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Executive Office of Energy & Environmental Affairs

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Comprehensive Review of Revised Water Management Act Permit Requirements

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Executive Summary

On November 7, 2014, the MassDEP Water Management Program adopted revised regulations (310 CMR 36.00) to implement the statutory requirement of the Water Management Act ([M.G.L. c. 21G](#)). These revised regulations built upon previously adopted Water Management Act (WMA) permitting policies and requirements that had evolved over time, and incorporated new requirements that were the result of a multi-year stakeholder process reflecting input from a variety of perspectives on water supply permitting and watershed management.

Chapter 286 of the Acts of 2014 requires MassDEP to conduct a review of the revised WMA permit requirements, review public water supply permits that include new permit conditions, and to estimate the cost of implementing those new permit conditions. This report is based on the experience of MassDEP in implementing the new requirements through permitting and through extensive pre-permitting work with communities with upcoming permits.

New requirements in the 2014 revisions include new approaches to resource protection in the issuance of permits. The following are the three core requirements that are included in WMA permits on a case by case basis:

1. coldwater fishery protections;
2. minimization of impacts in areas with the greatest groundwater depletion; and
3. mitigation of potential impacts when new withdrawals exceed historic baseline volumes.

Permittees are typically public water suppliers or commercial users – specifically golf course and cranberry bog owners. Developing permits incorporating the new requirements has required extensive consultation between MassDEP and applicants. In light of the new requirements, MassDEP has devoted considerable time and resources to outreach, technical assistance and pre-permitting help. This technical assistance and pre-permitting work has helped inform MassDEP of the issues associated with the permits and provided some insight into implementation costs. MassDEP will use this information in upcoming permitting work.

Since 2015, the Baker-Polito Administration has provided significant funding and technical assistance for many activities that fulfill the new WMA regulatory requirements including:

- nearly \$8 million for Land Acquisition for Natural Resource Protection;
- over \$2 million for Drinking Water Supply Protection;
- \$4.13 million for the MassDEP WMA Grant Program; and
- \$289,000 for the new Water Audit Technical Assistance Program

Nine public water supply permits issued under the revised regulations were reviewed for this report. One of those permits was for a new water supply system (Eastham, MA). The remaining eight are renewals.

Given the relatively short period of time for permitting under the new program regulations, MassDEP has done its best to estimate costs for permitting. In interviewing the communities with new permits,

only Shrewsbury was able to make a detailed estimate of costs associated with implementing its WMA permit, and those estimates are described in detail in this report. During interviews MassDEP received feedback on water rates and the potential impact on revenues resulting from conservation requirements. Water rates were provided by seven public water supply permittees interviewed. These issues are described in greater detail in this report.

To evaluate how the revised regulations might affect the larger universe of upcoming WMA permits, MassDEP has identified the number of permits that are expected to receive new permit conditions (see Table 8.2), developed a summary of estimated costs for types of projects that may meet new WMA permit requirements (see Part 9 of the report), and developed case studies to highlight how some permittees are implementing measures consistent with the new WMA permit conditions.

MassDEP's review of the new requirements and the cost information available for the types of projects that may fulfill the minimization and mitigation conditions required in WMA permits (see Part 9 of this report) shows that costs are dependent on each permittee's specific circumstances, and that new WMA permit requirements frequently overlap with other regulatory obligations.

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Comprehensive Review of Revised WMA Permit Requirement

INTRODUCTION

On November 7, 2014, revised Water Resources Management Program regulations (310 CMR 36.00) were promulgated to establish enforceable standards, criteria and procedures (including permit procedures) to implement the Water Management Act (M.G.L. c. 21G). The WMA became effective in March 1986 in order to protect the natural environment of the water in the Commonwealth, to assure comprehensive and systematic planning and management of water withdrawals and use in the Commonwealth, and allow continued and sustainable economic growth throughout the Commonwealth and increase the social and economic wellbeing and safety of the Commonwealth's citizens and of its work force. Water withdrawers typically requiring a WMA permit include public water suppliers, 18-hole golf courses, cranberry growers, ski areas, sand and gravel facilities, fish hatcheries and agricultural and industrial users. WMA permitting requirements apply to approximately 190 public water supply systems and an additional 140 other types of permittees.

The 2014 WMA regulations built upon the Program's previously adopted policies and incorporated requirements developed over time since the inception of the permitting program in 1991. The revised regulations contain requirements incorporated into permits prior to 2014 including: source water protection, municipal water conservation programs, water conservation performance standards and restrictions on non-essential outdoor water use. In addition, the 2014 revisions incorporated requirements developed through the multi-year SWMI stakeholder process, including a new methodology for calculating "safe yield," the concept of "streamflow criteria" and resource protection.

The purpose of this report is to conduct a comprehensive review of the revised Water Management Act Permit requirements pursuant to Chapter 286 of the Acts of 2014, Section 52 (below), as required by the Legislature.

SECTION 52. Notwithstanding any general or special law to the contrary, the department of environmental protection shall conduct a comprehensive review of the impact of any revisions to 310 C.M.R 36.00 on municipalities and public water systems. The review shall include:

- (i) an analysis of those municipalities and water systems affected by new permit conditions between the final promulgation date of the regulations and March 30, 2017;
- (ii) those municipalities and water systems required to develop minimization, cold water fishery or mitigation plans; and
- (iii) any rate increases experienced by ratepayers which water system operators attributed to minimization, cold water fishery or mitigation requirements.

The department shall report the results of its review, together with any supporting documentation or analysis, to the clerks of the senate and the house of representatives, the house and senate committees on ways and means and the joint committee on environment, natural resources and agriculture and shall post the review electronically on the website of the department not later than July 1, 2017.

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1. WMA Permitting Over Time

1986: The Water Management Program

The Water Management Act ([M.G.L. c. 21G](#)) became effective in March 1986. The Act authorizes the Massachusetts Department of Environmental Protection (MassDEP) to regulate large water withdrawals from both surface and groundwater supplies to ensure adequate water supplies for current and future water needs, protect the natural environment of the water, assure comprehensive and systematic planning and management of water use and allow continued and sustainable economic growth.

The WMA Program consists of a few key components, including a registration program and a permit program. Water users had the ability to register their existing water withdrawals based on their water use from January 1, 1981, through December 31, 1985. The registration program established a renewable right to continue existing water withdrawals over 100,000 gallons per day (gpd) on average. Registrations are valid for a 10-year period and are renewable.

Unregistered users withdrawing more than 100,000 gallons per day, or 9 million gallons in any three-month period, must apply for a WMA permit. Municipal public water suppliers, 18-hole golf courses, cranberry growers, ski areas, sand and gravel facilities, fish hatcheries and large agricultural and industrial users typically require a WMA permit. WMA permits may be issued for up to 20 years and can be renewed. The first round of WMA permits was issued on a rolling schedule between 1988 and 1995.

When issuing permits, MassDEP must consider, at a minimum, the following factors:

1. The impact of the proposed withdrawal on other water sources which are hydrologically interconnected with the water source from which the withdrawal is to be made;
2. The anticipated times of year when withdrawals will be made;
3. The water available within the safe yield of the water source from which the withdrawal is to be made;
4. Reasonable protection of water uses, land values, investments and enterprises that are dependent on previously allowable withdrawals;
5. The use to be made of the water proposed to be withdrawn and other existing withdrawals, presently permitted or projected uses of the water source from which the withdrawal is to be made;
6. Any water resources management plan for any city or town in which the affected water source is located;
7. Any state water resources management plan adopted by the Commission;
8. Reasonable conservation practices and measures, consistent with efficient utilization of the water;
9. Reasonable protection of public drinking water supplies, water quality, wastewater treatment capacity, waste assimilation capacity, groundwater recharge areas, navigation, hydropower resources water-based recreation, wetland habitat, fish and wildlife , agriculture, and flood plains; and
10. Reasonable economic development and the creation of jobs in the Commonwealth.

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As previously mentioned, WMA permit requirements developed to ensure consideration of these factors have evolved over time. The 2014 WMA regulations codified policies and practices developed in permitting since the Program's inception in 1988. The following is a summary of the evolution of those permit conditions.

2. History of the Conditions in WMA Permits

2003: Permitting in the Ipswich River Basin

Ipswich River Basin permits came up for a regularly scheduled 5-year review in 2003. The Ipswich River was simultaneously named one of the ten most endangered rivers in America in 2003 by the non-profit American Rivers, a Washington, DC-based river conservation advocacy group. In response, MassDEP convened a series of work groups that included both water supply and environmental advocacy representatives to review actions that could be taken to alleviate the hydrological stresses in the Ipswich River Basin, and potential ways to incorporate those actions into the amended Ipswich River Basin permits to be issued in 2003. The work groups helped develop a unique set of permit conditions that were designed to address the environmental stresses seen in the Ipswich River Basin due to water withdrawals. These new permit conditions included:

- Real-time summer streamflow measurements used to trigger outdoor water use restrictions;
- Regulating the use of unregulated irrigation wells or imposing stricter outdoor water use restrictions on public water supply customers;
- Performance Standards for residential gallons per capita water use (65 RGPCD) and system-wide unaccounted-for-water (10 percent UAW);
- Seasonal Cap on May 1st through September 30th total system-wide water use;
- Additional programmatic conservation requirements if the performance standards are not met; and
- Conservation outreach and water use reduction by each public water suppliers' largest customers.

Safe yield in the Ipswich River Basin was not reconsidered as part of the permits issued in 2003; safe yield for the Basin had been established in 1991 and was not challenged at the time the permits were first issued.

Ten permittees appealed the new 2003 permit conditions. The Ipswich River Watershed Association (IRWA) intervened in the appeal challenging the safe yield used in the permits and asking that the court require a new calculation of safe yield and the institution of a water bank by each permittee in order to decrease water withdrawals in the Ipswich River Basin. Seven of the appellants later either relinquished their WMA permits because their water use had fallen and they could again meet demand with their historically registered water volumes, or settled their appeal individually.

Ultimately, the remaining appeals were decided in July 2007 with the Court's determination that a) all new conditions in the permits were reasonable and justified and well within MassDEP's authority, but that b) when the 2003 permits were issued, MassDEP possessed information indicating that the safe yield as previously calculated was too high. The Court remanded the safe yield determination for the Ipswich River Basin back to MassDEP for recalculation as soon as reasonably possible (see **2009 Safe**

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Yield Discussions below). The Court also determined that water banks were not necessary as overall water consumption had been decreasing since the 2003 permits were issued.

2004-2006: Water Management Policy for Permit and Permit Amendment Applications and 5-Year Reviews (WMA Policy #: BRP/DWM/DW/P04-1, April 2, 2004);

- *Guidance Document for Water Management Act Permitting Policy* (Guidance #BRP/DWM/DW/G04-1, April 5, 2004); and
- *Guidance Document for Water Management Act Permitting Policy* (Guidance #BRP/DWM/DW/G05-01 (Supersedes Guidance #BRP/DWM/DW/G04-1), Effective Date: January 17, 2006)

The policy and April 2004 guidance were developed to extend the conservation measures developed for permits in the Ipswich Basin to other hydrologically stressed parts of the Commonwealth. The policy aim was to protect the waters of the Commonwealth and to better achieve the goal of balancing competing water uses by:

- 1) requiring more protection of stressed water resources through performance standards for residential water use and unaccounted-for-water, and measures to limit nonessential outdoor water use;
- 2) preventing conditions from deteriorating by setting new, higher standards to evaluate proposed increases in water use; and
- 3) requiring mitigation of new withdrawal impacts through offsets commensurate with the degree of stress in the basin and impact of a new withdrawal.

The policy and guidance initiated a debate among drinking water professionals, municipal officials and environmental advocates concerning public participation in developing the policy, the science upon which the policy was based and the potential economic impacts to municipalities and water suppliers. Consequently, the Legislature held a Special Hearing on October 26, 2005, to review the issues, and in 2006 established a special Water Management Act Blue Ribbon Panel within the Office for Commonwealth Development to study the effectiveness of the policy as a means to protect the waters of the Commonwealth, and report back to the Legislature by December 31, 2006.

In response to the finding of the Legislature's Special Hearing, MassDEP revised the 2004 permitting guidance to provide more flexibility for permittees addressing the new requirements. The 2006 permitting guidance set standards and conditions that were stricter for withdrawals in areas that were hydrologically stressed. The 2006 permitting guidance outlines standards for residential gallons per capita day (RGPCD) water use, unaccounted-for-water (UAW) within a water supply system, limits on nonessential summer water use, an individual baseline for water withdrawals by each permittee above which an Offset Feasibility Study would be required and implementation of offset measures that eliminate or minimize the impacts of withdrawals in excess of a public water supplier's baseline.

2006: The Water Management Act Blue Ribbon Panel

Pursuant to Chapter 139 of the Acts of 2006, a Water Management Act Blue Ribbon Panel was established. It was chaired by the Office for Commonwealth Development and held a series of public meetings organized around key points of contention and held individual meetings with panel members

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representing key stakeholders to identify concerns that could be addressed through negotiation. The Panel found that there was general support for:

- further study of hydrogeologic conditions;
- broadening policy implementation to include Best Management Practices (BMPs) employed by water supply systems in addition to performance standards and prescriptive mitigation requirements; and
- providing additional state aid to municipalities to implement BMPs and conservation.

The Blue Ribbon Panel was unable to conclude the negotiations for a variety of reasons and the Panel submitted an *Interim Report of the Water Management Act Blue Ribbon Panel* (December 31, 2006) to the Joint Committee on the Environment, Natural Resources and Agriculture outlining the Panel's deliberations. MassDEP continued to implement the 2004 Water Management permitting policy and 2006 permitting guidance.

2009: Safe Yield Discussions

In response to the Court's remand of the safe yield determination for the Ipswich River Basin, MassDEP moved toward a 2-step process for defining safe yield for Water Management permitting:

1. "Safe yield" would be defined as the maximum dependable withdrawal volume from a basin during the driest probable period; and
2. "Sustainable yield" would be developed through an Executive Office of Energy and Environmental Affairs (EOEEA)-led stakeholder process to develop streamflow standards.

Four members of the Water Management Program's Advisory Committee resigned from the Committee saying the new safe yield approach would remove environmental components from the safe yield determination. In November 2009, MassDEP suspended the safe yield interpretation and determinations and clarified that its interpretation of safe yield included environmental protection factors, including ecological health of river systems as well as hydrologic factors. EOEEA commenced SWMI to develop safe yield and streamflow standards for Water Management permitting.

2010: The Sustainable Water Management Initiative

The Executive Office of Energy and Environmental Affairs established SWMI for the purpose of incorporating the best newly available science into the management of the Commonwealth's water resources. The SWMI process was created with support from MassDEP, the Department of Fish and Game, and the Department of Conservation and Recreation. An Advisory Committee and a Technical subcommittee, comprised of a wide range of stakeholders, were established to advise EOEEA on sustainable management of water resources that balance human and ecological needs. The resulting Framework¹ was developed to guide WMA permitting.

After the SWMI Framework was released in November 2012, EOEEA agencies participated in numerous informal stakeholder discussions on key elements of SWMI and the proposed revisions to the Water Management Program regulations (310 CMR 36.00).

¹ <http://www.mass.gov/eea/waste-mgmt-recycling/water-resources/preserving-water-resources/sustainable-water-management/framework/sustainable-water-management-framework-summary.html>

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Pilot projects in Amherst, Danvers-Middleton, Dedham-Westwood and Shrewsbury were set up to test the on-the-ground impacts of the proposed SWMI Framework and incorporate lessons learned prior to developing the revised regulations. These pilots informed MassDEP's approach as the new regulations were developed. In addition, lessons learned from the pilots have been incorporated as MassDEP develops Guidance on how minimization and mitigation efforts will be included as part of the permitting process. The pilot projects were guided by a Steering Committee that included three public water supply representatives and three environmental advocate representatives.

These efforts were reflected in the draft regulatory revisions that were published for a 90-day public comment period on April 11, 2014. MassDEP held six public hearings and received over 160 written comments. The final revised regulations reflect a carefully developed balance to protect the health of Massachusetts' waterbodies while meeting the needs of communities for water.

2014: Revised Water Management Act Regulations

On November 7, 2014, the revised Water Resources Management Program regulations (310 CMR 36.00), were promulgated and incorporate the following SWMI-related elements:

- **Safe Yield**: A new methodology for calculating the amount of water that can be withdrawn from a basin;
- **Baseline**: The volume of water, based on 2003 through 2005 water withdrawals, above which a permittee will be required to mitigate the impacts of increasing withdrawal volumes;
- **Streamflow Criteria**: Criteria to guide permit conditions to protect the natural resources and ecology of waterways by specifying flow alteration percentages and corresponding mitigation requirements for water withdrawals from impaired subbasins;
- **Coldwater Fish Resources**: Waters that support a population of coldwater aquatic life. All applicants seeking groundwater withdrawals that will impact coldwater fish resources will be required to evaluate options for minimizing the impact by shifting withdrawals to their other withdrawal points, if any, and optimizing the timing of withdrawals;
- **Permit Review Categories**: Permit review categories, or "tiers," determine the requirements for obtaining a WMA permit;
- **Minimization Requirements**: All applicants seeking to withdraw water from groundwater depleted subbasins (August net groundwater depletion of 25 percent or more) will be required to minimize the impact of their withdrawal to the extent feasible through a combination of conservation, optimizing the timing of withdrawals, and returning water to the subbasin; and
- **Mitigation Requirements**: Applicants seeking an increased withdrawal over their baseline (permit tiers 2 and 3) will be required to develop and implement mitigation plans to offset the impacts of their increased withdrawal, to the extent feasible.

3. Requirements for Public Water Systems

The 2014 revisions to the Water Management Act regulations include permit requirements that had been established by policy and incorporated into Water Management permits over time since the permit program first began in 1988, including:

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- Zone II delineations for public water supply groundwater sources (1991);
- Wellhead and source water protection zoning requirements (1991);
- Water conservation requirements (1991);
- Performance standards for residential gallons per capita day water use and unaccounted for water (2004);
- Restrictions on nonessential outdoor water use (2004); and
- A baseline withdrawal rate beyond which permittees “offset” impacts of increasing withdrawals (2004).

The 2014 revisions also include requirements developed through the SWMI process, including:

- Minimization of the impacts of groundwater depletion;
- Mitigate withdrawal impacts (Note: “Offsets” established in the 2004 DEP Permitting Policy became more clearly defined as “mitigation requirements” through the SWMI process); and
- Coldwater Fisheries Protection.

A timeline of the development of the conditions in WMA permits can be found in Table 3.1. It will take several years for MassDEP to complete the permitting process in all Massachusetts’ river basins. Until the permitting process is complete for all basins pursuant to the revised regulations, the requirements in some permits may not include all the requirements outlined here.

As MassDEP developed WMA permit requirements, funding from state and federal sources has been made available to permittees to support the implementation of these requirements. Examples of funding available since 2000 include (but are not limited to):

- MassDEP State Revolving Fund (SRF) capital funds;
- MassDEP- funded firm yield analyses for public water supply reservoirs by the United States Geological Survey (USGS);
- EOEEA Drinking Water Supply Protection Grant Program;
- EOEEA Local Acquisitions for Natural Diversity (LAND) Grant Program;
- EOEEA Conservation Partnership Program (CPP);
- MassDEP Water Conservation Grant Program;
- MassDEP WMA Grant Program: AWWA M36 Water System Audits;
- MassDEP WMA Grant Program: project development and implementation; and
- MassDEP 319 grant program.

Table 3.2 provides more detail on these programs and on support provided to WMA permittees. The table may not capture all funding provided to WMA permittees, but it describes primary programs that have supported WMA permit implementation projects and programs.

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Table 3. 1- Timeline: Adoption of Special Conditions in WMA Permits			
Permit Condition	Policy Underlying the Adoption of Special Conditions in WMA Permitting		
	1991	2004	2014
Zone II Delineation	Included in WMA permits to provide means to require and enforce drinking water protection measures		
Wellhead and Source Water Protection Zoning Requirements			
Water Conservation Requirements	WRC 1987 Components of a Water Conservation Plan WRC 1992 Conservation Standards	DEP 2004 Permitting Policy WRC 2006 Conservation Standards Revision	
RGPCD Standard			
UAW Standard			
Outdoor Restrictions			
Baseline Withdrawals and Offsets to mitigate increasing impacts			
"Offsets" in WMA permitting became "mitigation requirements" through the SWMI process			
Minimize impacts of groundwater depletion			SWMI 2012 Framework
Mitigate withdrawal impacts			WMA 2014 regulations revisions
Coldwater Fisheries Protection			

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Table 3. 2- Technical and Financial Assistance for Implementation of WMA Permit Special Conditions	
Zone II Delineation for groundwater wells Firm Yield analyses for water supply reservoirs	<p>MassDEP State Revolving Fund (SRF) capital funds 1998-2001 - \$1.4 million to delineate the area of groundwater contribution (Zone II) for more than 180 public water supply wells with yields of $\geq 100,000$ gpd in over 80 water supply systems</p> <p>MassDEP- funded firm yield analyses for public water supply reservoirs by the United States Geological Survey (USGS) 2002 - Report 02-4278 with firm yield calculations for 3 surface-water supplies in the Ipswich River Basin 2011 - Report 2011-5125 with firm yield calculations for 38 reservoirs throughout Massachusetts</p>
Wellhead and Source Water Protection Zoning Requirements	<p>MassDEP provides technical assistance through:</p> <ul style="list-style-type: none"> • review and approval of municipal protection controls to ensure compliance with MA Drinking Water Regulations (310 CMR 22.00); • identification of potential land-use threats to drinking water supplies; and • review of land acquisition proposals for EOEEA Drinking Water Supply Protection Grants. <p>EOEEA Drinking Water Supply Protection Grant Program 2015-16 - \$1,258,600 to 6 public water supply systems 2016-17 - \$ 899,200 to 5 public water supply systems</p>
Land Acquisition for Natural Resource Protection	<p>EOEEA Local Acquisitions for Natural Diversity (LAND) Grant Program 2015-16 - \$2,163,400 to 10 municipalities 2016-17 - \$3,936,300 to 15 municipalities</p> <p>EOEEA Conservation Partnership Program (CPP) 2015-16 - \$ 874,000 to 10 land trusts 2016-17 - \$ 744,000 to 10 land trusts</p>
Water Conservation Requirements	<p>MassDEP Water Conservation Grant Program 2004-2010 - \$4.3 million for 128 grants to 92 public water suppliers for conservation projects. Saved over:</p> <ul style="list-style-type: none"> • 2.7 billion gallons of drinking water • \$3.2 million in pumping and treatment costs <p>MassDEP WMA Grant Program: AWWA M36 Water System Audits 2015-16 - \$ 135,000 for 15 community audits 2016-17 - \$ 154,000 for 25 community audits (See Appendix A - AWWA M36 Water System Audits Community List)</p>
RGPCD Standard	
UAW Standard	
Baseline Withdrawals and offsets to mitigate increasing impacts	<p>MassDEP WMA Grant Program: project development and implementation 2012-13 - \$ 858,000 for 11 projects 2013-14 - \$1,071,800 for 17 projects 2014-15 - \$ 760,000 for 12 projects 2015-16 - \$ 790,000 for 12 projects 2016-17 - \$ 648,000 for 9 projects (See Appendix B - SWMI Grant Program Project Summaries)</p> <p>MassDEP 319 grant program 2000-2015 – 35 separate grants have provided funds for 158 rain gardens and 4 stormwater runoff controls.</p>
Minimize impacts of groundwater depletion	
Mitigate withdrawal impacts	
Coldwater Fisheries Protection	

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4. Summary Descriptions of WMA Permit Requirements

Wellhead Zone II Delineations and Source Water Protection Requirements

From the outset, WMA permits included a special condition that required public water suppliers to conduct pumping tests and groundwater modeling to delineate areas that contribute water to supply wells (Zone II delineations). To ensure protection of both ground and surface water supplies, communities are required to implement zoning and non-zoning municipal controls to prevent contamination on contributing Zone II and reservoir watershed lands.

By 1998, it was clear that delineating Zone II's for all wells on-line prior to the WMA permitting program was too burdensome for some communities. MassDEP dedicated \$1.4 million in EPA State Revolving Fund capital and awarded three contracts to hydrogeological consulting firms to complete the Zone II delineations for all active community public water supply wells with approved well yields of 100,000 gallons per day (gpd) or greater. By the end of 2001, Zone II delineations had been completed for over 180 active wells with approved yields of 100,000 gpd or greater serving over 80 community public water suppliers.

WMA permits continue to require Zone II delineations and municipal land use controls for new public water supply wells with approved yields of 100,000 gpd or greater.

Water Conservation

A robust water conservation program has been a WMA permit requirement since the earliest days of the permitting program. MassDEP incorporated the recommended actions from the *Massachusetts Water Resources Commission Guidelines for Preparing a Water Conservation Plan* (January 1989) into the first permits issued in 1990 and 1991, and has continued to incorporate more comprehensive water conservation standards as they have been developed by the Massachusetts Water Resources Commission (WRC) in the *Massachusetts Water Conservation Standards* (October 1992 and July 2006).

The first WMA permits issued in 1990 and 1991 included the following minimum water conservation requirements, see Table 4.1. Public water suppliers in already stressed areas could be required to go beyond these minimum requirements.

Table 4. 1- Water Conservation Requirements for Public Water Supply Permits, 1990-1991
Meter installation of all customers and a program to repair or replace all meters every 10 years
Leak detection of the full distribution system at least every 5 years
Full-cost water pricing
Public information and education and employee awareness
Efficient water fixtures

The current water conservation requirements as described in Table 4.2, based on the WRC's 2006 Conservation Standards, address many of the same conservation issues, but provide greater specificity.

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Table 4. 2- Water Conservation Requirements for Public Water Supply Permits, 2006-present	
System Water Audits and Leak Detection	<ol style="list-style-type: none"> 1. Conduct a full leak detection survey at least every three years in accordance with American Water Works Association (AWWA) standards. More frequent detection is required for those not meeting the 10% UAW Standard.
Metering	<ol style="list-style-type: none"> 1. Ensure that the system is 100% metered. Meters must be properly sized for service lines, and meet AWWA calibration and accuracy standards. 2. Calibrate all source and finished water master meters at least annually. 3. Ongoing program to inspect service meters: a) for accuracy; b) for the need to repair or replace; and c) to check for tampering to identify and correct illegal connections.
Pricing	<ol style="list-style-type: none"> 1. Establish a water revenue structure that covers the full cost of the public water supply including operations, maintenance, capital improvements, water conservation activities, and indirect costs (such as environmental impacts and watershed protection). Evaluate revenues every three to five years and adjust rates as needed.
Residential and Public Sector Conservation	<ol style="list-style-type: none"> 1. Meet the standards of the Federal Energy Policy Act, 1992 and the Massachusetts Plumbing Code. 2. Meter or estimate water used by contractors using fire hydrants for pipe flushing and construction. 3. Submit a report of municipally owned public buildings retrofitted with water saving devices, and submit a schedule for retrofitting remaining buildings within two years or as agreed upon with the Department.
Industrial and Commercial Water Conservation	<ol style="list-style-type: none"> 1. Develop and implement an outreach program designed to inform and (where appropriate) work with industrial, commercial and institutional water users on ways to reduce water use.
Education and Outreach	<ol style="list-style-type: none"> 1. Develop and implement a Water Conservation Education Plan to educate customers on ways to conserve water. Permit lists the outreach techniques included in the WRC Conservation Standards.

RGPCD and UAW Performance Standards and Nonessential Outdoor Water Use Restrictions

RGPCD, UAW and nonessential outdoor water use restrictions were first established in the 2004 WMA permitting policy described above. The performance standards were amended and incorporated into the Massachusetts Water Conservation Standards (July 2006). The following describes the performance standards and nonessential outdoor water use restrictions as they are now incorporated into WMA permits.

Residential Gallons Per Capita Day (RGPCD) for public water supply permittees is 65 gallons of residential water use per person per day². Permittees that cannot comply within two full calendar years must develop a plan designed to bring the system into compliance within three additional years.

² The RGPCD performance standard is not applies to public water supply permittees on the Cape and Islands and other seasonal communities because large seasonal population shifts make calculating an accurate value difficult and its relationship to water use practices in seasonal communities is not clear cut.

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A permittee that has been unable to meet the standard within five years must implement a Functional Equivalence Plan which requires:

- a program that provides water savings devices at cost;
- a program providing rebates or incentives for purchase of low water use appliances;
- increased restrictions on nonessential outdoor water use;
- an ordinance, bylaw, or regulation requiring moisture sensors or similar climate technology on automatic irrigation systems;
- use of increasing block rates or a seasonal water rate structure; and
- billing at least quarterly.

Table 4.3 shows the statewide average for RGPCD for the past four years.

2016	2015	2014	2013
57	58	57	58

Unaccounted for Water (UAW) for public water supply permittees is 10 percent of water entering the distribution system for 2 out of every 3 years. Suppliers subtract all metered use and unmetered municipal uses, called “confidently estimated municipal use,” from the total amount of water entering the distribution system to determine how much water is “lost” to leaks, meter inaccuracies and theft within the system. Expressed as an equation, unaccounted-for-water is:

$$\text{UAW} = [\text{Total finished water entering the distribution system}] - [\text{Total metered use (billed and unbilled)}] - [\text{Confidently estimated municipal use, i.e. fire protection \& training, hydrant/water main flushing/main construction, flow testing, bleeders/blow-offs, tank overage \& drainage, sewer \& stormwater system flushing, street cleaning, source meter calibration adjustments, major water main breaks/not leak detection.}]$$

Public water suppliers’ year-to-year reported UAW typically varies by several percentage points, and review of UAW values reported over ten years has shown that a rolling look at performance over the most recent three years is a better indicator of a public water supplier’s long-term unaccounted-for-water. Assessing compliance based on the three-year basis avoids most instances of a permittee falling out of compliance because of an anomalous year.

A permittee that has had UAW of greater than 20 percent for 2 out of 3 years when the WMA permit is first issued, or has UAW of over 10 percent for 2 out of any 3 consecutive years during the permit period, must implement a Functional Equivalence Plan which requires “best practices” for controlling water loss. The Plan is based on annual water audits and guidance in the American Water Works Association/ International Water Association (AWWA/IWA) *Manual of Water Supply Practices – M36, Water Audits and Loss Control Programs* (AWWA M36). The water audits and resulting data are used to develop a system-specific plan for reducing water losses and improving system management to reduce unaccounted-for-water.

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Table 4.4 shows the statewide average for UAW for the past three years.

Table 4. 4- Massachusetts-wide UAW Average		
2015	2014	2013
15%	15%	14%

Municipalities and public water suppliers have expressed concern about the possibly open-ended level of effort and the expense that communities could incur meeting the performance standards. In response, MassDEP developed an *RGPCD and UAW Performance Standards Hardship Provision* that allows a permittee to present an analysis of the cost effectiveness of conservation measures included in the required Functional Equivalence Plans and to present alternatives that may be less costly or better suited to a community's circumstances. The analysis must consider environmental impacts and alternatives must produce equal or greater environmental benefits.

Restrictions on Nonessential Outdoor Water Use are required of all public water supply permittees from May 1st to September 30th. Certain water uses are not subject to mandatory restriction including any use required by regulation, for health or safety reasons, for production of food and fiber (including vegetable gardens), for maintenance of livestock or to meet the core functions of a business.

Permittees may choose:

- calendar triggered restrictions that remain in place from May 1st through September 30th, or
- restrictions that go into effect when local conditions fall below designated hydrologic triggers from May 1st through September 30th.

In most areas of Massachusetts restrictions are triggered by streamflows measured at designated United States Geological Survey (USGS) streamflow gages. On the Cape, Islands and parts of Southeastern Massachusetts restrictions are triggered by low groundwater measured at designated USGS monitoring wells and a drought declaration. Table 4.5 describes the nonessential outdoor water use restrictions included in WMA permits.

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Location	Environmental Conditions	Basis for Restrictions	Nonessential Outdoor Watering Restrictions
Restrictions triggered by streamflow monitoring in most of Massachusetts	Streamflow NORMAL	WMA Streamflow-based Restrictions	No restrictions
		WMA Calendar-based Restrictions	Watering limited to 7, 2 or 1 days per week, before 9 am and after 5 pm <ul style="list-style-type: none"> • 7 days in towns with 65 RGPCD or below • 2 day in towns with RGPCD above 65, or 65 RGPCD or below and depleted groundwater³ • 1 day in towns with RGPCD above 65 and depleted groundwater
	Streamflow BELOW Aquatic Base Flow	WMA Streamflow-based Restrictions	Same as WMA Calendar Restrictions above
	Streamflow BELOW 7-day low flow	WMA Streamflow or Calendar Restrictions	1 day per week, before 9 am and after 5 pm
Cape, Islands, and parts of Southeast MA	Groundwater below 25th percentile and Region in Drought	WMA Groundwater-based Restrictions	2 days per week, before 9 am and after 5 pm

Minimization, Mitigation and Protection of Coldwater Fish Resources

The WMA regulations require MassDEP and permit applicants to examine the potential environmental impacts of permitted water withdrawals. Baseline withdrawals and offsets to mitigate increasing impacts have been included in permits since the 2004 Water Management permitting policy, described previously. Requirements for minimization, mitigation and coldwater fish resource protection are now being incorporated into permitting based on the 2014 regulations in lieu of the earlier offset requirements.

WMA permit conditions have always focused on site-specific impacts and required efforts to alleviate any impacts. Permit conditions such as wetlands and vernal pool monitoring to detect and mitigate any long-term impacts, or shifts in a permitted well's pumping schedule to protect anadromous fisheries in adjacent streams have historically been included in permits. The November 2014 regulatory revisions introduced a broader framework of streamflow criteria for identifying cumulative environmental considerations.

Streamflow criteria, established in the *Massachusetts Sustainable Water Management Initiative Framework*, November 28, 2012, were developed using the modeled 2000-2004 existing hydrologic conditions at the subbasin scale across a gradient of alteration from least altered (Category 1) to most altered (Category 5).

³ August Net Groundwater Depletion > 25% in any subbasin where a supply well is located. August net groundwater depletion is the estimated unimpacted streamflow in a subbasin, less groundwater withdrawals, plus groundwater returns via septic systems and groundwater discharges for the month of August. It is expressed as a percent of unaffected August streamflow: $100 - ((\text{Aug Unaffected Flow} - 2000\text{-}2004 \text{ GW Withdrawals} + 2000\text{-}2004 \text{ GW Returns}) / \text{Aug Unaffected Flow}) \times 100$.

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- Biological Categories 1 – 5 categorize the existing biological conditions of Massachusetts’ flowing water habitats, using fish communities as a surrogate for aquatic habitat integrity;
- Groundwater Withdrawal Categories 1 - 5 estimate August median streamflow alteration, due solely to the impact of groundwater withdrawals, that corresponds with a change in the biological category of a stream; and
- Seasonal Groundwater Withdrawal Categories 1 - 5 reflect seasonal streamflow variation, the pattern of water use in Massachusetts, and the importance of seasonality in maintaining the natural flow of water over time.

These streamflow criteria are used to help determine mitigation and minimization requirements for a permit applicant.

Minimization is required of all permittees with groundwater wells in subbasins⁴ with an August net groundwater depletion of 25 percent or more (see the subbasin map at <http://www.mass.gov/eea/agencies/massdep/water/watersheds/sustainable-water-management-initiative-swmi.html>). Permittees are required to develop and implement a minimization plan and must consider the elements in Table 4.6.

Table 4. 6- Minimization Planning and Implementation
Desktop optimization analysis, evaluating whether sources controlled by the permittee, or any available alternative sources (including interconnections), could be used or operated at prescribed rates or times in a way that could reduce environmental impacts while still meeting water demands
Surface water releases from water supply impoundments to improve the timing, magnitude and duration of downstream flows to more closely mimic natural conditions without compromising other in-lake uses
Water returns that result in improvements to the quantity and timing of summer streamflow, including <ul style="list-style-type: none"> • stormwater recharge, • infiltration/inflow improvements, and • wastewater discharges
Nonessential outdoor watering restrictions of <ul style="list-style-type: none"> • 2 days per week for permittees with RGPCD of 65 or below, and • 1 day per week for permittees with RGPCD above 65
Additional conservation measures designed to <ul style="list-style-type: none"> • Reduce Demand • Reduce Water Losses • Reduce Nonessential Outdoor Watering while also taking into consideration cost, level of improvement expected to result from minimization actions, available technology and the applicant’s authority to implement the actions

The full suite of minimization activities that MassDEP has identified for inclusion in a minimization plan can be found in Appendix C.

⁴ The 1,395 subbasins delineated by the U.S. Geological Survey in Indicators of Streamflow Alteration, Habitat Fragmentation, Impervious cover, and Water Quality for Massachusetts Stream Basins (Weiskel et al., 2010, USGS SIR 2009-5272).

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Mitigation is required for withdrawals exceeding a permittee’s baseline, based on 2003-2005 withdrawals. Mitigation must be commensurate with the impact of their increased withdrawals, to the extent feasible. Mitigation activities that were implemented after January 1, 2005 which continue to provide environmental benefit may be considered as part of a mitigation plan. Permittees are required to develop a mitigation plan as part of the permit application process and must consider the elements in Table 4.7. However, should water use increase by less than forecast, mitigation implementation will be required only for actual water withdrawal increases.

Table 4. 7- Mitigation Planning and Implementation
<p>Permittees whose water withdrawals are returned to groundwater within the same subbasin, either via septic systems or wastewater treatment facility with a groundwater discharge permit, receive an 85% adjustment to the mitigation volume to account for the wastewater returns.</p> <ul style="list-style-type: none"> • MassDEP calculates the adjustment for wastewater return before an applicant develops the Mitigation Plan
<p>There are two types of mitigation and therefore mitigation credits:</p> <ol style="list-style-type: none"> 1. Direct Mitigation will result in enhanced streamflow as a result of groundwater contribution, streamflow contributions, or surface water releases. The credit is based on a calculated rate of water returned within the basin and is calculated volumetrically. 2. Indirect Mitigation is environmental improvement that will help to compensate for streamflow impacts resulting from withdrawals. The relative “value” of the indirect mitigation activity is determined by a credit system. A certain number of credits then equates to an increased withdrawal volume.
<p>Direct Mitigation activities include:</p> <ul style="list-style-type: none"> • surface water releases; • stormwater recharge (can include MS4 requirements); and • Sewer system infiltration and inflow (I/I) removal.
<p>Indirect Mitigation activities include, but are not limited to:</p> <ul style="list-style-type: none"> • land acquisition for water supply protection or habitat protection; • habitat improvement and protection projects; • local by-laws that promote environmental protection; • stormwater programs other than recharge projects; • TMDL implementation; • Other water quality improvement programs.
<p>Mitigation activities undertaken since 2005 may be eligible for credit.</p>
<p>The Mitigation Plan must include an anticipated implementation schedule for all mitigation required during the life of the permit.</p> <ul style="list-style-type: none"> • However, should water use increase by less than forecast, mitigation implementation will be required only for actual water withdrawal increases.

The full suite of direct and indirect mitigation activities that MassDEP has identified for inclusion in a mitigation plan can be found in Appendix C. Cost ranges for the most common mitigation measures can be found in section 9 of this report.

Coldwater Fish Resources (CFRs) are defined at 321 CMR 5.00 as water bodies that contain coldwater fish that reproduce in that waterbody or adjacent tributary and use the water body to meet one or more of their life history requirements. CFRs are critical resources that have seen significant loss over

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time, partially because these temperature-dependent habitats are strongly influenced by groundwater and particularly vulnerable to impacts from groundwater withdrawals.

Protection of Coldwater Fish Resources is required for withdrawals determined to have a hydrologic connection to streams that support coldwater fisheries. Table 4.8 outlines the activities required for permittees with a source with a known coldwater fishery.

Table 4. 8- CFR Protection Activities
<ul style="list-style-type: none">• MassDEP will prescreen WMA applications for withdrawals near CFR's to determine whether there is a hydrologic connection and whether the applicant has options to shift pumping to other withdrawal points.
<ul style="list-style-type: none">• For applicants with both a hydrologic connection to a CFR and potential operational alternatives, operational changes aimed at minimizing impacts to stream flow from groundwater withdrawals (optimization) is required.

5. Current WMA Permitting

As permits have been developed pursuant to the 2014 regulations, MassDEP found that extensive consultation with individual applicants is necessary in order to ensure that all applicants understand the new regulations and have the assistance they need to meet the new regulatory requirements as they relate to their withdrawals. MassDEP has been working closely with each permittee to fully consider all aspects of their individual situation and ensure thoughtful and implementable permits. This process has resulted in an extended timeline for issuing permits under the 2014 regulations.

Permits issued pursuant to the revised regulations assess each permittee's potential impact to the streamflow criteria and include requirements to address any impacts to the extent feasible. As discussed previously, the new permit requirements include the protection of coldwater fisheries, minimization of withdrawals from areas with depleted groundwater and mitigation of the environmental impacts of increasing water withdrawals.

In order to provide clear guidance to permit applicants, MassDEP developed a *Water Management Act Permit Guidance Document*, November 7, 2014. MassDEP is working to update the guidance document to incorporate more detailed information related to potential mitigation activities.

Regulatory Overlap

As MassDEP has begun to develop permits pursuant to the November 2014 regulations, many permittees' mitigation plans include projects that must be implemented to comply with other regulatory requirements. Mitigation projects that overlap with permittee's other regulatory obligations need to be carefully reviewed to ensure that mitigation projects mesh with the overlapping regulatory requirements. A WMA mitigation or minimization plan may include activities undertaken in order to comply with:

- a Municipal Separate Storm Sewer System (MS4) permit (314 CMR 3.00),
- a National Pollutant Discharge Elimination System (NPDES) (314 CMR 3.00) or ground water discharge (314 CMR 5.00) permit,

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- the development and implementation of an Infiltration/Inflow (I/I) identification and elimination (314 CMR 12.00),
- Massachusetts Wetlands Protection Act (310 CMR 10.00), or
- Safe Drinking Water Act (SDWA) requirements (310 CMR 22.00).

Funding for many mitigation and minimization activities may be available through the following grant and loan programs (this list is not exhaustive):

- Water Management Act Grant program (WMA Grants),
- Massachusetts State Revolving Fund (SRF) program,
- National Estuary Program grant programs (NEP),
- Clean Water Act Section 319 Nonpoint Source Management Program (319 Grants),
- Southeast New England Program (SNEP),
- Massachusetts Environmental Trust (MET)
- Section 604(b) Water Quality Management Planning grant program,
- various U.S. Environmental Protection Agency (USEPA) grant programs,
- various National Oceanic and Atmospheric Administration (NOAA) grant programs, and
- various U.S. Fish and Wildlife Service grant programs.

Funding Limitations on Mitigation Credit

While some mitigation projects can fulfill more than one regulatory requirement, other projects may be disqualified from inclusion in a mitigation plan. According to federal regulations and enabling language for some funding programs, activities supported through specific mechanisms cannot be used for any type of mitigation requirement. Using a project that has such restrictions for mitigation or minimization credit, may result in the permittee being required to repay grant monies used for the project. Therefore, projects that include restricted funds must be screened out of the mitigation plan, no matter how applicable the project might be.

Types of projects with funding that may prohibit their use in a WMA mitigation plan include dam removal, habitat restoration projects and land acquisition projects. Sources of project funding that may prohibit projects from being used for mitigation include, but may not be limited to, NOAA, the U.S. Fish and Wildlife Service, and the Massachusetts Environmental Trust. Use of funding sources that do not limit mitigation credit accruing for a project, would allow a permittee to receive credit for these types of projects if all other criteria are met.

Summary of Permits and Requirements Issued Pursuant to the 2014 Regulations

Between November 2014 and March 2017, MassDEP issued 15 new and renewed WMA permits under the 2014 regulations. Table 5.1 summarizes the requirements included in these final WMA permits issued pursuant to the November 2014 regulations. Table 5.1 also includes a brief description of the summer water use restrictions and the new permit conditions based on the 2014 regulations (coldwater fisheries resource protection, minimization and mitigation) included in each of these 15 permits. Case studies of highlighted permits are included in this report. The purpose of these case studies is to illustrate how the new WMA permit conditions are being implemented during the permitting process.

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Table 5. 1- Summary of Permits and Requirements Issued since Promulgation of the 2014 Regulations				
Permittee	Summer Restrictions	CFR	Minimization	Mitigation
Blackstone River Basin				
Town of Shrewsbury	Calendar or stream-flow triggered	_*	-	Mitigation Plan negotiated through Settlement Agreement of <u>Matter of Town of Shrewsbury – WMA Permit</u>, OADR Docket No. 2014-002
South Coastal Basin				
Town of Cohasset	Calendar or stream-flow triggered	-	-	Reservoir releases to augment streamflow
Town of Duxbury	Calendar or stream-flow triggered	-	-	-
Town of Kingston	Calendar or stream-flow triggered	-	-	-
North Sagamore Water District	Groundwater and Drought triggered	-	-	-
Town of Pembroke	Calendar or stream-flow triggered	See case study	<ul style="list-style-type: none"> • Prohibit irrigation hook-ups • Install radio read meters • Shut off Well #5 when Great Sandy Bottom Pond falls to specified level, 	-
Town of Scituate	Town-specific plan more protective than standard requirement and protective of local herring run	-	<ul style="list-style-type: none"> • Shift pumping as practical • Participate in 1st Herring Brook Operational Plan study • Town conservation plan 	No additional water allocated at this time. Plan to be developed prior to withdrawing more than baseline. Permit amendment will be required.
Plymouth Country Club	Golf Seasonal Demand Management Plan	-	-	Certification in the Environmental Planning, Water Conservation and Wildlife and Habitat Management components of the Audubon Cooperative Sanctuary Program
Widows Walk Golf Course	Golf Seasonal Demand Management Plan	-	-	Maintain Audubon Cooperative Sanctuary Program accreditation
Roger A. Correia Cranberry	Not applicable for agricultural use	-	-	Implementation of a Plymouth County Conservation District (PCCD) approved Farm Plan
Miller Bogs LLC	Not applicable for agricultural use	-	-	-
Cape Cod				
Town of Eastham	Groundwater or Drought triggered	-	-	Implementation of Cape Cod Commission approved Fertilizer Restriction By-Law to reduce nitrogen and phosphorous entering ground and surface waters
Town of	Groundwater and	-	-	-

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Permittee	Summer Restrictions	CFR	Minimization	Mitigation
Provincetown	Drought triggered			
Upper Cape Regional Water Supply Coop	Not applicable to regional wholesaler	-	-	Regional wholesaler –mitigation will be applied to purchasing water supply systems
Olde Barnstable Fairgrounds Golf	Golf Seasonal Demand Management Plan	-	-	-

***Note:** the dash, “-”, indicates that the permit does not include the specified requirement
 CFR: no hydrologic connection to a coldwater fishery
 Minimization: no groundwater withdrawals from subbasins with August net groundwater depletion > 25%
 Mitigation: permit does not authorize withdrawals above the permittee’s 2003-2005 Baseline withdrawals

- **Case Study: Shrewsbury Mitigation Plan** – In 2012 the Town of Shrewsbury was one of four pilot public water suppliers, along with Amherst, Danvers-Middleton and Dedham-Westwood, that conducted an on-the-ground analysis of the requirements and costs to communities of implementing the SWMI Framework. The subsequent Shrewsbury WMA Permit 9P4-2-12-271.01, issued January 29, 2014, prior to the adoption of the November 2014 regulations was developed with an understanding of the SWMI Framework and the results of the 2012 pilot project. The permit was subsequently appealed and the detailed mitigation plan included in Shrewsbury’s Final WMA Permit 9P4-2-12-271.01, July 2, 2015, was developed in the Settlement Agreement of Matter of Town of Shrewsbury – WMA Permit, OADR Docket No. 2014-002.

The streamflow criteria used in permitting were developed using the modeled 2000-2004 existing hydrologic conditions. Therefore, mitigation activities put in place from 2005 onward that continue to provide environmental benefit may be considered as part of a mitigation plan pending MassDEP review and approval. Shrewsbury, like most public water supply system’s going through the permit process, identified a number of mitigation activities completed since 2005. Shrewsbury’s mitigation plan identifies 0.234 million gallons per day (MGD) in direct and indirect mitigation credits that are already in place. The mitigation completed to date allows Shrewsbury to significantly exceed their baseline immediately, see Table 5.2. The costs are outlined in Table 5.3 below.

Shrewsbury’s water withdrawals have been below baseline since the permit was issued in 2015.

Baseline Water Use	Permitted Water Use through February 28, 2033	Withdrawal allowed with current Mitigation Plan	2015 Water Use	2016 Water Use
3.91 mgd	Up to 4.35 mgd (baseline + 0.44 mgd)	Up to 4.167 mgd (baseline + 0.257 mgd)	3.60 mgd (0.31 mgd below baseline)	3.62 mgd (0.29 mgd below baseline)

However, the mitigation currently in place is not enough to mitigate the impacts of Shrewsbury’s full 4.35 MGD allocation which is based on projected future water needs. As

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Shrewsbury’s water withdrawals approach levels that are not adequately mitigated by projects already in place, the mitigation plan will need to be adjusted and additional mitigation projects put into place.

Table 5.3 summarizes mitigation activities included in the July 2, 2015, permit and the estimated total costs of those activities. Some activities were required by other regulatory programs and have been implemented for those reasons (NPDES, MS4, I/I Removal). The costs associated with these activities are real, and the benefit of the activities will offset the impacts of water withdrawals, but the costs are not incurred as a result of mitigation requirements included in their Water Management permit. Costs incurred to achieve compliance with regulatory programs other than the Water Management Program are labeled as “Total Costs.” Costs incurred directly as a result of implementing the July 2, 2015, WMA permit are labeled as “Revenue Lost/Costs Incurred for Permit Compliance.

Table 5. 3- Shrewsbury Permit 9P4-2-12-271.01 Requirements and Order of Magnitude Cost Estimates			
	Total Costs	Revenue Lost/Costs Incurred per Permit	Credit awarded
Minimization - Demand Management			
Non-essential Outdoor Watering Limits ⁵ May 2014, local by-law amended to 2-day-per-week limit	Estimated at \$175,000 in lost revenue from 0.15 mgd annualized demand reduction ⁶	Estimated at \$175,000 in lost revenue from 0.15 mgd annualized demand reduction ²	Reduce demand and so: <ul style="list-style-type: none"> • reduce amount of future mitigation required • defer implementation of remaining mitigation requirements
Maintain the prohibition on new connections for in-ground irrigation systems, February 2003			
Industrial, Commercial, Institutional Water Conservation Program	costs are paid by water user	Administrative costs of identifying large users and meeting annually to review conservation	
Toilet Rebate Program	Costs are paid by homeowners + \$35 rebate per Water Sense-approved toilet installed	\$35 per eligible toilet	
Direct Mitigation			
2010-2020 Inflow & Infiltration (I/I) Removal Program	\$1.367 million for FY 15 (Year 4)	Commitment predates the WMA permit	0.127 mgd
Stormwater - Completed Projects	costs are paid by land owner	Administrative costs of tracking projects and approving project specs.	0.035 mgd
Stormwater - Future Projects			0.042 mgd pending DEP review and approval of completed project
Indirect Mitigation			

⁵ Costs represent lost revenue, but do not consider the cost savings achieved by reduced pumping and treatment.

⁶ *Sustainable Water Management Initiative Pilot Project Phase 2*, pg. 5-8, Comprehensive Environmental, Inc. in Association with Tighe & Bond, Inc., December 28, 2012.

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Table 5. 3- Shrewsbury Permit 9P4-2-12-271.01 Requirements and Order of Magnitude Cost Estimates			
	Total Costs	Revenue Lost/Costs Incurred per Permit	Credit awarded
Poor Farm Brook Habitat Funding	\$5000 annually	\$5000 annually	0.01 mgd 1 indirect mitigation credit = 0.01 mgd
Acquisition of Property in Zone I and II Acquisition of Open Space	None, accepted property for Open Space through Town Meeting process	None	0.02 mgd 2 indirect mitigation credits = 0.02 mgd
Wastewater Location Adjustment Factor for Credited Mitigation			
Wastewater Adjustment (Septic Credits)			0.023 mgd ⁷
Potential Mitigation Identified But Not Yet Developed or Credited			
Poor Farm Brook Dam Removal ⁸	\$300,000	Mitigation credit could be limited by funding source requirements ⁹	To be determined, if implemented
Stormwater Management by-Law Regulations ¹⁰	\$25,000	To Be Determined	
Indirect Credit for Stormwater By-Law Activities			
Stormwater Utility ¹¹	\$100,000 - \$200,000	To Be Determined	

- **Case Study: Pembroke CFR and Minimization Review** - Pembroke's WMA permit required an optimization review to ensure the Town's sources were managed in a manner that provided cold water fisheries protection and minimization of groundwater impacts. This case study describes the optimization review process and the resulting permit requirements.

Fisheries Protection— Four of Pembroke's wells are located in Subbasin 22023 through which runs Herring Brook. Herring Brook is both a Cold Water Fishery Resource and part of an important herring run that starts in Oldham and Furnace Ponds in Pembroke, and runs for approximately 12 miles through several ponds and fish ladders including through Pembroke's Herring Run Park, then into the North River which divides Norwell and Marshfield and finally into Scituate where it runs out to sea. Herring Brook, the CFR designated portions of the stream and the adjacent water supply sources are shown on the SWMI Interactive Map at http://maps.env.state.ma.us/flexviewers/SWMI_Viewer/index.html.

To prescreen applications for withdrawals near CFR's, MassDEP and the Department of Fish and Game (MassDFG) first do a general review of all sources in the CFR subbasin, and then conduct a more detailed review of sources in close proximity to the CFR to determine whether there is a hydrologic connection. Permittees with permitted withdrawals that impact streamflow at a

⁷ Section II Item C of the Mitigation Plan for Shrewsbury's Final WMA Permit 9P4-2-12-271.01, July 2, 2015.

⁸ Preliminary removal cost.

⁹ Certain programs that fund dam removal projects stipulate that funded projects cannot be used to meet other regulatory requirements.

¹⁰ Cost for consultant assistance.

¹¹ Costs include consultant and town staff time to evaluate and set up a stormwater utility.

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CFR are then required to shift withdrawals to their other withdrawal points, as feasible, to minimize impacts on the CFR.

In Pembroke's case:

- Hobomock Well-01G, Center Street Well-02G, Bryantville Well-04G and Windswept Well-05G are located in Subbasin 22023, where the Herring Brook CFR (and herring run) are located;
- MassDFG and MassDEP review identified Hobomock Well-01G as the source closest and with the most potential impact on Herring Brook and streamflow in the CFR;
- Further review of pumping information submitted annually by Pembroke to MassDEP on the Annual Statistical Report (ASR) showed that Well-01G has been off-line since 2009 due to water quality concerns and the Town's withdrawals had been shifted to other wells away from the CFR.

Based on this review, no further optimization for fisheries protection is required in Pembroke's permit as long as Well-01G remains off-line during the life of the WMA permit. Should Pembroke anticipate resuming withdrawals from Well-01G, Pembroke is first required to develop an optimization plan to minimize impacts to Herring Brook by managing the timing and magnitude of pumping to minimize streamflow impacts. In addition because this is a herring run, which has very specific flow requirements during the spring when the herring swim upstream to spawn, and in the fall when the young fish leave for the ocean, the optimization plan would also need to be tailored to address flow impacts during those critical time periods.

Minimization of Groundwater Impacts – Subbasin 22023 is 59.4 percent August net groundwater depleted, therefore, Pembroke was required to review its feasible options to minimize impacts to streamflow in subbasin 22023. In Pembroke's case:

- Pembroke has one groundwater source, Well-03G, in a subbasin which is underlain by Plymouth-Carver Aquifer where August net groundwater depletion cannot be readily determined. The subbasin includes anadromous fisheries and Well-03G is upstream of Silver Lake, which is also a public water supply source. MassDEP's review of Pembroke's pumping records show that Pembroke has consistently pumped Well-03G at between 60 percent and 65 percent of its approved capacity. Therefore Pembroke's WMA permit does not require shifting additional pumping to Well-03G because increased pumping could have adverse effects on sensitive resources in the area and could result in overuse and loss of capacity at the well.
- Pembroke has no surface water supplies and, therefore, cannot make releases to improve streamflow.
- Pembroke is required to implement enhanced conservation measures including:
 - outdoor water use restriction developed to minimize withdrawals in August net groundwater depleted subbasins,
 - continued implementation of the Town by-law prohibiting automatic irrigation systems connecting to the town's water distribution system; and
 - Installation and maintenance of radio-read meters.

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6. Rate Survey of Public Water Suppliers with New/Revised WMA Permits

An important part of this report is to hear from those public water suppliers who have received WMA permits under the revised regulations. MassDEP conducted a series of telephone interviews with seven of the eight public water suppliers who have been issued WMA permits pursuant to the November 2014 regulations in order to discuss impacts that the new permits have had on water rates to date, and to generally review their experience implementing their new permit.

Public water suppliers (date WMA permit issued) interviewed were:

- Shrewsbury (7/2/2015),
- Provincetown (1/30/2016),
- Cohasset (7/19/2016),
- North Sagamore (7/22/2016),
- Scituate (9/16/2016),
- Duxbury (10/6/2016), and
- Kingston (12/5/2016).

Prior to conducting interview phone calls, MassDEP contacted each permittee by email to outline:

- The survey questions (Table 6.1), designed to review impacts that the new permits have had to date;
- Arrange a time to conduct a telephone interview to discuss their recently issued WMA permit and any impact the permit requirements have had on water rates; and
- Request a copy of their water rates for the last three years and any supporting information.

A write-up of each interview and a copy of each public water suppliers' most recent water rates can be found in Appendix D.

Table 6. 1- Water Rate Survey Questions for Public Water Suppliers with New/Revised WMA Permits

- | |
|---|
| <ol style="list-style-type: none">1. Did your newly issued WMA permit) result in the implementation of any new water conservation or mitigation measures? Please explain.2. If yes, please estimate the cost of each of these newly implemented measures.3. Did you/do you anticipate increasing your rates to cover any costs incurred for implementing your WMA permit? If yes, when and by how much (per gallon increase estimate or per household increase estimate)? If no, why?4. What is the date of your last rate review?5. What is the date of next review? |
|---|

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7. Results to Date Under the New WMA Regulatory Requirements

As noted earlier in this report, developing permits that incorporate the new regulatory requirements has required extensive consultation with each applicant. MassDEP has worked with public water suppliers to consider all aspects of their individual situation and ensure thoughtful and implementable permits. Consequently, the new WMA permits have been in effect for approximately one year, or in Shrewsbury’s case, for nearly two years. Given this short time-frame, it is early to determine how these new WMA permits will impact public water supply rates and consumers’ water bills over the over the life of these 15-20 year permits.¹² The results of the Water Rate Survey are summarized in Table 7.1.

Table 7. 1– Rate Survey Summary Results			
Public Water Supplier	Costs identified during interview		Anticipate Rate Increase
Shrewsbury	Lost revenue	due to outdoor restrictions of up to \$175,000 without rate adjustment	yes
	Minimization costs	\$35 per toilet for rebate program	
	Mitigation costs	\$5000 annually for habitat improvement	
	Prior WMA permit costs	leak detection and customer meter replacement program	
	Capital Improvements not part of WMA permit	new water treatment plant	
Provincetown	No permit related costs identified during interview		
Cohasset	No permit related costs identified during interview		
North Sagamore	Lost revenue	due to outdoor restrictions and conservation to meet 65 RGPCD	Under consideration
Scituate	Lost revenue	due to outdoor restrictions and drought of 2016	yes
	Mitigation costs	could be incurred to meet streamflow release requirement	
	Capital Improvements not part of WMA permit	System expansion in planning stages to increase supply and meet streamflow release requirements	
Duxbury	Lost revenue	due to outdoor restrictions and conservation to meet 65 RGPCD	Yes
Kingston	Lost revenue	possible due to outdoor restrictions but does not anticipate a rate increase	no

Most permittees did not identify significant costs associated with the new minimization, mitigation and coldwater fishery protection requirements given the length of time the permits have been in effect. The one exception is Shrewsbury which has identified new costs incurred for its Toilet Rebate Program, required as enhanced conservation to minimize the impacts of groundwater depletion, and its annual

¹² Note: The duration of a permit can vary based on the timing of the Permit Extension Act (Chapter 240 of the Acts of 2010, as amended by Chapter 238 of the Acts of 2012) in the WMA 20-year permit cycle, and the schedule for issuing renewed permits. All permits in a river basin are issued on the same schedule.

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contribution toward the restoration of Poor Farm Brook, required to mitigate the impacts of increasing withdrawals¹³. Shrewsbury also highlighted other costs that are either associated with long-standing permit requirements, or were necessary to finance other infrastructure improvement projects that will help them to meet WMA permit requirements, but will not be implemented directly as a result of their new WMA permit¹⁴.

Most public water suppliers interviewed were concerned about lost revenue due to:

- conservation requirements;
- outdoor water use restrictions; or
- reducing overall water use to meet the 65 RGPCD performance standard.

Two public water suppliers (North Sagamore and Duxbury) believe significant rate increases could be needed to replace revenue lost when water use declines to meet the performance standard. A third public water supplier (Kingston) has implemented tighter outdoor water use restrictions to try and meet the performance standard, but did not anticipate future rate increases.

One public water supplier (Scituate) said that streamflow releases required in the WMA permit, in combination with the 2016 drought, had nearly resulted in activating a costly interconnection with a neighboring town when Scituate's reservoir fell below 22 percent of its capacity. In the end, the interconnection was not needed, but revenue for 2016 was down by nearly 10 percent due to the combination of outdoor water use restrictions, the late-summer ban on outdoor water use and calls for emergency conservation by residents which brought August water use 25 percent below June and July water use, and by late August had brought daily water use to mid-winter levels.

In summary, many of the identified increasing costs are attributable, at least in part, to capital improvement projects, treatment plant upgrades and expansions, and system operation and maintenance costs that would be incurred regardless of a WMA permit. Permittees did note that there were costs associated with long-standing WMA permit requirements (not new permit requirements), such as monitoring requirements and leak detection programs. There was concern expressed that the demand management and water conservation permit conditions may result in a loss of revenue. MassDEP will continue to work with public water suppliers to provide technical assistance for permit implementation and to ensure that public water suppliers are aware of all financial assistance available through the Commonwealth (see Table 3.2 - Technical and Financial Assistance for Implementation of WMA Permit Special Conditions).

¹³ Costs identified in the *Sustainable Water Management Initiative Pilot Project Phase 2*, Comprehensive Environmental, Inc. in Association with Tighe & Bond, Inc., December 28, 2012, and summarized in Table 5.3 of this report.

¹⁴ Costs identified during the Shrewsbury Water Department Rate Survey telephone interview, conducted on May 23, 2017, and transcribed in Appendix D of this report.

8. WMA Permit Renewal Moving Forward

Schedule for Permit Renewals

The majority of water withdrawers requiring a WMA permit are public water supplies, 18-hole golf courses and cranberry growers with over 9 acres brought into cultivation since the WMA registration period ended in 1986. Permits shown as “Other” in the schedule below include water use for agriculture, aquaculture, industrial uses, sand and gravel production and snowmaking at ski areas. MassDEP is reviewing all permit renewals for a given basin at one time. This allows MassDEP to look at cumulative impacts of water withdrawals in the basin. Table 8.1 outlines the numbers and types of permits for each of the 27 major basins and the anticipated timeframe for final permit issuance.

Table 8. 1- Schedule for WMA Permit 20-Year Renewal by River Basin						
Watershed Name	Total # of Permits	Public Supply Permits	Golf Irrigation Permits	Cranberry Cultivation Permits	Other Permits	Final Permit Issuance
South Coastal	19	11	5	2	1	2016-17
Cape Cod	25	17	8	-	-	2017
Deerfield	2	1	-	-	1	2017
Ipswich	7	6	1	-	-	2018
Taunton	46	23	5	18	-	2018
Boston Harbor	17	9	7	-	1	2018
Housatonic	9	2	-	-	7	2018
Buzzards Bay	37	11	4	21	1	2018
Islands	7	4	3	-	-	2019
Concord	17	13	2	-	3	2019
Ten Mile	7	4	-	-	3	2019
Westfield	6	3	1	-	2	2019
Millers	7	6	-	-	1	2020
Chicopee	13	8	2	-	3	2020
Quinebaug	2	1	-	-	1	2020
Connecticut	25	10	8	-	7	2020
Nashua	17	14	1	-	3	2021
French	2	2	-	-	-	2021
Shawsheen	1	1	-	-	-	2021
Merrimack	24	17	3	-	4	2021
Parker	5	4	1	-	-	2021
Narragansett	2	1	1	-	-	2021
Renewed WMA permits were issued in 2009 and 2010 in the following River Basins, prior to the Permit Extension Act or the SWMI process. Permit reviews for these Basins are proposed for 2018. The mitigation, minimization and CFR protection requirements for these permits will be evaluated and included in the permits as applicable at the review.						
North Coastal	7	4	3	-	1	2018
Charles	21	15	4	-	3	2018
Blackstone	19	14	3	-	2	2018
Hudson	6	3	-	-	3	2018

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Estimated 2014 Regulatory Requirements in Renewed Water Management Permits

As with already issued permits, permits going forward will be subject to the process as described in this section. The permit-renewal process begins with WMA Program staff, in consultation with MassDFG and Department of Conservation and Recreation (MassDCR) staff, conducting an in-house analysis of permits in each river basin, anticipated future water needs, and potential environmental impacts and mitigation opportunities for each permit. At Outreach Workshops hosted by MassDEP and held prior to the permit renewal application filing date, permittees are given a Permit Renewal Summary Sheet (example in Appendix E). The summary includes the following information that will be included in the permittee's renewed WMA permit:

- the previous five years' water use,
- RGPCD and UAW (for public water supplies only),
- water needs forecasts prepared by the MassDCR Office of Water Resources (for public water supplies only),
- 2003-2005 baseline water use,
- streamflow or groundwater triggers for nonessential outdoor water use restrictions, and
- a preliminary assessment of whether
 - CFR protection,
 - minimization, and
 - mitigation requirements.

Permittees may review and update or correct any information on the summary sheet as part of the permit renewal process. Specific permit requirements for CFR protection, minimization or mitigation are developed through consultation during the permit renewal process. To date, the in-house analyses have been completed for 18 river basins. MassDEP reviewed all available data for all WMA permittees in each basin and has estimated which permit conditions may apply to each permittee (see Table 8.2).

Of 145 public water suppliers assessed, MassDEP is estimating that:

- 49 may have options to optimize their withdrawals to address impacts to nearby CFR's;
- 80 to 100 will likely need to explore minimization and mitigation options depending on the withdrawal volumes permitted. MassDEP will continue to provide pre-permitting assistance in order to help establish cost effective approaches to permit implementation.

Of 45 golf courses assessed, MassDEP is estimating that:

- 3 may have options to optimize their withdrawals to address impacts to nearby CFR's;
- 8 may be required to minimize withdrawals through conservation or by shifting withdrawals to other available sources to minimize local groundwater depletion;
- 30 to 34 are expected to withdraw in excess of their 2003-2005 baseline withdrawal and be required to mitigate impacts through the Audubon Cooperative Sanctuary Program, including certification in "Environmental Planning" and "Water Conservation" and depending on the amount of mitigation required, certification in at least one of the following three categories: "Wildlife and Habitat Management," "Chemical Use Reduction and Safety" and "Water Quality Management."

Of 41 cranberry growers assessed, MassDEP is estimating that:

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- All cranberry growers who receive a new or renewed WMA permit will be required to develop a USDA Natural Resources Conservation Service (NRCS) Farm Plan. Specific elements of the Farm Plan that address water conservation and mitigating water quality impacts will be required as a condition of the permit, as appropriate.

Basin Name	Permit type		CFR Protection Hydrologic connection to a coldwater fishery	Minimization August net groundwater depletion > 25%	Mitigation Permitted withdrawal will be above Baseline
South Coastal	11	Public supplies	4	5	8
	5	Golf	-*	-	4
	2	Cranberry	-	-	1
	1	Other	-	-	1
Cape Cod	17	Public supplies	4	-	14
	8	Golf	-	-	5 to 8
Ipswich	6	Public supplies	1	5	2
	1	Golf	-	1	-
Deerfield	1	Public supplies	-	-	-
	1	Other	-	-	-
Taunton	23	Public supplies	5	16	18 to 22
	5	Golf	1	1	4
	18	Cranberry	To be determined	-	Up to 18
Boston Harbor	9	Public supplies	3	9	3 to 5
	7	Golf	1	4	2
	1	Other	-	1	1
Housatonic	2	Public supplies	1	-	-
	2	Ski	-	-	-
	5	Other	1	-	-
Buzzards Bay	11	Public supplies	1	4	4 to 7
	4	Golf	-	1	2
	21	Cranberry	To be determined	-	Up to 21
	1	Other	-	-	1
Islands	4	Public supplies	-	-	4
	3	Golf	-	-	2
Concord	13	Public supplies	4	9	4 to 9
	2	Golf	-	1	0 to 1
	3	Other	1	2	3
Ten Mile	4	Public supplies	-	3	3
	3	Other	-	3	-
Farmington	No Permits in the Farmington River Basin				
Westfield	3	Public supplies	2	2	1
	1	Golf	1	-	1
	2	Other	-	-	1
Millers	6	Public supplies	2	-	3 to 4
	1	Other	-	-	-
Chicopee	8	Public supplies	3	2	1
	2	Golf	-	-	3

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Table 8. 2- Estimated SWMI-Based Requirements in Renewed Water Management Permits					
Basin Name	Permit type		CFR Protection Hydrologic connection to a coldwater fishery	Minimization August net groundwater depletion > 25%	Mitigation Permitted withdrawal will be above Baseline
	3	Other	-	-	-
Quinebaug	1	Public supplies	1	-	1
	1	Other	-	-	1
Connecticut	10	Public supplies	8	5	8
	8	Golf	-	-	7
	3	Farms	-	-	3
	4	Other	1	2	4
Nashua	14	Public supplies	9	2	9 to 10
	3	Other	-	1	-
French	2	Public supplies	1	-	-
The Shawsheen, Merrimack, Parker and Narragansett Watersheds have not had Permit Renewal Outreach Meetings so permit estimates have not been developed					
Permit renewals in the Charles, Blackstone, North Coastal and Hudson Watersheds were issued in 2009 and 2010 prior to the SWMI process. Permit reviews for these Basins are proposed for 2018.					
*Note: the dash, “-”, indicates no permits are anticipated to have the specified requirement.					

9. Financial Information on Mitigation and Minimization Requirements

Demand management and an active water conservation program have been required in WMA permitting since the first permits were issued in 1989. The requirement to offset, or mitigate, withdrawals over a permittee's baseline withdrawal rate has been part of WMA permitting since 2004. The 2014 WMA regulation revisions clarify the requirement to mitigate increasing withdrawals by clearly defining how each permittee's baseline withdrawal is determined, and by setting out requirements for minimization and mitigation in WMA permits.

The 2014 WMA regulation revisions have emphasized a robust water conservation program for permittees, an effective conservation program can help reduce per capita water use, slow the rate at which a permittee's water withdrawals increase and thus provide environmental benefits in environmentally sensitive areas and defer, or for some permittees even eliminate, the need to implement mitigation measures designed to offset the impacts of increasing water withdrawals.

Part 9 of this report provides a brief description of projects and ranges in costs for a variety of common minimization and mitigation activities that may meet WMA permit requirements. Table 9.1 summarizes the low, median, average and high cost estimates for broad categories of minimization and mitigation activities. The project costs included in this report are based on review of available information from verifiable sources. The costs shown in Table 9.1 reflect detailed information and costs for projects funded through Massachusetts' Clean Water and Drinking Water State Revolving Funds, WMA Grant projects, Massachusetts Environmental Trust grants, and a variety of other regional sources. Specific project cost information compiled to create Table 9.1, as well as the other tables included in Part 9 of the report can be found at: <http://www.mass.gov/eea/agencies/massdep/water/watersheds/review-of-revised-wma-permit-requirements.html>.

The following sections have been assembled to provide baseline information on potential costs for implementing activities that may qualify for mitigation and minimization credit in a WMA permit. Many of the project categories included are required to meet other regulatory requirements and are noted as such.

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Table 9. 1– Summary List of Mitigation Action Implementation Costs by Major Category					
Category	Action	Low	Median	Average	High
Minimization & Deferral of Increased Water Use and Mitigation	Demand Management – Various See Table 9.2	\$1,000	\$248,000	\$454,000	\$21,000,000
Minimization & Direct Mitigation	Instream Flow -Surface Water Release See Table 9.3	\$5,000	\$75,000	\$393,000	\$1,100,000
Minimization & Direct Mitigation	Stormwater Recharge BMP See Tables 9.4 and 9.5	\$48,000	\$267,000	\$636,000	\$2,472,000
Minimization & Direct Mitigation	Stormwater - MS4 Requirements See Tables 9.6 and 9.7	\$4,840	\$27,620	\$162,000	\$2,160,000
Indirect Mitigation	Stormwater Bylaw See Table 9.13	\$1,000	\$2,500	\$2,500	\$5,000
Indirect Mitigation	Stormwater Utility See Table 9.13	\$75,000	\$212,500	\$212,500	\$350,000
Minimization & Direct or Indirect Mitigation	Wastewater Improvements Sewer System Infiltration and Inflow Removal See Tables 9.8 and 9.9	\$192,000	\$2,202,000	\$2,377,000	\$9,450,000
Indirect Mitigation	Wastewater Improvements - Septic System Maintenance Program See Table 9.10	\$15,000	\$20,000	\$22,000	\$30,000
Indirect Mitigation	Habitat Improvements See Table 9.11	\$20,000	\$619,000	\$678,667	\$3,645,000
Indirect Mitigation	Land Acquisition - Source Protection See Table 9.12	\$1,000	\$76,000	\$101,000	\$870,000

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Demand Management/Water Conservation Implementation Costs

In order to minimize overall water withdrawals, permittees with minimization and mitigation requirements should evaluate reasonable and cost-effective indoor and outdoor conservation measures that go beyond standard WMA water conservation requirements, and develop a plan to implement feasible measures. Permittees who are required to minimize their withdrawals should focus on measure that will be most effective in reducing August net groundwater depletion in their community.

The cost information in Table 9.2 is organized into six general categories.

- General System-wide Measures,
- Outdoor Water Use,
- Indoor Water Use,
- Rate Review and Changes, and
- System Audits, Leak Detection and Metering

Demand management activities that focus on system audits, leak detection and metering may have higher initial costs, but will ensure that the maximum amount of water that the permittee distributes will be revenue producing water and supplying the needs of the customers. Some demand management activities that reduce billed water use, such as outdoor conservation measures, may result in revenue loss through reduced water sales. Rate adjustments may be necessary, but systems may realize long-term savings if infrastructure expansions and mitigation activities can be deferred. The costs included in Table 9.2 to do not capture lost revenue, they are implementation costs.

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Table 9. 2– Demand Management								
Mitigation Action	Action Specifics	Comments	Description of Work involved	Typical Project Cost				Cost Information Source
				Low	Median	Ave.	High	
General								
Water Bank	Adopt water bank	The purpose of a Water Bank is to provide a public water supplier, developer, or municipality with required resources to maintain or reduce existing demand on water resources, while accommodating the water needs of existing and future development. For example, a water bank could require that anyone seeking to connect to the municipal water supply must reduce from the existing water supply system or end users at least two gallons for every new gallon that is required.	Revise By-law or Rules & Regulations as needed (work with counsel).	\$1,000	\$2,500	\$2,500	\$5,000	Cost assumes use of available model legal language. Estimated cost for Counsel (legal) review: \$1,000 to \$5,000. Assumes no administrative or other costs.
Reuse Wastewater	Wastewater reuse for irrigation	For town wide, this would involve extensive piping and plumbing changes that would not be feasible. Applicable situation would be a new development with on-site wastewater treatment.	This is a new approach in Massachusetts that is just beginning to be explored. Premature to have relevant cost information.					

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Table 9. 2– Demand Management								
Mitigation Action	Action Specifics	Comments	Description of Work involved	Typical Project Cost				Cost Information Source
				Low	Median	Ave.	High	
Residential per Capita Usage	Achieve higher rates of water efficiency	As water usage changes, water rates must be adjusted. Re-evaluate rates accordingly.	Work involves having a consultant evaluate water rates to account for less usage and then voting on the revised rates.	\$25,000	\$37,500	\$37,500	\$50,000	Rate Evaluations completed using WMA grant include Billerica (\$25,000); Wareham (\$50,000); and by Water Conservation Grant - Hatfield (\$37,500)
Outdoor Water Use								
Water Conservation	Adopt ban on non-essential seasonal water use	Re-evaluate rates accordingly.	Revise By-law or Rules & Regulations as needed (work with counsel). Evaluate rates.	\$26,000	\$40,000	\$40,000	\$55,000	Rate Evaluations completed using WMA grant include Billerica (\$25,000); Wareham (\$50,000); and by Water Conservation Grant - Hatfield (\$37,500). See also By-law Revision Costs .
Private Well Bylaw	Establish bylaw extending seasonal outdoor water use restrictions to private well users	Includes legal and political costs. Re-evaluate rates accordingly.	Work with counsel to modify Town By-law accordingly. Develop educational materials.	\$1,000	\$2,500	\$2,500	\$5,000	Cost assumes use of available model legal language. Estimated cost for Counsel (legal) review: \$1,000 to \$5,000.
Irrigation Systems	Adopt Best Available Technology bylaw for irrigation systems		Revise By-law or Rules & Regulations as needed (work with counsel).	\$1,000	\$2,500	\$2,500	\$5,000	Assumes no administrative or other costs.
Outdoor Water Restrictions	Adopt one day/week or zero day/week calendar streamflow trigger	As water usage changes, water rates must be adjusted. Re-evaluate rates accordingly.	Work involves having a consultant evaluate water rates to account for less usage and then voting on the revised rates.	\$25,000	\$37,500	\$37,500	\$50,000	Rate Evaluations completed using WMA grant include Billerica (\$25,000); Wareham (\$50,000); and by Water Conservation Grant - Hatfield (\$37,500)

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Table 9. 2– Demand Management								
Mitigation Action	Action Specifics	Comments	Description of Work involved	Typical Project Cost				Cost Information Source
				Low	Median	Ave.	High	
WaterSense Irrigation	On municipal properties with automatic irrigation systems, install WaterSense labeled weather based controllers	Cost depends on number of installations.	Purchase and install controller and rain gauge.	\$1,000	\$5,000	\$10,000	\$20,000	Sample cost for one brand of irrigation controller. Low cost is one location, Median cost is 5 locations; Average cost is 10 locations, High cost is 20 locations.
Indoor Water Use								
Efficient Plumbing and Appliances	Promote Efficient Plumbing and Appliances	Customer education	Develop education materials to be included with bills or separate mailing.	\$2,000	\$7,000	\$7,000	\$20,000	Water conservation education completed as part of a Water Conservation Grant for Clinton (\$7,000). Low range and high range costs proportioned accordingly.
Efficient Plumbing and Appliances	Implement Rebate Program for residential customers for high efficiency WaterSense labeled products and Energy Star labeled clothes washers		Work involves establishing an account for the rebates and managing the program.	\$10,000	\$150,000	\$150,000	\$278,500	Wrentham DPW, Abt Associates, Charles River Watershed Association, "Enabling Permittees to Prepare Cost-Effective Strategies: Support to the Town of Wrentham and Reusable Tools" Wrentham, June 2015. Exhibit 16. Page 21.

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Table 9. 2– Demand Management								
Mitigation Action	Action Specifics	Comments	Description of Work involved	Typical Project Cost				Cost Information Source
				Low	Median	Ave.	High	
Efficient Plumbing and Appliances	Offer incentives for those seeking municipal approvals to install high-efficiency WaterSense labeled products and Energy Star labeled appliances in new construction and renovations		Work involves establishing an account for the rebates and managing the program.	\$10,000		\$150,000	\$278,500	Abt Associates, Pioneer Valley Planning Commission, "Cost-Effective Permit Renewal in a Shared Source Subbasin for Southwick and West Springfield" June 2016. Exhibit 29. Page 38. Westford Water Department, "SWMI Implementation Project to Improve the Efficiency of Water Use and Reduce Water Demand" June 2015. Page 3.
Rate Review and Changes								
Rate Evaluation	Evaluate rate structure every two years			\$25,000	\$37,500	\$37,500	\$50,000	Rate Evaluations completed using SWMI grant include Billerica (\$25,000); Wareham (\$50,000); and by Water Conservation Grant - Hatfield (\$37,500)
Conservation water rates	Adopt DEP approved conservation water rates	Re-evaluate rates accordingly.	Work involves having a consultant evaluate water rates to account for new rate structure and then voting on the revised rates.	\$25,000	\$37,500	\$37,500	\$50,000	

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Table 9. 2– Demand Management								
Mitigation Action	Action Specifics	Comments	Description of Work involved	Typical Project Cost				Cost Information Source
				Low	Median	Ave.	High	
Seasonal Rate Structure	Implement seasonal rate structure that sets higher rates from May 1 to Sept 30	As water usage changes, water rates must be adjusted. Re-evaluate rates accordingly.	Work involves having a consultant evaluate water rates to account for less usage and then voting on the revised rates.	\$25,000	\$37,500	\$37,500	\$50,000	
Educate High Water Users	Identify highest water users. Target with monthly mailing about their use from May 1 to Sept 30. Provide information comparing use with most efficient customers	Billing - Costs include information gathering, additional admin time, software costs, etc.	Assumes system already has the ability to collect monthly data. Costs include office labor to create mailing, printing and mailing fees.	\$1,100	\$1,800	\$1,800	\$8,500	<p>Costs include a mailing to compare customer’s usage to more efficient customers, similar to those sent by energy utilities. This would be a separate mailing from billing and assumes that the water supplier already has the ability to collect monthly water usage.</p> <ul style="list-style-type: none"> • Cost to set-up the form mailer: \$1,000 • Cost to generate and send the mailers depends on the number of high water users. Since this is a targeted mailing, standard mailing rates apply (currently \$0.49). Assume cost to generate mailer is \$1.50 each. <ul style="list-style-type: none"> ○ Small system assumes 50 mailers ○ Medium system assumes 500 mailers ○ Large system assumes 5,000 mailers

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Table 9. 2– Demand Management								
Mitigation Action	Action Specifics	Comments	Description of Work involved	Typical Project Cost				Cost Information Source
				Low	Median	Ave.	High	
System Audits, Leak Detection and Metering								
System Audits, Leak Detection and Metering	Conduct system audits, leak detection and metering		Contract with a consultant for system audit. Contract with leak detection and metering specialists.	\$10,000	\$17,100	\$19,700	\$36,900	Leak detection completed using WMA Grant include Medway (\$18,208); Wareham (\$20,100); Holden (\$36,944) and Water Conservation Grant - Hatfield (\$10,000); Clinton (\$15,050)
Comprehensive Water Audit every Five Years	Conduct comprehensive Water Audit every Five Years		Contract with a consultant to complete a water audit. This includes analysis of meter calibration, site visits to verify all use at pumping and treatment facilities is metered, review of meter reading/billing, review of leak detection, etc.	\$11,800	\$44,300	\$46,200	\$117,700	Water Audits completed by WMA Grant include Acton (\$117,687 included training sessions); Foxboro (\$50,500); Medway (\$44,275) and Water Conservation Grant - Hatfield (\$20,000); Clinton (\$11,800)
Meter Replacement Program	Develop and implement meter replacement program	Meter replacement should be included as part of the annual operating budget. Even if most of the meters were installed around the same time, a certain amount of revenue should be set aside to save for replacement costs.	Meter replacement involves purchase of the meters for installation by Water Department operators.	\$200,000	\$1,000,000	\$2,000,000	\$8,000,000	Meter replacement quote for 2,000 meters; scaled for Small System with 1,000 meters, Medium System with 10,000 meters and Large System with 40,000 meters. Median water system assumed to be 5,000 meters.

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Table 9. 2– Demand Management								
Mitigation Action	Action Specifics	Comments	Description of Work involved	Typical Project Cost				Cost Information Source
				Low	Median	Ave.	High	
Automated, Remote Meter Reading System	Install automated, remote meter reading system		Includes replacement of older meters and installation of new remote read system.	\$520,000	\$2,610,000	\$5,200,000	\$21,000,000	Costs based on estimate of \$2.3 million for system with 4,400 services. Low Cost for system with 1,000 services; Median Cost for system with 5,000 services; Average Cost for system with 10,000 services; High Cost for system with 40,000 services.
Automated, Remote Meter Leak Detection System	Install automated, remote meter leak detection system		Purchase of correlators to install in the hydrant steamer nozzle and monitoring and analysis of the data collected.	\$160,000	\$400,000	\$800,000	\$4,800,000	Cost from one manufacturer. Units/Nodes are \$1,000 each. Assume install on 80% of system hydrants. Small system has 200 hydrants; Median system has 500 hydrants; Medium system has 1,500 hydrants; Large System has 6,000 hydrants.

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In-Stream Flow Improvements - Surface Water Releases

Surface water releases have the potential to improve the timing, magnitude and duration of downstream flows to more closely mimic natural conditions in a stream. Releases that can be made from surface water impoundments without compromising other in-stream uses (for example, significant impacts to water supply, recreation or ecology) can be considered for either minimization or mitigation credit in WMA permitting.

A Surface Water Release Plan should:

- address existing flow impairments in the identified stream reach below the dam, such as zero-flow periods in late summer or lack of peak flows in spring;
- propose a monitoring and reporting program which would provide information on actual releases;
- address potential impacts to other in-lake uses; and
- include a quantitative discussion of any changes in water supply management (e.g., increased withdrawals from other sources), so that net environmental impact can be evaluated.

The following Table 9.3 shows the range of costs for surface water release projects based on projects that have been undertaken in Massachusetts.

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Table 9. 3- In-Stream Flow Improvements - Surface Water Releases							
			Cost per Release Location				Cost Information Source
Action Specifics	Comments	Description of Work Involved	Low	Median	Average	High	
Surface Water Withdrawals Downstream Release at Least Aug Q75 Flows May-Sept	Without affecting ability to meet demands	Work could be as simple as labor to manually adjust gates. A more complex system would involve installation of control valves, power and SCADA programming.	\$5,000	\$75,000	\$393,000	\$1,100,000	GHD, "SCADA Feasibility and Design Memorandum at the Monponsett Pond System" Town of Halifax, June 2015. Table 1. Page 16. Abt Associates, Pioneer Valley Planning Commission, "Cost-Effective Permit Renewal in a Shared Source Subbasin for Southwick and West Springfield" June 2016. Page 35.
Surface Water Withdrawals Downstream Release at Least Aug Q90 Flows May-Sept	Without affecting ability to meet demands		\$5,000	\$75,000	\$393,000	\$1,100,000	
DFG Approved Releases in Non-Summer Months to Support Fish Migration		\$5,000	\$75,000	\$393,000	\$1,100,000		

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Stormwater Recharge

WMA permittee can receive direct mitigation credit when areas of directly connected impervious surface are redeveloped, or disconnected, so that stormwater has an opportunity to infiltrate into the soil and recharge the underlying aquifer. Directly connected impervious surfaces are those that drain to a stormwater collection system that subsequently discharges directly to a waterway. This type of mitigation could involve the removal of impervious surfaces and replacement with vegetation, porous asphalt or porous pavers, allowing runoff to infiltrate into the ground over these surfaces. Many of these types of projects are implemented to meet Municipal Separate Storm Sewer System (MS4) permit and other regulatory requirements.

Tables 9.4 and 9.5 outline common stormwater recharge BMP projects implemented in New England.

Table 9. 4– Stormwater Recharge Best Management Practices (BMP's)						
Action Specifics	Description of Work involved	Typical Projects				Cost Information Source
		Low Range Cost	Median Cost	Average Range Cost	High Range Cost	
Construction Project Including an Assortment of the Specific Action items Listed Below.	Work includes design, permitting and construction of Stormwater Mitigation projects.	\$48,000	\$267,000	\$636,000	\$2,472,000	Payment Requests, Bid Results and Cost Estimates for following Stormwater Mitigation Projects. <ul style="list-style-type: none"> ○ Pakachoag Golf Course Stormwater Mitigation Project - Auburn, MA (2015) ○ Oak Hill Stormwater Treatment - Pittfield, MA (2011) ○ Nutt Pond Watershed Restoration Phase II - Manchester, NH (2016) ○ Nutt Pond Inlet Improvement Project - Manchester, NH (2006) ○ Mast Landing Parking Lot Improvement Project - Wolfeboro, NH (2017) ○ Route 2 Eastbound On-Ramp - Templeton, MA (MA DOT) – 2013 ○ Route 116 - South Hadley, MA (MA DOT) – 2014 ○ Stormwater Retrofits on I-91, Route 5, Route 2 & Route 20 - Russell/Westfield, MA (MA DOT) – 2015 ○ District 1 and 2 Stormwater Retrofits - Leicester/Oxford, MA (MA DOT) – 2012 ○ I-84 BMP Implementation - Sturbridge, MA (MA DOT) – 2016 ○ I-195 BMP Implementation - Seekonk, MA (MA DOT) – 2015 ○ Route 114A BMP Implementation - Seekonk, MA (MA DOT) – 2015 ○ Subsurface Gravel Wetland - Barnstable, MA (WaterVision) – 2015 ○ Subsurface Gravel Wetland - Chatham, MA (WaterVision) - 2015

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Table 9. 5– Stormwater Recharge Best Management Practices (BMP's) Detailed Costs on Specific Items Typically Included in Stormwater BMP Construction Projects							
Action Specifics	Comments	Cost	Gallons per Unit per Year	Cost per Gallon	Impervious Area Treated per Unit (sf)	Assumptions	Cost Information Source
Leaching Catch Basin	Provides infiltration	\$6,500 each	22,001	\$0.30	2,598	4'diam x 4'deep with 2' stone surround	MassDEP, "Sustainable Water Management Initiative Pilot Project Phase 1" August 7, 2012. Table 4-4 Cost Estimating Guidance Tool Part 1, Page 4-16
Tree Box		\$7,000 each	5,105	\$1.37	603	8'diam x 4'deep	
Infiltration Trench		\$22 per linear foot	370	\$0.06	44	1'l x 1'w x 4'deep	
Infiltration Divider		\$56 per linear foot	908	\$0.06	107	1'l x 3'w x 3'deep	
Subsurface Infiltration		\$45 per linear foot	1,318	\$0.03	156	1'l x 3'w x 5'deep	
Bioretention Cells		\$30 per linear foot	370	\$0.08	44	1'l x 1'w x 4'deep	
Infiltration Basin		\$27 per square foot	1,016	\$0.03	120	1'l x 1'w x 5'deep	
Remove Impervious and Install Vegetation	Remove impervious cover	\$1 per square foot	7.9	\$0.13	1	recharge will vary based on soil type, assumes average of A&B soils using MassDEP Policy	
Remove Impervious and Install Porous Asphalt		\$ 7 per square foot	14.1	\$0.50	1	assumes 1" infiltration based on 4" reservoir course	
Remove Impervious and Install Porous Pavers		\$25 per square foot	14.1	\$1.78	1	assumes 1" infiltration based on 4" reservoir course	
Roof Leader Infiltration	Disconnects discharge to impervious	\$5,000 each	7,177	\$0.70	500	2'dia x 2'deep with 2' stone surround, collects 1.8" precipitation off 1,000 sf roof with two drywells. Installation by contractor.	
Rain Barrel		\$120 each	177	\$0.68	500	55 gal capacity, collects 0.18" off 1,000 sf roof with two rain barrels, assumes storage is available for 25% of annual rainfall (e.g., not emptied each time).	

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Stormwater Recharge - Municipal Separate Storm Sewer System (MS4)

Stormwater recharge is an example of a mitigation activity that frequently overlaps with other regulatory obligations. The majority of communities in Massachusetts are subject to the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit which will go into effect on July 1, 2017. Compliance with the MS4 permit will involve conducting a variety of site specific actions which will vary in cost. MassDEP's approach in WMA permitting is to give credit for these types of activities and projects that are implemented as part of a separate regulatory initiative. The cost information provided here reflects costs related to MS4, not the WMA regulations.

Tables 9.6 and 9.7 were developed using Comprehensive Environmental Incorporated's M\$4CASTER™ cost tool. Table 9.6 outlines the assumptions used to define small, medium, and large municipalities. These definitions were used in the cost assumptions included in Table 9.7, which estimate project-specific costs for each size of municipality. The U.S. Environmental Protection Agency (EPA) Region 1 has also published MS4 cost implementation information, https://www3.epa.gov/region1/npdes/stormwater/MS4_MA.html#ToolsInfoLinks. EPA Region 1's cost information was developed in consultation with Comprehensive Environmental Incorporated (CEI) and includes similar costs estimates.

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Table 9. 6– Stormwater Recharge- MS4 Municipal Size Assumptions			
Municipality Size Assumptions	Small Municipality	Medium Municipality	Large Municipality
General			
Population	5,000	15,000	50,000
Assumed # of households	1,938	5,814	19,380
Population in Regulated Area	2,000	14,000	45,000
Total Area (acres)	5,000	10,000	25,000
Total Impervious Area (Area)	500	1,500	3,000
Consultant Rate per hour	\$120	\$120	\$120
Illicit Discharge, Detection, and Elimination			
# Outfalls	25	200	500
# Catch Basins (10 per outfall)	250	2,000	5,000
Maximum # of illicit discharge incidents	1	3	6
Construction Site Control			
# of construction projects/year with inspections paid by Town	1 to 3	3 to 5	5 to 10
Post Construction Site Control			
# of permittee-owned facilities for evaluating BMP options	5	10	20
Good Housekeeping			
# of community-owned stormwater BMPs	5	20	30
# of facilities requiring SWPPPs	2 to 3	3 to 5	8 to 10
% of structures requiring cleaning (50% full)	20%	25%	40%
Miles of roadway for sweeping	10	75	190

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Table 9. 7– Stormwater Recharge - MS4 Requirements									
		Costs Ranges by Municipal Size							
		Small		Medium		Large			
Actions	Description of Work involved	Low	High	Low	High	Low	High	Comments	Cost Information Source
Implement MS4 Requirements for Municipality Subject to MS4	The components involved in the MS4 program include submitting a Notice of Intent (NOI), developing a Stormwater Management Program (SWMP) Plan, meeting the six minimum measures (Public Education, Public Participation, IDDE Plan, Construction Site Control, Post Construction Site Control, and Good Housekeeping), submitting an Annual Report, and meeting any requirements involved for a TMDL or Impaired Waterbodies	\$215,000	\$511,000	\$498,000	\$1,170,000	\$862,000	\$2,160,000	It was assumed that 0% of the NOI, SWMP, Minimum Measures, and Annual Report is already complete. It was also assumed that the small and medium sized municipalities will use rented trucks and the larger municipalities will use purchased trucks for catch basin cleaning and street sweeping.	Costs modeled using Comprehensive Environmental Incorporated's M\$4CASTER™ cost tool.
Adopt MS4 requirements for municipality not subject to MS4	If a municipality that is not subject to MS4 adopts MS4 requirements, the components involved are the same as the requirements for a municipality subject to MS4. Below is a breakdown of the costs for the requirements of NOI, SWMP, 6 Minimum Measures and Annual Report.								

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Table 9. 7– Stormwater Recharge - MS4 Requirements									
		Costs Ranges by Municipal Size							
		Small		Medium		Large			
Actions	Description of Work involved	Low	High	Low	High	Low	High	Comments	Cost Information Source
Notice of Intent (NOI)	The NOI requirement involves preparing and submitting a NOI which includes documenting endangered species, documenting historic properties preservation, and completing the NOI form and application. The application and narrative shall include information on the status of mapping and bylaws completed under the 2003 permit; a summary of the receiving waters (waterbody segment that receives flow from the MS4), number of outfalls into receiving water, impairment, pollutants causing impairment, whether there is a TMDL; and Identify new BMPs and goals to meet new permit.	\$6,000	\$13,400	\$6,000	\$13,400	\$6,000	\$13,400	It was assumed that 0% of the NOI requirements are already complete.	Costs modeled using Comprehensive Environmental Incorporated's M\$4CASTER™ cost tool.
Stormwater Management Plan (SWMP)	Work involved in this mitigation action includes developing a written SWMP. The SWMP shall include: a list of people responsible for program implementation; a list of all receiving waters, their classification, impairments, pollutants of concern, TMDLs, and number of outfalls (included in NOI); surface drinking water supplies; a list of interconnected MS4; endangered species & historic properties documentation; documentation of authorization of new or increased discharges; a map of MS4; practices to achieve compliance with TMDLs & non-TMDL impaired waters; practices to comply with six minimum measures; and measures to avoid or minimize impacts to surface water supplies. The SWMP shall also include a self-evaluation of compliance with the terms and conditions of the permit including the appropriateness of selected BMPs.	\$15,400	\$24,500	\$15,400	\$24,500	\$15,400	\$24,500	It was assumed that 0% of the SWMP requirements are already complete.	Costs modeled using Comprehensive Environmental Incorporated's M\$4CASTER™ cost tool.

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Table 9. 7– Stormwater Recharge - MS4 Requirements									
		Costs Ranges by Municipal Size							
		Small		Medium		Large			
Actions	Description of Work involved	Low	High	Low	High	Low	High	Comments	Cost Information Source
Public Education	A continuation of public education program required by 2003 permit. The following is involved in developing the program: define goals, express specific messages, define audience for each message, identify parties responsible for implementation, and identify methods to evaluate effectiveness of messages. This minimum measure requires development and distribution of two separate messages for each of 4 different audiences (residential, business/commercial/institution, developer & construction, industrial). An assumption is made that distribution is done annually and a total of 8 messages per permit term. Review the program and modify ineffective messages or distribution techniques. Document the program in the annual report: messages for each audience; method of distribution; and finally, measures and methods used to assess effectiveness of the message.	\$11,300	\$84,800	\$13,400	\$88,400	\$14,400	\$89,600	It was assumed that 0% of this Minimum Measure is already complete.	Costs modeled using Comprehensive Environmental Incorporated's M\$4CASTER™ cost tool.
Public Participation	The public participation and involvement measure involves complying with state public notice requirements; making the SWMP & annual reports available to public; and providing an annual opportunity for the public to participate in the review and implementation of the SWMP. This may include websites, hotlines, clean-up teams, monitoring teams, and advisory committees. Activities must be recorded in the annual report and the records must be kept for 5 years. These records relating to the permit shall also be made available to the public.	\$10,600	\$20,000	\$10,600	\$20,000	\$10,600	\$20,000	It was assumed that 0% of this Minimum Measure is already complete.	Costs modeled using Comprehensive Environmental Incorporated's M\$4CASTER™ cost tool.

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Table 9. 7– Stormwater Recharge - MS4 Requirements									
		Costs Ranges by Municipal Size							
		Small		Medium		Large			
Actions	Description of Work involved	Low	High	Low	High	Low	High	Comments	Cost Information Source
Illicit Discharge Detection and Elimination (IDDE) Plan	Inventory sanitary sewer overflows, develop outfall interconnection inventory, map the system, and develop a written Illicit Discharge Detection and Elimination program. The IDDE program should have an assessment and priority ranking of all catchments, outfall and interconnection screening and sampling procedures, and catchment investigation procedures. It is also required that a confirmatory screening be performed within one year of illicit discharge removal and a follow-up screening be scheduled within five years of the confirmatory screening.	\$42,420	\$96,210	\$103,010	\$317,210	\$207,390	\$699,680	It was assumed that 0% of this Minimum Measure is already complete.	Costs modeled using Comprehensive Environmental Incorporated's M\$4CASTER™ cost tool.

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Table 9. 7– Stormwater Recharge - MS4 Requirements									
		Costs Ranges by Municipal Size							
		Small		Medium		Large			
Actions	Description of Work involved	Low	High	Low	High	Low	High	Comments	Cost Information Source
Construction Site Control	<p>This minimum measure involves developing an ordinance that requires sediment and erosions controls for wastes at construction sites. This was required by 2003 MS4 Permit.</p> <p>Requirements include: adopt written procedures for the inspections and enforcement of the ordinance; clearly define who is responsible for site inspections and who has the authority to implement the enforcement procedures; document these written procedure in the SWMP; update the ordinance/bylaw to include the requirements for site operators to implement BMPs and control other wastes; develop written procedures for site plan review, inspection and enforcement within 1 year; a pre-construction review; consideration for the protection of water quality impacts; LID components; receipt of the information from the public; inspections during and after BMP installation; qualifications necessary to perform the inspections; and inspection forms and procedures for tracking the number of site reviews, inspections, and enforcement actions.</p>	\$4,840	\$23,500	\$4,840	\$23,500	\$4,840	\$23,500	It was assumed that 0% of this Minimum Measure is already complete.	Costs modeled using Comprehensive Environmental Incorporated's M\$4CASTER™ cost tool.

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Table 9. 7– Stormwater Recharge - MS4 Requirements									
		Costs Ranges by Municipal Size							
		Small		Medium		Large			
Actions	Description of Work involved	Low	High	Low	High	Low	High	Comments	Cost Information Source
Post Construction Site Control	This measure requires updating an ordinance or bylaw by adopting or amending a local ordinance to control projects that disturb an acre of land or more. Requirements include: incorporating design standards included in the permit; developing procedures to ensure O&M, such as dedicated funds or escrow accounts, acceptance of ownership by permittee, development of maintenance contracts between owner & permittee, and submission of an annual certification documenting maintenance; documenting measures that the permittee has done to meet these requirements in the annual report; developing report with an assessment of street design/parking lot guidelines and LID regulations/guidelines; updating the annual report on these requirements; estimating the annual increase or decrease in impervious area and directly connected impervious area, tabulating results, and documenting findings in the annual report; and lastly developing an inventory and ranking municipal properties suitable for modification or retrofit to reduce pollutants associated with stormwater runoff.	\$20,040	\$40,080	\$24,840	\$44,880	\$34,440	\$54,480	It was assumed that 0% of this Minimum Measure is already complete.	Costs modeled using Comprehensive Environmental Incorporated's M\$4CASTER™ cost tool.

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Table 9. 7– Stormwater Recharge - MS4 Requirements									
		Costs Ranges by Municipal Size							
		Small		Medium		Large			
Actions	Description of Work involved	Low	High	Low	High	Low	High	Comments	Cost Information Source
Good Housekeeping	Pollution prevention and good housekeeping requirements include developing facility O&M Procedures. This task involves gathering an inventory of all permittee owned facilities within the following categories: parks and open space; buildings and facilities; and vehicles and equipment. Developing infrastructure O&M Procedures is also required. This task involves developing a written optimization plan detailing procedures and schedule for cleaning and maintaining catch basins to ensure no catch basin is more than 50% full. inspection and maintenance prioritization shall also be included. The plan for optimizing catch basin cleaning, inspections or scheduling must be documented in the first annual report.	\$86,820	\$168,500	\$289,740	\$580,780	\$538,880	\$1,173,960	It was assumed that 0% of this Minimum Measure is already complete. It was also assumed that the small and medium sized municipalities will use rented trucks and the larger municipalities will use purchased trucks for catch basin cleaning and street sweeping.	Costs modeled using Comprehensive Environmental Incorporated's M\$4CASTER™ cost tool.
Annual Report	The Annual Reporting requirements involves submitting an annual report including self-assessment review, appropriateness of BMPs, status of impaired waters compliance, and items outlined in each of the minimum measures. The annual report must be updated with the current year's public involvement and public participation activities and documentation; IDDE report findings and activities; tracking information for construction site control; post site control requirement documentation and findings; and good housekeeping documentation, O&M activities, and findings from SWPP site inspections.	\$17,200	\$40,300	\$30,400	\$61,900	\$30,400	\$61,900	It was assumed that 0% of the MS4 requirements are already complete. This cost assumes that all minimum measure requirements have been met and are included in the Annual Reporting.	Costs modeled using Comprehensive Environmental Incorporated's M\$4CASTER™ cost tool.

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Sewer System Infiltration and Inflow (I/I) Removal

Infiltration is groundwater that enters collection systems through sources such as defective pipes, pipe joints and manhole walls, and inflow is water that enters the collection systems through catch basins, manhole covers, cross connections with storm drains, sump pumps, foundation drains and downspouts

Infiltration and inflow removal programs are an example of a mitigation activity that overlaps with a permittee's other regulatory obligations. Municipalities typically undertake an Infiltration/Inflow Removal Program (I/I program) in order to comply with wastewater standards and pretreatment requirements at 314 CMR 12.00: Operation, Maintenance and Pretreatment Standards for Wastewater Treatment Works and Indirect Dischargers.

The following Sewer System Infiltration and Inflow (I/I) Removal Tables (Tables 9.8 and 9.9) show specific costs for I/I removal projects funded through Massachusetts State Revolving Fund Loan Program.

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Table 9. 8- Sewer System Infiltration and Inflow (I/I) Removal							
Action Specifics	Comments	Description of Work involved	Typical Project Costs				Cost Information Source
			Low	Median	Average	High	
I/I Study with Flow Metering and Assessment and Sewer System Evaluation Survey	This study work is completed to identify areas of the sewer system with high I/I and identify conceptual projects for implementation.	I/I removal studies involve evaluation of a section of the sanitary sewer system. Flow meters are installed to monitor dry and wet weather flows. Analysis is performed to identify areas with high I/I. Field work involves Manhole inspection, TV of lines, smoke testing, dye testing and home/business inspections for private sources.	\$192,000	\$463,000	\$713,000	\$1,900,000	CWSRF Project Costs in Exhibit A of the PRAs for Dartmouth, Hopkinton, Westborough, Worcester (one page) and Revere Project Narrative Page 5.
Construction Project for Reduction of I/I includes an assortment of specific action items, some listed below.	Includes cost for pre/post construction flow metering and evaluation to document I/I removal after construction.	Construction for I/I Removal involves a variety of work ranging from pipe lining to manhole repair to pipe replacement. The range of costs are representative of the variety of work. Details for specific types of work are shown below.	\$1,080,000	\$3,940,000	\$4,040,000	\$9,450,000	CWSRF Project Costs for Brockton, Malden, Nantucket, Revere and Worcester.

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Table 9. 9- Sewer System Infiltration and Inflow (I/I) Removal Detailed Costs on Specific Items Typically Included in I/I Removal Construction Projects							
Action Specifics	Comments	Cost per Unit	Unit	Estimated Flow Removal	Average Gallons Removed Year per Unit	Cost per Gal.	Cost Information Source
CIPP (Lining Mains) 6" to 12"	Cost for "installed" product does not include other items typically listed as separate bid items such as paving.	\$35	linear foot	4,000 gpd/IDM*	2500	\$0.01	CWSRF Project for Brockton, Malden
CIPP (Lining Mains) 16" to 24"		\$55	linear foot	4,000 gpd/IDM	5500	\$0.01	CWSRF Project for Brockton, Malden
CIPP (Lining Mains) 30" and above		\$85	linear foot	4,000 gpd/IDM	8300	\$0.01	CWSRF Project for Revere
Lining Sewer Services		\$1,575	each				CWSRF Project for Revere
Main Replacement 6" to 12"		\$200	linear foot	4,000 gpd/IDM	2500	\$0.08	CWSRF Project for Nantucket; Revere
Main Replacement 16" to 24"	Cost for "installed" product does not include other items typically listed as separate bid items such as paving.	\$300	linear foot	4,000 gpd/IDM	5500	\$0.05	CWSRF Project for Revere
Main Replacement 30" and above		\$400	linear foot	4,000 gpd/IDM	8300	\$0.05	
Manhole Replacement		\$4,000	each	1000 gal/yr [^]	1000	\$4.00	CWSRF Project for Nantucket
Manhole Cover Replacement to remove vent holes		\$2,000	each	1500 gal/yr ^{**}	1500	\$1.33	CWSRF Project for Malden
Disconnect Private Sources	Remove items such as pumps, roof leaders, yard drains from sanitary sewer, Includes cost for flow metering and evaluation	\$15,000	each	1000 gal/yr [^]	1000	\$15.00	CWSRF Project for Revere, Project WW-004(1A)

*4,000 gpd/IDM is minimum flow removal considered cost effective, from MassDEP Guidelines for Performing Infiltration/Inflow Analyses & Sewer System Evaluation Survey, 1993

**Flow estimate is an average of the vent hole flows shown in Table 7 of MassDEP Guidelines for Performing Infiltration/Inflow Analyses & Sewer System Evaluation Survey, 1993

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Establish a Septic System Maintenance Program

There are two main factors that cause septic system failure: overload and lack of maintenance. Lack of maintenance can lead to problems even if the system is not overloaded. If the solid material is not periodically removed from a septic tank there could be insufficient room for solid matter to settle out. In such cases, solid material may also clog parts of the drain field. If the septic system is both overloaded and the septic tank full with solids, then there can be a real risk of environmental degradation, such as nitrates moving to aquifers.¹⁵

An innovative concept for a municipal septic system maintenance program is a system in which owners pay an annual fee to the municipality. The municipality would then manage a program to maintain participating septic systems on a regular basis, probably through a town contract with a maintenance subcontractor. Although MassDEP is not aware of any such program in Massachusetts, the concept is included here for reference.

The following Table 9.10 presents replacement costs for failing septic system. These costs could be used as guidance in developing fees for a septic system maintenance program based on the average life of septic system and documented replacement costs.

Action Specifics	Description of Work involved	Cost per Septic System				Comments	Cost Information Source
		Low	Median	Average	High		
Funding Community Septic Management Program	Program provides funds to assist homeowners with compliance with Title 5 through the SRF Program. Loan program for homeowners to upgrade septic systems.	\$15,000	\$20,000	\$22,000	\$30,000	Costs are impacted by soil types. Higher costs result in the presence of ledge, gravel and very large boulders.	MassDEP SRF Septic Maintenance Program

¹⁵ American Groundwater Trust, Septic Systems for Wastewater Disposal: <https://agwt.org/content/septic-systems>

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Habitat Improvements

Habitat improvement projects cover a range of activities. Costs for the following types of activities are included in Table 9.11.:

- Remove a dam or other flow barrier;
- Culvert replacement to meet stream crossing standards;
- Stream restoration (riparian planning and daylighting); and
- Install and maintain fish passage;

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Table 9. 11- Habitat Improvements												
Action	Comment	Description of Work involved	Unit Costs			Unit	Typical Project Costs				Assumptions	Cost Information Source
			Low	Ave.	High		Low	Median	Ave.	High		
Remove Dam or other flow barrier		Work includes permitting, design and construction. Permitting requirements for dam removal would include completing a NOI application for all applicable conservation commissions; Clean Water Act (CWA) s404 Dredge and Fill Permit; Chapter 253 Permit from the Department of Conservation Office of Dam Safety; MA Historical Commission coordination; and other local permitting that may be required. Construction typically includes but is not limited to mobilization and demobilization; erosion control and staging; excess vegetation removal; dredging and excavation; disposal of dam material; dewatering; and stream channel and streambank restoration.					\$320,000	\$920,000	\$832,000	\$1,700,000	Actual or estimated cost of dam removal projects. Cost to Owner may be less depending on availability of funding programs.	Mass Department of Fish and Game and Division of Ecological Restoration, "Economic & Community Benefits from Stream Barrier Removal Projects in Massachusetts Report & Summary", March 2015. Exhibit ES-1; Pages ES-5. CDMSmith, "Poor Farm Pond Dam Removal Feasibility Study" City of Worcester, June 2013. Table 9-1. Page 9-3. CDMSmith "Patch Pond Dam Removal Feasibility Study" City of Worcester, June 2014. Table 9-1. Page 9-3.

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Table 9. 11- Habitat Improvements												
Action	Comment	Description of Work involved	Unit Costs			Unit	Typical Project Costs				Assumptions	Cost Information Source
			Low	Ave.	High		Low	Median	Ave.	High		
Culvert Replacement to meet stream crossing standards		Work includes permitting, design and construction. Permitting requirements include completing a WPA Form 3 and Notice of Intent application and any other supplemental requirements by the MassDEP. Design work would involve modeling the stream or channel hydraulics and sizing the culvert . The construction phase includes mobilization and demobilization; erosion control and staging; clearing, grubbing, and tree removal if necessary; pavement and saw cutting and removal if necessary; temporary stream diversion; existing culvert and associated drainage infrastructure removal; dewatering; culvert subbase excavation and preparation; culvert installation; other precast structure installation including wingwalls and headwalls; streambank and stream channel restoration; and other work that may be involved for a culvert replacement project.		\$4,360		Costs are per square foot of culvert opening.	\$128,000	\$355,000	\$441,000	\$1,040,000	Project costs are for actual projects completed to upgrade culverts and include permitting, design and construction. Cost to Owner may be less depending on availability of funding programs.	<p>The average Unit cost for a culvert replacement was based off of four culvert replacements in Lexington, MA. Two culverts were 8'x6' precast concrete box culverts, one was a 7'x6' precast concrete box culvert, and one was a twin 10'x6' precast concrete box culvert, all of which are considered medium sized culvert replacement projects. Bid results provided for reference.</p> <p>MassDFG and DER, "Economic & Community Benefits from Stream Barrier Removal Projects in MA Report & Summary", March 2015. Exhibit ES-2; Pages ES-5-6.</p> <p>Stantec, "Conceptual Evaluation for Culvert Replacement: Stage Road Stream Crossing," Cummington, June 2012. Table 3. Page 3-6.</p> <p>CEI, Bid Result Summary, Lexington, Concord Ave Culvert Replacement.</p> <p>Tighe & Bond, Sawmill Brook Watershed Flood Mitigation Study, Manchester by the Sea, 2016, Pg 1.</p> <p>American Rivers and DER, MA Stream Crossing Case Studies, Pg 19.</p>

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Table 9. 11- Habitat Improvements												
Action	Comment	Description of Work involved	Unit Costs			Unit	Typical Project Costs				Assumptions	Cost Information Source
			Low	Ave.	High		Low	Median	Ave.	High		
Streambank Restoration - Riparian planting and daylighting		Work includes permitting, design and construction. Permitting requirements include completing a WPA Form 3 and Notice of Intent application through the Department of Environmental Protection (DEP), and notifying agencies such as NHESP and ACOE of the project. Construction typically involves mobilization and demobilization; erosion control and staging; pruning and trimming of existing vegetation; vegetation clearing and construction access; dredging and dewatering; bank stabilization; planting plugs, brush cuttings and seeding; and shrub and tree planting.	\$190	\$450	\$710	Linear foot of Streambank Restoration	\$42,000	\$216,000	\$204,000	\$354,000	Costs for actual streambank restoration projects. Costs are based off of projects completed approximately 5 years ago therefore these costs were adjusted.	Low range cost is based off of Onota Lake bank restoration in Pittsfield, MA (186-10); this streambank averaged approximately 5 feet high and the restoration length was 480 linear feet. High range cost is based off of CT River bank restoration in Hatfield, MA (238-8) and Bass Island bank restoration in Manchester, NH (178-11); these streambanks averaged approximately 20 feet high and restoration length was 300 and 425 linear feet, respectively. The average range cost for streambank restoration was based off a streambank approximately 12-15 feet high. Refer to bid results provided for reference.

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Table 9. 11- Habitat Improvements												
Action	Comment	Description of Work involved	Unit Costs			Unit	Typical Project Costs				Assumptions	Cost Information Source
			Low	Ave.	High		Low	Median	Ave.	High		
Stream Channel Restoration Riparian planting and daylighting		Repairs to the stream bed include grading, placement of rock, some stream bed repair. Cost of project depends on size of stream and length of repairs.					\$40,000	\$124,000	\$172,000	\$543,000		<p>MassDFG and DER, "Economic & Community Benefits from Stream Barrier Removal Projects in Massachusetts Report & Summary", March 2015. Exhibit 2-3; Pages 2-6.</p> <p>USDA, Stream Restoration Cost Estimates, Tables 1 & 2. Pages 109 & 111.</p> <p>Oregon DEQ, Cost Estimate to Restore Riparian Forest Buffers and Improve Stream Habitat in the Willamette Basin, Oregon, March 2010, Page 21.</p> <p>Virginia DCR, The Virginia Stream Restoration & Stabilization Best Management Practices Guide, 2004. Table 3.2. Page 60.</p> <p>Clemson University, Estimation and Analysis of Expenses of Design-Bid-Build Projects for Stream Mitigation in North Carolina, 2008. Table 1. Page 25.</p>

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Table 9. 11- Habitat Improvements												
Action	Comment	Description of Work involved	Unit Costs			Unit	Typical Project Costs				Assumptions	Cost Information Source
			Low	Ave.	High		Low	Median	Ave.	High		
Stream Buffer Restoration Riparian planting and daylighting		Stream buffer restoration involves grading and planting of appropriate vegetation. Cost depends on acreage included.					\$20,000	\$401,000	\$404,000	\$1,180,000		<p>Tighe & Bond, Sawmill Brook Watershed Flood Mitigation Study, Manchester by the Sea, 2016, Page 1.</p> <p>Coonamessett River Park Coalition, A Restoration Plan for the Coonamessett River, Page 18-20.</p> <p>Official Web Site of Williston, Vermont; Stream Buffer Restoration, 2017.</p> <p>US Army Corps of Engineers, Lower Willamette River Ecosystem Restoration Project, Appendix C. Page 62, 64, 65.</p>

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Table 9. 11- Habitat Improvements												
Action	Comment	Description of Work involved	Unit Costs			Unit	Typical Project Costs				Assumptions	Cost Information Source
			Low	Ave.	High		Low	Median	Ave.	High		
Install and maintain fish passage		Work includes fish passage modification engineering, hydraulic and hydrologic modeling, structure design, permitting, construction management and administration, and construction. Construction typically involves mobilization and demobilization; installing temporary construction facilities including but not limited to silt fence, staging areas, and temporary cofferdam; modifying the existing spillway weir, or fish passage; and modifying the entrance or exit channel of the fish passage. Fish passage improvement projects often require additional design and construction for spillway modifications including crest gate, inflatable dam support, and flashboard installation; and infrastructure improvements including roadway, sewer extension, septic system upgrades, property protection dikes, structure modifications, and property compensation.					\$866,000	\$1,697,000	\$2,019,000	\$3,645,000	Project cost includes fish passage repairs and additional work to spillway, infrastructure, engineering, permitting.	EA Engineering, Science and Technology Inc. "Feasibility Report Reservoir Dam Modifications for Higher Pond Levels, First Herring Brook Fish Passage Improvements" Town of Scituate, June 2013. Tables 12 and 13, Pages 48 and 49. Tetra Tech "Preliminary Design Memorandum for Reservoir Dam Fish Passage Project" Town of Scituate, June 2014. Table 5-1. Page 20.

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Land Acquisition - Acquire Property in Zones II or Contributing Watershed Area of Water Supply Well or Reservoir

Public water suppliers purchase land to protect water supply sources and to support other key projects and goals. Land acquisition costs vary significantly by region and purpose.

Table 9. 12– Land Acquisition - Acquire property in Zones II or contributing watershed area of water supply well or reservoir											
			Land Cost per Acre				Typical Project Cost				
Action Specifics	Comments	Description of Work involved	Low	Median	Average	High	Low	Median	Average	High	Cost Information Source
Acquire property in Zone II or contributing watershed area	Cost is dependent upon location of community and land development potential.	Purchase of property in Zone II including land value, legal and other administrative costs.	\$500	\$11,000	\$60,000	\$587,000	\$5,200	\$223,000	\$297,000	\$870,000	Massachusetts Executive Office of Energy and Environmental Affairs FY 2016 and 2017 Drinking Water Supply Protection and the Land Acquisitions for Natural Diversity Grant Programs.

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Municipal Regulatory Development, Implementation and Enforcement

Many municipal regulatory activities can provide substantial water quantity, water quality and broader environmental benefits. Municipal accounting practices, by-laws and utilities that are eligible for mitigation credit are included in Table 9.13.

Table 9. 13- Municipal Regulatory Development, Implementation and Enforcement							
Action Specifics	Comments	Description of Work involved	Typical Project Cost				Cost Information Source
			Low	Median	Average	High	
Adopt an Enterprise Account	Activity can include both legal and political costs	Adopt standard language at Town meeting and internal re-organization of accounts.	\$1,000	\$2,500	\$2,500	\$5,000	Cost assumes use of available model legal language. Estimated cost for Counsel (legal) review: \$1,000 to \$5,000. Assumes no administrative or other costs.
Establish Wetlands Bylaw							
Establish Stormwater Bylaw							
Establish a Fertilizer Restriction Bylaw		Revise By-law or Rules & Regulations as needed (work with counsel).					
Establish a Bylaw restrictions the use of private irrigation wells							

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Establish Stormwater Utility	<p>Cost ranges based the following implementation information:</p> <p>Canton cost range of \$75,000 to \$150,000.</p> <p>Auburn cost range of \$150,000 to \$350,000.</p> <p>Does not include legal costs associated with potential challenges to stormwater fee.</p>	<p>Establishment of stormwater management plan and associated budget for O&M and capital projects, assessment of impervious areas (GIS based), cost allocation, development of rates, development of credit system.</p>	\$75,000	\$212,500	\$212,500	\$350,000	<p>Canton Stormwater Utility Feasibility Study, Kleinfelder and AMEC, SWMI Grant BRP-2013-06, Section 9.3, page 21. Does not include the cost of the feasibility analysis as a preliminary step for establishing the stormwater utility.</p> <p>Auburn Stormwater Management Master Plan, Utility Development and Implementation, CWSRF-2990, CW-07-33. From agreement, low range cost assumes stormwater management plan and budget already established. High range costs assumes stormwater management plan and budget need to be completed in order to determine cost allocation.</p>
<p>Note: A stormwater utility could have higher on-going administrative costs for the municipality</p>							

10. Demand Management

Water conservation and demand management have been a core element of the WMA permitting program since its inception; a robust water conservation program has been a WMA permit requirement since the earliest days of the permitting program. Water conservation and demand management can have long-term cost saving benefits, helping to ensure the availability of water during scheduled (and un-scheduled) maintenance activities, emergencies such as droughts, to accommodate additional growth, and may help to avoid environmental impacts that come with increasing water withdrawals. Although there are long-term benefits to demand management, public water suppliers need to plan for potential short-term revenue impacts when implementing new demand management and water conservation programs.

Revenue/Cost Implications of Water Conservation Programs and Summer Water Use Restrictions

Based on an analysis conducted by the American Water Works Association Research Foundation¹⁶, anything that lowers demand for water from a public water supply system, either economic downturn, a change in customer base, indoor conservation, summer water use restrictions or a wet summer when outdoor watering is not needed, creates a number of challenges and opportunities for public water suppliers. There are real benefits that come from demand reduction, primarily avoided future operating and capital costs that are associated with reduced or delayed increases in water production. In the short-term, revenue losses from lower water sales may be greater than cost savings from producing and delivering less water. Therefore, in the short-term, public water suppliers must determine how they are going to meet all of their costs, variable and fixed, when the amount of revenue earned is decreasing. Ultimately, it will be necessary to adjust rates to meet revenue requirements on an ongoing basis.

Cost Savings and Revenue Losses

Demand reduction is likely to reduce revenues for most public water suppliers for a short period of time, creating pressure to increase rates to make up for lost revenues. There are a number of pricing strategies, some discussed below, that can be used to adjust rates to keep customer water bills stable and equitable, and also help provide revenue stability for public water suppliers. The cost per gallon may rise, but on average users are using fewer gallons. The difficulty is developing the fee structure that does not shift the costs onto those who can least afford it and have the smallest ability to reduce demand. While the politics of rate adjustments are difficult and real, at the end of the day, customer's bills may not need to change appreciably when use declines as rates increase.

Major Benefits Resulting From Long-Term Capital Savings

The real benefits of demand reduction come, not from the short-term changes, but rather from the long-term capital reductions that can be made in response to lower water demand. Compared to the costs that would have been incurred in the absence of demand reduction, capital costs can be reduced by very significant amounts. The closer a public water supply system's current demand is to its existing

¹⁶ Daniel B. Bishop and Jack A. Weber, AWWA Research Foundation and American Water Works Association (1996), *Impacts of Demand Reduction of Water Utilities*, pp. 111-113

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capacity, the greater its need to expand capacity through additional supply, storage, treatment and distribution. The public water supplier who might be considering spending several million dollars to develop a new well in order to meet peak summer demands may find that a strong water conservation program and summer outdoor water use restrictions are more cost-effective in the long-term, because they avoid the need to add new infrastructure.

Long-term cost savings, particularly in capital reduction, provide the justification for public water suppliers to pursue demand management programs. Public water suppliers can in effect augment their available water supplies through demand management programs as effectively as traditional new supply development. In the context of the WMA permitting program, demand management may also reduce mitigation requirements included in their WMA permit. As demonstrated by the Massachusetts Water Resources Authority (MWRA), water conservation also provides an opportunity to use the “water saved” to provide for economic growth and new development without adding to the available water supplies or increasing overall water use.

- **Case Study: MWRA Deferred New Source Development and Expanded Customer Base** - The MWRA is a dramatic example of the potential benefits of reducing demand. The MWRA was able to lower demand from 340 million gallons per day (gpd) in 1980 to 200 million gpd in recent years through a variety of system improvements including a strong water conservation program throughout the supply system, infrastructure improvements, and rate adjustments. As a result of reduced demand, the MWRA has been able to indefinitely postpone development of a controversial new supply on the Connecticut River, and has been able to begin expanding its service area in recent years. Some new MWRA member-communities are in the Ipswich and Neponset River Basins. The expanded MWRA membership has helped relieve the environmental stresses in both basins, and in particular, the stress that had led to the Ipswich River being named one of the ten most endangered rivers in America in 2003.
- **Case Study: Franklin Deferred New Source Development and Improved Environmental Conditions through Water Conservation** - In the 1990’s Franklin was identified as one of the fastest growing towns in Massachusetts. To meet growing water demand, the Town sought to develop two new sources (Wells #11 and #12). During the Massachusetts Environmental Policy Act (MEPA) review of these proposed sources, concerns were raised about pumping impacts, particularly the impact of Well #4 on Kingsbury Pond, a 26-acre kettle pond on the border of Franklin and Norfolk.

Since Franklin installed Well #4 in the mid-1960s, water levels had fluctuated with the pond reaching a low of 9 acres during the late 1990s. On February 9, 1998, the MEPA Secretary’s Certificate required Franklin to prepare a full Environmental Impact Report to address Franklin’s source management as well as efforts to control demand, implement conservation and reduce impacts on Kingsbury Pond. Franklin ultimately chose to implement conservation measures that led to substantial water use reductions and, to date, have eliminated the need to develop costly new sources.

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When Franklin’s WMA permit was renewed in 2010, the total allocated withdrawal volumes was reduced by more than 16 percent (4.10 mgd to 3.44 mgd) despite the Town now supplying over 4,000 new residential users (33,590 in 2016 vs. 29,300 in 2000). Franklin’s aggressive conservation program allows lawn watering only one-day per week before 9 am and after 5 pm. The town is also currently running a rebate program on high efficiency clothes washers and toilets. Table 10.1 shows Franklin’s reduction of total water use, residential water use (RGPCD), and the peak demands associated with high water use on hot summer days.

Year	Ave. Daily Use (MGD)	Peak Day Use (MGD)	RGPCD
2016	2.59	4.01 (April 19)	45*
2015	2.69	3.75 (May 31)	48
2014	2.63	3.68 (July 29)	46
2013	2.59	3.84 (July 15)	49
2012	2.57	3.78 (July 15)	53
2011	2.57	3.77 (July 7)	53
2010	2.54	3.28 (July 11)	55
2009	2.59	3.71 (May 23)	61
2008	2.73		64*
2007	2.74	4.90	65*
2006	2.72	4.35 (May 8)	64*
2005	2.93	4.58 (August 10)	
2004	2.93	3.79 (June 28)	
2003	3.05	4.16 (July 6)	
2002	2.92		
2001	3.10	4.74 (May 13)	
2000	2.88	4.88 (May 6)	
1999	3.16		
*estimated			

Franklin’s water rates have risen somewhat more quickly than the state average. Based on the *Tighe & Bond Water Rate Survey* (T&B) for 2002, published prior to Franklin’s one-day per week restrictions were put in place, a typical homeowner spent \$381 per year for water. The state-wide average cost of residential water was \$290. According to the T&B 2014 Survey, Franklin’s average annual residential water bill had risen 92 percent to \$732, while statewide the average had risen 83 percent to \$531 over the same 12 years.

Pricing Strategy to Address the Revenue/Cost Implications of Water Conservation

Public water suppliers tend to collect most or all revenues on a volumetric basis (charge-per-unit-sold), while many of their costs are fixed, especially in the short-term. To avoid the financial gaps that can result from both in-door conservation programs that reduce water demand throughout the year, and seasonal outdoor water use restrictions that reduce peak summer water demands, rates will need to be strategically designed to recover costs. Maintaining affordable water rates for basic needs (e.g., drinking, cooking and sanitation) remains a key consideration for many public water suppliers as more discretionary uses are targeted for conservation.

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Through customization of a variety of rate structure approaches, and through use of increasingly advanced rate-setting tools and resources, public water suppliers can set rate structures that not only recover all costs, but that also help to:

- Stabilize revenue streams;
- Protect affordability for efficient, essential uses; and
- Distribute costs fairly and equitably.

Strategies to help stabilize revenue include maintaining a reserve fund and/or increasing fixed or base charges as a component of customer bills. To ensure an adequate revenue stream and equitable pricing, the volumetric portion of rates should be simultaneously re-evaluated and adjusted as needed when fixed charges are adjusted.

Protecting affordability can be achieved, for example, by employing discount rates for customers qualifying on the basis of income. Some public water suppliers address affordability by setting low (subsidized) per-unit charges across the full customer base for the first tier of use, intended to cover efficient water use for essential needs, although this approach can make full cost recovery more challenging.

Mechanisms to distribute costs equitably might include allocating charges that reflect relative burdens on the system, such as fire protection charges, based on infrastructure costs across the service area, peak usage charges that apply during times when supplemental sources or treatment facilities are used to meet peak demands, or steep excess use charges for the highest seasonal water users to help recover costs associated with acquiring new sources.

Specific rate structures that public water suppliers often now consider include:

- Seasonal Rates – unit charges increase to reflect seasonal peak demands and/or seasonal source stressors, such as naturally low flows;
- Tiered Rates – unit charges increase as a customer’s usage crosses set volume thresholds within a billing period;
Note that simple increasing blocks, in which tiers are applied identically across a customer base, can promote conservation if structured appropriately and applied to a fairly homogeneous customer base. More tailored or customized tiers account for differences in customer type, such as single-family vs. multi-family units, household size (*budget-based* tiers), or other distinguishing factors. Such rates are more data and resource-intensive, but have been shown to be more effective at conservation, and generally more equitable, than simple increasing block rates.¹⁷
- Drought or Scarcity Rates (unit charges increase based on drought triggers or other specific indicators of source stress, such as deteriorating water quality or decline in reservoir levels caused by increasing demands).

¹⁷ Wang et al., American Water Works Association (2005). *Water Conservation-Oriented Rates: Strategies to Extend Supply, Promote Equity, and Meet Minimum Flow Levels*.

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- **Case Study: Sharon Water Rate Structure** - The Town of Sharon’s water rates demonstrate a framework that incorporates a basic fee, seasonal rates, tiered rates and a specific charge for irrigation (see Table 10.2). For each public water supplier the specific rates for each water use category would vary due to the short-term and long-term costs for the system, and the affordability and equity goals of each community.

Table 10. 2- Town of Sharon’s Water Rates

	Residential		Other*	Irrigation Only
Base Fee	\$22.50	\$22.50	\$22.50	\$37.50
	Spring/Summer	Fall/Winter		
0-4,500 gallons	\$4.50	\$3.50	\$4.00	\$10.00
4,500-7,500 gallons	\$7.50	\$6.50	\$4.50	\$10.00
7,500-17,500 gallons	\$10.00	\$8.75	\$5.00	\$11.00
17,500-27,000 gallons	\$12.50	\$12.00	\$5.50	\$13.50
>27,000 gallons	\$15.00	\$14.00	\$6.00	\$14.50

*Agriculture, commercial and industrial uses

- **Case Study: Billerica Water Rate Study Results** - As part of the Water Management Act Grant Program for Public Water Suppliers (WMA Grant Program), MassDEP has offered funding for WMA permittees to conduct rate studies. The Town of Billerica has completed a rate study¹⁸ using WMA Grant funds and found that increasingly utilities are moving away from generating most or all revenues on a volumetric basis. The study findings recommend that Billerica adopt fixed monthly charges for customers based upon AWWA connection size factors. These fees are fixed monthly charges billed to customers based upon the size of their water meter, very similar to the fixed customer charges seen with virtually all other types of utilities. The benefits of these fees are two-fold: first, they provide a durable fixed revenue stream to the utilities which have them; and second, they can significantly reduce year-to-year revenue instability due to weather.

The Billerica rate study used published AWWA meter size factors to project revenues from the current customer base assuming a \$5 monthly charge per meter equivalent. A “meter size factor” is the relative capacity of larger connections in comparison to an average residential unit. All connections of 1” and smaller received an equivalency value of 1, and larger connections were assigned equivalencies as shown in Table 6.3. For example, an average residential customer (with a ¾” meter) would pay a \$5 monthly charge while a larger commercial customer (with a 4” meter) would pay a \$50 monthly charge (\$5 charge multiplied by the equivalency factor for a 4” meter).

¹⁸ Toby Fedder and Jessica Richard, Woodard & Curran, *Billerica Water Rate Study (2228801)*, June 2016

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Billerica includes municipal and exempt customers who would not pay the monthly charges in the total accounts shown in Table 10.3; this leaves a customer base of approximately 13,200 factored accounts which would be subject to the monthly charge. If the Town institutes a \$5 monthly charge per factored meter, this would generate approximately \$790,000 in stable annual revenue. By generating this portion of annual revenue through fixed charges, the volumetric rates required to generate the remaining needed revenues could be reduced by approximately 15 percent, thus effectively reducing water bills for customers with smaller connections sizes, typically residential water users.

Size	Equivalency Factor	Accounts	Factored Accounts
5/8"	1.0	11,502	11,502.0
3/4"	1.0	218	218.0
1"	1.0	240	240.0
1½"	2.0	145	290.0
2"	3.2	238	761.6
2½"	4.5	0	0
3"	6.0	11	66.0
4"	10.0	27	270.0
6"	20.0	2	40.0
8"	32.0	1	32.0
10"	46.0	0	0
12"	86.0	0	0
Total		12,384	13,419.6

Demand Management Success During Drought and in Water-Scarce Communities

- **Case Study: Scituate Drought Response** – In recent years the Town of Scituate has worked with the North & South Rivers Watershed Association (NSRWA) and the Massachusetts Division of Ecological Restoration (MassDER) to manage seasonal streamflows and operate the Old Oaken Bucket Pond fish ladder for aquatic community needs while maintaining adequate water supply for Town needs. MassDEP’s WMA Grant Program has contributed with three awards:
 - in 2012 to examine the feasibility of improving fish passage in First Herring Brook at the Reservoir through a combination of structural improvements to the fish ladders at Old Oaken Bucket Pond and Reservoir Dam and maintaining Reservoir Dam at a higher level for a longer duration;
 - in 2013 to fund the preliminary design of the recommended alterations; and,
 - in 2016 to complete 60 percent permit level design and initiate the permit process for implementation of spillway and fishway structure modifications to maintain a higher Reservoir Dam pond level.

The current *First Herring Brook Interim Operation Plan* (Plan) outlines downstream releases from Scituate’s Reservoir and from Old Oaken Bucket Pond to maintain streamflows to allow

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herring passage through the existing infrastructure. The Plan also includes summertime demand management through restricting irrigation systems to watering one-day per week and calls for a total outdoor water use ban when the Reservoir falls to 36 feet (48 inches below the spillway or 49 percent full), and shut-off of downstream releases when the Reservoir falls to 32 feet (96 inches below the spillway).

The plan went into effect in 2011 and flows measurably improved.¹⁹ The summer of 2015 was relatively dry, and water levels in the Reservoir fell to about 45 inches below the spillway in September and October, but recovered quickly in October and November. The plan was a success and it was incorporated into Scituate's WMA permit to fulfill Scituate's minimization requirement.

During the summer of 2016, Massachusetts experienced severe drought conditions throughout most of the Commonwealth by August. Scituate began the season with a full reservoir and normal restrictions on outdoor water use (watering by irrigation systems limited to one-day per week), but as the summer progressed, the drought took a toll. By July 8 outdoor water use was limited to a hand-held hose, and by early August all outdoor water use was banned and all streamflow releases were stopped. But the weather remained dry and the Reservoir continued to fall.

May 1 - Implemented standard restrictions (One-day per week)

- May 6: reservoir at 100 percent capacity
- June 1: reservoir at 65 percent capacity
- July 1: reservoir at 53 percent capacity

July 8 - Hand-held only watering allowed

- July 15: reservoir at 43 percent capacity

August 5 - Total outdoor water use ban

- Reservoir below 28 percent capacity triggering full ban
- August 8: release stopped
- September 6: reservoir at 21.5 percent capacity
- September 26: reservoir at 21.4 percent capacity

Scituate moved forward with an aggressive public education and demand management plan that included:

- Drought Crisis Management Team meeting weekly
- Water conservation post-card sent September 2
- Town website posting of Public Service Announcement (PSA) and water conservation tips
- Soliciting town residents to submit water conservation tips
- Facebook postings and emails via Town email alert list
- Conservation education in schools with NSRWA

¹⁹ Improving Flows in First Herring Brook – How Are We Doing?, Scituate Water Resources Committee, January 26, 2016

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- Video series on Scituate’s water supply and water conservation tips
- Enforcement
 - Violations of bans being issued
 - Public posting of streets where violations occurred

Scituate’s approach was highly successful. Water use during the month of August was 25 percent lower than in June or July, and by late August daily water use had fallen to the same level as January water use, a truly unique response by a community to a truly alarming water supply shortfall.

Subsequently, Scituate is working with the NSRWA and MassDER to review the releases and shut-off requirements in the Plan. The WMA permit can be amended to reflect any modifications to the Plan that are developed in response to the 2016 drought. In addition, Scituate continues to pursue a longer-term effort to improve fish passage in First Herring Brook at the Reservoir through a combination of structural improvements to the fish ladders at Old Oaken Bucket Pond and Reservoir Dam, as well as maintaining Reservoir Dam at a higher level for a longer duration and provide greater resiliency to drought and emergencies. As a result of Scituate’s water conservation efforts in 2016 and the larger effort to increase storage in the Reservoir for system resiliency and fishery restoration, the Town may need to adjust water rates. Conservation reduced water use during 2016 by almost 10 percent, and the proposed infrastructure improvements will be costly. The Town anticipates undertaking a rate review this year or next year.

- **Case Study: Norwell Demand Management in Response to Chronic Supply Limitations** - The Town of Norwell has had difficulty meeting peak water demand for many years. The local aquifers in which the Town’s 10 water supply wells are located are relatively small and shallow. One of the aquifers that Norwell relies on underlies the boundary with a neighboring town that also has water supply wells drawing from the same small resource.

Therefore, regardless of WMA permit requirements, Norwell has found it necessary to impose mandatory restrictions on lawn watering and outdoor water use to ensure essential needs such as drinking water and fire protection can be met on hot summer days. During the drought of 2016 Norwell implemented the “Guidance on Outdoor Water Use Restriction” (see a copy in Appendix F) prepared by MassDEP and sent to all public water suppliers in monthly letters updating them on the status of the drought. The Town has now used that guidance as a template to develop a New Tier based Water Restriction Program that will go into effect in 2017. Norwell has determined that they need a more proactive conservation program than most communities and will be in year-round restrictions going forward.

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Table 10. 4 - Town of Norwell's New Tier Based Water Restriction Program

Why New Water Restrictions?

In an effort to minimize confusion each year on what current water restrictions allow and disallow the Water Department has developed a new Tier based system for water restrictions.

Eliminate Wasteful Watering

The new Tier based water restriction program allows residents and businesses to utilize their lawn irrigation systems while eliminating inefficient and wasteful lawn watering.

Year-Round Water Restrictions

The Board of Water Commissioners has voted to implement a new Tier based water restriction program. This new program will consist of 4 Tiers of restrictions. **The Town will always be in Tier 1 water restrictions at a minimum**, and transition to more restricted Tiers as the Board of Water Commissioners or DEP deems necessary. **Watering during the hours of 9AM-5PM is PROHIBITED in all Tiers.** This only applies to Town water supplied systems, however we do recommend those with private wells follow the restrictions as well.

Tier 1 Water Restrictions

- Automated Irrigation systems may be used **ONLY** during the hours of 3AM-7AM.
- Odd/Even lawn watering. Residents with even-numbered addresses may water on Monday & Wednesday; odd-numbered addresses may water on Tuesday and Thursday.
- The use of Hand-Held hoses is allowed **ONLY** between the hours of 5PM-9AM.

Tier 2 Water Restrictions

- The use of automated irrigation systems is allowed one day a week. Residents with even-numbered addresses may water on Monday **ONLY**. Odd-numbered addresses may water on Thursday **ONLY**.
- Automated Irrigation systems may be used only during the hours of 3AM-7AM.
- The use of Hand-Held hoses is allowed **ONLY** between the hours of 5PM-9AM.

Tier 3 Water Restrictions

- NO** automated irrigation systems are allowed.
- Hand-Held hose watering is allowed only during the hours of 5PM-9AM.

Tier 4 Water Restrictions

- TOTAL OUTDOOR WATER BAN.** All non-essential outdoor water use is prohibited.

Vegetable Gardens/Plants

Watering of vegetable gardens and plants are allowed during all Tiers under the following conditions:

Vegetable gardens and valuable shrubbery may be watered on any day but **ONLY** with a hand-held hose during the hours of 5PM-9AM.

Watering pots are also allowed at any time.

New Lawns

The Department recommends all new lawns be planted from August 15th-September 30th. New lawns will be allowed to be watered every other day for no longer than 20 minutes per zone or cycle until established.

Violations

Any resident or business who violates these restrictions will be subject to the following:

1st offense: Written Warning

2nd offense: \$50.00 Fine

3rd and each subsequent offense: \$100.00 Fine

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11. Golf Courses

Requirements for Golf Courses

Many golf courses in Massachusetts pre-date the Water Management Act's passage in 1986, and were therefore eligible to register their water use with MassDEP. Typically, golf courses requiring a Water Management permit are courses that missed the registration process, new courses and expansions of existing registered or unregistered courses that will irrigate:

- 23 acres or more during the period of initial vegetation grow-in or 36 months from planting, whichever period is longer; or
- 35 acres or more of mature established turf.

The 2014 revisions to the WMA regulations include:

- conservation requirements that have evolved over time since the permit program first began in 1990; and
- new programmatic requirements developed through the SWMI process.

Conservation – Water Management permits for golf course irrigation have included water conservation requirements since the earliest days of the permitting program in the 1990's. Seasonal drought management requirements that restrict irrigation during times of drought or low streamflow/low groundwater were incorporated into permits in the mid-2000's. The water conservation and drought management requirements for golf course permittees are outlined in the Water Management Act Permit Guidance Document, November 7, 2014.

Table 11.1 outlines the required water conservation best management practices (BMP's):

Table 11. 1- Water Conservation Requirements for Golf Courses
Employee training in water conservation and management
Metering <ul style="list-style-type: none"> • Water use is 100% metered. • Source meters are calibrated annually.
Implementation of an irrigation system inspection and maintenance program that includes leak detection and repair, sprinkler had maintenance and replacement <ul style="list-style-type: none"> • Use of low trajectory sprinkler heads. • Irrigation ponds are lined with impervious material.
Implementation of a Turf Management Plan <ul style="list-style-type: none"> • Regular inspection of course to determine irrigation needs • Use of soil sensors or soil samples to determine soil moisture content • Regulator aerating of turf to decrease the percolation of water into the soil • Use of drought tolerant grasses and shrubs • Raising turf height during dry weather and drought conditions • Elimination of irrigation whenever possible, such as in rough areas • Limited ornamental watering.
Reuse of wastewater and/or stormwater for irrigation.

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Implementation of a course’s Seasonal Drought Management Plans is triggered by dry conditions, including either a drought declaration by the Massachusetts Drought Management Task Force or low streamflow or groundwater levels measured at a local USGS streamflow gage or groundwater monitoring well assigned to each golf course in their permit. The drought management requirements that restrict irrigation during times of drought or low streamflow/low groundwater are included in Table 11.2.

Table 11. 2- Seasonal Drought Management Plan for Golf Courses				
Trigger for irrigation restrictions	Landscape & Ornamentals	Roughs	Fairways	Tees & Greens
MA Drought Advisory or streamflow/groundwater trigger in permit	No irrigation	Irrigation reduced to 50%	Irrigation reduced to 80%	Irrigation remains at 100%
MA Drought Watch	No irrigation	No irrigation	Irrigation reduced to 60%	Irrigation remains at 100%
MA Drought Warning	No irrigation	No irrigation	Irrigation reduced to 40%	Irrigation remains at 100%
MA Drought Emergency	No irrigation	No irrigation	TBD*	TBD*

*Action To Be Determined by the Governor’s Emergency Proclamation

Minimization requirements for golf courses are typically an extension of conservation and demand management requirements. Water conservation is the only feasible option for most golf courses located in subbasins that are net groundwater depleted during August. Golf courses do not generally have extra capacity to rely on and any that is available is typically in the same subbasin, options for buying water are prohibitively expensive and golf courses lack the ability to make streamflow releases.

Minimization requirements do not apply to WMA permittees, including golf courses, located in the areas underlain by Plymouth-Carver Aquifer and on Cape Cod, Martha’s Vineyard and Nantucket, where August net groundwater depletion cannot be readily determined.

Mitigation - Very few golf courses are expanding and even fewer new courses have been built since the 2003-2005 baseline period that determines mitigation requirements in WMA permits. Of the approximately 60 WMA permits for golf course irrigation, early estimates identify that less than half will be required to mitigate. Table 11.3 outline mitigation opportunities available to golf courses with WMA permits.

Table 11. 3- Mitigation Activities for Golf Courses
Direct Mitigation
Direct Mitigation will result in enhanced streamflow as a result of groundwater contribution, streamflow contribution, or surface water releases. Direct Mitigation activities include: <ul style="list-style-type: none"> • Stormwater recharge – feasibility limited to golf courses with on-site options such as parking areas • Surface water releases – typically infeasible for golf courses • Infiltration and inflow (I/I) removal from sewer systems – not applicable to golf courses
Indirect Mitigation
If direct mitigation options are not feasible, then the permittee considers indirect mitigation. The Audubon

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Table 11. 3- Mitigation Activities for Golf Courses
<p>International Cooperative Sanctuary Program offers golf course certification programs that fulfill WMA mitigation requirements. A golf course may fulfill the mitigation requirement through another certification program after consultation and approval from MassDEP.</p>
<p>New Golf Courses may choose the Audubon International Signature Program.</p> <p>Fees for this program include:</p> <ul style="list-style-type: none"> • a one-time registration fee of \$7500; and • an annual membership fee of \$500. <p>Recertification is required every two years after the first certification. Fees for recertification include:</p> <ul style="list-style-type: none"> • an \$800 site visit fee; and • the cost of travel for the Audubon International Director. <p>When a course has two successful recertification reviews, recertification is required every three years thereafter.</p>
<p>Expanding Golf Courses that are adding more holes and require a permit for more water than their baseline volume may choose the Audubon International Classic Program.</p> <p>Fees for this program include:</p> <ul style="list-style-type: none"> • a one-time registration fee of \$4500; and • an annual membership fee of \$500. <p>Recertification is required every two years after the first certification. Fees for recertification include:</p> <ul style="list-style-type: none"> • an \$800 site visit fee; and • the cost of travel for the Audubon International Director. <p>When a course has two successful recertification reviews, recertification is required every three years thereafter.</p>
<p>Existing Golf Courses that require a permit for more water than their baseline volumes may choose the Audubon Cooperative Sanctuary Program (ACSP). Annual Fees for this program are \$300 per year and there are no recertification fees.</p> <p>The ACSP includes six certification categories. Courses must certify in:</p> <ul style="list-style-type: none"> • Environmental Planning; and • Water Conservation. <p>In addition, depending on the amount of mitigation required, courses must certify in at least one of the following three categories:</p> <ul style="list-style-type: none"> • Wildlife and Habitat Management; • Chemical Use Reduction and Safety; and • Water Quality Management. <p>The mitigation requirement will be evaluated by MassDEP on a case by case basis.</p>
<p>For All Participating Golf Courses, there may be additional project costs needed to fulfill program requirements. According to the Audubon International Cooperative Sanctuary Program, average project costs are difficult to estimate, because depending on current management practices when joining the program, a participating golf course may not need to make many changes.</p> <ul style="list-style-type: none"> • Total staff time estimates to complete the process, including all projects and paperwork: approximately 90 hours, or approximately \$3,150 per course in staff time based on average salary rates. • Depending on the current structure of a course's maintenance area, project costs could range anywhere from \$500 up to \$5,000 to ensure that the wash area is mitigating risk. <p>These cost estimates do not factor in return on investment, which is difficult to estimate and depends on the project/time frame, but which could offset a golf course's investment in the program.</p>

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Coldwater Fish Resources (CFRs) are water bodies that contain coldwater fish that reproduce in that waterbody or adjacent tributary and use the water body to meet one or more of their life history requirements. CFRs are critical resources that have seen significant loss over time, partially because these temperature-dependent habitats are strongly influenced by groundwater and particularly vulnerable to impacts from groundwater withdrawals.

Protection of Coldwater Fish Resources, as outlined in Table 11.4, is required for withdrawals determined to have a hydrologic connection to streams that support coldwater fisheries.

Table 11. 4- CFR Protection Activities for Golf Courses
<ul style="list-style-type: none">• MassDEP will prescreen WMA applications for withdrawals near CFR's to determine whether there is a hydrologic connection and whether the applicant has options to shift pumping to other withdrawal points.
<ul style="list-style-type: none">• Options for operational changes at golf courses for CFR protection may be limited because of the physical lay-out of the course and lack of alternative sources. Adherence to the permit conservation and mitigation requirements will provide benefits to CFR streams by reducing the amount of water used for irrigation and by reducing nutrient and pesticide use and run-off from golf course management.

- **Case Study: Concord Country Club** – The Concord Country Club is a registered golf course that voluntarily decided to obtain the full Audubon Cooperative Sanctuary Program (ACSP) Certification because the program has been shown to enhance wildlife habitat on and around a golf course, improve efficiency, and thus cut costs, and minimize the potential environmental impacts of golf course operations. The Club completed their certification in 2015.

Concord Country Club estimates their initial start-up costs to be \$2,500 spent over a three-year period to achieve the certification. Those expenses covered:

- the man-hours to document required information for the certification program;
- laboratory costs for water testing;
- birdhouses to enhance wildlife habitat on the property;
- signage for the property; and
- an informational booklet on the environmental practices on the course for members.

Ongoing expenses have run approximately \$800 to \$1,000 per year since the initial certification. Those expenses include the \$300 annual fee, on-going water testing and maintaining birdhouses and signage.

12. Cranberry Cultivation

Requirements for Cranberry Growers

Most cranberry bogs in Massachusetts pre-date the Water Management Act's passage in 1986, and were therefore eligible to register their water use with MassDEP. Cranberry bogs requiring a Water Management permits are either new bogs, bogs that failed to register, or expansions of existing bogs of:

- 4.66 acres or more of bogs that are not certified by the Natural Resource Conservation Service as using best management practices; or
- 9.3 acres or more of bogs that are certified by the Natural Resource Conservation Service as employing best management practices.

The 2014 revisions to the WMA regulations included:

- conservation requirements that had been incorporated into WMA permits over time since the permit program first began in 1990, and
- new programmatic requirements developed through the SWMI process.

Conservation - Cranberry growers with WMA permits are required to adhere to the Best Management Practices (BMP's) as defined in the *Memorandum of Agreement for Implementation of Water Conservation BMP's at Cranberry Bogs signed by the Cape Cod Cranberry Growers' Association, the Commission for Conservation of Soil, Water and Related Resources and the Department of Environmental Protection*, effective September 8, 2004.

Table 12.1 outlines the required water conservation BMP's.

Table 12. 1- Conservation BMP's for Cranberry Cultivation

- | |
|---|
| <ul style="list-style-type: none">• annual flume and dike repair maintenance• use of low-volume sprinkler heads• on-site water supply/tailwater recovery system• return of all unconsumed water back to the water supply/tailwater recovery system• laser leveling of bog sections• sequential flooding of bog |
|---|

Minimization requirements for cranberry cultivation are typically an extension of conservation requirements because cranberry growers generally use surface water sources which are not subject to the minimization requirements, do not often have access to alternative water sources, and do not have the ability to make streamflow releases to minimize impacts if they are located in subbasins that are net groundwater depleted during August. Minimization requirements do not apply to bogs located in areas underlain by the Plymouth-Carver Aquifer and on Cape Cod, Martha's Vineyard and Nantucket, where August net groundwater depletion cannot be readily determined.

Mitigation requirements are fulfilled through development and implementation of a Natural Resources Conservation Service (NRCS) approved Conservation Farm Plan. A Farm plan is a tool to help grower's manage their land profitably while protecting the natural resources on the farm. It is used to schedule

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improvements, document conservation practices, as well as assist with compliance regarding local, state and federal regulations. A Farm Plan can be developed by an NRCS conservationist or farm planner, a NRCS-recognized service provider or a grower can hire a private firm to develop a plan. The cost to have a plan created by a private firm is typically \$1,000 - \$3,000, with \$2,000 as an average price, varying depending on the size and complexity of the individual bog system.

The Farm Plan includes specific best management practices that provide water quality benefits when they are implemented as part of the operation of the bogs. The Farm Plan is supplemented by an annual publication called the *Cranberry Chart Book* and prepared by the University of Massachusetts Cranberry Experiment Station. The cost to implement the Farm Plan will vary widely based on the size of the farm, the practices that need to be implemented, availability of resources (including labor) for the farm, etc. Table 12.2 outlines specific provisions included in cranberry growers' Farm Plans that mitigate the impacts of the permitted water withdrawals.

Table 12. 2- Mitigation Activities for Cranberry Cultivation	
<ul style="list-style-type: none"> • Optimize the use of fertilizer per the <u>Best Management Practice Guide</u> and annually-updated UMass Cranberry Chart Book recommendations for nutrient management. • Retain excess nutrients on-site through an on-site water supply/tailwater recovery system. <ul style="list-style-type: none"> ○ The cost of a tailwater recovery system will be highly variable, depending on soils and excavation costs, the size of the system, if the grower is able to recover costs through selling the excavated material, etc. ○ Systems for very large bog operations could be as high as 6 figures. 	
<ul style="list-style-type: none"> • Reduce, whenever possible, nutrient and pesticide applications. <ul style="list-style-type: none"> ○ The cost to develop an Integrated Pest Management Plan (IPM) averages ~\$100+/acre. <ul style="list-style-type: none"> ▪ The cost to implement an IPM averages ~\$600+/acre for pesticides, labor and other costs. ○ The cost to develop a nutrient management plan averages ~\$250/acre. <ul style="list-style-type: none"> ▪ The cost to implement a nutrient management plan averages ~\$200+/acre. 	

Coldwater Fish Resources (CFRs) are water bodies that contain coldwater fish that reproduce in that waterbody or adjacent tributary and use the water body to meet one or more of their life history requirements. CFRs are critical resources that have seen significant loss over time, partially because these temperature-dependent habitats are strongly influenced by groundwater and particularly vulnerable to impacts from groundwater withdrawals.

Protection of Coldwater Fish Resources, as outlined in Table 12.3, is required for withdrawals determined to have a hydrologic connection to streams that support coldwater fisheries.

Table 12. 3- CFR Protection Activities for Cranberry Cultivation	
<ul style="list-style-type: none"> • MassDEP will prescreen WMA applications for withdrawals near CFR's to determine whether there is a hydrologic connection and whether the applicant has options to shift pumping to other withdrawal points. • Options for operational changes at cranberry bogs for CFR protection may be limited because of the physical lay-out of the bog and lack of alternative sources. Adherence to the permit conservation and mitigation requirements will provide benefits to CFR streams by reducing the amount of water used for cultivation and by reducing nutrient and pesticide use and run-off from cranberry bogs. 	

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- **Case Study: Cranberry Mitigation Requirements** - An established cranberry grower in Middleboro, Massachusetts, obtained a WMA permit in 2016 for water to cultivate 15 acres of newly developed bog. In order to fulfill the permit mitigation requirement, the grower will implement their Farm Plan, dated 2015, which was developed in conjunction with the Plymouth County Conservation District (PCCD). The grower is required to review its Farm Plan with PCCD, and update the Plan as needed, every 5 years or if major changes are made to the farm or its operating practices.

The permit requires:

1. Optimization of fertilizer use per the University of Massachusetts Cranberry Experiment Station *Best Management Practice Guide* and *Cranberry Chart Book* recommendations for nutrient management;
2. Retention of excess nutrients through an on-site water supply/tailwater recovery system; and
3. reduction, whenever possible, of nutrient and pesticide applications.

Based on cost estimates provided by industry experts and based on industry standards, the costs to a grower to implement mitigation required for 15 acres of new cranberry bog may be approximately:

- \$1,500 (approximately \$100 per acre) to develop an Integrated Pest Management Plan (IPM);
 - \$9,000 (approximately \$600 per acre) to implement the plan;
- \$3,750 (approximately \$250 per acre) to develop and implement a nutrient management plan;
 - \$3,000 (approximately \$200 per acre) to implement the plan;
- possible changes in costs for fertilizer and pesticides due to implementation of the IPM and nutrient management plans cannot be quantified based on the time that the permit has been in effect; and
- no additional tailwater recovery system costs because a system was in place to service the grower's pre-existing, registered bog acreage.

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Appendix A – MassDEP WMA Grant Program AWWA M36 Water System Audits Community List

Abington & Rockland Joint Water Works
Acton (2)
Andover
Aquarion Water Company (Hingham, Hull, and Cohasset)
Attleboro (2)
Bellingham
Concord
Dedham-Westwood Water District (2)
Dracut (2)
Fitchburg
Gloucester
Hadley
Hanover (2)
Holden
Hopkinton
Lincoln
Littleton
Medway
Needham
Onset Fire District
Pepperell
Provincetown
Rutland
Salisbury
Scituate
Shirley Water District
Shrewsbury
Tewksbury
Webster
Westborough (2)
Westborough
Westford
Wilkinsonville Water District

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Appendix B - MassDEP WMA Grant Program Project Summaries

MASSDEP FY 2012-2013 WMA GRANT PROGRAM FUNDING RECOMMENDATIONS	PROJECT	COST
APPLICANT	AMOUNT	SHARE
2013-02 Well Pumping and Recharge Strategies for Streamflow Augmentation Town of Franklin The project will involve six major tasks: coordinating with the project team; gathering and analyzing the available data; developing an optimal pumping strategy; locating recharge practices at optimal locations; preparing conceptual designs for the highest priority recharge sites; and developing a report and outreach brochure. Data will be assembled by the Town to facilitate both the optimization and the recharge tasks. For the optimization task, all the relevant pumping data and existing permit conditions would need to be gathered. For the recharge task, data on stormwater infrastructure, surficial geology, soils and site-specific conditions will be needed. This project proposes to develop an optimization tool for groundwater withdrawals and a specific pumping strategy for the Town of Franklin. The outcome of this part of the project will be to allow the Town to adopt an optimal pumping regime to augment streamflow and minimize energy use.	\$120,000	\$45,000
2013-03 Monponsett Ponds and Silver Lake Water Use Operations & Improvements Town of Halifax This project will supply necessary information to further the on-going restoration efforts of the Jones River, Silver Lake, Monponsett Ponds and Stump Brook. Prior to damming, Stump Brook and the Jones River were active migratory fish runs for river herring and the American eel and home of abundant wildlife. The Forge Pond Dam at the outlet of Silver Lake represents a complete obstacle to fish passage. In addition to the physical/structural impediment, unnatural flows as a result of the diversions present significant challenges to restoration. The primary goal is to determine actions necessary to restore flow to Stump Brook, providing relief during high water periods, over-usage, and restoring more natural flow regimes to the Jones River. The identified actions will result in benefits to the restoration of migratory fish in both river systems, and identify constructible and feasible mitigation and management efforts. Both structural and non-structural BMPs (as management efforts) will play key roles. This project was combined with #17 for a cost savings.	\$65,238	\$0
2013-05 Poor Farm Pond Dam Removal Feasibility Study City of Worcester This application seeks to obtain funding for the Poor Farm Pond Dam Removal Feasibility Study. Removal of this dam would benefit the City of Worcester, Town of Shrewsbury and the aquatic health of Poor Farm Brook by providing improvements in habitat and instream flow. Deliverables include: performing an evaluation of potential infrastructure that could be impacted by dam removal; reviewing available information; evaluating priority or estimated habitat for state-listed rare or endangered species; obtaining topographic data using LiDAR (Light Detection and Ranging) supplemented by field survey as needed; sediment assessment; hydrologic and hydraulics analyses; evaluating alternatives for deconstruction and removal of the dam structure, workshops, and a draft report.	\$139,500	\$0
2013-06 Neponset Water Management Act Planning Project Dedham-Westwood Water District This project will apply a watershed-based approach to help public water suppliers in the Neponset River Watershed understand and begin preparing for their potential future obligations under the SWMI Framework, and to develop opportunities for regional collaboration in WMA compliance. The project will gather and generate data on the range of quantifiable alternatives for responding to potential future permit requirements. This project will help communities to: develop the environmental and cost data	\$116,332	\$0

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needed to submit WMA permit renewals; raise awareness among their partner municipal departments, benefit from examples of successful programs in neighboring communities; and develop regional and/or innovative strategies for complying with the new requirements with the least impact on area residents. This project will also establish a model for the use of multi-community, watershed-based planning as a tool for enhancing the effectiveness of the WMA permitting process, and to shed additional light on how to measure and implement the concepts of minimization and mitigation under SWMI.

2013-09	Wastewater Reuse Study Town of Amherst	\$105,527	\$0
	A preliminary Reuse Feasibility Study has been completed, which evaluates the feasibility for UMass to transfer the responsibility of reuse water treatment to the Town. The goal of this project is to expand upon the findings of this preliminary Reuse Feasibility Study to include other potential reuse water users such as Amherst College and Amherst Regional High School, as well as explore the potential location for such a reuse water treatment facility. A further understanding of the necessary treatment, required testing and licensing, volume potential, and location options will be researched as well. Additionally, with the potential for an anaerobic digester to be located next to the WWTF, the opportunity for reuse water to be used at this facility, and any potential interactions with the reuse water and the anaerobic digester will be fully explored.		
2013-14	First Herring Brook Passage Improvements Town of Scituate	\$60,180	\$4,800
	First Herring Brook is a tributary to the North River in the South Coastal Basin. A crucial part of continuing to improve habitat and fish passage in the First Herring Brook system is making modifications to the fishway infrastructure at Old Oaken Bucket Pond and the Reservoir, the two impoundments that make up Scituate's surface water supply. This proposal seeks to address this issue through fishway improvements at Old Oaken Bucket Pond and preparation of a feasibility study to determine the best approach to improve passage into the Reservoir. Task 1 of this grant would be to install removable weirs in the Old Oaken Bucket fishway to maximize efficiency of the releases for fall outmigration while improving depth for fish passage. Raising the concrete weirs at Old Oaken Bucket with removable notched weirs would provide effective downstream passage through the fishway. These weirs could also be used in the spring to improve immigration with the addition of a weir in the fishway entrance, which would raise the water level in the entrance channel and reduce the height differential between pools. Task 2 of this grant would be to conduct a feasibility analysis of improving passage at the Reservoir through fishway improvements and Reservoir storage increases and the potential impacts to local septic systems, looking at both upstream passage in the spring and downstream passage in the fall.		
2013-16	Stormwater Recharge and Infiltration Planning Town of Hopkinton	\$58,989	\$0
	This project will define favorable areas for stormwater recharge and infiltration based on sound science and a discrete set of criteria regarding feasibility, ecological benefit and flow improvements. GIS map development, field mapping, and stormwater workshops to develop local bylaw revisions will be utilized. A training video will also be developed for towns in the region. By developing an overall plan for recharge, future municipal processes can be developed to leverage changes to existing impervious surfaces and stormwater management practices, and will allow new development to provide beneficial recharge.		
2013-18	Quantifying Benefits and Identifying Areas for Recharge Town of Pembroke	\$54,980	\$0
	This project will define favorable areas for stormwater recharge based on sound science and a discrete set of criteria regarding feasibility, ecological benefit and flow improvements. GIS map development,		

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field mapping, and an evaluation of stormwater BMPs, and MODFLOW analysis will be utilized. By developing an overall plan for stormwater recharge, future municipal processes can be developed to leverage changes to existing impervious surfaces and stormwater management practices, and will allow new development to provide beneficial recharge.

2013-23	Supply Management Protocol Town of Kingston	\$74,000	\$0
	<p>This project will develop a supply management protocol that will assist the Town in determining a preferred balance of operating the Town’s various groundwater sources that will satisfy the Town’s water demands most efficiently while considering environmental impacts, specifically on the Jones River streamflows. This protocol will be developed for the Kingston water system, but could be adapted for use by the numerous Massachusetts public water suppliers who face similar operational decisions. Deliverables include conducting hydraulic simulations (extended time period) to simulate the operation of the Town’s water system during a typical “dry” summer using <i>WaterCAD</i>, and the development of a protocol that can be used as a guide by the Town to select the most beneficial blend of groundwater sources and water transfers (High Zone to Low Zone) based upon the time of year, streamflow level, and anticipated water system demands. Protocol will consider the supply operations of other communities (Brockton) that impact Silver Lake water levels and quality through their diversion/withdrawal activities, which subsequently impact the Jones River streamflows.</p>		
2013-25	Feasibility Cost/Benefit Analysis of Minimization, Mitigation, &Offsets Town of Medway	\$99,197	\$0
	<p>This project will provide a feasibility and cost / benefit analysis of minimization, mitigation and offset options required under the SWMI Framework for its water withdrawals. By undertaking this study, Medway will be able to identify additional water supply development constraints under the SWMI framework and more strategically prioritize and plan new source development efforts. The outcome of the study will help the Town prioritize implementation of projects that provide the most environmental benefit for the best value. The project will both qualitatively evaluate and rank the feasibility of minimization options from SWMI Framework Table 5, and evaluate all potential categories in SWMI Table 6, but focus quantitative analysis efforts on actions expected to provide the greatest volumetric offset: inflow / infiltration removal and local stormwater recharge.</p>		

MASSDEP FY 2013-2014 WMA GRANT PROGRAM FUNDING RECOMMENDATIONS

NUMBER	TITLE APPLICANT	PROJECT AMOUNT	COST SHARE
2014-05	Regional Evaluation of Water Management Alternatives to Reduce Streamflow Impacts in the Upper Charles Watershed Town of Franklin	\$149,460	\$30,000
	<p>This project proposes the use of a regional analysis to find ways to reduce the streamflow impacts and provide solutions for towns in the upper Charles River Watershed that will help them to meet the SWMI requirements. The project will use an optimization framework to evaluate the effects of enhanced water conservation, alternative well pumping regimes, recharge of stormwater runoff, reducing groundwater leakage into sewer pipes, and alternative sources of water.</p>		

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2014-06	Wastewater Analysis Town of Ashland	\$89,455	\$22,000
	<p>This planning project proposes an analysis of the offset/mitigation action of wastewater improvement, specifically wastewater recharge through treated groundwater discharge. Surface discharge, aquifer recharge, and deep well injection will be investigated. This will involve analyzing the feasibility of constructing a wastewater treatment plant (WWTP) in Ashland with a high level of treatment prior to dispersal. The plant will be sized based on three scenarios: receiving a portion of total wastewater flow, receiving all wastewater flow, receiving all wastewater flow plus capacity for future expansion. The proposed WWTP will accept redirected flow, eliminate the wastewater IBT to MWRA, and improve basin health through groundwater recharge. In addition to feasibility, cost-benefit analyses will be performed on disposal/groundwater recharge options.</p>		
2014-07	SWMI Feasibility Analysis Town of Hudson	\$128,886	\$41,566
	<p>This planning project will work with contiguous municipalities located in the center of the SuAsCo watershed bordering either the Assabet or Sudbury Rivers. To address anticipated permit requirements, this analysis will gather and generate data on the range of quantifiable SWMI mitigation alternatives, including: demand management; I/I reduction opportunities; water supply optimization, alternative sources and releases; stormwater and wastewater recharge; and minimization and mitigation measures. It will define favorable areas for stormwater and treated wastewater infiltration based a discrete set of criteria regarding feasibility, ecological benefit and flow improvements, resulting in practical plans for stormwater and wastewater recharge.</p>		
2014-08	Regional Water Conservation Project Town of Sharon	\$120,770	\$30,000
	<p>Six of the eight communities in the Neponset Valley have come together to propose a Regional Water Conservation Pilot Project. The goal of the project is reduce water demand in each participating community through implementation of an integrated outreach and rebate program while also evaluating the potential for creating a longer-term collaboration on water conservation across the region. The participating communities will include: Canton, Foxborough, Sharon, Stoughton and the Dedham-Westwood Water District. The goal will be to replace 360 toilets, 360 clothes washers and 720 showerheads and faucet aerators. The expectation is that the rebate program will result in a confidently estimated savings of 10.8 million gallons per year and a total savings of 157 million gallons over the anticipated useful lives of the rebated fixtures.</p>		
2014-09	Demand Management Planning Town of Canton	\$46,672	\$9,334
	<p>This proposed project consists of two Planning tasks: a Water Audit of the Town's water with recommendations to be made for reducing unaccounted for water; and a Stormwater Utility analysis that will evaluate the feasibility and potential revenue associated with establishing a utility. Educational information will be presented at public workshops and the potential offset volume and cost will be quantified at a planning level.</p>		
2014-10	Water Audit Evaluation Town of Acton	\$117,687	\$35,500
	<p>The standard setting body for public water suppliers, American Water Works Association (AWWA), has released new guidance (M36) for water systems to evaluate water loss, but the methodology is not widely understood or utilized, especially by small and medium water systems. This project proposes to create case studies to document the level of effort to undertake the M36 audit. These studies would demonstrate the efficacy of the AWWA methodology and would be coupled with appropriate training so</p>		

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as to encourage appropriate use of the most meaningful water audit methodology given the nature, the size, the customer base and condition of each system.

2014-12	Recharge Analysis and Site Construction Town of Hanover	\$100,079	\$41,120
	<p>The Rte. 53 corridor represents a major economic driver for the towns of Hanover and Pembroke. Commercial and light industrial development is focused along this corridor. Unfortunately this region falls within an important watershed which supports existing and future groundwater withdrawals in the area. This project proposes to identify areas to safely return recharge to the North River drainage basin including the Pudding Brook, Mine Brook and Third Herring Brook tributaries; and develop and implement a project to demonstrate the feasibility of site modifications to increase recharge.</p>		
2014-13	Maximizing Sustainable Water Management by Minimizing the Cost of Meeting Human and Ecological Water Needs Town of Littleton	\$121,097	\$25,275
	<p>This project proposes to use an EPA management tool (WMOST) to determine the least-cost combination of management actions that will meet both Littleton’s projected water needs and SWMI minimization and mitigation requirements to protect streamflow and ecological health. Planning considerations will include potential effects of climate change, data and modeling uncertainty, and other pertinent factors such as regulatory and permitting options. Findings and recommendations will be reported specifically for Littleton and generally for other public water utilities facing increased demand in highly impacted basins.</p>		
2014-17	First Herring Brook and Reservoir Dam Fish Passage Town of Scituate	\$67,092	\$14,512
	<p>The fishway at Reservoir Dam is currently inoperable because the exit channel into the reservoir is at the same elevation as the spillway crest and normal. The fishway can only be used for upstream and downstream fish passage when water is discharged over the spillway. Modeling has suggested that several scenarios combining both Reservoir level increases and fishway modifications would meet fish passage requirements during the majority of both the spring in-migration and fall out-migration periods, while minimizing the number of summer days when an outdoor watering ban is enforced. This proposed project is Phase One of three phases for restoring fish passage at Reservoir Dam, and include: Fishway Modifications Preliminary Engineering, Design, and Public Outreach.</p>		
2014-19	Sectional Flow Monitoring Program Town of Holden	\$46,180	\$9,236
	<p>The Town has conducted annual system wide leak detection over the past two years with successful results in that numerous leaks were found and repaired; however there has not been a significant reduction in UAW. In conjunction with the 2009 Water Audit, sectional flow monitoring has been determined to be a cost effective way of reducing the Town’s UAW. The intent of this grant application is to fund a full scale, system wide, sectional flow monitoring program in order to reduce the Town’s unaccounted for water. This program would include the following tasks: Master Meter Testing, Master Meter Calibration, Distribution System Analysis and System Model Updates, Creating System Isolation Areas, Sectional Flow Monitoring of Several Isolated Areas, Further Division and Flow Monitoring of High Flow Areas, Detailed Leak Detection Efforts within High Flow Areas, and Repair of Leaks.</p>		
2014-18	Patch Pond Dam Removal Feasibility Study City of Worcester	\$148,800	\$29,760
	<p>This application looks to fund a Patch Pond Dam Removal Feasibility Study, as the dam serves no useful purpose, is detrimental to the aquatic biology of Tatnuck Brook, and is an unsafe condition. Removing Patch Pond Dam would restore a segment of Tatnuck Brook for unimpeded fish passage, improved water</p>		

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quality and aquatic habitat, and improved recreation conditions. Tatnuck Brook is a coldwater fishery. The Feasibility Study would include an infrastructure evaluation, habitat evaluation, sediment evaluation, hydrologic and hydraulics analyses, and the identification and evaluation of deconstruction and removal alternatives.

2014-20	Optimization of Stormwater Infiltration Town of Auburn	\$60,080	\$11,560
	<p>This project involves optimization of stormwater infiltration as a potential offset/mitigation. Similar to other water systems with public water supply wells near major highways, the applicant's water supplies are highly susceptible to impacts from stormwater infiltration associated with roadway runoff if the sites for infiltration have not been optimized. This project will serve as a tool for the District and other public water suppliers with highways located within the Zones I and II of the wells by developing a prioritization tool that can be used to assist in locating stormwater infiltration sites, balancing the benefits of groundwater recharge with the critical need to protect public water supply wells from contamination. This proposal includes identifying and prioritizing alternative potential infiltration sites and stormwater treatment options.</p>		
2014-21	Water Audits Town of Medway	\$44,275	\$8,855
	<p>This project seeks funding for a Demand Management Implementation Project that will conduct audits of both the Town's water system and the ten largest water users served by the Town. Under the first round of the SWMI grant program, Medway completed a study that analyzed the feasibility, costs, and benefits of implementing minimization, mitigation and offset options relating to its sources and within the Town's boundaries. That study resulted in a specific set of prioritized recommendations, which the Town seeks to begin implementing this year with the assistance of SWMI grant funding. The demand management project that Medway proposes will address the two most highly ranked recommendations from its prior study and could result in measurable water savings benefits to the Charles River Basin.</p>		
2014-22	Jones River Stream Gage Town of Kingston	\$16,000	\$3,200
	<p>This project involves maintenance of the Jones River stream gage located in the Town of Kingston for 2014, to allow time to develop a new strategy for future funding. Historically, USGS has operated and maintained the Jones River stream gage, with historical records dating back to the 1960s. USGS determined it was unable to fund maintenance of the stream gage as of 2012. The Massachusetts Division of Ecological Restoration (MassDER) funded the Jones River stream gage maintenance under its 2013 operating budget. MassDER has indicated that it will be unable to continue funding the maintenance of the Jones River stream gage in 2014.</p>		
2014-23	Water Supply Optimization Town of Kingston	\$93,800	\$18,800
	<p>This project involves implementation of the recommendations from the Town of Kingston 2012 Sustainable Water Management Initiative (SWMI) Grant Program project. The results of the 2012 project indicated that the Town's water supply protocol could be optimized, but some infrastructure improvements would be required. These improvements will allow the town to implement the supply optimization protocol that will allow preferential use of the Trackle Pond Well (High Zone) while minimizing use of registered wells located in the Low Zone, proximate to the Jones River. This implementation project involves (1) removal of one of three booster pumps at Soules Pond Booster Pump Station, (2) installation of flow control valve and appurtenances and programming, and (3) installation of residual chlorine analyzer.</p>		

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2014-24	Water Supply Management and Demand Management Plans Town of Groton	\$66,800	\$13,400
	<p>This project includes the development of a Supply Management Protocol/Optimization Plan and the development of a Demand Management Plan for the town. The Supply Management Protocol/Optimization Plan will allow the town to assess how to preferentially pump its wells (existing and pending) for the benefit of drinking water supply and the environment. The Demand Management Plan will identify those efforts the GWD have already implemented and will also investigate additional water conservation efforts that the Town may wish to consider in order to reduce the overall volume to be mitigated under SWMI. These efforts will include the implementation of higher conservation rates for all second/irrigation meters in Town. There are approximately 800 irrigation meters in Town which currently pay the same rates as single meters. In order to encourage conservation, a new rate structure for irrigation meters will be evaluated along with the expected water savings.</p>		
2014-26	Water Audits to Reduce UAW Town of Foxboro	\$50,500	\$20,500
	<p>This project involves the completion of a Water Audit including implementation of master/production meter improvements for the Town of Foxboro. The Town's Unaccounted for Water (UAW) in 2011 was 18% and rose to 20% during 2012. The Town's residential demands were 62 and 59 residential gallons per capita day (RGPCD) for the years 2011 and 2012 respectively. The current goals set by the State to improve water conservation efforts are 65 RGPCD residential water usage along with 10% UAW. While the Town's residential water usage is below the goal, the UAW exceeds the goal by 100%. This indicates that the Town has excellent residential water conservation efforts in place, but excessive water losses are a problem. This water audit will provide the Town with a greatly needed tool to help reduce water losses and improve water resource efficiency.</p>		

MASSDEP FY 2014-2015 WMA GRANT PROGRAM FUNDING RECOMMENDATIONS

NUMBER	TITLE APPLICANT	PROJECT AMOUNT	COST SHARE
2015-02	Alternate Water Supply Study and Rt. 20 Reallocation Study Town of Shrewsbury	\$36,286	\$7,257
	<p>This project would identify alternative water supplies to minimize pumping impacts by the existing Shrewsbury well fields, and to allow the reduction of pumping impacts to the Poor Farm Brook. Options include purchasing water from various sources, re-opening of a well, or a new well.</p>		
2015-03	Integrated Assessment and Basin-Wide Training Town of Westborough	\$91,315	\$18,263
	<p>This project would assess the implications of the revised Water Management Act regulations on the planning, operations and management of the water resources of the Town of Westborough, and identify cost-effective ways to meet both human and environmental water needs. In addition, materials will be developed and a training workshop conducted for Westborough and up to 20 other WMA permittees to enable them to use WMOST and other existing tools to assess requirements applicable to their permits, and to perform analyses to determine cost-effective strategies for meeting those requirements.</p>		
2015-04	Support and Reusable Tools Town of Wrentham	\$122,895	\$24,579
	<p>This project is designed to build on prior projects using WMOST to develop strategies for meeting the WMA regulations. At the same time, it will create tools to help Wrentham and other municipalities to plan their strategy. Considerations will include the potential effects of climate change, data and modeling uncertainty, and other pertinent factors such as regulatory and permitting options. The tools will be a</p>		

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stormwater calculator and a demand management calculator for use to estimate credits for these actions under the new regulations and associated costs. These tools will be stand-alone Excel files that can be used by other permittees.

2015-05	Third Herring Brook Town of Norwell	\$80,240	\$20,330
	This project proposes to conduct work to better understand Third Herring Brook and its water resources, for both the sustainability of the water supplies of Norwell and Hanover as well as its instream ecology. Project tasks will include using Water Evaluation and Planning (WEAP) software to model the dynamics of water within the Third Herring Brook watershed, and sediment testing and a bathymetric survey of Jacob's Pond.		
2015-07	Path from Screening Analysis to Permit Conditions Town of Littleton	\$59,427	\$11,885
	This project would be for conducting activities recommended in the planning study done by Littleton in the previous grant round: initiating UAW and demand management programs. These activities will prepare Littleton for the permit renewal process. In addition to technical assistance, the tools that will be developed will be generalized templates so that other permittees may perform the same analyses with fewer resources.		
2015-09	Stormwater Infiltration Planning Town of Auburn	\$94,300	\$20,200
	A prior SWMI grant project for Auburn evaluated existing stormwater outfalls from Routes I-90, I-395 and I-295 proximate to the Auburn Water District's water supply wells. This proposed project will evaluate of the ability to infiltrate stormwater in areas outside of the study areas of the prior SWMI grant project, but still within the Town. In particular, this analysis will include evaluation of the feasibility of implementing a roof leader disconnection and infiltration program for larger industrial and commercial sites, of which there are numerous opportunities given the nature of existing development within the Town of Auburn.		
2015-11	Minimization and Mitigation Planning Town of Lincoln	\$75,292	\$15,392
	This project will include four activities which will help the Town of Lincoln proactively address future Sustainable Water Management Initiative (SWMI) compliance under the Water Management Act regulations. These activities include: (1) An Evaluation of Alternative Sources; (2) An Evaluation of Additional Conservation Measures; (3) An Assessment of Existing Mitigation Measures; and (4) Leak Detection and Meter Calibration.		
2015-15	Culverts and Stormwater Town of Kingston	\$55,000	\$12,000
	This proposal is for culvert replacement and stormwater upgrades near the headwater of the Jones River to improve fish passage and stream health in the context of significant impacts from water withdrawals. The current water allocation system has resulted in the upper Jones River unnaturally drying up seasonally alternating with unnatural flooding. These conditions result in the loss of fish and other aquatic species dependent on those habitats.		
2015-16	Targeted Leak Detection Town of Medway	\$18,208	\$3,642
	Medway has completed water audits of both its own system and those of its largest water consumers. These audits have provided a specific set of prioritized recommendations, which the Town has already		

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begun to implement. This year, Medway seeks funding to build upon prior efforts and develop a District Metering Program to help the Town target and prioritize specific areas of the system for more intensive leak detection based on water main age, break history, system pressure and other factors.

2015-17 Implementation Project

Town of Westford

\$107,867 \$28,925

This project includes the implementation of a rebate program for water efficient appliances and municipal building retrofits to low-flow toilets, both of which will improve the efficiency of water use in town, help reduce water demands, and help the town meet the performance standard for RGPCD. Radio-read meters or interfaces will be purchased and installed to continue Westford's effort to move from quarterly to monthly reading and eventually billing to help encourage conservation, reduce RGPCD and overall system demands, and improve operations.

2015-18 Implementation of Stormwater Recharge Practices

Town of Franklin

\$148,890 \$30,000

This project is a continuation of the work completed in two prior SWMI projects that identified potential sites for installing new stormwater recharge practices or retrofitting existing ones. Stormwater practices are one of several ways to mitigate the effect of water withdrawals on streamflow by recharging groundwater thereby providing a slow replenishment of streamflow. This project will design and install stormwater recharge practices at three of the best sites from these two prior studies.

2015-19 SCADA Feasibility

Town of Halifax

\$74,850 \$17,400

The goal of this project is to determine the feasibility of installing automated controls to remotely manage the water levels of Monponsett Ponds, greatly reducing the man-hours needed to manually visit the dam, operate the aged infrastructure and monitor the health of the up-stream and down-stream ecosystem. The technology proposed for this project and evaluation would be a series of automated valves and controls installed at strategic locations to monitor and operate, based on constant and controllable settings. These valves and controls would require modification to the existing infrastructure and implementation of a SCADA system.

MASSDEP FY 2015-2016 WMA GRANT PROGRAM FUNDING RECOMMENDATIONS

NUMBER	TITLE APPLICANT	PROJECT AMOUNT	COST SHARE
2016-02	Assessment or Reservoir Storage Capacities and Evaluation of Operational Modifications to Assess Potential Streamflow Impacts in the Adams Brook Town of Amherst	\$103,238	\$19,283
	Amherst proposes to assess current operational practices at the Atkins reservoir to determine if water supply obligations can be met in a manner that improves streamflow conditions in Adams Brook, downstream of the diversion to Atkins. This project will also assess restoring reservoir storage to previous levels and/or increasing reservoir storage for operational and environmental improvements throughout our water supply system. Reservoir bathymetry will be conducted, and sediment cores taken. The WEAP or the HSPF model will be used.		
2016-03	Evaluation of Permanent Interconnection to Supplement or Replace Existing Sources Auburn Water District	\$88,900	\$18,000
	This project would help determine the costs, benefits and impacts of the purchase of water by the Auburn Water District from the City of Worcester. The prospective purchase has been identified as a		

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potential alternative to the District’s local groundwater withdrawal sources (existing and future). This project includes an evaluation of the critical hydraulics, pertinent regulatory requirements and costs associated with this potential purchase of water from Worcester by the District.

2016-04 Demand Management

Town of Avon

\$106,020 \$26,505

This project would fund an enhanced water audit and implementation of a continuous water use performance measurement system. The outcome will be a system that schedules the collection of water use related over the year. Goals include: Reviewing and auditing all sources of data used for a first year AWWA M36 Water Audit; Automating the collection and production of ASR reporting, linking the Town’s daily field-deployed Work Order system and other sources of data into the ASR report formats and annual M36 Audits; Developing a meter replacement program, a master meter testing and calibration program, a leak detection approach, and a meter replacement approach. This project would also quantify the cost benefit of water loss reduction programs.

2016-05 Water Rate Study

Town of Billerica

\$25,000 \$5,000

The Town of Billerica would complete a detailed Cost of Service (COS) Water Rate Study to determine the actual costs for current and projected future management and Operation & Maintenance project (O&M) programs associated with operation of the Billerica Water Division. Water pricing can help to reduce demand by providing an economic incentive for customers to conserve water. Specifically, the Town would like to review its current water rate schedule and determine the impact of billing four times per year instead of three, review implementing an irrigation meter fee, review the Town’s current meter replacement program and its water conservation and demand management recommendations.

2016-06 Mitigation and Minimization Alternatives to Improve Streamflow in the Neponset River Watershed

Town of Canton

\$72,000 \$15,000

This project will build on work completed for the Neponset Watershed by using a regional analysis to help towns meet their WMA requirements and reduce impacts of water withdrawals on streamflow. The analysis of source optimization opportunities will use a spreadsheet modeling previously applied in the Upper Charles River Watershed. The model incorporates approximate groundwater dynamics based on the USGS Stream Depletion tool, allowing for a site specific evaluation of optimization opportunities. The project involves the following major tasks: investigating alternative pumping strategies; integrating existing and potential demand management strategies; prioritizing potential stormwater recharge volumes; integrating potential reduction in infiltration and inflow to sewers; providing a menu of water management alternatives with associated unit costs; and, quantifying the benefits to streamflow from the above practices.

2016-07 Alternative Source Study and Mitigation Planning

Town of Groton

\$98,400 \$20,200

This grant project would leverage the work completed under a prior SWMI grant to further the optimization of Groton’s existing and future sources, relative to minimizing the potential impact of their groundwater withdrawals. This grant proposal includes the following:

1. Development of an Alternative Source Study to provide a roadmap for implementation of future water sources;
2. Identification and quantification of existing mitigation measures implemented in the Town of Groton since 2005 to offset future water sources/withdrawals;
3. Evaluation of water rates considering the potential effect of implementation of future water sources and associated mitigation efforts.

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2016-11	Third Herring Brook Town of Norwell	\$102,630	\$22,524
	<p>This project proposes to conduct work to better understand Third Herring Brook and its water resources, for both the sustainability of the water supplies of Norwell and Hanover as well as its instream ecology. Project tasks will include using MODFLOW software to model the dynamics of water within the Third Herring Brook watershed, and testing different management scenarios in order to prioritize action.</p>		
2016-12	Water Loss Control Program Town of Rutland	\$59,000	\$15,000
	<p>Rutland has had a UAW of greater than 25% since 2010. This project would utilize the latest AWWA water loss control software to evaluate the Rutland water supply system, and apply results from the water audit to the latest Water Research Foundation real loss control software. Based on the results of loss analysis, the system would perform system analysis which may include nighttime system loss survey, meter calibration/registration checks, and acoustical leak detection on elements of the system not surveyed in the past two years.</p>		
2016-14	Stormwater Quality Investigation Town of Shrewsbury	\$40,000	\$8,000
	<p>Shrewsbury is required to review potential stormwater quality measures at the Bowditch Drive outfall. This project would identify and evaluate potential drainage system improvement and Best Management Practices to improve stormwater quality in the area and in the Poor Farm Brook. This project would also try to identify illicit stormwater connections to the Bowditch Drive outfall.</p>		
2016-15	Cost Effective Permit Renewal for West Springfield and Southwick Town of Southwick	\$132,113	\$28,924
	<p>This project would assess the impact of the Water Management Act Regulations on the planning, operations and management of the water resources used by Southwick and West Springfield, and identify cost-effective ways to meet both human and environmental water needs. The analytical approach may involve using several models and conducting multiple analyses, including: STRMDPL for optimizing withdrawals; Water Efficiency Calculator to estimate the potential for demand reduction in both towns; Stormwater Credit and Cost Calculator to estimate volumetric credit from infiltration practices implemented since; Reservoir release and volume calculator; and a GIS-based analysis to calculate and verify septic recharge with updated data, as applicable. Each of these analyses evaluates actions for meeting optimization, minimization and/or mitigation requirements, as well as their relative cost-effectiveness.</p>		
2016-16	UAW Reduction Wareham Fire District	\$174,000	\$58,000
	<p>This project would focus on reducing UAW below 10% in the District; for the last two years it has been at 14% or greater. Components of the project include: conducting a water audit; developing a UAW Compliance Plan; conducting a leak detection survey; performing a billing data review and a leakage component analysis; providing low-flow plumbing fixture to residents; conducting a water rate survey; and providing outreach to the District on current conservation measures.</p>		
2016-17	Stormwater Assessment for Recharge Opportunities Town of Wrentham	\$51,403	\$10,400
	<p>This project would assess opportunities for mitigation of streamflow impacts using stormwater recharge in the headwaters of the Charles, Blackstone, Taunton, and Ten Mile Rivers. All retrofit opportunities for stormwater controls in the Town would be assessed and ten conceptual designs for stormwater treatment would be developed. The retrofit sites will prioritize those that result</p>		

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in significant recharge and phosphorus reduction. Lastly, one of the best conceptual designs would be advanced it to the 30% level.

MASSDEP FY 2016-2017 WMA GRANT PROGRAM

FUNDING RECOMMENDATIONS

NUMBER	TITLE APPLICANT	PROJECT AMOUNT	COST SHARE
2017-01	Interconnections with Worcester and Drought Impacts Town of Auburn This project would complete a preliminary evaluation and design of the proposed interconnection(s) between the Auburn Water District and the City of Worcester. The prospective purchase of water from Worcester has been identified as a potential alternative to the District's local groundwater withdrawal sources (existing and future) which experience water quality problems. The prior SWMI grant project demonstrated that it is hydraulically feasible for the District to supplement its local water supply in its Low Pressure Zone with water transferred from the City. Two potential interconnection locations would be evaluated, along with a rate evaluation and drought considerations.	\$96,450	\$20,450
2017-02	Data Collection and Planning Town of Danvers This project will involve stakeholders by holding meetings for permitted and registered sources in the Ipswich Basin, performing data collection, evaluating Optimization options and alternates supply sources, and exploring whether a Joint Powers Agreement between the Ipswich member communities would be useful.	\$129,925	\$29,985
2017-03	Dropcounter, Source Optimization, and Stormwater Dedham Westwood Water District This project brings together four communities, each of which faces challenges and opportunities under the SMWI permitting framework. The work to be done includes: A pilot implementation of the Dropcounter water conservation system in the DWWD area; continued refinement of source optimization scenarios for Stoughton, Canton, Dedham and Westwood based on work completed earlier this year under a prior WMA grant; and development of 30% design plans for six stormwater recharge BMPs in the communities of Stoughton, Westwood and Dedham.	\$121,020	\$24,410
2017-05	Stormwater Utility Feasibility Analysis Town of Millis This project will evaluate the feasibility and potential revenue associated with establishing a Stormwater Utility in the Town of Millis. Educational information will be presented at two public workshops.	\$55,926	\$11,185
2017-07	Water Rate Study Town of Plainville The proposed Cost of Service Water Rate Study will determine the actual monetary costs for current and projected future management and O&M costs associated with operation of the Plainville Water Department. The Water Rate Study will also assess the impact of customer service charges and fire suppression charges on the overall revenue streams. The report will review the adoption of a water enterprise fund, a review of irrigation meters and recommendations for a separate irrigation rate, recommendations to adopt and enforce a bylaw requiring moisture sensors or similar climate technology on automatic irrigation system.	\$24,900	\$4,980

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2017-08	Leak Detection and AC Pipe Condition Assessment		
	Town of Provincetown	\$94,500	\$18,900
	This project would evaluate approximately two miles of asbestos/concrete pipe for leaks using approximately 30 data loggers and correlators over a period of four months. The pipe to be assessed includes the main transmission pipe line. An acoustic assessment of the pipe will also occur. Data will be continually transmitted thru a radio repeater. The goal is to assist Provincetown in reducing their UAW below 10%.		
2017-09	First Herring Brook - Reservoir Dam Modifications		
	Town of Scituate	\$154,880	\$39,630
	This project builds on work conducted through 2012 and 2013 SWMI Grants to the Town of Scituate. The 2012 grant examined the feasibility of improving fish passage in First Herring Brook at the Reservoir through a combination of structural improvements to the fish ladders at Old Oaken Bucket Pond and Reservoir Dam, as well as maintaining Reservoir Dam at a higher level for a longer duration. The 2013 grant funded the Preliminary design of the recommended alterations (Executive Summaries, Attachments). In this project phase, the Town of Scituate proposes to complete 60% permit level design and initiate the permit process for implementation of spillway and fishway structure modifications to maintain a higher Reservoir Dam pond level.		
2017-10	Water Accounting		
	Town of Shrewsbury	\$61,690	\$16,000
	This project will develop a tool that can utilized by other water utilities to assist in the correlation of source meter and customer metered usage to identify anomalies that can lead to a reduction of losses in the distribution systems. Specific tasks include: Redefining meter reading zones to be consistent with discrete pressure zones for comparison to booster pump meters; evaluating the current billing software for errors; developing a spreadsheet model to show usage in each zone and in subset areas where future zone isolation could be achieved to verify water consumption and compare it with water pumped into the distribution system and each pressure zone; developing of electronic forms for tracking non-revenue water; and developing a guidebook. There will be two free workshops, I providing a discussion of types of management software, methods for data export into easily manipulated excel spreadsheets and a discussion of the monitoring/management and reporting tools that can be developed for water utility operators and municipal managers.		
2017-12	Bioretention System		
	Town of Wrentham	\$85,937	\$17,200
	This project will install an infiltrating bioretention system at Sweatt Beach in Wrentham. Sweatt Beach is located on Woolford Road at the edge of Lake Pearl. This beach is highly popular with the residents of Wrentham and has a large number of users in the summer. The bioretention system will provide recharge to groundwater and augment streamflow, remove sediment and chemical pollutants from the stormwater runoff, and provide great educational opportunities to the public.		

Appendix C – Minimization and Mitigation Activities

Minimization is required of all permittees with groundwater wells in subbasins with an August net groundwater depletion of 25 percent or more (see the subbasin map at <http://www.mass.gov/eea/agencies/massdep/water/watersheds/sustainable-water-management-initiative-swmi.html>).

The table below shows the full suite of minimization activities identified in the *Water Management Act Permit Guidance Document*, November 7, 2014. Permittees are expected to implement the activities tailored to their particular circumstances that will minimize water withdrawals and withdrawal impacts, taking into consideration cost, level of improvement expected to result from the minimization actions, available technology and the applicant’s authority to implement an activity.

Appendix C: Minimization Table for Public Water Systems	
Minimization activities to be evaluated for inclusion in a Minimization Plan required of Permittees with groundwater withdrawals in subbasins with an August net groundwater depletion of 25% or more	
<ul style="list-style-type: none"> operational changes aimed at minimizing impacts to stream flow from groundwater withdrawals (optimization) 	
<ul style="list-style-type: none"> surface water releases from water supply impoundments to improve the timing, magnitude and duration of downstream flows to more closely mimic natural conditions without compromising other in-lake uses 	
<ul style="list-style-type: none"> water returns that result in improvements to the quantity and timing of streamflow, including <ul style="list-style-type: none"> stormwater recharge, infiltration/inflow improvements, and wastewater discharges 	
<ul style="list-style-type: none"> prescribed nonessential outdoor watering restrictions 	
<ul style="list-style-type: none"> additional conservation activities outlined below 	
Conservation Measures to Reduce Demand	<ul style="list-style-type: none"> Implement a rebate program for residential customers for high-efficiency WaterSense-labeled products (toilets, lavatory faucets, showerheads, and irrigation controllers) and Energy Star-labeled clothes washers Offer incentives for those seeking municipal approvals to install high-efficiency WaterSense-labeled products and Energy Star-labeled appliances in new construction and renovations. Document numbers of products installed in annual report Evaluate rate structure every two years and increase rates for the highest rate block Implement a seasonal rate structure that sets higher rates from May 1 to September 30 Increase billing frequency to at least quarterly On water bills, provide customers with water consumption information in gallons and show consumption history
Conservation Measures to Reduce Water Losses	<ul style="list-style-type: none"> Conduct comprehensive water audit of water system every five years Develop and implement a meter replacement program to ensure that all nonresidential water use is properly accounted for Establish penalties and fines for stealing water Install an automated, remote meter reading system Install an automated, remote leak detection system
Conservation Measures to Reduce	<ul style="list-style-type: none"> Include some or all of the following provisions in an outdoor water use bylaw or ordinance to ensure proper installation and efficient operation of automatic sprinkler systems:

Appendix C: Minimization Table for Public Water Systems	
Minimization activities to be evaluated for inclusion in a Minimization Plan required of Permittees with groundwater withdrawals in subbasins with an August net groundwater depletion of 25% or more	
Nonessential Outdoor Watering	<ul style="list-style-type: none"> ○ require registration of automatic irrigation systems; ○ minimize installation of high water use landscape areas; ○ restrict land clearing and lawn size in new developments and require a minimum 6-inch depth of topsoil on all cleared areas to help retain moisture; and, ○ prohibit topsoil stripping ● Provide incentives to improve efficiency of automatic irrigation systems ● On municipal properties with automatic irrigation systems, install WaterSense-labeled weather-based controllers ● Target highest water users with monthly mailing about their use from May 1 through Sept. 30. Provide information comparing their use with most efficient customers ● Extend seasonal limits on nonessential outdoor water use to private well users ● Provide incentives for customers to infiltrate rainwater; infiltrate rainwater on municipal properties ● Provide incentives for customers to enhance soil health; enhance soil health on municipal properties

Mitigation is required for withdrawals exceeding a permittee’s baseline, based on 2003-2005 withdrawals. Mitigation must be commensurate with the impact of the increased withdrawals, to the extent feasible. Permittees are required to develop a mitigation plan as part of the permit application process and must consider the elements in the table below. However, should water use increase by less than forecast, mitigation implementation will be required only for actual water withdrawal increases.

The table below shows the full suite of mitigation activities identified in the *Water Management Act Permit Guidance Document*, November 7, 2014. Permittees are expected to implement the activities tailored to their particular circumstances that will mitigate water withdrawals and withdrawal impacts.

Appendix C: Mitigation Table for Public Water Systems	
Mitigation activities to be evaluated for inclusion in a Mitigation Plan required of Permittees with for withdrawals exceeding a permittee’s baseline, based on 2003-2005 withdrawals	
Direct Mitigation – Activities that result in enhanced streamflow through groundwater contribution, streamflow contribution or surface water releases. Credit is based on volume of water returned to streamflow.	
	<ul style="list-style-type: none"> ● surface water releases from water supply impoundments to improve the timing, magnitude and duration of downstream flows to more closely mimic natural conditions without compromising other in-lake uses ● stormwater recharge to groundwater, including but not limited to, physically disconnecting redeveloped impervious areas that are directly connected to surface water so that stormwater has an opportunity to infiltrate into the soil and recharge the underlying aquifer ● Municipal Separate Storm Sewer Systems Permit (MS4) implementation work that results in increased stormwater infiltration

Appendix C: Mitigation Table for Public Water Systems	
Mitigation activities to be evaluated for inclusion in a Mitigation Plan required of Permittees with for withdrawals exceeding a permittee’s baseline, based on 2003-2005 withdrawals	
<ul style="list-style-type: none"> • infiltration and inflow (I/I) – completed rehabilitation work and follow-up analyses <ul style="list-style-type: none"> ○ infiltration is groundwater that enters collection systems through sources such as defective pipes, pipe joints and manhole walls ○ inflow is water that enters the collection systems through catch basins, manhole covers, cross connections with storm drains, sump pumps, foundation drains and downspouts <ul style="list-style-type: none"> ▪ direct mitigation credit is not given for I/I program plans and studies done prior to undertaking rehabilitation work 	
<ul style="list-style-type: none"> • activities that physically return wastewater to groundwater • activities or releases that will offset impacts to fishery resources 	
Indirect Mitigation - Activities undertaken to compensate for streamflow impacts resulting from withdrawals. Indirect mitigation activities are not generally amenable to volumetric calculation.	
Habitat Improvement	<ul style="list-style-type: none"> • Remove a dam or other flow barrier • Culvert replacement to meet stream crossing standards • Stream restoration (riparian planting and daylighting) • Install and maintain fish passage • Establish and contribute to an aquatic habitat restoration fund
Habitat Protection	<ul style="list-style-type: none"> • Acquire property in Zone II of public water supply wells to protect source water quality • Acquire property for other natural resource protection
Wastewater	<ul style="list-style-type: none"> • Infiltration and inflow (I/I) program plan and studies (not completed I/I rehabilitation work)
Optimization	<ul style="list-style-type: none"> • Make withdrawals from a subbasin adjacent to stream reach surcharged by discharge flows
Stormwater	<ul style="list-style-type: none"> • Stormwater bylaw that exceeds MS 4 requirements • Other MS4 implementation (not work that results in increased stormwater infiltration) • Stormwater utility resulting in increased groundwater recharge
Bylaws (non-stormwater)	<ul style="list-style-type: none"> • By-law regulating non-essential outdoor water use from privately owned wells • Wetlands bylaw • By-law regulating the nutrient content of fertilizer
Water Quality Improvements	<ul style="list-style-type: none"> • TMDL implementation activities • Septic system maintenance program • Other water quality improvements

Appendix D - Rate Survey of Public Water Suppliers with New WMA Permits**Shrewsbury Water Department Conservation Rate Survey**

Contact Person(s): **Dan Morgado, Robert Tozeski, Jeff Howland, Kristen Las**

Date of Phone Survey: **May 23, 2017**

6. Did your newly issued WMA permit result in the implementation of any new water conservation or mitigation measures? Please explain.

Yes. The following is a list of some of the new water conservation/mitigation measures taken because of the WMA Permit:

- **Annual Industrial, Commercial, and Institutional Water Conservation Program**
- **Toilet Rebate Program (2015-2016 only)**
- **Tracking of Additional Stormwater Recharge through Redevelopment**
- **Additional Seasonal Limits on Nonessential Outdoor Water Use**
- **More frequent Leak Detection Survey & Repairs**

The WMA permit reinforced many of the Town of Shrewsbury's existing water conservation/mitigation measures. Some of the measures include:

- **Provision of water-saving devices (faucet aerators & low flow showerheads)**
- **Public Education & Outreach**
- **Retrofit of all Municipal Buildings**
- **Meter Replacement Program**
- **Calibration of Source/Finished Water Meters**
- **Infiltration / Inflow removal program**

7. If yes, please estimate the cost of each of these newly implemented measures.

One of the largest costs to the Town of Shrewsbury because of the WMA permit is the \$50,000 per year for the Poor Farm Brook Monitoring although it is not a new water conservation/mitigation measure.

Other costs include \$5,000 annual appropriation for the restoration of the Poor Farm Brook Habitat, \$17,000 per year for leak detection, and \$250,000 to replace the residential meters. However, many of these measures were already ongoing.

8. Did you/do you anticipate increasing your rates to cover any costs incurred for implementing your WMA permit? If yes, when and by how much (per gallon increase estimate or per household increase estimate)? If no, why?

Yes, albeit a minimal increase because of the WMA permit since the permit reinforces many of the existing water conservation/mitigation measures. Other capital projects, such as a new Water Treatment Plant, has a much larger impact on rates.

9. What is the date of your last rate review?

August 2016

10. What is the date of next review?

August 2017

Shrewsbury Water Department Rates

<u>Rate</u>	<u>Range</u>	<u>7/1/1991</u>	<u>6/1/2003</u>	<u>8/29/2006</u>	<u>9/1/2008</u>	<u>3/1/2012</u>	<u>1/1/2016</u>
Residential & Condominiums	Minimum (0 to 5,000 Gallons)	\$24.00	\$15.00	\$16.50	\$19.00		
	5,001 to 25,000 Gallons/Thousand	\$1.80	\$2.50	\$2.85	\$3.20		
	25,001 to 50,000 Gallons/Thousand	\$1.80	\$4.50	\$5.20	\$6.00		
	Over 50,000 Gallons/Thousand	\$2.40	\$5.50	\$6.35	\$7.75		
	Minimum (0 to 5,000 Gallons)					\$21.00	\$24.00
	5,001 to 25,000 Gallons/Thousand					\$3.40	\$3.70
	25,001 to 60,000 Gallons/Thousand					\$6.30	\$6.90
	Over 60,000 Gallons/Thousand					\$10.00	\$14.00
Commercial	Minimum (0 to 5,000 Gallons)	\$24.00	\$24.00	\$27.50	\$32.50	\$36.00	\$40.00
	5,001 to 25,000 Gallons/Thousand	\$1.80	\$1.80	\$2.10	\$2.50	\$2.80	\$3.30
	25,001 to 50,000 Gallons/Thousand	\$1.80	\$1.80	\$2.10	\$2.50	\$3.80	\$4.30
	Over 50,000 Gallons/Thousand	\$2.40	\$2.40	\$2.80	\$3.50	\$3.80	\$4.30
Apartments	Flat Rate/Thousand	\$3.00	\$3.00	\$3.45	\$4.00	\$4.25	\$4.50
Residential Lawns	Minimum (0 to 5,000 Gallons)	\$24.00	\$24.00				
	5,001 to 25,000 Gallons/Thousand	\$1.80	\$1.80				
	25,001 to 50,000 Gallons/Thousand	\$1.80	\$1.80				
	Over 50,000 Gallons/Thousand	\$2.40	\$2.40				
Residential Lawns	Minimum			N/A	\$19.00	\$21.00	\$24.00
	0 to 60,000 Gallons/Thousand			\$4.50	\$5.75	\$6.30	\$6.90
	over 60,001 Gallons/Thousand			\$4.75	\$6.00	\$10.00	\$14.00
Residential Summer	Flat Rate/Thousand	\$3.00	\$3.00				
	Minimum			N/A	\$19.00	\$21.00	\$24.00
	0 to 60,000 Gallons/Thousand			\$4.50	\$5.75	\$6.30	\$6.90
	over 60,001 Gallons/Thousand			\$4.75	\$6.00	\$10.00	\$14.00
Apartment Lawns	Flat Rate/Thousand	\$3.00	\$3.00				
	Minimum			N/A	\$19.00	\$21.00	\$24.00
	0 to 60,000 Gallons/Thousand			\$4.50	\$5.75	\$6.30	\$6.90
	over 60,001 Gallons/Thousand			\$4.75	\$6.00	\$10.00	\$14.00
Commercial Lawns	Flat Rate/Thousand	\$3.00	\$3.00				
	Minimum			N/A	\$19.00	\$21.00	\$24.00
	0 to 60,000 Gallons/Thousand			\$4.50	\$5.75	\$6.30	\$6.90
	over 60,001 Gallons/Thousand			\$4.75	\$6.00	\$10.00	\$14.00
Condominium Lawns	Flat Rate/Thousand	\$3.00	\$3.00				
	Minimum			N/A	\$19.00	\$21.00	\$24.00
	0 to 60,000 Gallons/Thousand			\$4.50	\$5.75	\$6.30	\$6.90
	over 60,001 Gallons/Thousand			\$4.75	\$6.00	\$10.00	\$14.00
School & Municipal	Minimum (0 to 5,000 Gallons)	\$24.00	\$24.00	\$24.00	\$24.00	\$36.00	\$40.00
	5,001 to 50,000 Gallons/Thousand	\$1.80	\$1.80	\$1.80	\$1.80	\$2.30	\$2.50
	Over 50,000 Gallons/Thousand	\$2.40	\$2.40	\$2.40	\$2.40	\$3.40	\$3.80
School & Municipal Lawns	Flat Rate/Thousand	\$3.00	\$3.00	\$3.00	\$3.00	\$3.50	\$3.80

Provincetown Water Department Conservation Rate Survey

Contact Person(s): **Cody Salisbury**

Date of Phone Survey: **May 19, 2017**

1. Did your newly issued WMA permit result in the implementation of any new water conservation or mitigation measures? Please explain.

No. First, the renewed permit did not change withdrawal volume from the previous permit (overall withdrawal is limited to registered volume). Second, non-essential outdoor restrictions were previously implemented as a result of operating under a Declaration of Water Emergency, and most recently as a condition of the prior Water Management Act permit (until a redundant water supply was placed in service). Provincetown Water Department is continuing to implement water use restriction annually beginning on June 1, and will implement on May 1 per the WMA permit should the assigned monitoring well trigger be reached.

2. If yes, please estimate the cost of each of these newly implemented measures.

N/A

3. Did you/do you anticipate increasing your rates to cover any costs incurred for implementing your WMA permit? If yes, when and by how much (per gallon increase estimate or per household increase estimate)? If no, why?

Not at this time, see response to Question 1.

4. What is the date of your last rate review?

Rates were last adjusted in 2009

5. What is the date of next review?

Currently undergoing a rate study, to be implemented within 6-8 months.

Provincetown Water Department Rates

Basic Service Fee Per Account:

Meter Size	Fee Per Billing Period
5/8"	\$ 66.00
3/4"	\$ 72.60
1"	\$ 92.40
1½"	\$ 118.80
2"	\$ 191.40
3"	\$ 726.00

Peak Period – April 15 through October 15:

0 to 15,000 gallons	\$5.00 for each 1,000 gallons
16,000 to 40,000 gallons	\$7.50 per additional 1,000 gallons
41,000 to 100,000 gallons	\$12.00 per additional 1,000 gallons
Over 100,000 gallons	\$16.00 per additional 1,000 gallons

Off-Peak Period –October 16 through April 14:

0 to 15,000 gallons	\$3.00 for each 1,000 gallons
16,000 to 40,000 gallons	\$5.00 per additional 1,000 gallons
41,000 to 100,000 gallons	\$7.00 per additional 1,000 gallons
Over 100,000 gallons	\$9.00 per additional 1,000 gallons

On September 18, 2015 the Provincetown Water and Sewer Board held a public hearing and voted to adopt the following schedule of water rates.

Schedule of Various Water-Related Fees

Miscellaneous Fees	
Turn on/off: Monday - Thursday: 7:00 a.m. - 4:00 p.m.; or Friday: 7:00 a.m. - 11:00 a.m.	No Charge
Turn on/off: Outside regular business hours	\$150.00
Meter Testing	\$50.00, waived if meter over-registers
Fire Flow Test	\$75.00
Mark Out Water Service	No Charge
Leak Detection	No Charge
Damaged/Frozen Meter	Current Meter Price
Private Water Main/Commercial Fire Service Inspection	\$2.75/LF of pipe, \$225.00 Minimum

Tap Fees	
1" Service Tap	\$2,100.00 (add'l \$375.00 for street crossing)
1 ½" Service Tap	\$2,300.00 (add'l \$375.00 for street crossing)
2" Service Tap	\$2,500.00 (add'l \$375.00 for street crossing)
>2" Service Tap (incl. Fire Service)	Private Contractor/\$100.00 Permit Fee

Backflow & Cross Connection Survey	
RPPA & DCVA	\$75.00 per device
Cross Connection Survey	\$125.00

On September 18, 2015 the Provincetown Water and sewer Board held a public hearing and voted to adopt the following schedule of miscellaneous water-related fees. On October 13, 2015, the Provincetown Board of Selectmen voted, pursuant to MGL c. 40, §22F, to approve the recommendation of the Water and Sewer Board, effective October 29, 2015.

Cohasset Water Department Conservation Rate Survey

Contact Person(s): **Carl Hillstrom**

Date of Phone Survey: **May 19, 2017**

1. Did your newly issued WMA permit result in the implementation of any new water conservation or mitigation measures? Please explain.

No. Cohasset continues to follow Massachusetts Water Conservation Standards. Cohasset has complied with the water conservation requirements listed in the new permit. Regarding mitigation Cohasset was granted a 1.42MGD credit less the 0.16MGD the permit required.

2. If yes, please estimate the cost of each of these newly implemented measures.

N/A

3. Did you/do you anticipate increasing your rates to cover any costs incurred for implementing your WMA permit? If yes, when and by how much (per gallon increase estimate or per household increase estimate)? If no, why?

No, new permit did not incur new costs.

4. What is the date of your last rate review?

March 30, 2015

5. What is the date of next review?

Anticipated date would be 2020

Cohasset Water Department Rates

Effective July 1, 2015

QUARTERLY CAPITAL RECOVER CHARGES BY METER SIZE AND YEAR					
Meter Size	2016	2017	2018	2019	2020
1-1/2" or Unmetered	\$187	\$187	\$180	\$168	\$170
2"	\$93.50	\$93.60	\$90	\$84	\$85
3"	\$542	\$542	\$523	\$487	\$493
4"	\$1,056	\$1,056	\$1,017	\$949	\$961
4"	\$1,547	\$1,547	\$1,489	\$1,389	\$1,406

ANNUAL FIRE SERVICE CHARGE BY CONNECTION TYPE	
Hydrants (Municipal or Private)	\$730
4" and smaller Sprinkler Connection	\$370
6" and smaller Sprinkler Connection	\$1,100
Larger than 6" Sprinkler Connection	\$1,530

RECOMMENDED BOLUMETRIC WATER RATES		
Tier	Usage	Rate (\$/HCF)
Tier 1	<20 HCF/qtr	\$5.11
Tier 2	>20 HCF/qtr	\$10.22
Municipal Use	All	\$5.11

North Sagamore Water District Conservation Rate Survey

Contact Person(s): **Matt Sawicki**
Date of Phone Survey: **May 19, 2017**

1. Did your newly issued WMA permit result in the implementation of any new water conservation or mitigation measures? Please explain.

Yes, The District must meet 65 RGPCD by December 31, 2019. If we do not meet the 65 RGPCD, we may still have to meet the functional equivalent. Mandatory water restrictions based on a groundwater trigger and drought conditions. Mitigation measures are pending on the preparation of a water needs forecast for the district.

2. If yes, please estimate the cost of each of these newly implemented measures.

To meet the 65 RGPCD, the District must pump 26.164 million gallons of water less to our customers. This is based on our 2016 pumping numbers. This equates to a loss of roughly \$85,033. This is roughly 7.6 percent of our FY18 operating budget. This figure does not include savings on electricity, pump wear etc. A subcontracted water conservation plan/rate evaluation and demand management plan will cost roughly \$74,000. The District also spends \$3,000 annually on water conservation tools offered to our residents to assist in meeting the 65 RGPCD.

3. Did you/do you anticipate increasing your rates to cover any costs incurred for implementing your WMA permit? If yes, when and by how much (per gallon increase estimate or per household increase estimate)? If no, why?

If the District is forced to meet the 65 RGPCD, we must raise our water or tax rates. This will come to roughly \$46.72 annually for our 1,820 customers if our operating budget was to see no increase.

4. What is the date of your last rate review?

April 29, 2014

5. What is the date of next review?

2019

North Sagamore Water District Rates

Past 3 years of water rates:

Up to July 1, 2014:

- \$35.00 Semiannual Fee (includes 40,000 gallons of water)
- \$2.00 per 1,000 gallons - 40,001 to 100,000 gallons
- \$2.25 per 1,000 gallons - over 100,001 gallons

July 1, 2014 to Present

- \$30.00 Semiannual Fee (no included gallons)
- \$1.25 per 1,000 gallons - 1 to 20,000 gallons
- \$2.50 per 1,000 gallons - 20,001 to 50,000 gallons
- \$4.00 per 1,000 gallons - over 50,001 gallons

The District reads meters and bills our residents twice per year (January and July).

Tax Rates:

FY15 -	Bourne	\$0.88 per \$1,000 of assessed property valuation
	Sandwich	\$0.93 per \$1,000
FY16	Bourne	\$0.79 per \$1,000
	Sandwich	\$0.87 per \$1,000
FY17	Bourne	\$0.84 per \$1,000
	Sandwich	\$0.91 per \$1,000

Our income is split about 50/50 between water rates and tax revenue.

Scituate Water Department Conservation Rate SurveyContact Person(s): **Kevin Cafferty & Sean Anderson**Date of Phone Survey: **May 25, 2017**

1. Did your newly issued WMA permit result in the implementation of any new water conservation or mitigation measures? Please explain.

The permit includes outdoor water use restrictions tied to the water level in Scituate's reservoir. In the 2016 drought, outdoor restrictions went into effect very early. Permit also incorporates streamflow releases from Scituate's reservoir that were very burdensome in the drought.

2. If yes, please estimate the cost of each of these newly implemented measures.

Had streamflow releases led to tapping an emergency interconnection with Cohasset, the connection cost was estimated at \$10,000 and \$2,000 - \$4,000 in water quality testing.

However, Scituate got an agreement to stop releases earlier than outlined in the First Herring Brook Operational Plan, and the emergency connection was not needed.

Note: the releases in the First Herring Brook Operational Plan are being reviewed and may be revised in light of last year's drought and supply problems in Scituate.

3. Did you/do you anticipate increasing your rates to cover any costs incurred for implementing your WMA permit? If yes, when and by how much (per gallon increase estimate or per household increase estimate)? If no, why?

Scituate needs to expand the capacity of the water supply system in order to meet demand and to maintain the releases outlined in the First Herring Brook Operational Plan. System expansion could be on the order of \$1.5 million.

Scituate experienced a 10% drop in revenue in 2016 due to the extraordinary conservation measures instituted during the drought.

4. What is the date of your last rate review?

2015

5. What is the date of next review?

Have begun work with Tighe and Bond on a rate review for this year or next

Scituate Water Department Rates

Water Rates Effective with billings after 01-July-2015 /2016

July 1, 2015 Water Rate Increase 19.5%

(Note: Fees below do not include service charge.)

cubic feet	Residential	Commercial
0	\$1.16/100cf \$0.00	\$0.00
100	\$1.16	\$5.38
200	\$2.32	\$10.76
300	\$3.48	\$16.14
400	\$4.64	\$21.52
500	\$5.80	\$26.90
600	\$6.96	\$32.28
700	\$8.12	\$37.66
800	\$9.28	\$43.04
900	\$10.44	\$48.42
1000	\$11.60	\$53.80
1100	\$12.76	\$59.18
1200	\$13.92	\$64.56
1300	\$5.04/100cf \$18.96	\$69.94
1400	\$24.00	\$75.32
1500	\$29.04	\$80.70
1600	\$34.08	\$86.08
1700	\$39.12	\$91.46
1800	\$44.16	\$96.84
1900	\$49.20	\$102.22
2000	\$54.24	\$107.60
2100	\$59.28	\$112.98
2200	\$64.32	\$118.36
2300	\$69.36	\$123.74
2400	\$74.40	\$129.12
2500	\$79.44	\$134.50
2600	\$84.48	\$139.88
2700	\$89.52	\$145.26
2800	\$94.56	\$150.64
2900	\$99.60	\$156.02
3000	\$104.64	\$161.40
3100	\$8.19/100cf \$112.83	\$166.78
3200	\$121.02	\$172.16
3300	\$129.21	\$177.54
3400	\$137.40	\$182.92
3500	\$145.59	\$188.30
3600	\$153.78	\$193.68
3700	\$161.97	\$199.06
3800	\$170.16	\$204.44
3900	\$178.35	\$209.82
4000	\$186.54	\$215.20
4100	\$194.73	\$220.58
4200	\$202.92	\$225.96
4300	\$211.11	\$231.34
4400	\$219.30	\$236.72
4500	\$227.49	\$242.10
4600	\$235.68	\$247.48
4700	\$243.87	\$252.86
4800	\$252.06	\$258.24
4900	\$260.25	\$263.62
5000	\$268.44	\$269.00
5100	\$276.63	\$274.38
5200	\$284.82	\$279.76
5300	\$293.01	\$285.14
5400	\$301.20	\$290.52
5500	\$309.39	\$295.90
5600	\$317.58	\$301.28
5700	\$325.77	\$306.66
5800	\$333.96	\$312.04
5900	\$342.15	\$317.42
6000	\$350.34	\$322.80
Add \$8.19 for each 100 cu ft over 6000 (e.g. for 8300 cubic feet, usage charge equals \$511.17)		Add \$5.38 for each 100 cu ft over 6000 (e.g. for 8300 cubic feet, usage charge equals \$446.54)

water service charge*	
5/8 inch	\$ 61.75
3/4 inch	\$ 76.00
1.0 inch	\$ 96.00
1.5 inch	\$ 166.55
2.0 inch	\$ 240.75
3.0 inch	\$ 400.05
4.0 inch	\$ 537.55
6.0 inch	\$ 942.95

water usage charges*	
Residential:	
0-12 ccf	@ \$1.16/100cf
13-30 ccf	@ \$5.04/100cf
over 30 ccf	@ \$8.19/100cf
Others: @ \$5.38/ccf	
Commercial, for all ccf etc.	

7/1/16 NONE
 *7/1/15 water increase 19.5%
 7/1/14 water increase 19.2%
 8/1/13 water increase 10%
 10/16/12 water increase 10%
 07/01/11 water increase 5%
 7/1/10 water increase 5%
 7/1/09 water increase 5%
 7/1/2008

sewer service charge**
\$58.50 which includes 12.5 hundred cubic feet of usage
Additional hundred cubic feet at \$4.70 each

**7/1/13 sewer increase 2%
 2/1/11 sewer increase 10%

10/1/16
 58.50 which includes 12.5 hundred cubic feet of usage -

Duxbury Water Department Conservation Rate Survey

Contact Person(s): **Peter Mackin**

Date of Phone Survey: **May 23, 2017**

1. Did your newly issued WMA permit (provide actual date) result in the implementation of any new water conservation or mitigation measures? Please explain.

Duxbury's permit was issued October 6, 2016. Mandatory outdoor water use restrictions (three days a week, watering allowed 4 am to 8 am and 5 am to 9 pm) were implemented for the first time on June 26, 2016 in an effort to meet the upcoming permit standard of 65 RGPCD.

2. If yes, please estimate the cost of each of these newly implemented measures.
 - **\$3,200 for signage outlining restrictions.**
 - **Cost of enforcement has not yet been determined, due to the fact the permit was issued after the outdoor water use restriction season was over.**
 - **Loss of revenue has not yet been determined, for the same reason as above.**
3. Did you/do you anticipate increasing your rates to cover any costs incurred for implementing your WMA permit? If yes, when and by how much (per gallon increase estimate or per household increase estimate)? If no, why?

Yes, rates are expected to increase based on the need to make up for the revenue loss associated with achieving 65 RGPCD (2016 RGPCD was 84). Expect to have rate study done by May of 2018. Preliminary calculations indicate the increase may be about 20 percent, or \$120 per household.

4. What is the date of your last rate review?

February, 2010.

5. What is the date of next review?

May, 2018.

Duxbury Water Department Rates

Effective March 1, 2010

BASE CHARGE (SEMI-ANNUAL) (SENIOR RATE MUST BE 62 YEARS OF AGE OR OLDER – CALL THE WATER DEPT OFFICE @ 781-934-1100 Ext 129)

CURRENT FULL RATE \$40.00

SENIOR RATE \$20.00

CONSUMPTION (SEMI-ANNUAL PER 1,000 GALLONS)

0 - 20,000 GALS	\$4.55 Per Thousand
21,000 – 60,000 GALS	\$5.83 Per Thousand
61,000 – 120,000 GALS	\$6.70 Per Thousand
121,000 + GALS	\$8.05 Per Thousand

SERVICES CHARGES

TURN-OFF = \$25.00

TURN-ON = \$25.00

FROZEN METER = ACTUAL COST OF METER / READ BOX = ACTUAL COST OF BOX

WATER LATE FEE POLICY BASED ON THE BILLING DATE OF ISSUE – Per Water & Sewer Commissioners: A Demand Notice and \$10.00 fee will be generated when bill is 31- 45 days old. A SHUT-OFF WARNING NOTICE and an additional \$10.00 fee will be generated when the bill is 60 days old. When the bill becomes 75 days or older ACTUAL SHUT-OFF PROCEDURES BEGIN.

SYSTEM DEVELOPMENT CHARGE (NO PROPOSED CHANGES) – FOR EACH FAMILY OR EQUIVALENT FAMILY UNIT TO BE PROVIDED WITH WATER SERVICE THROUGH THE PROPOSED NEW SERVICE CONNECTION, A ONE-TIME CHARGE SHALL BE DUE AND PAYABLE WHEN APPLICATION FOR WATER SERVICE IS MADE. THE CHARGE SHALL BE **\$1000.00 (PLUS SERVICE CONNECTION FEE)** PER FAMILY OR EQUIVALENT, **BUT NOT LESS THAN** THE FOLLOWING CHARGES BASED ON THE SIZE METER TO BE INSTALLED.

<u>METER SIZE</u>	<u>METER CAPACITY*</u>	<u>CHARGE PER METER</u>
5/8"	20	\$ 1,000.00
3/4"	30	\$ 1,500.00
1"	50	\$ 2,500.00
1 1/2"	100	\$ 5,000.00
2"	160	\$ 8,000.00
3"	300	\$15,000.00
4"	500	\$25,000.00
6"	1000	\$50,000.00
8"	1600	\$80,000.00

*RATED CAPACITY OF DISPLACEMENT METERS IN GALLONS PER MINUTE A.W.W.A. MANUAL NO. M8

SERVICE CONNECTION FEE FOR PHYSICAL CONNECTION (NO PROPOSED CHANGE)

TAPPED	\$ 500.00
UNTAPPED	\$1,000.00

Kingston Water Department Conservation Rate Survey

Contact Person(s): **Matt Darsch**
Date of Phone Survey: **May 23, 2017**

1. Did your newly issued WMA permit result in the implementation of any new water conservation or mitigation measures? Please explain.

Changed outdoor water use restrictions from odd/even days down to 2 days per week because they are above 65 RGPCD.

2. If yes, please estimate the cost of each of these newly implemented measures.

No additional costs are anticipated due to renewed permit conditions.

3. Did you/do you anticipate increasing your rates to cover any costs incurred for implementing your WMA permit? If yes, when and by how much (per gallon increase estimate or per household increase estimate)? If no, why?

No anticipated rate changes in the near future. Rates were last raised in 2014 to account for new treatment plant. RGPCD is 67 to 69, so no large reduction in water use is anticipated.

4. What is the date of your last rate review?

May 2014

5. What is the date of next review?

Will review after seeing what the impacts of increased water use restrictions are, but do not anticipate that a rate increase will be necessary. Commissioners have raised rates only twice in the last 20 years, most recently in 2014.

Kingston Water Department Rates

WATER RATES EFFECTIVE 5-1-14- - QUARTERLY BILLING

\$36.00 – Service Charge (\$12.00 per month)

\$2.50 – Per Thousand	0 Gallons – 10,000 Gallons
\$3.00 – Per Thousand	10,001 Gallons – 20,000 Gallons
\$4.00 – Per Thousand	20,001 Gallons – 30,000 Gallons
\$4.25 – Per Thousand	30,001 Gallons – 40,000 Gallons
\$5.75 – Per Thousand	40,001 Gallons - 60,000 Gallons
\$6.00 – Per Thousand	60,001 Gallons – 80,000 Gallons
\$6.25 – Per Thousand	80,001 Gallons - 100,000+ Gallons

Comprehensive Review of Revised WMA Permit Requirement

Appendix E - Sample 20-Year Permit Renewal Summary Sheet

WMA Program staff, in consultation with staff from MassDFG and MassDCR, conducts in-house analyses of permits in each river basin prior to conducting pre-permitting Outreach Workshops. At the workshops each permittee is given a Permit Renewal Summary Sheet with an initial assessment of their water use, residential gallons per capita day water use (RGPCD) and unaccounted-for-water (UAW), water needs forecasts for the coming permit, and a preliminary assessment of the permittee's baseline and outdoor water use triggers, and whether minimization, mitigation or CFR protection will be required in the permit.

Sample 20-Year Permit Renewal Summary Sheet

Reported Use Summary

Reporting Year	2009	2010	2011	2012	2013	2009-13 Average	Current Allocation
Rate of Withdrawal (mgd)	1.33	1.33	1.29	1.32	1.24	1.30	1.26

Performance Standard Summary

	Base from Forecast	2013 DEP-Accepted	Statewide Standard
RGPCD	56.5	52.3	65
UAW	12.8	1.3	10

Water Needs Forecast Summary

Water Needs Forecast Scenarios (mgd)	2020	2025	2030	5% Buffer	2030 + buffer
Based on 65 rgpcd and 10% UAW	1.64	1.70	1.75	0.09	1.84
Based on Current Trends	1.51	1.56	1.61	0.08	1.69

Permit Data Summary

Permit Requirements Information		Comments
CFR Consultation Required?	Yes	CFR in subbasin xyz
Minimization Required?	Yes	August net depletion is greater than 25% in subbasin xyz
Estimated renewal in mgd	1.69	Based on Current Trends Forecast for 2030+buffer
Baseline (BL) in mgd	1.26	Based on 2003-2005 Average Volume plus 5%
Projected increase above BL	0.43	Based on Current Trends Forecast for 2030+buffer minus baseline (1.69-1.26)
Estimated Permit Tier	2	Renewal request is above baseline but doesn't change BC or GWC
Mitigation Required?	Yes	Projected increase above baseline

Subbasin Data Summary

	subbasin ID xyz
Percent August Net Groundwater Depletion	59.40%
Groundwater Withdrawal (GWC)	5
Increase causes GWC change?	No
Biological Category (BC)	5
Increase cause BC change?	No
Coldwater Fishery (CFR)?	Yes

Non-essential Outdoor Water Use Streamflow Trigger

Trigger location:	
USGS Streamflow Gage 01010101- ABC River at DEF, MA	
Time Period	Trigger Value
May-June Trigger	31 cubic feet per second (cfs)
July-Sept Trigger	13 cfs
7 Day Low Flow Trigger	4.9 cfs

Comprehensive Review of Revised WMA Permit Requirement

Appendix F – 2016 “Guidance on Outdoor Water Use Restrictions for Specific Drought Levels”

“Limiting outdoor water use helps ensure that enough water is available for essential needs, including drinking water, fire protection, crop irrigation and harvesting and our natural resources. Towns may have particular circumstances that make limiting water use more urgent to ensure water in an emergency.

Nothing in a Water Management Permit or Registration prevents a public water supplier from implementing water use restrictions that are more stringent than those set forth in their permit, registration or in this guidance.

Regions in Drought Warning: Severe drought conditions

- Outdoor water use should be banned.

Regions in Drought Watch: Moderate drought conditions

- Outdoor watering should be limited to “handheld” with a hose or a watering can after 5 p.m. or before 9 a.m. (to avoid evaporative losses).
- Outdoor watering with irrigation systems and sprinklers should be banned.
- Watering of municipal parks and recreation fields with irrigation systems and sprinklers may continue, at the public water supplier’s discretion, before 9 a.m. and after 5 p.m.
- Filling swimming pools, washing cars and washing buildings should be banned.

Regions in Drought Advisory: Conditions are abnormally dry

- Outdoor watering with irrigation systems and sprinklers should be limited to no more than one day per week before 9 a.m. and after 5 p.m.
- Watering with a handheld hose should be limited to after 5 p.m. or before 9 a.m. (to avoid evaporative losses).

Households and businesses that draw water from private wells should conserve water by reducing indoor and outdoor water usage, and by abiding by the water use restrictions in place in their community.

In Water Management permits, certain water uses are not subject to mandatory restrictions. The following water uses should be exempted from mandatory water restrictions and water bans.

- For health or safety reasons;
- For the production of food and fiber;
- For the maintenance of livestock;
- To meet the core functions of a business (for example, irrigation by plant nurseries as necessary to maintain stock).”