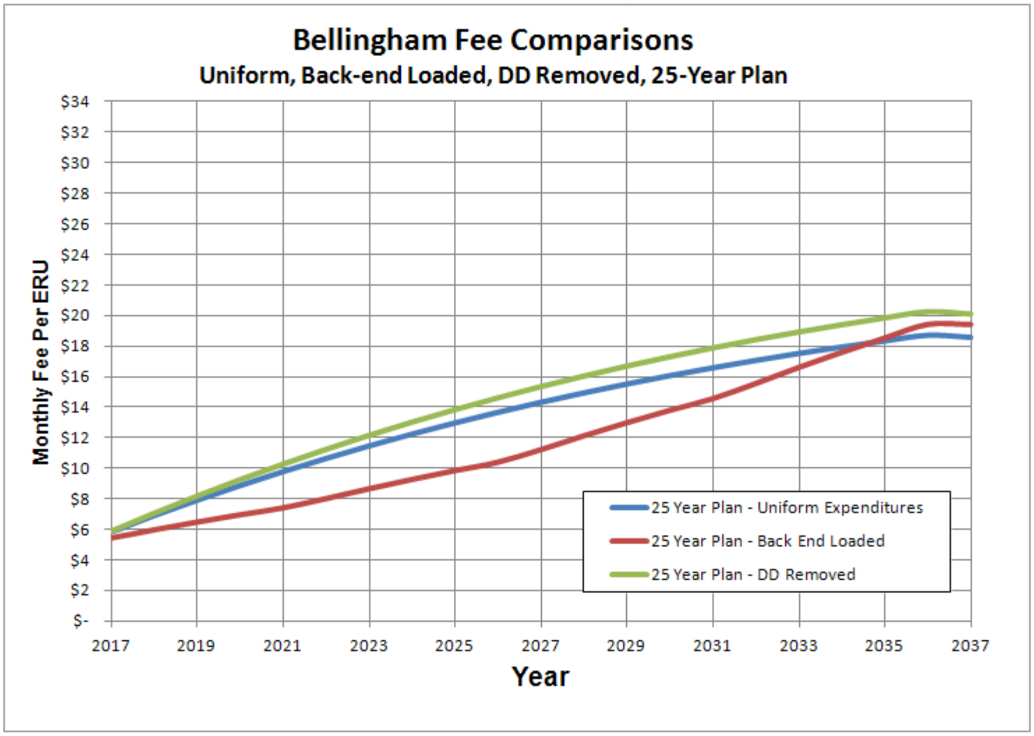


Figure 6.12: Five-Year Fee Averages for 2017-2021 Uniform CIP Option

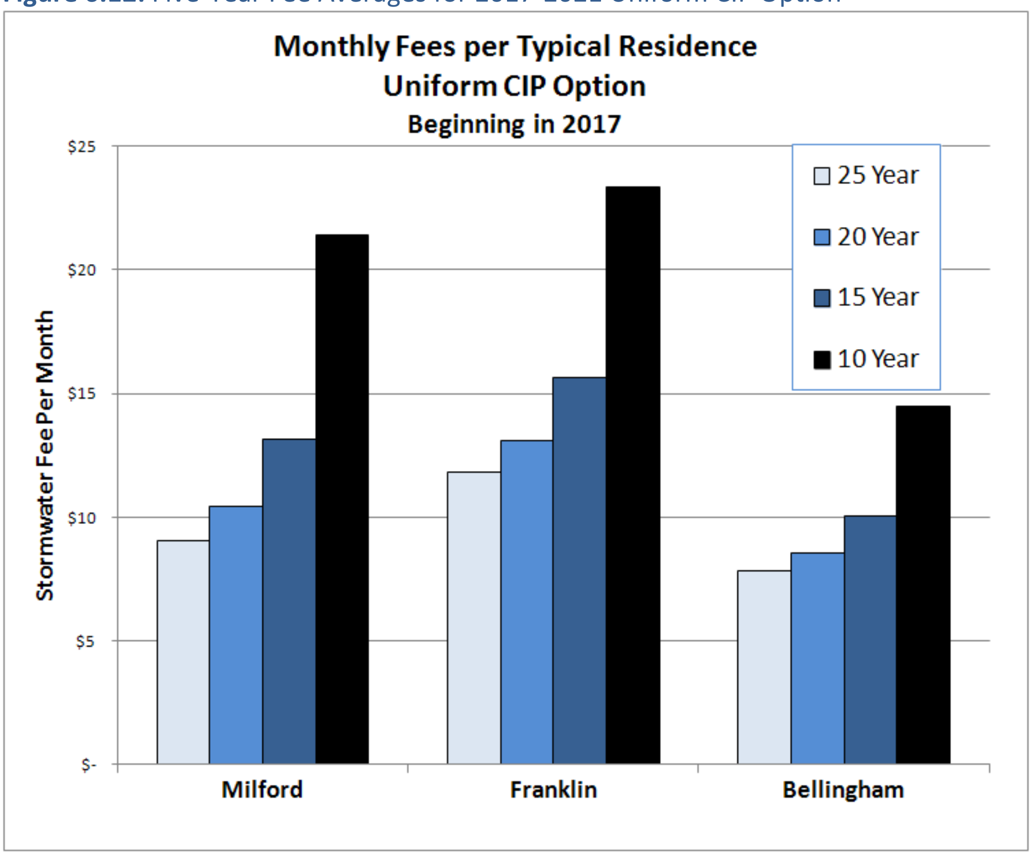


Figure 6.13: Five-Year Fee Averages for 2017-2021 Back-End Loaded Option

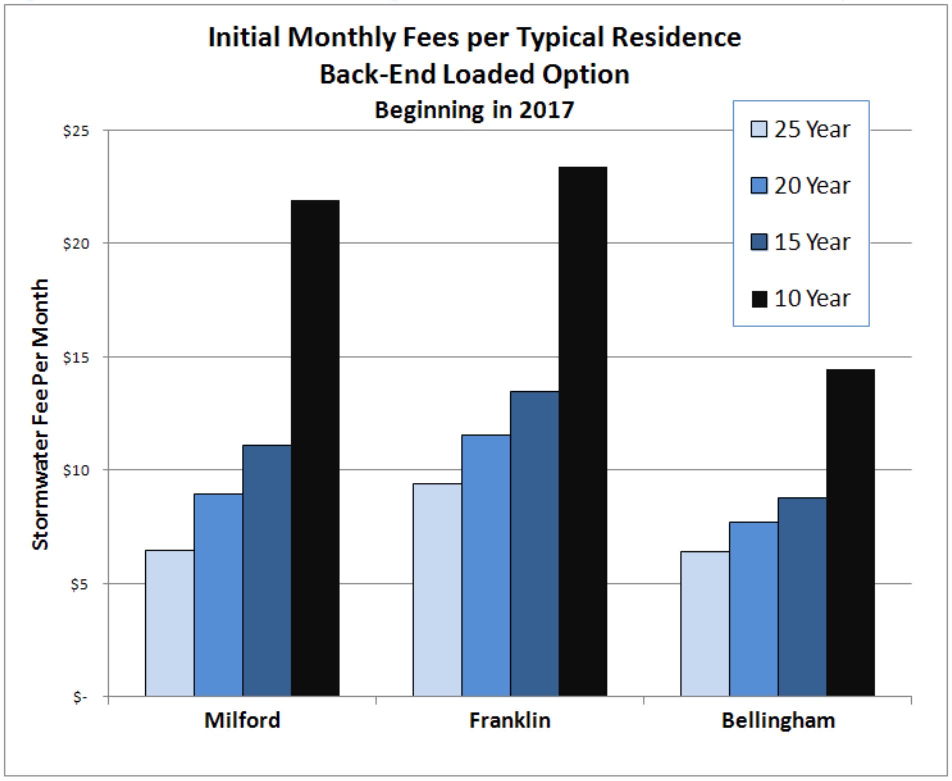
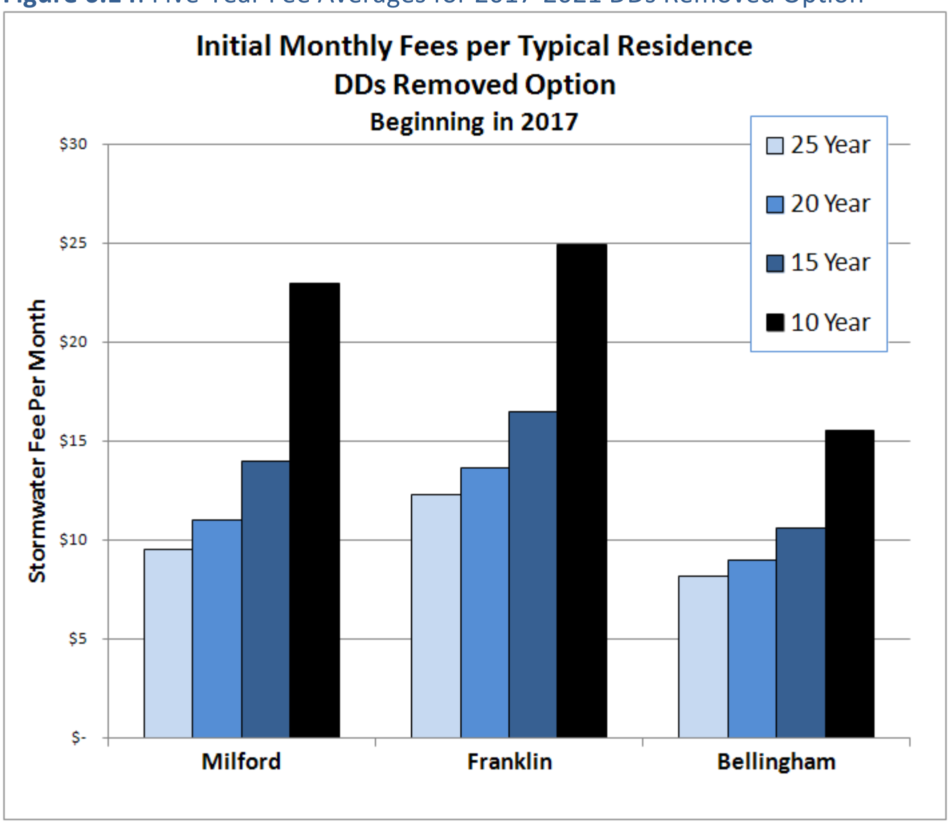


Figure 6.14: Five-Year Fee Averages for 2017-2021 DDs Removed Option



7.0 Billing Options

As part of the Program Funding Options evaluated in Section 6.3, the project team incorporated costs and assumptions for billing a stormwater utility. The following key assumptions were made based on experience with stormwater utilities for communities that are similar in size to Bellingham, Franklin and Milford:

- Bills are sent out quarterly by each town;
- Bills are attached to another existing billing system; and
- Billing and administrative cost = $0.65/account/bill
  - Bellingham: 6,103 accounts = $15,867 annually
  - Franklin: 10,399 accounts = $27,037 annually
  - Milford: 9,554 accounts = $24,839 annually

The above assumptions were developed by the project team to provide a reasonable cost (perhaps conservative) and simplified approach for this element of the future stormwater program. However, billing will have to be re-evaluated depending on the organizational structure (e.g., multi-municipal, single town) for the future stormwater program and a more detailed review of billing systems (e.g., platform/software needs). In general, the following criteria are used when evaluating the various options available for billing a stormwater fee:

- Ease to add a service fee;
- Flexibility to add credits or refunds;
- Potential integration and maintenance issues;
- Time required for set-up;
- Percentage of parcel information contained in the database; and
- Cost to bill.

The following subsections provide additional background on how a stormwater utility billing system operates and a brief analysis of the existing billing data and needs for the towns with consideration of the above criteria.

7.1 Overview of Stormwater Utility Billing Systems

When most people think of municipal bills to support revenue or services the most common are tax, water and sewer bills. These bills are associated with a specific billing or physical address and are typically billed monthly, quarterly, or semi-annually. In the case of stormwater utility bills, the key association is "account," which may not be a unique address or a unique parcel. Therefore, a stormwater utility billing system requires the development of a new "master account file" and potentially the development of a new mechanism to deliver the bill. This information is discussed further below.

Master Account File

The master account file is a derivative of the rate methodology. For example, an impervious rate methodology drives the estimation of the impervious surfaces on each measured parcel (often residential parcels are simply charged a flat rate to avoid short and long term maintenance costs). However, the availability of data should also influence the rate methodology decision. In some cases the tax assessors file has sufficient number of relevant fields and accuracy to allow for a surrogate of development intensity without a lot of handwork.

The fundamental challenge in developing the master account file is due to the fact that the existing parcel and impervious feature data was not developed specifically to support utility billing. The parcel positions are not always rectified with imagery, and the impervious features are not 100% complete or accurate. In some cases, certain impervious features are maintained as lines rather than polygons. Thus, the would-be database developer is left to search for the best available information and edit it, or develop information from scratch. The purpose of the master account database is to relate the underlying features and independent variables needed by the rate structure (via mathematics) to the key unique index that is needed by the chosen billing methodology. Thus, if you use the tax billing system, you are simply computing areas by parcel then billing the parcels similar to a tax billing system. If you choose a stormwater utility system, the master account file has to do the above, plus it has to relate parcels to accounts (which is not a 1:1 relationship).

Billing System Options

There are generally four options for billing systems: Tax bill; public utility bill (water or wastewater - most common); private utility bill (e.g., electric); and a new stand-alone bill. Table 7.1 summarizes some of the advantages and disadvantages of each.

Table 7.1: Billing System Options, Advantages & Disadvantages

Billing System Option	Advantages	Disadvantages
1. Tax Bill	- Tax file is parcel based, correlates one-to-one for most parcels (except tax exempt) - Tax records are updated frequently	- Mailed 1-2 times a year, complicating cash flow - May resemble a tax
2. Public Utility Bill (water or wastewater)	- More familiar, looks like water & wastewater - Legally a user fee, not a tax - Possible lower delinquency through ability to shut off water	- Not all properties have water or wastewater accounts - Utilities may be managed by a separate entity
3. Private Utility Bill	- Existing billing vehicle	- Not all properties currently receive a bill
4. New Stand-Alone Bill*	- Controlled and focused solely on stormwater - Can be billed at any interval	- More costly to develop and maintain - May be difficult to enforce
*This option was used in the funding evaluation in Section 6.3 of this report to simplify the costs for billing across the three towns.		

7.2 Available Billing Data & Needs in the Towns

The initial analysis of available billing data for the three towns indicates that there are sufficient parcel data and water/wastewater billing systems to develop a master account file that could be updated with the assessor's database, once established. Relevant characteristics, existing data and billing systems for each of the towns are outlined below with considerations for a potential stormwater utility billing system:

Bellingham:

- Operates water and wastewater utilities;
- Satellite derived impervious area GIS data-layer only;
- Absolute parcel area is not very accurate in GIS data-layer; and
- Parcel GIS data-layer contains numerous property identification (PIN) errors.

Franklin:

- Operates water and wastewater utilities;
- Impervious area GIS data-layer is derived from aerial imagery (but not perfect);
- Absolute parcel area is relatively accurate in GIS data-layer; and
- Relatively few PIN errors identified.

Milford:

- Water utility is operated by the Milford Water Company (private entity), town handles billing to residents due to property database management;
- Operates a wastewater utility;
- Satellite derived impervious area GIS data-layer only (from MassGIS); and
- Absolute parcel area is not very accurate in GIS data-layer.

Add to an Existing Water or Wastewater Bill

For each of the towns, it appears that the existing utility billing system for water and wastewater could be modified to accommodate a new fund and a new charge for stormwater, and could accommodate the receipt and processing of a periodic "change file" of amended stormwater charges (see Data & Billing Account Maintenance below).

In order to append the stormwater charge to an existing utility bill in each town, each billable land parcel will need to be linked to the existing utility account(s) that are associated to that parcel. There may be some policy decisions about how to handle tenant/owner issues (e.g., condominiums, apartments) and other non-conforming relationships that might exist between the utility account and the parcel of land. However, the greater challenge will be addressing water and sewer accounts that are not 1:1 with parcels, which can be time consuming to resolve.

The recommended approach to establish this relationship would be "address matching." Given the small number of accounts and parcels per town (~6,000-10,000) and the generally high quality of address data that exists in the two data sources, this effort should be moderate. However, it is very difficult to know the actual level of effort until data reconciliation work actually starts.

Data & Billing Account Maintenance

Maintaining the data over time will require that the towns monitor new or changed information in the utility billing system (since in most cases, new construction will lead to new utility accounts in advance of impervious feature data being collected). This new data will be used as an event trigger, triggering a measurement and stormwater charge calculation, as well as an assignment of the charge to one or more utility accounts. It is important to note that account changes are triggered by development activity and not activity on the account (e.g., owner updates). In some cases, the water utility will recognize the change (i.e., service connection) before the stormwater change (e.g., increased impervious area) occurs or vice versa.

In addition to monitoring changes to the utility billing system, changes to the stormwater fee for accounts will need to be passed to the utility billing system. This can best be done with a compact “change file” that will contain only the data needed to effect the change to a stormwater charge. This file will be founded on the account number for the appropriate utility account(s).

Customer Service Considerations

In general, basic customer service can be provided by the same staff currently performing this duty for the existing utilities; however, the level of staff effort may increase significantly at first with a subsequent modest increase in perpetuity. This basic customer service would generally be limited to FAQ-type answers and the associated provision of information regarding the town’s billing policies for stormwater. For customer service requests that require research, map-based answers, or edits to stormwater charges, these will likely need to be passed on to technical staff (e.g., GIS Manager) who can provide the detailed response required. In the event that a customer service procedure results in the need to make a change to bills or charges, the change(s) will need to be stipulated in the “change file” (mentioned above), and conveyed to the utility billing system periodically.

By using the existing utility billing system to convey the stormwater charges, the accounting of charges and revenues can be automatically handled in an appropriately rigorous way (once the new stormwater fund is established). Additionally, customer service must be provided to customers who request such service, and fee revenues must be collected and accounted for in a rigorous manner consistent with a public utility.

8.0 Recommendations and Next Steps

The previous sections of this report provide a general estimate of the range of implementation costs and required fee structure for future stormwater programs in each of the three municipalities. This assessment was accomplished without the benefit of a guiding watershed management plan or a public education and outreach component; conducting both are key recommendations for moving forward. Based on the data and information presented in the previous sections, the weight of evidence indicates that: 1) the costs for the future stormwater management programs for the three municipalities will be significantly higher than current expenditures; 2) compliance with phosphorus reduction requirements will require a combination of non-structural and structural controls implemented over time and through a comprehensive strategy; and 3) the likelihood that the general fund in each community can continue to fully support implementation is low.

The recommendations provided herein offer suggestions on the next steps that the municipalities, EPA and other stakeholders may choose to pursue, either in the interim before the applicable general permits are finalized, or afterwards. These recommendations are based on the team's current assessment given the terms and conditions of the draft permits, and thus, are subject to revision depending on the requirements of the final MS4 and RDA GPs. The following list of general recommendations is offered for consideration:

1. Implement the following non-structural control measures to the maximum extent practicable:
   - Pursue a phosphorus ban on fertilizers at the state level (and locally if deemed within the authority of home rule);
   - Conduct enhanced street sweeping with vacuum-assisted street sweeping equipment and where possible using high-efficiently regenerative-air street sweeper technologies. Evaluate enhanced street sweeping effectiveness from current and future studies such as the current research being conducted by the U.S. Geological Survey in Cambridge, MA (Sorenson, 2011);
   - Conduct and/or enhance an organic waste/leaf litter collection program and evaluate its effectiveness based on current and future research documenting phosphorus removal rates;
   - Continue and/or enhance catch basin cleaning and evaluate its effectiveness based on current and future research documenting phosphorus removal rates;
   - Identify un-needed or under-utilized impervious surfaces and eliminate them; calculate the load reduction potential; and
   - Identify un-used or under-utilized turf areas that could be converted to forest or other minimally maintained vegetative cover; calculate the load reduction potential.
2. Periodically petition EPA to review and update presumed TP reduction values for non-structural controls based on data collected by the municipalities and on the results of published current and future research.

3. Implement structural control measures in the context of a watershed management plan. Periodically petition EPA to review and update TP removal efficiencies for structural controls based on data collected by the municipalities and the results of published current and future research.
4. The communities should seek EPA approval for, and EPA should consider, a longer implementation period than proposed in the draft GPs based on the data in this report that demonstrates greater flexibility associated with an extended construction period.
5. The communities should seek EPA approval for, and EPA should consider, revising the draft GPs to allow for implementing structural controls using a "back-end-loaded" approach. Under this approach initial funding is lessened to allow for better quantification of benefits from non-structural measures and early implementation of the most cost effective structural practices. This approach should also reduce initial expenditures as practitioners gain expertise and will likely lead to long-term savings over time.
6. Pursue the implementation of a stormwater utility at the individual municipal level initially, but structure it to allow other municipalities to join it through inter-municipal agreements in the future.

The following list of specific short-term recommendations is offered for consideration by the municipalities, EPA, and interested stakeholders:

1. Review this report's cost estimates and implementation analyses as each community decides on their next steps – refine estimates as appropriate; (refer to Sections 8.3 and 8.4).
2. Convene an inter-municipal working committee to document areas of agreement and areas of divergent positions on implementation of a comprehensive regional stormwater management program. Decide whether to move forward regionally or individually (refer to Section 8.3);
3. The DD property owners should be polled on their likely participation in a CMPP and/or stormwater utility;
4. Develop of a regional watershed management plan, or at a minimum, develop separate watershed plans for each municipality; and
5. Implement a public education and engagement project explaining the benefits of a comprehensive stormwater program. The public will need to understand why stormwater management is important, how stormwater management affects daily activities and the range of broad-scale potential benefits of a comprehensive stormwater program. Public support will be a critical and necessary component for future stormwater programs throughout the watershed.

8.1. A Recommended Watershed Approach and Adaptive Management

The strategy of managing water resources and water resource quality at the watershed scale has gained momentum over the last 15 or 20 years. Today, most water resource managers would argue that a watershed approach offers the best opportunity to affect water resource quality through a comprehensive approach to identify and implement a management strategy (e.g., regulations, policies, programs, and projects) arranged around a set of unifying goals. The water resource quality of the Charles River did not get to its current condition as a result of one single action or even a small number of actions. The current system is the result of years of human activities, decisions (large and small), altered land uses, in-river manipulations and natural changes. The protection and restoration of the system will require a concerted effort, implemented over time and adapted, as necessary, and as appropriate.

While this project was envisioned with a fairly narrow scope of work to assess the costs and required potential revenue sources associated with the effective management of stormwater runoff from the three upper Charles River municipalities, it has become evident that a comprehensive watershed management plan is needed to move forward. This plan would build on the results of the TMDL assessment, this evaluation, and others activities in the watershed, and might be conducted for a watershed area beyond the three municipalities. Since the entire Charles River watershed is subject to the MS4 GP and the required phosphorus load reductions contained therein, a regional watershed management plan might logically include an area as big as the upper one-third of the watershed. Ideally, a plan would be conducted through an inclusive process involving the participating municipalities, affected stakeholders, and the public. At a minimum, plans should be developed for each municipality, and include the following:

- A recognition of the findings and requirements of the TMDL that identifies the causes and sources of impacts and required load reductions;
- A comprehensive agreement on short-term and long term goals for protection and restoration of resources;
- The identification of regulations, policies, programs and projects needed to achieve the needed load reductions. Projects would include the location, size, and initial cost estimate for implementation and the source of funding;
- A major public education and engagement component in the development of the plan;
- A detailed schedule for implementation, including identification of responsible parties, actions, and a sequence for implementation;
- A monitoring plan to assess progress in meeting the goals identified, and a means to adjust target load reductions as necessary to meet water quality standards.

8.2 Funding Approach

All sources of "free" money should be exploited, and every effort made to reduce overall program costs and to move irreversible costs back in time to allow for the gathering of both better data, investigation into new technologies for phosphorous reduction, and to measure the effectiveness of non-structural measures. However, in the end, the long-term costs of this program will be borne by the residents and businesses of the towns. As such, the most equitable, adequate, flexible, and stable source of funding to support the phosphorous reduction program as well as the rest of the surface water/stormwater programs is a Stormwater Utility/user fee approach.

Because of the similarity of the eventual programs and charges among the three towns, it also makes sense to avoid duplication of efforts and mistakes. Assuming there is consistently good political and public support across the three municipalities, significant savings can result if a joint effort is undertaken, though the level of detail in this report is insufficient to more accurately estimate these savings, beyond the very general percent savings estimate presented in Section 4.3.

8.3 Roadmap for Moving Forward

This section discusses the steps necessary to consider when implementing a stormwater utility. Not all of the steps may apply and some of them do not require much effort except to consider the step, make a decision, and move on. Overall the efforts will follow four major phases:

1. Basic framework development and agreement;
2. Background studies to provide data for implementation;
3. Implementation work; and
4. Initiation campaign and response.

The first next step, the basic framework, can be developed in a simple "does it make sense" to work together (DIMS) exercise. In such an exercise, conducted in a series of five to seven meetings, the following basic questions can be discussed and answers developed:

1. Why might a cooperative regional effort be an attractive idea?
2. What would the cooperative regional group do, and not do?
3. How would its activities be paid for?
4. How would it be organized, staffed, governed and managed?
5. What is the process for setting it up?

The **process** of decision making will be as important as the product and it must involve the right people at the table asking the right (and tough) questions by reviewing all of the facts and information. It is recommended that a "Stormwater Committee" be created with its members who have the authority to represent each entity, who have technical understanding of the issues, and are able to make preliminary decisions. Thus, it is recommended that two to four members from each town be part of the Stormwater Committee and that local governing bodies be kept appraised of the progress and final recommendations.

The Stormwater Committee discussions should focus on the concept of a cooperative regional effort in the context of the anticipated stormwater management program. In these discussions, it is important to remember that some items such as the level of effort or the exact program needed to meet regulatory requirements do not need to be addressed at this point. The sole purpose is to address points of agreement (see short-term recommendation #2, above) amongst the three municipalities.

The outcome (report) of the Stormwater Committee process will be a uniform set of recommendations, or even a uniform resolution, to be passed by each town's governing body.

The report itself will lay out the details of an implementation roadmap – though some of the topics generally discussed below would be considered by the Stormwater Committee.

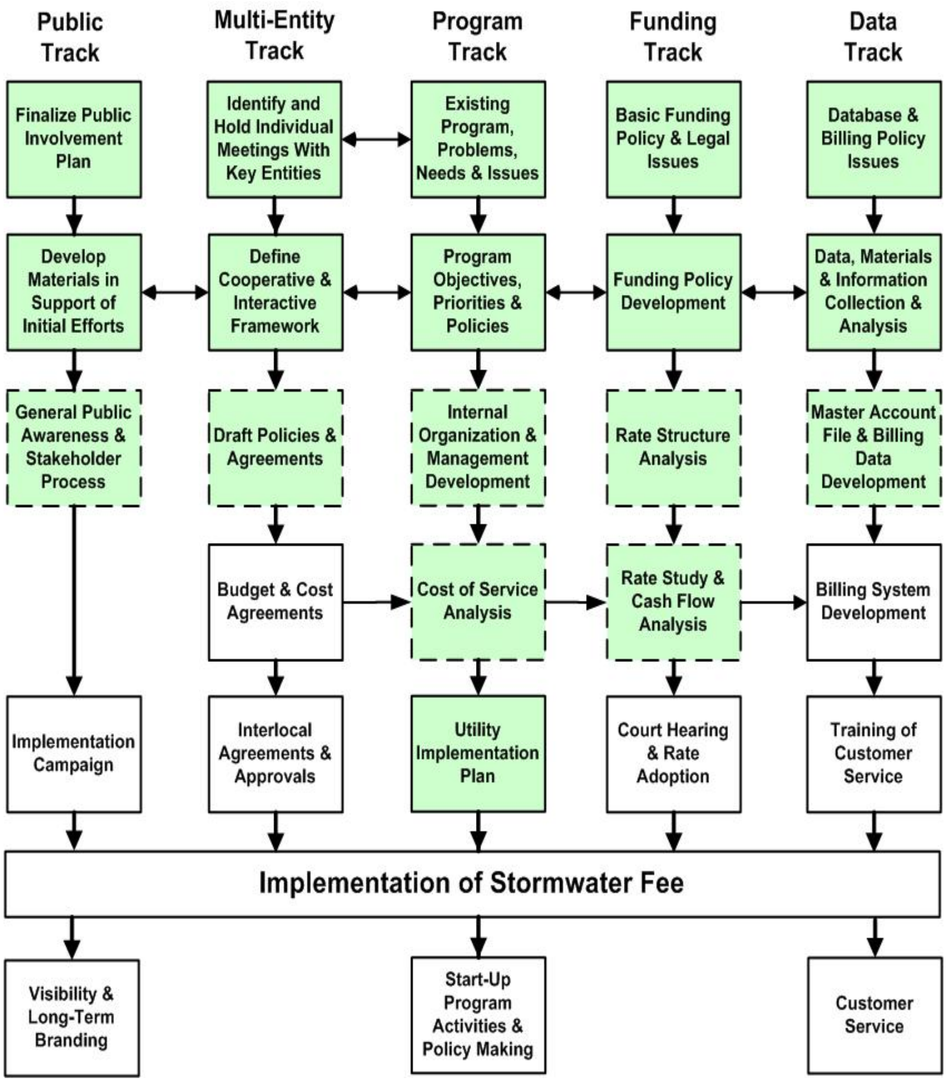
8.4 Description of the Implementation Steps for Stormwater User Fee Implementation

While this feasibility assessment has provided the basic data to initially assess the cost and revenue potential of a stormwater user fee system for the three Upper Charles municipalities, it has not been conclusive in determining if a stormwater user fee will be developed for any of the Upper Charles municipalities, either individually or at a multi-municipal level. To provide additional information to factor in to the decision making as to whether one or more of the municipalities wish to move toward implementation of a stormwater fee, this section of the report provides a brief description of those elements that would be required to fully develop and implement a user fee to support a stormwater program designed to improve water quality discharging from local MS4s in the Upper Charles watershed. Each of these activities is critical to ensuring that the resulting stormwater user fee is effective, legally defensible, and generally supported by the public. However, the approach to each of these steps will differ based on whether they are being conducted for a single municipality or for a multi-municipal or regional utility. It is also important to realize that many of these steps are inter-related and would not be implemented in the sequence presented but rather simultaneously.

Figure 8.1 illustrates a typical stormwater utility implementation program. The solid green boxes indicate elements addressed in this study, at least at a general or basic level. Green boxes with a dotted line would be the next logical steps of an implementation plan, and those in white would be the last steps to be taken if the final decision is made to implement a Utility. Although many of these concepts have been addressed at a macro level of detail in this study, they will need to be revisited to either confirm or provide the additional detail required to move toward implementation.

This feasibility study did not include public involvement and engagement components, therefore the Public Track would be started from scratch. Also, Figure 8.1 includes a track for the development of a multi-entity utility. Should the decision be made to develop a utility at a single town level, the multi-utility track would no longer be germane. Generally these tracks would be implemented simultaneously.

Figure 8.1: Stormwater Utility Implementation Program Flow Chart



8.4.1 Program Development and Costs for 5-Years

During this study, each of the three towns identified the major stormwater program components that would need to be included in a future stormwater program (referred to in the 6-29-11 Steering Committee meeting as the “big rocks”) as well as the estimated costs. Types of costs include infrastructure capital costs, operation & maintenance, as well as non-structural BMPs. Section 4 of this report provides detailed estimates for the likely future costs associated with the major cost centers of a stormwater program that would be necessary to addresses MS4 responsibilities and Charles River nutrient TMDL requirements.

Each of the towns included different program components based on their needs as well as different levels of detail in calculating their cost center estimates. In an implementation phase, each town should once again review and confirm their program needs and the options available to meet them. Once the final stormwater program has been defined the next step is to refine the detailed 5-year cost model to estimate costs of all associated components needed to successfully implement program activities.

It should be kept in mind that costs may vary depending on whether they are calculated for a single town or for a multi-municipal approach. It may be necessary to develop two sets of costs; single municipality and combined. While these estimates can be found in Section 4 of this report, there will likely be some differences at the implementation stage where an additional level of detail is employed.

One of the first steps needed to implement a stormwater user fee is to determine program development costs. These costs include establishing the capacity within the billing agency to levy and collect user fees, assessing and updating parcel data, and educating administrative personnel on new functions related to fee collection.

8.4.2 Cost of Service Analysis

Program expenses will vary based on the level of service and options that are to be provided. When the program and costs were developed, as outlined previously, there were assumptions made in allocating these costs. These program decisions were made primarily by staff, without the benefit or input from the town's stakeholders and those who would be paying the fee. When program priorities are rated by staff, versus rated by landowners, it is not uncommon for there to be a difference of opinion as to the level of service, or the services themselves, that should be provided. In the implementation stage it will be important to include stakeholders input in determining the optimal level of service to be provided.

A higher level of service may be desirable for a number of reasons, such as: a total long-term cost-savings as a result of long-term planning; protection of regional fisheries; or to meet local stakeholders' preferences for environmental stewardship. Additionally, a higher level of service to address some well known problem areas can serve as "low hanging fruit" displaying early results that in turn can bolster fee payer's support.

Examples of activities going beyond those which are typically necessary for minimum regulatory compliance, but may be of interest include:

- **Mapping:** Complete infrastructure mapping enables a comprehensive view of stormwater conveyances and BMPs, including pipe dimensions, age, slope, and materials. Such mapping, kept up to date, would have multiple uses for managing stormwater activities and assessing flooding issues.
- **Education:** Each municipality will likely meet the minimum education standards included in the MS4 permit. However, an expanded education program delivered to residents, business owners, and municipal staff could serve the program by creating a stronger foundation on which to build support for future stormwater program initiatives or result in a lessening of non-point source runoff.

- **Outreach:** Including public outreach and involvement activities in addition to those required by regulatory mechanisms can also create more local buy-in for the stormwater program. These activities may include community environmental fairs, stream or wetland clean-up events, and stakeholder charettes designed to solicit public input on water resource activities.
- **Water Quality Monitoring:** Regular monitoring of pollutants of concern in water bodies, will enable local communities to establish a water quality baseline on which to measure the effects of watershed management activities and show their progress.
- **Landowner Assistance:** Some municipalities with stormwater user fees that also include a credit system provide assistance to landowners that apply for credits to reduce their fee. This assistance can take the form of site consultations that offer landowners general ideas for green infrastructure installation and plan review services.

It is not uncommon to provide higher levels of service in some activities while providing the minimum level in others; based on what the drivers are in each municipality for key land owners and influence leaders. It may also be preferable to phase in levels of service over a few years – in which case the decision will also need to be made as to whether fees are also phased in or whether they will be constant. However, this will be heavily influenced by the approach and schedule for implementation that is driven primarily by permit requirements. This is apparent from the funding analysis completed in Section 6.3 that shows very high fees for the shortest implementation periods (e.g., 10-15 years) where there is minimal opportunity to phase in the level of service as fees are driven primarily due to an aggressive capital improvement program.

8.4.3 Financial/Funding Analysis

Once the program, level of service, and associated costs have been finalized the next step is to analyze how to pay for those services. An analysis needs to be conducted to identify which program costs will be paid for by the fee, and which costs will be paid for by other means. Because the total costs will be broken out in detail, each cost center will be able to have funding method allocated to it. An additional benefit with this level of detail is that it will also provide the planned program and cost information necessary to apply for grant funding that might be available. A municipality may decide that some costs, like management and office expenses, will continue to be paid out of the general fund. It is not uncommon to make the decision that some services will be paid (or continue to be paid) by specific fees targeted to those who directly receive benefit; for example, construction stormwater plan reviews.

Some municipalities choose to pay for as many stormwater and water quality services as possible with the fee; while others choose to identify various sources of funding and keep the fee as low as possible. Each of these options, and the alternatives in between, should be reviewed and analyzed to find the correct fit for each town.

Also during the financial/funding analysis it will need to be determined what type of property owners will pay and if some property (or owner types) will be exempt. For example; many municipalities exclude roads as well as municipal properties and schools from the fee structure (roads were excluded in the ERU analysis presented in Section 6); some municipalities also have chosen to charge a "base fee" for undeveloped land as well as those with pervious cover as they still can contribute to run-off issues. Also considerations for those on fixed income or those that take measures to reduce their impact may be taken into consideration and would be considered in a credit analysis.

Any policy decision made in the financial/funding analysis will affect how much revenue will need to be recovered with a fee and then how that cost will be distributed. It is not uncommon to find that once the financial model is run and the revenue and fee is calculated based on the first cut of policy decisions that municipalities have gone back and modified those policy decisions.

8.4.4 Credit Analysis

Some user fee programs choose to offer fee credits to property owners that will reduce the demand on the municipality's stormwater infrastructure by reducing their property's contribution of stormwater runoff. Property owners that implement BMPs that reduce their sites' impacts on the stormwater system by controlling runoff peak, volume, and/or water quality, eventually should reduce their demand for services from the municipality. In theory the implementation of these stormwater management BMPs will reduce the cost to the MS4 operator resulting in a lower fee for that parcel. However the realization of these cost reductions may be years in the making; therefore it is important to realize that the implementation of a credit system will not likely change the program costs to be financed in the short run. It is also important to realize that a credit program will reduce the total number of ERUs being charged; which in turn results in a higher cost per ERU to those property owners who do not receive a credit. Therefore the decision to implement credits includes a political decision as well as a financial one, if it is believed that it will gain property owner support for the fee program.

Municipalities that wish to make credits available to property owners as part of their user fee program must establish a direct link between the reduction of runoff and pollutant load from the property that must be managed by the MS4 operator and the proportion of credit awarded. It will also be necessary to decide what proportion of a user fee might be eligible for credits and whether there will be a cap. These decisions are based on the overall goals of the program and the intent of the municipality as well as what the financial impact will be. Some municipalities welcome property owners that take action to manage runoff on their site and take advantage of cost savings available through the credit program. Other municipalities prefer to run a minimal credit program so as not to dramatically decrease the revenue of the user fee program, which would either limit the potential number of municipally run projects that could be accomplished or add to the cost of those who do not receive credits.

It is important to keep in mind that a credit program will add administrative, plan review, and inspection costs to a user fee program. The analysis of the credit system will be made using a combination of information related to program costs and data to develop different scenarios upon which a policy decision can be made.

8.4.5 Rate Structure Analysis

Rate structures typically split all parcels into two categories: single family residential (SFR) properties and non-SFR (NSFR) properties. These two categories can then be broken down farther into sub-categories based on attributes such as total tract area, total impervious cover, and intensity of use. Some rate structures choose to not charge a fee to parcels that have impervious area less than a certain threshold; while others use a base-rate based on a certain threshold. In other programs, large tracts that have a small percentage of impervious cover, for example ≤5% are also exempt from the stormwater fee.

In Section 6.2 there is a description of the rate structure that was initially developed to calculate the estimated ERUs and evaluate revenue. As discussed in the previous sections, once decisions have been finalized on program, costs, and the financial and credit analysis are done, a more detailed rate structure analysis should also be conducted plugging in different scenarios into the rate model. Like the financial analysis, the rate structure is a two way decision making process of policy decisions and how they impact revenue rates and conversely how these rate decisions impact revenue.

After user fees are established and mature, program administrators should consider revisiting their rate structure to refine fees and re-structure any categories to more accurately reflect the needs of the overall stormwater program. Timing for this analysis may occur three to five years after the effective date of the user fee.

8.4.6 Budget and Cash Flow Rate Model

Budget and cash flow models provide insight into the amount of revenue that will/should be recovered and the timing of receipt of revenues to be able to better plan for when to incur expenses. It is typical to develop a five year rate model with 2 to 3 different rate structures before finalizing the rate structure policies. In this way, revenue projections can be reviewed to determine if estimated fees will be sufficient to recover costs; or in some instances if the revenue exceeds what is viable to spend in an allotted time period. The availability of funds will be influenced by the billing method that is chosen. By modeling revenue it will also be possible to analyze "back end loading" versus a consistent funding approach to rates. Having too much revenue can be as bad as having too little revenue if the stormwater program cannot keep pace with the rate payers expectations.

8.4.7 Organizational/Governance Recommendations

The first "next step" that needs to be addressed relating to organizational/governance is whether there is going to be an attempt made at some sort of multi-municipal program or if the towns move forward to develop one or more standalone utility(ies). If this decision can be made immediately then that would save a lot of effort and cost rather than having to develop parallel scenarios of all of the steps described above (as well as others that have not yet been discussed). However it may still be a "chicken and egg" scenario where until some of the above decisions are made, it will still not be clear as to the most viable approach. From an organizational viewpoint, a standalone single town stormwater program/Utility is a less complex scenario.

Even with a single town utility, the most streamlined approach for the administration of the stormwater program should be considered. As presented in previous sections, there currently is a diversity of stormwater management activities being conducted by several municipal departments, and various outside consultants. Public Works, Administration, Finance, and Engineering all contribute effort to operating, maintaining, and administering stormwater infrastructure. It is recommended that each town analyze how stormwater management activities fall into their current organizational structure and consider if leadership and staffing needs to be reallocated or if there is an advantage to centralizing some functions. It is not uncommon to find that having a dedicated stormwater coordinator can improve management issues even if there is not a wholesale reorganization. These various scenarios should be reviewed not just from solely the cost of adding a new employee but from an overall cost/benefit point of view.

Should it be determined that a multi-municipal or regional utility will be developed, the governance decisions become much more complex and important because they are no longer just administrative decisions but legal decisions. Legally binding inter-municipal agreements (i.e., contracts) will be required between each of the entities which in turn imply that there will likely be a high level of negotiations that will need to take place. These negotiations will need to specify who will be responsible for carrying out what activities, and should include a description of measures for potential breach of the terms of the "contract." It is important to remember that each permit holder is ultimately responsible for meeting the permit requirements even with multi-municipal contracts.

8.4.8 Billing Options Analysis

As with other analyses, it is going to make a difference if billing is going to be done for a single town or for multiple towns. However, the first step is to look at what billing mechanisms already exist (e.g., tax bills, water bills, sewer bills) and whether any of these would seem to be options for billing a stormwater fee. There are generally a couple of issues with "piggybacking" on an existing billing format, including: timing of bills; what parcels are and are not already in that data base and how to add new ones; and data integrity to ensure that the correct amount is billed. Because a stormwater fee will be charged to all landowners and not just those who have taxable properties, those non-taxable properties will need to be added to the system and billed the stormwater fee, only. If a wastewater utility bill is used as the vehicle, then a line item will need to be added for stormwater. And since there are going to be properties that do not currently have a wastewater bill, such as those on septic systems, they will now need to be billed their stormwater fee. Another consideration is the timing; are these other bills yearly, biannual, quarterly, monthly, and what is the implication related to the needed cash flow to implement the stormwater program. With any system, data compatibility will need to be evaluated to ensure that the data is in the format to not only bill correctly but to support any challenges made. In addition to these logistical issues, the question of another entities' willingness to take on this added responsibility needs to be resolved. It should be assumed that there will be billing questions and challenges to the amounts being charged and there will need to be a system in place to handle this customer issues.

8.4.9 Public Outreach/Education and Stakeholder Involvement

There are two schools of thought on when to do public outreach and education. Historically, once many of the internal decisions related to the new stormwater program were made, then the municipality conducted a public education program to fully inform the public of changes to occur under the new rate structure. However many municipalities are now finding that public outreach and education should actually be one of the first steps to be taken in order to successfully achieve fee implementation by building awareness of the need for and improved stormwater management program (though not necessarily discussion of the fee).

To promote public buy-in, the public education program should provide residents, business owners, and municipal staff with fundamental concepts of stormwater management, water quality, and perhaps most importantly, the regulatory drivers behind the program. This outreach should include education about ways residents and business owners can more efficiently adjust behaviors and practices that cause or contribute to adverse stormwater impacts, as well as potentially reduce the overall cost of compliance with regulatory requirements.

At the same time, a commitment to involve key stakeholders at the earliest stages of decision making during the program development has proven to be critical to the success of most stormwater utilities. Input from representative of the residential and business communities, community groups, and municipal offices, offers a forum to answer stakeholder questions and allay concerns of how the stormwater program will affect landowners.

Conversely, when a comprehensive public involvement program is not carried out, municipal leaders spearheading the user fee initiative generally have insufficient opportunity to reach out to stakeholders and make the rational case. This often results in misperceptions about the stormwater program that may end up derailing the program. Stakeholder involvement should include well-planned public meetings as well as individual sessions with landowners who may be most affected by a user fee.

Different stakeholders will have different concerns regarding the program, and some of those concerns and potential solutions conflict with other key stakeholders. By creating and executing a stormwater advisory committee that consists of varying stakeholders representing core groups (non-profits, small businesses, consulting engineers, etc.) that are representative from across the region, the program can find solutions that meet many of the community's diverse needs and concerns. This ultimately helps gain the public's buy-in about the program.

8.4.10 Rate Ordinance Development

Activities up until this point are in preparation of development a stormwater fee. It is not until a rate ordinance is passed, that a fee can actually be established. Once all of the above decisions have been made, the ordinance vote serves as a "go/no go" decision to proceed to the billing process. Massachusetts law provides enabling legislation (MGL 83 Section 1A and 16) which outlines some of the state specific requirements for creating the bylaw or ordinance for a stormwater fee. In addition to these requirements, there are a series of "litmus tests" that ordinances which create fees must meet in order to be legally considered a fee and not a tax. It is common for municipalities to have their fees challenged in court therefore it is of utmost importance to have the fee established in such a manner so that it will be defensible against such a challenge. Each town's elected officials will need to pass the appropriate by-law or ordinance to enact a user fee. Such ordinance code authorizes a municipal office, or other public corporation, to have the ability to oversee the implementation of the stormwater program and collect user fees.

8.4.11 Master Account File and Billing Data

Once the vote has passed to develop a stormwater fee, then it is time to undertake the effort to develop the master account file. If the towns have been updating and developing the required supporting data throughout the process, then getting the bills ready to send should not be a lengthy process. However if the decision is made to wait on updating the data until such time as a fee is certain, the cost and time to develop that supporting data may add several months to the process. There is neither a right nor wrong time to develop the supporting data and the advantages and disadvantages to do it sooner should be discussed early in the process.

8.4.12 Billing

When the time comes to actually send out the bills there are at least three associated activities: 1) running a test batch to make sure that it all comes together; 2) implement the part of the public outreach plan to announce that the bills are about to come out and what to do if the recipient has questions or issues; and 3) make sure that there is a trained team, at the ready, to answer questions and respond to mistakes.

8.5 Implementation Considerations

As part of the process of implementing a user fee, municipalities will need to consider a series of policy and management options to shape their program to best fit local needs. Local decisions on the series of topics listed below will have significant impact on the specific methods of how the user fee will attain regulatory compliance, manage program costs, and improve the quality of the water resources in the Upper Charles watershed.

8.5.1 Governance Structure

The decisions on how to answer many of the implementation questions and considerations hinge on the decision of what governance structure is going to be used. There are a number of decisions to be made; some of the preliminary considerations to be discussed by the three towns relative to a regional stormwater program will bring each potential member into a better understanding of the benefits and the costs of moving ahead with a regional program.

Considerations for Determining Governance Structure

- Is there sufficient common interest to create a shared program?
- Do cost savings from cooperation outweigh greater effort needed to initiate and establish a shared program?
- Do regional programs have an advantage in competitive grant programs?
- Will a shared program include two or three municipalities?
- Should a shared program be open to accepting additional members in the future?
- What are the chances that individual town property owners will generally accept a shared program?
- If a shared program is selected, what are the available shared elements?
- Will a new entity be created?
- Should there be different rates for different municipalities?
- How will administrative duties and implementation responsibilities be assigned?
- Will each municipality have its own billing and collection system?
- What are options if a municipality does not cooperate in program?
- Will a regional member be allowed to leave the program? How long would the required notice period be?

8.5.2 Timing

Several factors play a role in determining when to begin charging a stormwater user fee. Once data sets are complete and policy decisions are refined, program administrators should expand their public involvement program to reach out to the entire community. Each municipality should fully develop a public education and outreach program that clearly states the reasons why a stormwater user fee is being adopted, the basic methodology of rate creation, how it will impact residential and commercial landowners, and availability of credit options for landowners.

Common timing issues may relate to election cycles or other tax or utility increases. Understandably, officials are concerned about the addition of any new financial impacts on their constituents. There is likely never going to be "a good time" to implement these fees so it is really a question of when it the least disruptive time. That is why the stakeholder and public education effort are so important. Also the billing method chosen will affect the timing especially if the bills are sent out only once or twice a year. It will be necessary to work backward from the date that bills need to be prepared to provide sufficient time to: pass the necessary ordinance, set up the master account files and billing system, train the customer service staff, set up a credit system (if that is going to be included) and implement the public awareness campaign.

Considering all that will need to be accomplished prior to any bills being sent; it is unlikely that it would be less than a year from the beginning of the next phase, and more likely 18 months would be the timeframe until billing begins. If a multiple municipal approach is taken than the time frame needed will likely be significantly longer due to the negotiations and inter-municipal agreements that will be required.

Of course overlying all of these other considerations is the timing of the finalization of the general permits themselves and when funding will be required to meet major milestones. This driver may in fact trump all of the other timing concerns and dictate the implementation schedule.

Considerations for Timing for Fee Implementation

- Date general permit is issued
- Dates of major stormwater program milestones
- Other planned increases such as wastewater or drinking water fees
- Billing schedule related to when resources are required to fund activities

8.5.3 Cultivating Popular Support

At the end of the day the Town Council or Town Meeting will need to vote for or against the ordinance or by-law to create the stormwater fee. Adequate education regarding the purpose and methodology of the user fee is critical for elected officials and the public in general.

Elected officials will be more apt to support a stormwater fee if they feel comfortable that the majority of their constituents will support (or at least not oppose) the new fee. This is why a robust stakeholder process will be so necessary during the next phase. The stakeholders should include a representative body of property owners, interest groups, influence leaders, and key elected officials. The goal is to educate this group so that they will understand the need for an enhanced stormwater program and be supportive of the fee as the most fair and equitable approach to funding the program. Often municipalities have found that the participants of the stakeholder group can in turn become credible and influential spokespeople for the new fee, often more so then town staff or other officials.

Considerations to Increase Popular Support

- Who are key influence leaders and how do we keep them informed?
- Who are the likely supporters and how to we get them involved?
- Who are the likely naysayers and how do we get them involved so they are a part of the process and can hopefully become convinced that this is the best option?

8.5.4 Phases of Implementation

A consideration in developing a fee is whether it is more advantageous to set fees that will remain static for several years, or if there should be a phasing-in approach to fees over time.

As was identified previously, it is likely that the initial focus will be on maximizing the initial load reduction from lower cost measures and that decisions on more expensive capital improvements could likely be postponed until it is determined what progress is being made with the initial implementation. Another option is to bring in certain classes of properties into the system first to gradually ramp up the user fee administrative needs.

Considerations on Phasing in Implementation

- If we start charging a flat fee now will we be able to spend revenue in a manner to show benefit?
- Will it be more difficult to get an increase then to bite the bullet up front?
- Are there classes of property owners that by phasing in their fee would provide an increased level of probability for payment as well as support without causing detriments to the town and that would still pass the legal litmus test for a fee?

8.5.5 Accuracy of Existing Information

Is the data at the required level of accuracy or does it needs to be updated? The GIS data may not need to be absolutely accurate before implementation of a user fee. As seen throughout this project, different sources of impervious surface data provided different measurements. By using a standardized ERU instead of an actual square footage measurement of impervious cover, program administrators can reduce the impact of these data inconsistencies. Accuracy of billing information is equally important. However, if bills are tied to an existing system (sewer or water bills) it is likely that data is relatively accurate already.

8.5.6 Level of Public Involvement

Developing a stormwater program, consciously or not, is often done as a series of phases and the level of corresponding public involvement will also vary. As has been discussed throughout this report, determining how and when to take the discussion of an enhanced stormwater program and a new funding scenario needs to be well planned in order to gain insight and support of the rate payers in developing policy decisions.

There are typically 5 major phases:

- The Quiet Phase
- The Build-Up Phase
- Billing Day
- Post Billing
- On-Going

The **"Quiet Phase"** is where we are right now. This is when discussions are primarily at the municipal staff level. There may be a few others brought in to the discussions to provide added in-sight. During the Quiet Phase there are still many unanswered questions. Quiet does not mean secret, by any means. But since many of the final decisions about what is needed, how permit conditions might impact implementation, and what the exact next steps will be; it would be difficult to go external with any specific messages about what is going to actually happen.

The **"Build-Up"** phase would be the next stage of implementation, once the permits have been issued and if the communities decide to move forward with a Utility. The Build-Up may have several sub-phases depending on the circumstances in each of the three municipalities as they go through the development and implementation of a utility. Generally speaking, the Build-Up is the period of time for gathering and/or enhancing data; refining decisions and information; identifying and meeting with different key stakeholders and public sectors and educating the press; making decisions on the various policies that have been outlined previously in the report and disseminating strategic information.

The **"Billing Day"** phase starts from the codification of the utility and rate and extends to the time when the bills are mailed with the new stormwater charge. This is a good time do a test run of the billing system and make sure that those who will be answering questions about the program and the billing system are fully trained to respond to those who may call in with inquiries and complaints. Depending on the outreach to date, this is often the first "public"-wide coverage of the reasons for the billing with examples of the new effectiveness of the stormwater program.

The **"Post Billing"** period is a finite period of time that typically lasts from the time the bills are mailed through the next month or two. During that phase there is generally a heightened level of information that then blends into a more long term "On-Going" outreach program that will educate the rate payers about the utility as well as general stormwater education.

When developing the **"On-Going"** phase, plan keep in mind that public education is not only important for gaining support for stormwater funding, but can be an effective stormwater management strategy for prevention; it is also a requirement of the MS4 permitting process. Even though the towns may currently be meeting the minimal MS4 requirement for public outreach, it may be in everyone's' best interest to go beyond the minimums to undertake an education program that will, to the best of its ability, prevent and reduce stormwater impacts before they ever happen. If the towns want to sustain an on-going public education program they will need to include those costs in the program development in order to adequately fund it.

An on-going education plan might contain the following areas of information for the public at large of even more specific information for certain sectors like construction or landscaping:

- Impacts their actions have on stormwater runoff quantify and quality;
- The need for having and adequately financing a stormwater management program;
- Options for reducing impacts and that can also reduce fees; and
- Understanding the legal requirements pertaining to stormwater and why this is required under federal and state laws.

Considerations on Level of Public Involvement

- Who – are the audiences? What people or groups should be involved?
- When – is the best time to engage key stakeholders and reach out to other audiences?
- What – are the appropriate targeted messages for each of those audiences?
- How – do we engage them? What approaches? Who would be the best spokespeople?

8.5.7 Funding the Utility Implementation, Estimated Cost and Schedule

As has been discussed throughout this report, the implementation stage will be a multi-step process that will require an investment on the part of the towns both in their own personnel and the cost of consulting services. It will therefore be necessary to determine how the cost of implementation will be covered; whether this will be a town expense, if there are grants that are available for all or part of the project or if EPA is interested in continuing the pilot project into the implementation the stage. How the implementation phase is funded may determine the next steps and pace for implementation. Below are some basic considerations for implementation funding, followed by a potential scenario for understanding the cost and schedule for implementing one or more utilities for the Upper Charles River communities of Bellingham, Milford and Franklin.

Considerations for Implementation Funding

- Are there any grant funds available? If so what is the timing? Are there any stipulations on use?
- Is the EPA interested in funding a pilot project? Will that limit the flexibility of the town(s) in their decision making process?
- Have the towns included the cost of implementation in their 2012 budget? If not, is there a mechanism in place to allocate funds?
- Can implementation be carried out over multiple fiscal years and still meet the required schedule? If so what should be the next steps?

Stormwater Utility Implementation Cost & Schedule

It is difficult to estimate the cost and schedule for implementation of a stormwater utility for one or more of the three Towns due to the number of variables that have only been touched upon in this study. Additionally, there are many factors (e.g., level of support, competing interests, regulatory initiatives) that will continue to change over time that may influence the development of the funding mechanism. However, in order to provide an initial understanding and framework for a rough order of magnitude cost and estimated schedule, the project team evaluated the following two scenarios:

Major items that drive cost include: quality of the data (e.g. impervious area, parcel, owner, billing system matching), complexity of the rate structure (e.g. use of modifiers, gross area implications, bases for the rate, etc.), amount of hand adjustment in billing, complexity of policy decisions on billing, credits, and rate adjustment, amount of public involvement and participation in special meetings with stakeholders, number of reviews of reports and meetings, and assistance needs during roll out.

- **Single Municipal Stormwater Utility:**
    - Assumptions: Town has political and public support to move forward and funding for full implementation is available. Public education and involvement campaign is moderate.
    - Approximate Cost: $200,000 – $300,000 depending on data needs and other public interactions.

- Schedule: 12-18 months total, estimated major milestones below:
  - Month 6 – public education plan started & data development completed;
  - Month 9 – rate structure, revenue analysis & master account file completed;
  - Month 12 – trial run of bills & customer support training completed; and
  - Month 18 – first quarter of billing completed and payment due.

- **Multi-Municipal Stormwater Utility:**
  - Assumptions: Bellingham, Franklin and Milford are interested in working together and have the political and public support to develop some type of program. Public education and involvement campaign is aggressive. Funding for full implementation is available and the timing for development of each municipal program is consistent.
  - Approximate Cost: $700,000 – $1,000,000 depending on data needs and other public interactions.
  - Schedule: 18-24 months total, estimated major milestones below:
    - Month 3 – inter-municipal work group & project road map established;
    - Month 6 – scope of work defined and work begins for developing public education plan;
    - Month 9 – data development completed & public education plan begins;
    - Month 12 – rate structure & revenue analysis completed;
    - Month 15 – master account file completed;
    - Month 18 – trial run of bills & customer support training completed; and
    - Month 24 – first quarter of billing completed and payment due.

It is important to understand that these cost estimates and schedule are intended to give a very general overview of the scale of the effort and can vary greatly depending on the list of variables cite above. At the same time, the implementation approach can be varied based on the availability of funding. For example, a Town may wish to work in phases. Phase I could consist of development of data, public outreach, decision making on policies related to rate structure and billing. The second phase could be addressed with next fiscal year's funding, or an alternative funding source, and include developing the master account file, billing and implementation. Despite the variables, experience shows that the cost to implement the utility is less than the first year's revenue and can be paid back over time through the utility.

9.0 References

Black and Veatch. 2010. 2010 Stormwater Utility Survey. Sponsored and administered by B&V Management Consulting.

Center for Watershed Protection (CWP). 2009. Seeking, Designing, and Implementing Stormwater Retrofits Webcast October 13, 2009 Excel Cost Estimate Spreadsheet, Derived From: Urban Subwatershed Restoration Manual (USRM) 3, Appendix E, Table E.4, Median Cost.

Center for Watershed Protection (CWP) Brown, E., Caraco, D., University of Alabama Pitt, R. 2004. Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments. Prepared for EPA, Office of Water and Wastewater.

Charles River Watershed Association (CRWA). 2010. Stormwater Management Plan for Spruce Pond Brook Subwatershed. Prepared for Town of Franklin. Jesse B. Cox Charitable Trust Fund.

Charles River Watershed Association (CRWA). 2011. Final Total Maximum Daily Load for Nutrients in the Upper/Middle Charles River Basin, Massachusetts. CN 272.0. Prepared for MA DEP and US EPA Region 1, New England.
http://www.mass.gov/dep/water/resources/ucharles.pdf

Crisafulli, Scott. 2011. Town of Milford. NPDES PII Small MS4 General Permit Annual Report. Reporting Period March, 2010 to March, 2011. EPA NPDES Permit number: MAR041135.

Crisafulli, Scott. 2010. Town of Milford. NPDES PII Small MS4 General Permit Annual Report. Reporting Period March, 2009 to March, 2010. EPA NPDES Permit number: MAR041135.

DiMartino, Donald. 2011. Town of Bellingham. NPDES PII Small MS4 General Permit Annual Report. Reporting Period March 2010-March 2011. EPA NPDES Permit number: MAR041091, MA DEP Transmittal number: W-040693.

DiMartino, Donald. 2010. Town of Bellingham. NPDES PII Small MS4 General Permit Annual Report. Reporting Period March 2009 to March 2010. EPA NPDES Permit number: MAR041091, MA DEP Transmittal number: W-040693.

Emerson College v. City of Boston, 391 Mass. 415 (1984).

Greater Franklin Developers Association, Inc. v. Town of Franklin, 49 Mass. App. Ct. 500 (2000).

Massachusetts Department of Environmental Protection (MA DEP) and United States Environmental Protection Agency (US EPA), New England Region 1. 2007. Final Total Maximum Daily Load for Nutrients in the Lower Charles River Basin, Massachusetts. CN 301.0.
http://www.mass.gov/dep/water/resources/charlesp.pdf

Massachusetts Department of Environmental Protection (MA DEP). 2010. Massachusetts Year 2010 Integrated List of Waters. Proposed Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act. CN 360.0. Division of Watershed Management, Watershed Planning Program, Worcester, MA. http://www.mass.gov/dep/water/resources/10list3.pdf

Massachusetts Department of Transportation (massDOT). 2011. Commonwealth of Massachusetts 2010 Road Inventory Year-End Report. Office of Transportation Planning. Funded by Federal Highway Administration.

Mass. Gen. Laws ch. 21, § 28. Water pollution abatement districts; establishment; dissolution; enlargement or consolidation.

Mass. Gen. Laws ch. 40, § 4A. Governmental units; joint operation of public activities; termination of agreement; "governmental unit'' defined; financial safeguards.

Mass. Gen. Laws ch. 40, § 25. Repealed.

Mass. Gen. Laws ch. 40N, § 4. Towns; power to contract; purposes

Mass. Gen. Laws ch. 83, § 1A. Common sewers and main drains in public or private ways; voter approval and comprehensive water resources management plan.

Mass. Gen. Laws ch. 83, § 16. Charge Use for Sewers.

Nutting, Jeffery. 2011. Town of Franklin. NPDES PII Small MS4 General Permit Annual Report. Reporting Period May 1, 2009 to April 30, 2011. EPA NPDES Permit number: MAR041117, MA DEP Transmittal number: W-041238.

Nutting, Jeffery. 2010. Town of Franklin. NPDES PII Small MS4 General Permit Annual Report. Reporting Period May 1, 2009 to April 30, 2010. EPA NPDES Permit number: MAR041117, MA DEP Transmittal number: W-041238.

Pinard, Lee. 2011. Personal Communication – Long Creek Watershed Management District. Executive Director – Long Creek Watershed Management District.

Schueler, T. 2011. Stormwater Design for High Intensity Development Projects in the Chesapeake Bay Watershed. Technical Bulletin No. 5 (version 3.0). Chesapeake Stormwater Network. http://csnetwork.squarespace.com/documents/csn-documents/Version%203%20TB%205%20Redevelopment%202011.pdf

Schueler, T. D. Hirschman, M. Novotney & J. Zielinski. 2007. Urban Stormwater Retrofit Practices. Manual 3 in the Urban Watershed Restoration Manual Series. Center for Watershed Protection, Ellicott City, MD.

Sorenson. J. 2011. Improving Water-Quality in Urban Watersheds Using a High Efficiency Street Sweeping Program, Cambridge Massachusetts. Slideshow Presentation of Preliminary Results. U.S. Geological Survey, MA-RI Water Science Center, Northborough, MA.

Spatial Climate Analysis Center (SCAS), 2000. Average Annual Precipitation: Massachusetts, PRISM datasets. Oregon State University. Available at: www.climatesource.com

Tetra Tech. 2009. Optimal Stormwater Management Plan Alternatives: A Demonstration Project in Three Upper Charles River Communities: Final Report. Prepared for US EPA, Region 1 and MA DEP. Tetra Tech, Fairfax, VA.

Tighe & Bond. 2010. 2010 Massachusetts Sewer Rate Survey. Prepared for Communities in Massachusetts. Tighe & Bond, Westfield, MA. Available at: http://rates.tighebond.com

Tighe & Bond. 2010. 2010 Massachusetts Water Rate Survey. Prepared for Communities in Massachusetts. Tighe & Bond, Westfield, MA. Available at: http://rates.tighebond.com

Voorhees. 2011. Methodology for Developing Cost Estimates for Structural Storm Water Controls for Preliminary Residual Designation Sites and for Charles River Watershed Areas in the Communities of Milford, Bellingham and Franklin, Massachusetts. – unpublished manuscript and accompanying spreadsheets derived from Tetra Tech, 2009.

US EPA. 2010. Draft NPDES General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts North Coastal Watersheds. Available at http://www.epa.gov/region1/npdes/stormwater/draft_manc_sms4gp.html

US EPA. 2010. Draft General Permit for Residually Designated Discharges in Milford, Bellingham, and Franklin, Massachusetts. Available at: http://www.epa.gov/region1/npdes/charlesriver/index.html