Water Management Act Permit Guidance Document

November 7, 2014

Massachusetts Department of Environmental Protection

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1. Introduction

This document serves as a companion to the Massachusetts Department of Environmental Protection (the Department) Water Management Act Regulations (310 CMR 36.00) and is intended to provide guidance on Water Management Act (WMA) permit requirements outlined in the regulations, with a specific focus on new and revised requirements incorporated through the Executive Office of Energy and Environmental Affairs (EEA) Sustainable Water Management Initiative (SWMI), summarized in Section 2. Additional general guidance for WMA permits is posted on the Department's website at http://www.mass.gov/eea/agencies/massdep/water/watersheds/water-management-act-program.html. The intended audience for this guidance is WMA permit applicants, WMA permittees, and others assisting with the 20-year permit renewal process for WMA permits.

2. Background on the Sustainable Water Management Initiative

The Sustainable Water Management Initiative (SWMI) was created in 2010 by EEA in partnership with the Department, the Department of Conservation and Recreation (DCR), and the Department of Fish and Game (DFG); together the three Departments are referred to as "the agencies." The initiative established an Advisory Committee and a Technical Subcommittee, comprised of a wide range of stakeholders, to advise EEA and its agencies on sustainable management of water resources that balance human and ecological needs.

The SWMI Advisory Committee adopted an overall principle to help frame the discussion and future decisions: "The Commonwealth's water resources are public resources that require **sustainable management practices** for the well-being and safety of our **citizens**, protection of the **natural environment**, and for **economic growth**." (Emphasis added) The SWMI Framework Summary (the Framework), published in November 2012, summarized the elements developed through SWMI and outlined how the Department will apply these elements to the WMA permitting program. The Framework can be found at: http://www.mass.gov/eea/waste-mgnt-recycling/water-resources/preserving-water-resources/sustainable-water-management/framework/sustainable-water-management-framework-summary.html

The Framework also outlined a pilot application of SWMI to evaluate how the Framework would be applied, and thereby inform and guide the incorporation of SWMI into the WMA regulations. The pilot process, which included four public water suppliers (PWSs) representing different system characteristics, spanned approximately nine months and provided very valuable insights on implementation of the SWMI framework, which are summarized in the final reports (http://www.mass.gov/eea/agencies/massdep/water/watersheds/sustainable-water-management-initiative-swmi.html and are reflected in this document and the regulations.

The Framework and pilots, along with ongoing and extensive consultation with stakeholders, have helped to determine how the core SWMI principles of sustainable management practices for the well-being and

safety of citizens, protection of the natural environment, and economic growth have been incorporated into the WMA Regulations. The following is a short summary of how the WMA regulations reflect these three principles.

Sustainable Management Practices

The WMA regulations have been revised to reflect over ten years of scientific investigation developed in partnership with the United States Geological Survey (USGS), which resulted in four major studies that build upon each other and lay the framework for the science that supports SWMI and WMA decision making. These studies have informed the agencies' and public's understanding of sustainable management and are briefly described in Appendix A. The key elements used in SWMI are outlined below:

- Natural streamflow estimates are used as a reference point to help understand the magnitude of changes resulting from water withdrawals and wastewater discharges.
- A cumulative water balance picture was developed to establish a "cumulative condition" and account for the effect of withdrawals and discharges during the time period from 2000-2004.
- Baseline water use was established to approximate use during the 2000-2004 time period and to serve as a reference point from which to measure future increases in water withdrawals.
- Streamflow Criteria, Biological Categories and Groundwater Withdrawal Categories were developed to capture the key insight of these studies—that the more water that is withdrawn from an aquifer, particularly in summer months, the greater the loss of the functions and values of streams and rivers. These include five Biological Categories (1 = least impacted to 5 = most impacted) using fish data as a surrogate for aquatic health, five Groundwater Withdrawal Categories (1 = least withdrawals to 5 = most withdrawals) using withdrawals compared to estimated natural flow, and Seasonal Groundwater Withdrawal Categories using withdrawals compared to estimated natural flow for five bioperiods. The upper boundaries of each category are the Streamflow Criteria for that category. See Appendix A and the Framework for a further description of the categories.

Recognizing the well-being and safety of our citizens and economic growth

The Framework states that existing water supply areas or those subbasins that currently provide public water (approximately 35% of all subbasins) are considered critical areas. Not surprisingly, many of these areas are categorized as a Groundwater Withdrawal Category 4 or 5 because they are serving as significant public water supplies. These areas are also almost exclusively located within the high and medium yield aquifers of the state as those are the areas where it made the most sense (from a water supply perspective) to develop groundwater sources. Ensuring that there is ample water available for the well-being and safety of our citizens and economic growth is addressed in the WMA regulations through:

- The Water Needs Forecasts Methodology applied by DCR to develop 20-year water needs forecasts for the Department's WMA permits for PWSs. Forecasts include economic growth considerations and assume efficient water use, represented by the State Water Conservation Standards of 65 residential gallons per capita per day (RGPCD) and 10% unaccounted for water (UAW).

- Emphasis on the importance of existing withdrawals and legitimate future needs which are acknowledged through the factors outlined in the WMA that the Department must consider in permitting. To meet the goal of protection of the natural environment, PWSs are being required to manage water efficiently to reduce further environmental impact and to improve conditions to the greatest extent feasible, through permit requirements outlined below and further described throughout this document.

Protection of the Natural Environment

Sections 4 through 9 of this document provide detailed information on WMA permit requirements which are intended to protect the natural environment. In summary the requirements include but are not limited to:

- Standard Permit Conditions Implementing Best Management Practices (Section 5): All permittees must implement water conservation and demand management measures and place limits on nonessential outdoor watering.

- Minimization (Section 6): Groundwater permittees in areas where groundwater is depleted must minimize their existing impacts, even if they are not increasing their withdrawals.

- Coldwater Fish Resource (CFR) Protection (Section 7): All permittees with withdrawals that impact streamflow at a CFR must evaluate ways of reducing their impacts. Permittees whose withdrawals are increasing must evaluate ways to mitigate their increased impacts, in consultation with the Department and DFG.

- Alternative Sources (Section 8): Groundwater permittees whose increasing withdrawals will change the biological or groundwater withdrawal category of the subbasin in which they are withdrawing must show they have no feasible alternatives that are less environmentally harmful.

- Mitigation (Sections 4 and 9): Permittees whose withdrawals are increasing must mitigate the increased impacts of their withdrawals.

For more information on SWMI, consult the November 28, 2012 Framework Summary at http://www.mass.gov/eea/waste-mgnt-recycling/water-resources/preserving-water-resources/sustainable-water-management/framework/sustainable-water-management-framework-summary.html

3. Overview of the Permitting Process

The timeline and process for requesting a WMA permit renewal or a WMA permit for a new withdrawal are different and are outlined separately in the tables below. For additional information on application review timelines for all permits, and for permit amendments, refer to 310 CMR 4.00: Timely Action Schedule and Fee Provisions.

For most river basins, the Sustainable Water Management Initiative concepts will be incorporated into WMA permits at the 20-year permit renewal. The schedule for permit renewals by river basin is shown in Appendix C. For permits that have already been renewed in the Hudson, Blackstone, Charles and North Coastal basins, SWMI-related permit conditions will be developed in consultation with the Department and EEA Agencies and incorporated at the next 5-year review. The WMA permit renewal process begins approximately 18 months prior to the expiration date for existing permits in each basin. Table 3-1 provides a timeline and summary of activities by the Department and other EEA Agencies to introduce the permit renewal process before permittees submit renewal applications. Table 3-2 provides a timeline and summary of the permit renewal process for existing WMA permits. Table 3-3 provides a timeline and summary of the process for new WMA permit applications.

Table 3-1: Water Management Permit Renewal Roll-out in a River Basin

DEP and EEA Agency Activities before Renewal Application Submission		
Timeline	**Activity**	**Notes on Deliverables**
6 months before application submission date	Water needs forecasts development	DCR Office of Water Resources will contact public water supply permittees to begin development of draft water needs forecasts for permit renewal. Projected water needs and baseline for each applicant will determine the permit tier for its application and will determine the permit conditions in the final permit. Public water supplier (PWS) applicants should see the DCR OWM forecast method at (http://www.mass.gov/eea/agencies/massdep/water/watersheds/water-management-act-program.html). Non-PWS applicants will develop and document water needs projections as part of their application.
Consultations can be scheduled prior to application submission by applicant request	Consultation meetings with permit applicants to identify possible offsets to withdrawal impacts	Required for applicants requesting withdrawals: • that could impact coldwater fish resources; or • that will be greater than the applicant's baseline

Table 3-1: Water Management Permit Renewal Roll-out in a River Basin		
DEP and EEA Agency Activities before Renewal Application Submission		
Timeline	**Activity**	**Notes on Deliverables**
4 months before application submission date	Basin outreach meeting	In river basins with numerous permits, DEP, DCR and DFW will conduct a presentation for all permittees. The presentation will cover the permit renewal process, the SWMI process and new demand management and resource protection conditions that may appear in renewed permits. The basin outreach meeting may serve as a preliminary consultation meeting to identify possible offsets (unless applicants request an earlier consultation).
Application submission date – 12 months before permit expiration	Applicant submits a renewal application.	Submit Water Management Act Permit Renewal Application, available on DEP's website.

Table 3-2: Permit Renewal Application Timeline (Renewals cannot be for more than was previously permitted)		
Timeline	**Activity**	**Notes on Deliverables**
Before Application Submission		
12 months before permit expiration	Applicant submits a renewal application.	Submit Water Management Act Permit Renewal Application, available on DEP's website.
Consultations will be scheduled by DEP as necessary for applicants that have not met with state agencies prior to application submission	Consultation meetings with state agencies to identify possible offsets to withdrawal impacts	Required of applicants requesting withdrawals: • that could impact coldwater fish resources; or • that will be greater than the applicant's baseline.
After Application Submission		
1 month	Public notice	• DEP posts notice of all renewal applications in a basin in the Environmental Monitor. • DEP accepts written comments for 30 days

Table 3-2: Permit Renewal Application Timeline (Renewals cannot be for more than was previously permitted)		
Timeline	**Activity**	**Notes on Deliverables**
2 ½ months	DEP 72-day technical review period	After the technical review, DEP issues Order to Complete (OTC) requesting any additional information needed to complete the application review, including any required plans to minimize and mitigate the impacts of withdrawals and response to public comment received by DEP.
5 ½ months	Applicant has 90 days to respond to the OTC	Response deadline may be extended upon applicant's request.
8 months	DEP 72-day supplemental technical review period	After the supplemental technical review, DEP will either: • Deem the application complete; • Extend response deadline at the applicant's request; or • Deny the application. An application is complete if all required information is provided.
9 months	If application is complete, DEP will issue draft permit within 30 days for public comment	• DEP notifies other users and watershed associations and posts notice in the Environmental Monitor that draft permit is available for review. • DEP accepts written comment for 30 days.
12 months	DEP issues final permit	DEP may extend the review for up to 9 months if additional time is necessary to give the application proper consideration.
21 days after permit issuance	Permit appeal period.	

Table 3-3: New Permit Application Timeline For withdrawals not previously authorized by registration or permit		
Timeline	**Activity**	**Notes on Deliverables**
Before Application Submission		
Concurrently with application process An application cannot be deemed	For a new public water supply source, the Source Approval Process must be completed prior to permit issuance	Submit, with application or under separate cover, a copy of the Source Approval for the new source. See Drinking Water Regulations (310 CMR 22.21), Guidelines for Public Water Systems.

Table 3-3: New Permit Application Timeline For withdrawals not previously authorized by registration or permit		
Timeline	**Activity**	**Notes on Deliverables**
permit cannot be issued without these approvals	Massachusetts Environmental Policy Act (MEPA) review must be completed as part of the application process	Submit, with application or under separate cover: • A determination that the project does not meet MEPA thresholds; or • A certificate stating that no EIR is required; or • A certificated stating that any FEIR is adequate. See MEPA Regulations (301 CMR 11.00)
6 months before application submission date – PWS applicants should contact DCR Office of Water Resources	Water needs forecasts development	Projected water needs and baseline for each applicant will determine the permit tier for its application and will determine the permit conditions in the final permit. Public water supplier (PWS) applicants should see the DCR OWM forecast method at (http://www.mass.gov/eea/agencies/massdep/water/watersheds/water-management-act-program.html). Non-PWS applicants will develop and document water needs projections as part of their application.
Consultations can be scheduled prior to application submission upon request by the applicant	Consultation meetings with permit applicants to identify possible offsets to withdrawal impacts	Required for applicants requesting withdrawals: • that could impact coldwater fish resources; or • that will be greater than the applicant's baseline.
12 months before applicant anticipates commencing the water withdrawal	Applicant submits a permit application.	Submit Form BRP WM 03, available on DEP's website, and submit applicable fee under separate cover. • See Timely Action Schedule and Fee Provisions Regulations (310 CMR 4.10(6)(oo)) Note: Municipal public water supply systems are exempt from permitting fees
After Application Submission		
1 month	Public notice requirements	• Applicant notifies abutters and posts public notice in local newspaper • DEP notifies other users and watershed associations and posts notice in the Environmental Monitor. • DEP accepts written comments for 30 days.

Table 3-3: New Permit Application Timeline For withdrawals not previously authorized by registration or permit		
Timeline	**Activity**	**Notes on Deliverables**
2 ½ months	DEP 72-day technical review period	After the technical review, DEP issues Order to Complete (OTC) requesting any additional information needed to complete review of the application, including any required plans to minimize and mitigate the impacts of withdrawals and response to public comment received by DEP.
5 ½ months	Applicant has 90 days to respond to the OTC	Response deadline may be extended upon applicant's request.
8 months	DEP 72-day supplemental technical review period	After the supplemental technical review, DEP will either: • Deem the application complete; • Extend response deadline at the applicant's request; or • Deny the application. An application is complete if all required information is provided, including any required MEPA determination or certificate, and Source Approval documentation for a new PWS source.
9 months	If application is complete, DEP will issue draft permit within 30 days for public comment	• DEP notifies other users and watershed associations and posts notice in the Environmental Monitor that draft permit is available for review. • DEP accepts written comment for 30 days.
12 months	DEP issues final permit	DEP may extend the review for up to 9 months if additional time is necessary to give the application proper consideration.
21 days after permit issuance	Permit appeal period.	

4. Overview of Permit Requirements

The Department strives to establish and implement permit requirements that protect, and where possible, improve the natural environment. Five major permit requirements are summarized below and in Tables 4-1, 4-2 and 4-3, and are described in greater detail in Sections 5 through 9.

In this section, we provide a description of the method the Department will use to assess the cumulative impacts of permitted withdrawals to help inform mitigation requirements, and to determine the permit tier for each application. Permit Tiers are based on whether a permittee's requested withdrawal will be more than their baseline water withdrawal, as well as on the impact that the withdrawal will have on the environmental condition in that subbasin.

The following are elements that are part of the permit requirements:

Standard Permit Conditions Implementing Best Management Practices: Permittees must meet (or exceed) standard best management practices outlined in Section 5, including but not limited to:

- Water Conservation requirements including leak detection, metering and education for public water suppliers (Section 5, Table 5a-1 for public water suppliers, Table 5b for cranberry cultivation and Table 5c-1 for golf courses);
- Performance Standards of 65 residential gallons per capita per day (RGPCD) and 10% unaccounted for water (UAW) for public water suppliers (Section 5, Table 5a-2); and
- Limits on non-essential outdoor water use (Section 5, Tables 5a-3 and 5a-4 for public water suppliers and Table 5c-2 for golf courses).

Minimization: All groundwater permittees with withdrawals in subbasins with significant groundwater depletion must minimize the impacts of their withdrawals in those subbasins. These subbasins are defined as having August net groundwater depletion (August NGD) of 25% or greater (http://www.mass.gov/eea/agencies/massdep/water/watersheds/sustainable-water-management-initiative-swmi.html). The equation and data used to calculate August NGD and the specific requirements to minimize the impacts of withdrawals for this group are outlined in Section 6.

Coldwater Fishery Resource (CFR) Protection: All permittees with withdrawals that impact streamflow at a CFR (identified on the interactive SWMI maps and in the permitting tool) must evaluate reducing impacts to CFRs through feasible optimization. Tier 2 and Tier 3 applicants whose withdrawals will increase above their baseline water use must evaluate further protection of their CFRs as part of their required mitigation planning, in consultation with the Department and DFG, Division of Fisheries and Wildlife (DFW).

Alternative Sources: Tier 3 permittees, whose groundwater withdrawals will increase above their baseline water use and cause a change in the biological or groundwater withdrawal category of a subbasin, must show that they have no feasible alternative source that is less environmentally harmful. Section 6 of this document includes the WMA guidance on evaluating optimization of available sources to reduce impact to streamflow and aquatic habitats. Without limitation, technical feasibility and cost should also be evaluated in determining whether a source is a feasible alternative.

Mitigation: Tier 2 and Tier 3 permittees requesting an increase above their baseline withdrawal level must undertake mitigation commensurate with the impact of their increased withdrawals. Permit applicants that cannot avoid changing the biological or groundwater withdrawal category of a subbasin and having no feasible alternative sources that are less environmentally harmful) will be required to implement the highest level of mitigation.

Method for Determining Tiers and Assessing Cumulative Impacts

At the start of the 20-year WMA permit renewal process or soon after the initial filing for a new WMA permit application, the Department will determine an applicant's permit tier based on the rules listed below.

The first threshold that determines a tier is the exceedance of a baseline volume of water, unique to each water system. Baseline water use was established to approximate use during the period where cumulative impacts were assessed. Specifically, baseline water use is the amount of water withdrawn during calendar year 2005 plus 5%, or the average volume withdrawn from 2003 through 2005 plus 5%, whichever is greater, provided that the:

- Baseline cannot be less than registered volume;
- Baseline cannot be greater than the volume authorized in the permit for 2005; and
- When a PWS-permit is renewed, the authorized volume cannot exceed a permittee's 20-year water needs forecast prepared by DCR even if the permittee's baseline is higher than the forecast. Should the permittee's water use rise above the 20-year forecast thereafter, baseline would still be based on 2003-2005 water use and would be used to determine the Permit Tier.
- PWSs that are in multiple basins will have separate baselines for each basin calculated as outlined above and a total system-wide allocation allowing no more than these two values combined. The above listed qualifiers will continue to apply. If either value is exceeded, the baseline condition would be considered to have been triggered.

Rules for Permit Tier Determination

Tier 1: The permittee's withdrawal request is not above baseline.

Tier 2: The permittee's withdrawal request is above baseline, and the

- Permittee only has surface water sources, or
- Permittee has sources only on Cape Cod, the Islands, or the Plymouth-Carver aquifer region, or
- Permittee has groundwater sources, and their groundwater withdrawals will not change the biological category (BC) or groundwater withdrawal category (GWC) in any of their subbasins.

Tier 3: The permittee's withdrawal request is above baseline, and the

- Permittee has groundwater sources, and withdrawals from these sources will change a BC or GWC in any of their subbasins.

* Note that volumes requested which are greater than those already allocated in an existing WMA permit will require the filing of a *new WMA permit* application.

Permittees with surface water sources only or who are located in groundwater-driven water sources (the southern portion of the South Coastal, Cape Cod, Islands, and portions of the Buzzards Bay), cannot be Tier 3 because there are currently no BCs or GWCs defined for these areas[1].

The method for determining whether groundwater withdrawals are in Tier 3 because they will change a BC or GWC is outlined below.

[1] In groundwater-driven areas, the USGS Sustainable Yield Estimator (Archfield et al., 2010) used to develop the BC and GWC for each subbasin is not applicable.

Impact Assessment for Individual Groundwater Withdrawal Points

The individual subbasin assessment allows the Department to evaluate whether an applicant's groundwater withdrawal above baseline will contribute to one or more subbasins changing BC or GWC categories. For this assessment, the Department will assume that any withdrawal request above baseline could be withdrawn from any one subbasin in which the applicant has permitted groundwater sources, unless the applicant specifies otherwise. For each subbasin within which the applicant has a permitted groundwater source, the Department will evaluate whether the entire withdrawal above baseline will cause a change in BC or GWC in that subbasin. If the increased withdrawal would cause a change in BC or GWC in any subbasin within which the applicant has a permitted groundwater source, then the applicant will be subject to Tier 3 requirements. Data and assumptions used in the individual assessment may be refined by the applicant at the start of the permit process. Data refinement options are described in Section 10.

Impact Assessment for the Major Basin

A cumulative impact assessment will be completed for each major basin at the beginning of the WMA permit renewal cycle or upon filing for a new WMA permit. The cumulative impact assessment will consider all new requested WMA permit withdrawals and WMA permit renewal withdrawals above each applicant's baseline. If the Department finds that the cumulative impacts of all increased withdrawals will result in an adverse change in BC or GWC in any subbasin in the major basin, it will be taken into consideration as part of mitigation planning for Tier 2 and Tier 3 applicants whose withdrawals contribute to that subbasin's change in BC or GWC. In addition, those applicants whose withdrawals above baseline are more than 5% of unimpacted August median flow that contribute to a downstream change in BC or GWC may be required to demonstrate there is no feasible alternative source that is less environmentally harmful consistent with the requirements outlined at 310 CMR 36.22(7)(a).

Typical and Non-Typical Seasonal Withdrawal Patterns

Typical Withdrawal Patterns: In order to determine whether an increased individual groundwater withdrawal would contribute to a change in BC or GWC, the Department will assume that: (1) the highest groundwater withdrawal rates occur in the summer months; and (2) impacts to streamflow are greatest during the low flow bioperiod (July to September). The Department will evaluate proposed withdrawals and August streamflow estimates. If there is no change in BC or GWC in any subbasin as a result of the increased individual withdrawal, the streamflow criteria have been met. If proposed withdrawals would meet streamflow criteria in August, the Department will assume that streamflow criteria will be met in all seasons.

Non-Typical Withdrawal Patterns: For withdrawals that will have their greatest impact during the non-summer months, an assessment of the impact of the individual withdrawal on Seasonal Streamflow Criteria for the subbasin will determine whether the groundwater withdrawal is in Tier 3.

Table 4-1: Permit Requirements for Public Water Suppliers			
Water Conservation (Section 5)	Yes, required for all		
Performance Standards of 65 residential gallons per capita per day (RGPCD) and 10% unaccounted for water (UAW) (Section 5)[2]	Yes, required for all		
Limits on nonessential outdoor water use (Section 5)	Yes, required for all		
Minimization of impacts in 25% August Net Groundwater Depleted Subbasins (Section 6)	Required for those permittees with groundwater withdrawal points in subbasins with ≥25% August NGD		
Coldwater Fish Resource (CFRs) Optimization Planning (Section 7)	Required for permittees with ground or surface withdrawals in subbasins with CFRs.		
Mitigation Conditions by Tier for Groundwater Withdrawals (Section 9)[3]	Tier 1	Tier 2	Tier 3
1. Mitigation Mitigate impacts commensurate with withdrawal above baseline, in consultation with agencies.	Not required	Yes, required for all	Yes, required for all. Tier 3 requires up to twice the level of indirect mitigation as Tier 2.
2. Demonstrate no feasible alternative source that is less environmentally harmful. (Section 8)	Not required	Not required	Yes, required for all
Mitigation Conditions by Tier for Surface Water Withdrawals (Section 9)		Tier 1	Tier 2
1. Summer Management Plan with Environmental Considerations Develop summer management plan that ties nonessential outdoor water use restrictions to environmental triggers that can include: reservoir elevations, streamflow triggers, fisheries management plans, reservoir releases, etc.		Not required, unless permittee seeks alternative triggers for nonessential outdoor water use restrictions	
2. Mitigation Mitigate impacts commensurate with withdrawal		Not required	Yes, required for all

[2] PWS permittees on the Cape and Islands and other season communities are not required to meet the RGPCD standard because of seasonal population shifts that make calculating an accurate value difficult.

Table 4-2: Permit Requirements for Cranberry Bogs			
Water Conservation (Section 5b)	Yes, required for all		
Minimization of impacts in 25% August Net Groundwater Depleted Subbasins (Section 6)	Required for those permittees with groundwater withdrawal points in subbasins with ≥25% August NGD		
Coldwater Fish Resource (CFRs) Optimization Planning (Section 7)	Required for permittees with ground or surface withdrawals in subbasins with CFRs.		
Mitigation Conditions by Tier for Groundwater Withdrawals (Section 9)[3]	Tier 1	Tier 2	Tier 3
1. Mitigation Mitigate impacts commensurate with withdrawal above baseline, in consultation with agencies.	Not required	Yes, required for all	Yes, required for all. Tier 3 requires up to twice the level of indirect mitigation as Tier 2.
2. Demonstrate no feasible alternative source that is less environmentally harmful. (Section 8)	Not required	Not required	Yes, required for all
Mitigation Conditions by Tier for Surface Water Withdrawals (Section 9)		Tier 1	Tier 2
1. Mitigation Mitigate impacts commensurate with withdrawal		Not required	Yes, required for all

Table 4-3: Permit Requirements for Golf Courses			
Water Conservation (Section 5c)	Yes, required for all		
Limits on nonessential outdoor water use (Section 5)	Yes, required for all		
Minimization of impacts in 25% August Net Groundwater Depleted Subbasins (Section 6)	Required for those permittees with groundwater withdrawal points in subbasins with ≥25% August NGD		
Coldwater Fish Resource (CFRs) Optimization Planning (Section 7)	Required for permittees with ground or surface withdrawals in subbasins with CFRs.		
Mitigation Conditions by Tier for Groundwater Withdrawals (Section 9)[3]	Tier 1	Tier 2	Tier 3

[3] Groundwater withdrawals in groundwater-driven water sources (the southern portion of South Coastal, Cape Cod, Island, and portions of Buzzards Bay) will be assigned to Tier 1 or Tier 2 based on their baseline and 20-year withdrawal projections.

Table 4-3: Permit Requirements for Golf Courses			
3. Mitigation Mitigate impacts commensurate with withdrawal above baseline, in consultation with agencies.	Not required	Yes, required for all	Yes, required for all. Tier 3 requires up to twice the level of indirect mitigation as Tier 2.
4. Demonstrate no feasible alternative source that is less environmentally harmful. (Section 8)	Not required	Not required	Yes, required for all
Mitigation Conditions by Tier for Surface Water Withdrawals (Section 9)		Tier 1	Tier 2
2. Mitigation Mitigate impacts commensurate with withdrawal		Not required	Yes, required for all

5. Standard Permit Conditions for Water Conservation and Demand Management

5a Public Water Supply Permits

Water Conservation Requirements

All permit applicants must include a water conservation program with their application. To fulfill this requirement, public water suppliers complete the Water Conservation Questionnaire for Public Water Suppliers. At a minimum, permits will include conservation measures summarized in Table 5a-1 that are based onstandards outlined in the Massachusetts Water Resources Commission's *Water Conservation Standards* (July 2006 or subsequent updates). Both the Water Conservation Questionnaire and the Water Conservation Standards can be found at http://www.mass.gov/eea/waste-mgnt-recycling/water-resources/preserving-water-resources/partners-and-agencies/water-resources-commission/water-policies.

Table 5a-1: Water Conservation Requirements for Public Water Supplier
System Water Audits and Leak Detection
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. 2. Full leak detection survey whenever unaccounted for water increases by 5% or more over the percentage reported on the Annual Statistical Report (ASR) for the prior calendar year. Submit a report detailing the leak detection survey, dates of leak repairs, and estimated water savings. 3. Have repair reports available for inspection by the Department. 4. A schedule shall be established for repairing leaks based on guidance provided by the Department.

Table 5a-1: Water Conservation Requirements for Public Water Supplier

Metering

1. Ensure that the system is 100% metered.
2. Calibrate all source and finished master water meters at least annually.
3. Properly size service lines and meters for all water users. Meters must meet AWWA calibration and accuracy standards.
4. 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

1. Establish a water revenue structure that covers the full cost of the PWS 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.
2. Decreasing block rates are not allowed by M.G.L. Chapter 40, Section 39L. Increasing block rates are strongly recommended.

Residential and Public Sector Conservation

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. Municipal buildings
   - Submit a report of municipally owned public buildings retrofitted with water saving devices
   - Submit a schedule for retrofitting remaining buildings within two years or as agreed upon with the Department
   - Water Districts and Water Companies must demonstrate "Best Effort" to work with the Town and complete retrofits.
   - Municipally owned public buildings scheduled for rehab or demolition may be exempted from this condition.

Industrial and Commercial Water Conservation

1. Review the use records for industrial, commercial and institutional water users and develop an inventory of the largest water users.
2. 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.
3. Upon request by the Department, submit a report on conservation results.

Lawn and Landscape

1. Permittees must have a water use restriction bylaw, ordinance or regulation providing authority to implement and enforce required restrictions on outdoor water use.

Education and Outreach

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.

Permittees must be in compliance with these measures on or before a date specified in the permit.

Performance Standards

Permits will include performance standards summarized in Table 5a-2. Some permittees may not be able to meet the Performance Standards, or they may need additional time beyond the first five years of their permit, in spite of their best efforts. In recognition of this, the Department has developed Functional Equivalence Plan (FEP) requirements for those permittees. Each FEP includes best management practices that establish a level of effort that a permittee who has not met the Standard(s) must demonstrate. Permittees implementing the FEP will be considered to be in compliance with the Performance Standard(s).

Table 5a-2: Performance Standards in Public Water Supplier WMA Permits

Performance Standard for Residential Gallons Per Capita Per Day Water Use (RGPCD)

• The RGPCD performance standard for PWS permittees is 65 gallons*.
• If the permittee fails to document compliance within two full calendar years, then it must implement either an Individual RGPCD Compliance Plan of its own creation designed to bring the system into compliance within three additional years, or adopt the Department's RGPCD Functional Equivalence Plan (FEP) that includes BMPs.
  o An Individual RGPCD Compliance Plan must, at a minimum, include at least one of the following:
  ▪ Program that provides water savings devices at cost;
  ▪ Program that provides rebates or other incentives for purchase of low water use appliances; and/or
  ▪ Adopt and enforce an ordinance, bylaw, or regulation requiring moisture sensors or similar climate technology on automatic irrigation systems.
  o The Department's RGPCD FEP requires:
  ▪ Permittee be in compliance with conditions of their permit including the limits on nonessential outdoor water use;
  ▪ Adopt all three items from the Individual RGPCD Compliance Plan above;
  ▪ Use of increasing block rates or a seasonal water rate structure; and
  ▪ Implement bi-monthly or quarterly billing.
• A permittee that has been unable to meet the standard within five years must implement the Department's RGPCD FEP.
 	
* PWS permittees on the Cape and Islands and other season communities are not required to meet the RGPCD standard because of seasonal population shifts that make calculating an accurate value difficult.

Table 5a-2: Performance Standards in Public Water Supplier WMA Permits

Performance Standard for Unaccounted-for-Water (UAW)

- The UAW performance standard for all PWS permittees is 10% of total water withdrawal.
- If the permittee fails to document compliance within two full calendar years, then they must implement either an Individual UAW Compliance Plan of their own creation designed to bring the system into compliance within three additional years, or they may adopt the Department's UAW FEP that includes BMPs.
    - The Department's UAW FEP requires:
        - Permittee must complete a water audit and leak detection survey of the entire system within one year;
        - Within one year of conducting the audit/survey, make sufficient repairs to reduce leaks by 75% (by water volume) of all leaks detected in the survey;
        - If UAW remains above 10%, repeat above steps;
        - Repair, replace, and calibrate meters as follows:
            - Large Meters (2" or greater) within one year,
            - Medium Meters (1" - 2") within two years,
            - Small meters (<1") within three years;
        - Implement bi-monthly or quarterly billing within three years; and
        - Within one year of filing the UAW FEP, implement water pricing that is sufficient to pay the full cost of operating the system including: repairs resulting from any leak detection survey(s); meter repair, replacement and calibration; employee and equipment costs; and ongoing maintenance and capital costs.

A permittee that has been unable to meet the 10% UAW performance standard within 5 years must implement the Department's UAW FEP.

Hardship Provision for Performance Standards

Both RGPCD and UAW FEP Plans include a hardship provision that allows a permittee to present an analysis of the cost effectiveness of conservation measures included in the Department's plans and to present alternatives. The analysis must consider environmental impacts and alternatives must produce equal or greater environmental benefits.

Limits on Nonessential Outdoor Water Use

Table 5a-3 outlines outdoor water use restrictions for public water suppliers with all groundwater sources that are not August NGD. Table 5a-4 outlines outdoor water use restrictions for permittees with groundwater sources in subbasins with an August NGD depletion of 25% or more.

Table 5a-3: Standard Calendar and Streamflow Options for Nonessential Outdoor Watering Restrictions (all sources in subbasins with August NGD less than 25%)				
Standard Outdoor Water Use Restrictions*	Calendar Option		Streamflow Option	
	All Season	**When 7-day low-flow trigger occurs**	**When flow is below ABF**	**When 7-day low-flow trigger occurs**
Below 65 RGPCD	7 days, no 9 am to 5 pm	1 day, no 9 am to 5pm	7 days, no 9 am to 5 pm	1 day, no 9 am to 5 pm
Above 65 RGPCD	2 days, no 9 am to 5 pm	1 day, no 9 am to 5 pm	2 days, no 9 am to 5 pm	1 day, no 9 am to 5 pm

* Permittees with withdrawals in groundwater-driven basins (i.e., the southern portion of South Coastal, Cape Cod, Islands, and portions of the Buzzards Bay Basin) may be required to implement an alternative approach to nonessential outdoor watering restrictions, which may include groundwater triggers for implementation.

Table 5a-4: Calendar and Streamflow Options for Nonessential Outdoor Watering Restrictions for Minimization Planning (sources in subbasins with August NGD greater than 25%)				
Outdoor Water Use Restrictions for Minimization Plans**	Calendar Option		Streamflow Option	
	All Season	**When 7-day low-flow trigger occurs**	**When flow is below ABF**	**When 7-day low-flow trigger occurs**
Below 65 RGPCD	2 days, no 9 am to 5 pm	1 day, no 9 am to 5 pm	2 days, no 9 am to 5 pm	1 day, no 9 am to 5 pm
Above 65 RGPCD	1 day, no 9 am to 5 pm	1 day, no 9 am to 5 pm	1 day, no 9 am to 5 pm	1 day, no 9 am to 5 pm

**Permittees required to minimize withdrawals in subbasins with an August net groundwater depletion of 25% or more will be required to adopt these restriction or propose an equivalent action. Permittees required to mitigate (i.e., Tiers 2 and 3) may select these Nonessential Outdoor Watering Restrictions as a component of their Mitigation Plan or propose an equivalent action.

The permittee can choose one of two options to implement nonessential outdoor watering restrictions for its community. The first option is based on a calendar year which runs from May through September. The second option is based on Aquatic Base Flow streamflow triggers. Aquatic Base Flow (ABF) is a statistical method of determining the natural flows necessary for the protection and propagation of aquatic life. It is expressed as the median of monthly mean flows, and is calculated for each month using estimated near-natural daily flow values. The ABFs for June and August are the streamflow triggers for outdoor water use

restrictions: the June ABF is the May through June trigger and the August ABF is the July through September trigger. These ABF trigger flows for June and August are specified in the outdoor water use restriction condition in WMA permits. Restrictions for both the Calendar and Streamflow Option are summarized in Tables 5a-3 and 5a-4.

Both the Calendar and Streamflow Option also include a low flow trigger at which restrictions increase. Prior to SWMI, the low flow trigger was tied to a drought advisory declaration. To more accurately relate nonessential outdoor watering restrictions to more local streamflow impacts and to be more responsive to changing conditions, a low-flow statistic was chosen to replace the drought advisory declaration to trigger increasing restrictions. The median value of annual 7-day low flows for the period of record for a local USGS gage (7-day low-flow), was chosen to replace the drought advisory trigger. Once the 7-day low-flow is triggered at the USGS gage that is associated with a permit, the permittee will be required to impose more stringent restrictions as outlined in Tables 5a-3 and 5a-4.

Each WMA permit will identify a specific USGS gage to be used for the analysis, with corresponding ABF and the 7-day low flow trigger values included in the permit. Permittees will be responsible for monitoring flows as necessary to ensure compliance.

Surface water suppliers seeking to implement conditions different from those outlined above will be required to develop a Summer Management Plan that ties outdoor watering restrictions to reservoir elevation and environmental considerations and must receive approval by the Department. Environmental considerations may include alternative downstream flow augmentation, releases that do not impact the PWS's ability to meet demand, fishery or other habitat management plans, or other measures developed in consultation with the Department.

5b Cranberry Cultivation Permits

Water Conservation Requirements

All permit applicants must include a water conservation program with their application. To fulfill this requirement, cranberry growers must submit a Farm Conservation Plan, certified by the Natural Resources Conservation Service (NRCS), that includes the elements outlined in the Memorandum of Agreement among the Cape Cod Cranberry Growers Association and the Department (September, 2004). At a minimum, permits will include BMPs summarized in Table 5b, as applicable to the permitted bog(s). For more information on cranberry cultivation BMP's, see the University of Massachusetts Cranberry Station's website at http://www.umass.edu/cranberry/pubs/bmps.html.

Table 5b: Water Conservation Requirements for Cranberry Cultivation
Cultural and Resource Management BMPs
• "Flood Management": Covering the use of flooding to protect the plants during winter, to harvest fruit and remove debris, and to control pests. • "Frost Management": Covering the need for monitoring weather conditions, tolerance and irrigation system performance. • "Irrigation Management": Covering the use of tensiometers, water level float and irrigation system performance. • "Sprinkler System Design and Use": Covering the design, engineering, construction, replacement and maintenance of sprinkler systems. • "Water Control Structures": Covering flumes, dikes to conserve water, flooding the beds, impounding water, manipulation of the water table in the bed, and drainage functions • "Water Resource Protection and Enhancement": Covering the definition of use of tailwater and laser leveling.
Crop and Pest Management BMPs
• "Nutrient Management": Covering proper nutrient management for the unique demands of cranberry cultivation.
Other
• Best Management Practices for Cranberry Growers with Anadromous Fish, Published by the Cape Cod Cranberry Growers' Association, 1998, as applicable to the bog(s) to be permitted.
The NRCS-Certified Conservation Farm Plan shall document any exceptions from these BMPs.

5c Golf Course Permits

Water Conservation Requirements

All permit applicants must include a water conservation program with their application. To fulfill this requirement, golf course applicants submit a golf course water conservation plan that addresses the elements outlined in the best management practices (BMPs) summarized in Table 5c-1, as applicable to the permitted golf course. For more information on environmental management practices for golf courses, see GCSAA Environmental Institute for Golf BMPs at http://www.eifg.org/education/bmps/, and Audubon International's Cooperative Sanctuary Program for Golf Courses (ACSP) guidelines at www.audubooninternational.org.

Table 5c-1: Water Conservation Requirements for Golf Courses
Employee training in water conservation and management
Metering • Water use is 100% metered. • Source meters are calibrated annually.

Table 5c-1: Water Conservation Requirements for Golf Courses
Implementation of an irrigation system inspection and maintenance program that includes leak detection and repair, sprinkler had maintenance and replacement • Use of low trajectory sprinkler heads. • Irrigation ponds are lined with impervious material.
Implementation of a Turf Management Plan • Regular inspection of course to determin irrigation needs • Use of soil sensors or soil samples to determin soil moisture content • Regulator aerating of turf to dincrease 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.

Streamflow Triggered Drought Management Plan

All permits for golf course irrigation will include Drought Management Plan irrigation restrictions as follows:

Table 5c-2: Streamflow Triggered Drought Management Plan for Golf Courses				
Massachusetts Drought Level	Landscape & Ornamentals	Roughs	Fairways	Tees & Greens
Advisory	No irrigation	Irrigation reduced to 50%	Irrigation reduced to 80%	Irrigation remains 100%
Watch	No irrigation	No irrigation	Irrigation reduced to 60%	Irrigation remains at 100%
Warning	No irrigation	No irrigation	Irrigation reduced to 40%	Irrigation remains at 100%
Emergency	No irrigation	No irrigation	TBD*	TBD*

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

6. Minimization

Applicants with groundwater sources in subbasins with an August net groundwater depletion of 25% or more[4], as identified in the Department's WMA permitting tool (see Section 11) and map (both tools are available at :(http://www.mass.gov/eea/agencies/massdep/water/watersheds/sustainable-water-management-initiative-swmi.html) are required to develop and implement a plan to minimize impacts. All components of the minimization plan must be approved by the Department. The plan should reflect the following three analyses, taking into consideration cost, level of improvement expected to result from minimization actions, available technology and the applicant's authority to implement the actions.

a. ***Desktop Optimization***: Conduct a desktop optimization analysis, evaluating whether the applicant's existing sources, or any available alternative sources (including interconnections), could be utilized or operated at prescribed rates or times in a way that could reduce environmental impacts while still meeting water demands.

b. ***WaterReleases and Returns:*** Evaluate releases from surface water supply impoundments and measures that could return water to the subbasin or basin to improve flow

c. ***Additional Conservation Measures***: Evaluate reasonable and cost-effective indoor and outdoor conservation measures consistent with public health and safety that go beyond standard WMA water conservation requirements outlined in Section 5 for the applicant's type of water use.

If an applicant wishes to propose alternative measures to minimize the impact of its withdrawals – in addition to, or in place of the above requirements, the Department will consider those measures on a case-by-case basis. In considering alternative measures, the New England Water Works Association (NEWWA Toolbox http://www.newwa.org/Resources/UtilityResources/NEWWABMPsandAdvisories.aspx) is a useful reference which provides many best management practices PWSs can evaluate for the potential to minimize withdrawal impacts.

6a Desktop Optimization

Desktop Optimization is a screening process to help evaluate the feasibility of operational changes aimed at minimizing impacts to streamflow from groundwater withdrawals. The permittee should use this process to assess whether the impact of the withdrawals on streamflow in the subbasin can be decreased, without significantly altering the permittee's ability to meet demands, by: 1) modifying well withdrawal operations, including timing of withdrawals from various sources; or 2) using potential alternative sources, such as water from an adjacent system (interconnection), where availability exists.[5] In addition to

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[4] August net groundwater depletion is the estimated unimpacted streamflow in a subbasin, less groundwater withdrawals, plus returns to groundwater via septic systems and groundwater discharges for the month of August (withdrawals and returns are either reported or estimated for the years 2000 to 2004, representing the existing condition). The equation to describe it is:

100-((Aug Unaffected Flow – 2000-2004 GW Withdrawals + 2000-2004 GW Returns)/Aug Unaffected Flow) x 100)

environmental concerns, a Desktop Optimization must consider existing system constraints including, but not limited to, infrastructure, pressure, water quality, operations, costs, regulatory matters, and societal needs. Optimization shall ensure that environmental concerns are part of the decision making process. What constitutes an optimized water supply system is a decision that will be made by the water supplier following full review of all relevant factors. The results of a Desktop Optimization should include the locations and withdrawal schedules of sources that will be utilized to meet system demand while minimizing ecological impacts of withdrawals.

Table 6a provides a list of questions that can help an applicant assess which sources/subbasins might be less impacted during pumping in the low flow periods (summer/fall) and which sources/subbasins may cause a greater impact.

Instructions: For questions 1 through 4, use the Department's permitting tool (Section 11) (http://www.mass.gov/eea/agencies/massdep/water/watersheds/sustainable-water-management-initiative-swmi.html)to look up each subbasin in which you have groundwater sources and record answers. Questions 5 and 6 can be answered through knowledge of the community's water supply system.

[5] Applicants should be aware of the requirements and exemptions under the Interbasin Transfer Act when reviewing potential alternative sources. If any alternative sources are located outside of the major basin in which the water will be used by customers or disposed of through a wastewater treatment facility, review under the Interbasin Transfer Act may be required.
[6] If a CFR is present, optimization should focus on reducing potential impact to CFR (Section 7).

Table 6a: Source Optimization – for use in Coldwater Fish Resource (CFR) Protection Planning, Minimization Planning, and Alternative Source Review	
Optimization Parameter	**Guidance**
1) Is there a CFR present?[6]	Withdrawals with no known impact or least impact to a CFR are preferred.
2) What is the Mass Water Indicators (MWI) August affected streamflow in cubic feet per second per square mile (cfsm)? MWI affected flow is (unaffected streamflow – groundwater withdrawals + all returns)/drainage area	Withdrawals in subbasins with a higher cfsm are preferred.
3) Does the increase over baseline cause a change in BC or GWC? (This step is applicable to Tier 2 and 3 applicants only and is not used for minimization.)	Withdrawals that do not result in a subbasin changing BC or GWC are preferred.
4) What is the groundwater withdrawal percentage (withdrawals/unaffected streamflow)?	Withdrawals in subbasins with lower percentages are preferred (as long as there is no change in BC or GWC).
5) Is there an available surface water supply with a release plan approved by the Department?	Shifting pumping from groundwater to surface water sources with approved release plans during low-flow periods is generally preferred. Surface water sources without ability to be released may be preferred based on a case-by-case evaluation.
6) Are other sensitive resources present such as vernal pools?	Withdrawals with no known impact or least impact to sensitive resources are preferred.

An optimization review should include, but is not limited to, the parameters outlined above. Those who wish to go beyond the simple desktop optimization method outlined above can apply more sophisticated modeling tools. These modeling tools may include: MODFLOW, MODOPTIM, and the Web-Based STRMDEPL08.

6b Water Releases and Returns

Releases

If a permittee has surface water supply impoundments located in or upstream of the subbasin(s) in which their wells are located, and these impoundments have the capacity for releases, the permittee should determine if releases can be made to improve the timing, magnitude, and duration of downstream flows to more closely mimic natural conditions without compromising other in-lake uses (for example, significant impacts to water supply, recreation, or ecology).

An evaluation of releases from a surface water supply impoundment should include: a) an analysis of the affect that releases will have on the firm yield of the supply impoundment, b) how any identified change to firm yield will affect the permittee's ability to meet the projected 20-year demands used to prepare the

permit application, c) any affect to the permittee's ability to meet anticipated peak seasonal or peak day demands, and d) whether there are sources within the current PWS-system with capacity that could be used to meet projected demand.

If releases are possible, the permittee should develop and implement a release plan subject to the Department's approval.

Returns

Evaluate whether there are or could be feasible opportunities to return water. Returns include stormwater recharge, infiltration/inflow (I/I) improvements, and wastewater discharges that would result in improvements to the quantity and timing of streamflow. Potential returns should be evaluated in the following order: to the same subbasin, same major basin, and finally another major basin.

6c Additional Conservation Measures

Nonessential Outdoor Watering Restrictions

The nonessential outdoor watering restrictions for PWS permittees that must minimize withdrawals are described in Section 5, Table 5a-4. For those below 65 RGPCD, either limit watering to no more than 2 days per week (1 day per week when the 7-day low-flow trigger occurs) or propose an equivalent action. For permitees above 65 RGPCD, either limit watering to no more than 1 day per week or propose an equivalent action.

Additional Reasonable Conservation

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. In particular, applicants should focus on measures that will be most effective in helping to reduce August net groundwater depletion in their community. Table 6c lists conservation activities, drawn largely from the recommendations section of the Massachusetts *Water Conservation Standards*, to help applicants identify additional reasonable conservation measures. These recommendations, along with the NEWWA Toolbox (http://www.newwa.org/Resources/UtilityResources/NEWWABMPsandAdvisories.aspx), are suggested as references for developing a Minimization Plan.

Minimization Plans for those permittees not meeting the Performance Standards of 65 RGPCD or 10% UAW, should focus first and foremost on activities that will provide the greatest progress towards achieving the Performance Standards. Permittees subject to the minimization requirements that are also implementing a Functional Equivalence Plan (FEP)for the Performance Standard(s) must evaluate additional reasonable conservation measures beyond those required in the FEP.

Table 6c: Example Conservation Measures	
Conservation Measure	**FEP Requirement**

Table 6c: Example Conservation Measures	
Conservation Measure	**FEP Requirement**
Additional Measures to Reduce Demand	
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.	
Additional Measures to Reduce Water Losses	
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.	

Table 6c: Example Conservation Measures	
Conservation Measure	**FEP Requirement**
Additional Measures to Reduce Nonessential Outdoor Watering	
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: • 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.	
Identify highest water users. Target 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.	

7. Protection of Coldwater Fish Resources

Coldwater Fish Resources (CFRs) are critical resources that require special consideration within the WMA permitting process. There has been a significant loss in CFR habitat over time, partially because these temperature-dependent habitats are strongly influenced by groundwater and particularly vulnerable to impacts from groundwater withdrawals. All WMA permit applicants with a CFR in any of their permitted subbasins (per the Department's interactive map showing DFW designated CFRs http://www.mass.gov/dep/water/resources/swmi.htm) will be required to conduct a desktop optimization (described in Section 6, Table 6a). This desktop optimization should focus specifically on reducing impacts to the CFRs. At the basin outreach meeting, applicants with CFRs will have an opportunity to consult with DFW staff. DFW will also provide general guidance on minimizing CFR impacts in the subbasin.

Tier 2 and Tier 3 WMA permit applicants with CFRs will consult with agencies to ensure that impacts to their CFRs are adequately addressed as part of their mitigation planning.

8. Alternative Source Analysis

Tier 3 sets a higher bar for permittees and requires applicants whose withdrawal will result in a change in BC or GWC to show that they do not have an alternative source that can be used instead. Tier 3 review

requires that applicants demonstrate that there is no feasible alternative source that is less environmentally harmful than the option they have proposed. To evaluate potential environmental harm, applicants should refer to the parameters and preferences outlined in the optimization guidance (see Section 6) and use the questions outlined in Table 6a to compare their existing sources to available alternatives to determine which are environmentally preferable. In addition to assessing the environmental impact of each potential source, the applicant must consider the feasibility of utilizing an alternative source.

Table 8: Alternative Source Analysis Guidelines

Environmental Guidelines
An alternative source is considered less environmentally harmful if withdrawals: • have no known impact or least impact to a CFR; • are from a subbasin with a higher flows; • do not result in a subbasin changing BC or GWC; • are from a subbasin with more plentiful groundwater (as long as there is no change in BC or GWC) • have no known impact or less impact to sensitive resources such as vernal pools or endangered species.
Shifting pumping from groundwater to surface water sources with approved release plans during low-flow periods is generally preferred. Surface water sources without the ability to be release may be preferred and will be evaluated individually.
Water Quality Guidelines
Use of water from an alternative source must meet all drinking water standards for public water supply at 310 CMR 22.00.
Technical and Legal Guidelines
An alternative source is considered feasible if: • Infrastructure or technology needed is in place, or could be put in place; • The permittee has the legal authority, or a legal agreement, to use the alternative source.
Cost Feasibility Guidelines
Use of an alternative source, including water quality, technical and legal costs, meet the cost feasibility assessment outlined in Section 9h of this Guidance Document.

9. Mitigation

Overview

The WMA regulations specify that all Tier 2 and 3 permittees must mitigate any increases in withdrawals above baseline, commensurate with impact. The impact is quantified volumetrically as the authorized withdrawal volume above baseline. This volume approximates the reduction in groundwater or surface water contribution to streamflow from the increased withdrawals. For groundwater WMA permittees (excluding the Cape, Islands and Plymouth Carver Aquifer Area), impact is further characterized by whether the increase in withdrawals over baseline causes a change in a biological or groundwater category (BC and GWC). Permittees who cause a change in BC or GWC in a subbasin in which they withdraw will be assigned a Tier 3 designation. The presumed volumetric impact to streamflow (the authorized withdrawal volume minus baseline) may be reduced by eligible wastewater adjustments (described in this Section) and commitments to conduct additional demand management (described in Sections 5 and 6). Demand management should result in the WMA permittee not needing to withdraw their entire authorized volume under the permit or in a delay in exceeding baseline.

Any remaining authorized volume above baseline, following calculations of savings from a demand management plan and accounting for any wastewater, will need to be mitigated commensurate with impact. Tier 2 and 3 permittees will need to develop a mitigation plan at the start of the 20-year WMA permit period. This plan should estimate the required volume of mitigation, identify feasible mitigation options, and include a timeline for the implementation of the mitigation options. The process and components of mitigation planning are outlined below followed by a description of each component.

a) Mitigation Hierarchy
b) Location Adjustment Factor
c) Wastewater Adjustments
    i. Groundwater Returns
    ii. Surcharged Reach
d) Calculation of Mitigation Volume
e) Direct Mitigation
f) Indirect Mitigation
g) Mitigation Plan Implementation Timeline
h) Mitigation and Cost Feasibility Guidance

Note: All mitigation projects that include discharges of wastewater or stormwater must comply with all other applicable laws and regulations. including Drinking Water Program source protection requirements (Zone I, Zone II and surface water source protection), groundwater discharge and stormwater requirements.

9a Mitigation Hierarchy

Prior to beginning any mitigation planning, priority should be given to exhausting all feasible options for demand management that can reasonably be expected to reduce demand and therefore reduce the amount withdrawn. Prioritizing demand management may help to avoid or delay the need to increase withdrawals above baseline and implement mitigation. When demand management opportunities have been exhausted, the mitigation plan should prioritize direct mitigation (i.e., actions that are volumetrically quantifiable) over indirect mitigation (i.e., actions that cannot be quantified volumetrically) measures to the fullest extent practicable. Additionally, applicants should prioritize mitigation actions in the following order: 1) in the same subbasin as the withdrawals , 2) upstream of the withdrawal in the same major basin, 3) downstream of the withdrawal in the same major basin and lastly, 4) in a different major basin.

NOTE: Surface water suppliers with reservoirs that could be used to supplement downstream flow conditions should evaluate the feasibility of reservoir releases first when considering direct mitigation options.

9b Location Adjustment Factor

Direct mitigation and wastewater adjustments shall be subject to a location adjustment factor (LAF). The LAF accommodates the reduced environmental benefit of returning water outside of the major basin from which it is withdrawn. Application of the LAF is summarized in Table 9b and further described below.

LAF for Direct Mitigation

Surface or groundwater that is returned through eligible direct mitigation activities (described in section 9e) will receive 100% credit for returns within the major basin and 50%* credit for returns outside the major basin.

LAF for Wastewater Adjustments

Water that is returned to groundwater via septic systems or groundwater discharges (further described in section 9c) will receive 85% credit (equivalent to 100% of eligible withdrawals less a 15% consumption factor[7]) if it is returned within the same major basin and 50%* of that credit (43% of eligible withdrawals) if it is returned outside the major basin.

*Returns outside the major basin may receive an additional 25% credit (for a total of 75%) if they can show the direct mitigation or wastewater return is to a more depleted subbasin (measured as August net ground water depleted) than the subbasin from which the water is withdrawn. If withdrawals and returns are from multiple subbasins with varying August NGD conditions, the applicant can receive 75% credit if they can show that, on the whole, the August NGD condition is worse (i.e., more net depleted) where they are returning the water than where they are taking it from.

Table 9b: Summary of Location Adjustment Factors (LAF) for Direct Mitigation and Wastewater Adjustment

Activity	Location of Returned Withdrawal Volumes	Credit
Direct Mitigation to Surface Water and Groundwater	In Major Basin	100%
	Outside of Major Basin	50% (75% if returned to an area with greater net groundwater depletion)
Wastewater Adjustment for Groundwater returns	In Major Basin	85% wastewater return adjustment (15% consumption factor applied to 100% credit)
	Outside of Major Basin	43% (15% consumption factor applied to 50% credit) Or, if return is to an area with greater net groundwater depletion 64% (15% consumption factor applied to 75% credit)

9c Wastewater Adjustments

Groundwater Returns

The volume of water that an applicant must mitigate can be reduced if some of the water withdrawn above baseline will be returned to groundwater through septic systems or permitted groundwater discharges. The reduction in total mitigation resulting from wastewater returns to groundwater is called a wastewater adjustment. The calculation used to determine an applicant's wastewater adjustment is described below.

[7] Consistent with the Massachusetts Water Indicator Project report, the volume of water disposed of via septic systems is estimated to be 85% of the water withdrawn.

Within Major Basin Adjustment

Steps 1 through 3 apply to all water withdrawn from and returned to the same major basin. For any portion of an applicant's water withdrawal that is returned to a different major basin, see steps 4 through 7.

Step 1: Determine the percent of annual water withdrawals that are returned to the same major basin through septic systems and permitted groundwater discharges.

Step 2: Multiply the percentage calculated in Step 1 by the anticipated withdrawal rate (in million gallons per day, mgd) above baseline.

Step 3: Multiply the volume of water calculated in Step 2 by 85%, to account for a 15% consumptive loss.

Out of Major Basin Adjustment

Steps 4 through 7 apply to all water withdrawals which are returned to a different major basin.

Step 4: Determine the percent of annual water withdrawals that are returned to a different major basin through septic systems and permitted groundwater discharges.

Step 5: Multiply the out of major basin percentage calculated in Step 4 by the anticipated withdrawal rate (in mgd) above baseline.

Step 6: Multiply the volume of water calculated in Step 5 by 85%, to account for a 15% consumptive loss.

Step 7: Multiply the amount of water calculated in Step 6 by 50%. This reflects the location adjustment factor. The location adjustment factor provides an accommodation for the environmental impact of returning water out of the major basin from which it was withdrawn.

Note: In the case where water withdrawals are returned to a different major basin, applicants able to demonstrate that the subbasin(s) to which the wastewater is being returned through septic or groundwater discharges has a more depleted August NGD condition than the subbasin from which the water is withdrawn may receive an additional 25% percent credit. In this case, the 50% multiplier used in Step 7 should be replaced with a 75% multiplier.

Step 8: An applicant should calculate their wastewater adjustment for groundwater returns by adding the total volumes calculated in Steps 3 and 7.

Surcharged Reach

Some subbasins that receive large treated wastewater returns (i.e., NPDES discharges) are estimated to be surcharged[8] by the Massachusetts Water Indicator Project (MWI) Report, but these surcharges are not considered when determining the GWC for a subbasin. In certain situations, outlined below, withdrawals

[8] The term surcharge describes subbasins where affected flows (taking into account withdrawals and returns) are estimated to be higher than the unaffected flows because more wastewater is returned than the amount of water withdrawn for water supply.

above baseline from significantly surcharged subbasins may qualify for an adjustment, which could offset the mitigation required for the increased withdrawal.

If an applicant can show that the entire requested withdrawal above baseline will come from wells that are hydrologically connected to surcharged stream reaches, then the applicant is eligible for a surcharge offset adjustment.

The determination is made as follows:

1) The well must be located in a significantly surcharged subbasin. The surcharge must be more than 10% above the annual average unaffected flow, as determined through the annual surcharge index ((MWI affected annual flow/MWI unaffected annual flow x 100) – 100), and the surcharge must be more than 1.0 MGD.

   An initial screening by the Department indicates that five major basins contain surcharged reaches with eligible subbasins: the Blackstone, Concord, South Coastal, Ten Mile, and Taunton (see Appendix B for a list of subbasins with surcharged reaches).

2) Wells eligible for a surcharge offset adjustment must be hydrologically connected to the surcharged stream reach, that is, the well must be able to induce infiltration from the surcharged reach. Factors that determine whether a well is hydrologically connected to the adjacent stream include:
   a. distance from the stream;
   b. type of well (unconfined overburden, confined overburden, or bedrock);
   c. aquifer characteristics (hydraulic conductivity and transmissivity);
   d. streambed hydraulic conductivity; and
   e. well pumping rate.

   If a well's wellhead protection area (Zone II) includes a portion of the surcharged stream reach, it is presumed that the well is hydrologically connected. If the wellhead protection area does not include a portion of the surcharged stream reach, but the well is located within the surcharged subbasin, the applicant may provide an analysis of the hydrology of the well or provide the results of pumping tests to demonstrate that the well is under the influence of an adjacent surcharged stream reach and is therefore eligible for the surcharge offset adjustment.

3) If the criteria in 1) and 2) above are met, the surcharge offset adjustment will be the lesser of:
   a. The applicant's withdrawal above baseline; or
   b. The amount of surcharge in the subbasin for August, less a 1 mgd buffer.

4) If multiple applicants are seeking a surcharge offset in the same surcharged stream reach, and the combined requests are greater than the total surcharge amount available, the Department will apportion the adjustment among the applicants.

The total surcharge offset adjustments in an eligible subbasin shall not exceed the maximum August surcharge of the applicable stream reach.

5) Subsequent applicants for increases in the subbasin will not be eligible for a surcharge offset adjustment if the entire surcharge has been apportioned.

Note: If an applicant cannot show that the entire increased withdrawal will come from eligible wells, the applicant can develop an optimization plan to show what portion of the withdrawals will be taken from the eligible wells, and thereby obtain indirect mitigation credits.

9d Calculation of Mitigation Requirement

Mitigation commensurate with impact is required for the volume of all water withdrawn over baseline, to the extent feasible. An applicant's mitigation volume is calculated as follows:

1) **Determine Volume over Baseline**

Establish the requested permit withdrawal volume. For PWSs, this is, under most circumstances, expected to be based on the Water Needs Forecast (WNF) developed in accordance with the methodology adopted by the Massachusetts Water Resources Commission (http://www.mass.gov/eea/waste-mgnt-recycling/water-resources/preserving-water-resources/partners-and-agencies/water-resources-commission/water-policies/). If the requested volume is less than the applicant's baseline, no mitigation is required. If the request exceeds the applicant's baseline, proceed to the next step.

2) **Estimate Savings through Additional Demand Management**

Evaluate the potential to reduce demand over the life of the WMA permit, by meeting and achieving higher levels of water efficiency than the state Performance Standards of 65 RGPCD and 10% UAW. The state Performance Standards for RGPCD and UAW are used in nearly every DCR WNF projection on which the Department bases the WMA permit volumes. If an applicant is already achieving a higher level of efficiency in RGPCD and UAW than the state Performance Standards at the time the forecast is developed, these efficiencies will be reflected in a "current trends forecast," also prepared by DCR. In cases where a current trends forecast is developed based on values lower than those used in their 65/10 WNF projection, the applicant may request that its (lower) current trends rate be utilized for the WMA permit, thereby avoiding the need to mitigate the difference between the two projections. Alternatively or additionally, the applicant could estimate demand reductions anticipated to be achieved by implementing specific additional conservation measures listed in Table 6c to further reduce the anticipated withdrawal volume above baseline.

3) **Determine Any Applicable Wastewater Adjustments**

If a portion of an applicant's withdrawal is returned via septic systems or permitted groundwater discharge, determine the adjustment volume as described in the Wastewater Adjustment – Groundwater Return Section. If all of the applicant's withdrawal volumes above baseline will be

withdrawn from sources meeting the criteria described previously in the Wastewater Adjustment - Surcharged Reach Section, determine the surcharge offset, as described in that section.

4) **Calculate Mitigation Amount**

The amount the applicant must attempt to mitigate is equal to:

(Requested rate over baseline) – (Savings through enhanced demand management) – (all applicable wastewater adjustments)

If the answer to the above equation is less than or equal to zero, no mitigation is required. Figures 1a and 1b provide an example of this calculation.

Figure 1a: Example of mitigation calculation

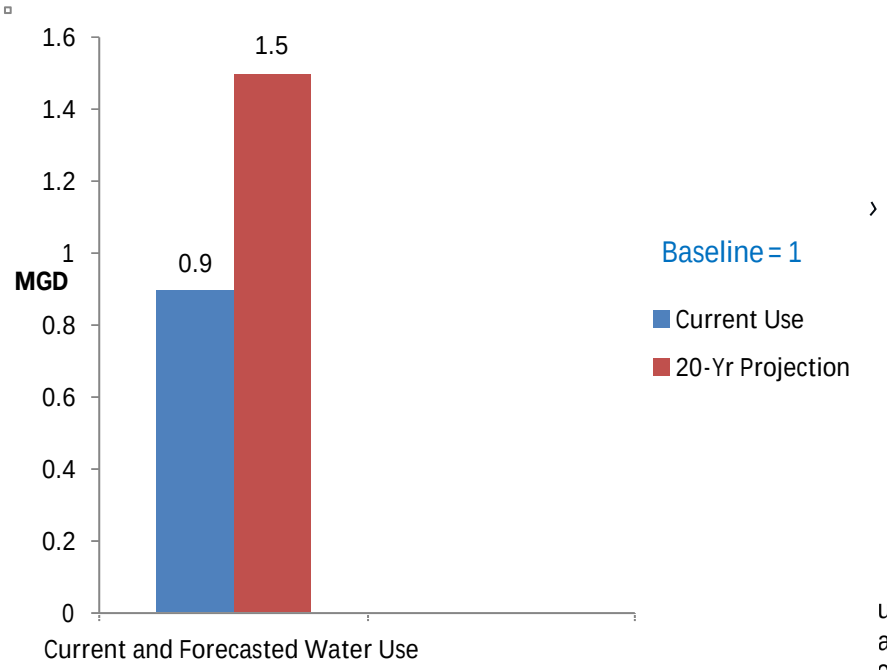
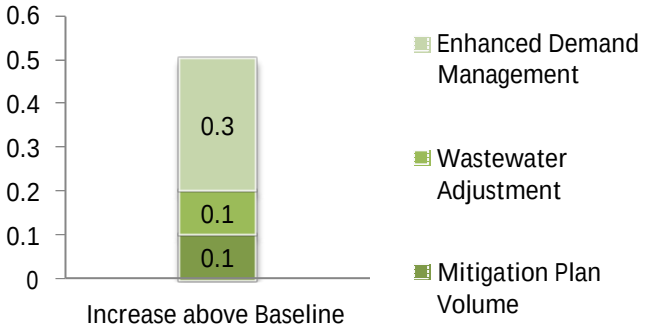


Figure 1b: Detail on increase above baseline from Figure 1a



›

urrent Use = 0.9 MGD
aseline = 1.0 MGD
_0-year projection = 1.5 MGD

D. Increase above Baseline (C minus B) = 0.5 MGD

E. Enhanced Demand Management Estimate = 0.3 MGD

F. Wastewater Adjustment for Groundwater Returns = 0.1 MGD

   a. The groundwater return adjustment could have ranged from zero, if the service area were entirely sewered and discharged through a NPDES discharge, to a maximum of 0.17 MGD (the increase above baseline minus the enhanced demand management, multiplied by 85% (taking 15% consumptive loss into account). *See Section 9.*

G. Mitigation Plan Volume (D minus E minus F) = 0.1

Items A through F are all either known or estimated at the start of the WMA permitting process. Item G, the Mitigation Plan, must be developed and submitted as part of the WMA permit application review process.

Direct and Indirect Mitigation

This section specifies eligible mitigation activities and discusses the difference between direct and indirect mitigation. The section also outlines the method for calculating mitigation credits necessary to meet an applicant's total mitigation requirement. There are two types of mitigation and therefore mitigation credits:

1. **Direct Mitigation** – Direct mitigation will directly result in enhanced streamflow, as a result of enhanced 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, as described in the following sections.
2. **Indirect Mitigation** – Indirect mitigation are environmental improvements that will help to compensate for streamflow impacts resulting from withdrawals. Examples of indirect mitigation include habitat improvements and water supply protection. The relative "value" of the indirect mitigation activity is determined by a credit system, described below. The credits required for a given rate of withdrawal to be mitigated are shown in Table 9f-2.

Post-2005 activities qualifying as direct or indirect mitigation that continue to provide environmental benefit may be considered as part of an initial mitigation plan pending Department review and approval.

Certain activities could be considered for either direct or indirect mitigation credits. Regardless of which type of mitigation credit is chosen, an activity can only be given credit once.

9e Direct Mitigation

The following actions can be considered for direct mitigation credit:

Surface Water Releases

A permittee may have control over an impoundment that could be used to supplement downstream flow conditions, through controlled releases. Such opportunities will be informed by factors such as a reservoir's firm yield; ecological, infrastructure and recreation considerations for the impoundment, and structural limitations of the dam. Potential releases should be evaluated for their ability to improve the timing, magnitude, and duration of downstream flows to more closely mimic natural conditions and improve habitat or fish passage, without compromising other in-lake uses. The implementation plan for such surface water releases would need to be determined on a case-by-case basis, along with the equivalent volume of credit awarded toward the permittee's required mitigation. A consultation with the appropriate state agencies will be required for permittees who would like to include surface water releases as part of their mitigation plan.

NOTE: In consultation sessions with surface water suppliers, if the supplier identifies releases as a mitigation option, then further evaluation of the feasibility of reservoir releases should be the first priority before evaluating other direct mitigation options.

Stormwater Recharge

Direct mitigation credit will be awarded in cases where 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. Soils in areas proposed for stormwater recharge must have sufficient infiltration capacity and calculated annual recharge volumes must be approved by the Department. 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. Increases in annual recharge volumes resulting from any redevelopment projects that are approved by the Department will be awarded direct mitigation credit on a gallon-for-gallon basis. Creditable projects will also require operation and maintenance plans approved by the Department.

Infiltration and Inflow (I/I) Removal

Infiltration

Infiltration, in the context of wastewater collection system maintenance, is groundwater that enters collection systems through sources such as defective pipes, pipe joints, and manhole walls. Typical I/I studies quantify seasonal, high groundwater infiltration rates for areas within a wastewater collection system.

Mitigation credit for removal of infiltration is based on a calculated total removable infiltration volume determined in accordance with the Department's most current version of *Guidelines for Performing Infiltration/Inflow Analyses and Sewer System Evaluation*. Generally, it is assumed that I/I projects result in a maximum of 50% infiltration removal. This percentage may be adjusted depending on the specifics of the infiltration removal process. Credit for infiltration removal will be awarded following an assessment that includes a discussion of the basis for the infiltration rates and outlines the infiltration removal project(s) proposed or completed for which the applicant would like to receive mitigation credit.

Inflow

Inflow, in the context of wastewater collection system maintenance, is water that enters the collection system through direct sources such as: catch basins, manhole covers, cross connections with storm drains, sump pumps, foundation drains, and downspouts. Typical I/I studies will quantify inflow rates measured during various storms for areas within a wastewater collection system using the Department's *Guidelines for Performing Infiltration/Inflow Analyses and Sewer System Evaluation*. An Inflow reduction project typically results in the removal of 100% of the inflow to the collection system from the identified sources. Inflow may be redirected to the ground, to a dry well, or to a stormwater collection system. Only that portion of inflow that is directed to recharge will be awarded direct mitigation credit. Credit for inflow removal will be awarded following an assessment that includes a discussion of the basis for

the inflow rates and outlines the inflow removal project(s) proposed or completed for which the applicant would like to receive mitigation credit.

9f Indirect Mitigation

Indirect mitigation activities are activities undertaken to offset the impacts of a withdrawal. Indirect mitigation activities are generally not amenable to volumetric calculation; the Department will utilize a qualitative credit system for the benefits of a particular action. The credit system reflects the effectiveness of a particular action in augmenting base flow (e.g., by promoting stormwater recharge during storms), improving habitat conditions, improving watershed protection, or providing other benefits that could offset the impacts of a withdrawal.

Indirect Mitigation Credit System

The indirect mitigation credit system is a qualitative assessment converted to a score represented as credits. In order to determine how many indirect mitigation credits an applicant may need, the applicant should subtract their direct mitigation plan volume from the total volume the applicant is required to mitigate (commensurate with impact). Table 9f-1 translates indirect mitigation volumes (this would be an applicant's remaining mitigation volume requirement assuming the implementation of their direct mitigation plan) into credits for Tier 2 and Tier 3 applicants. Please note that the credit structure is different for Tiers 2 and 3.

Table 9f-1: Credits Required for Indirect Mitigation

Indirect Mitigation Amount (MGD)	Credits required for Tier 2	Credits required for Tier 3
> 0 to 0.1	Up to 10	Up to 20
>0.1 to 0.2	Up to 20	Up to 40
>0.2 to 0.3	Up to 30	Up to 60
>0.3 to 0.4	Up to 40	Up to 80
>0.4 to 0.5	Up to 50	Up to 100
>0.5 to 0.6	Up to 60	Up to 120
>0.6 to 0.7	Up to 70	Up to 140
>0.7 to 0.8	Up to 80	Up to 160
>0.8 to 0.9	Up to 90	Up to 180
>0.9 to 1	Up to 100	Up to 200
1.0 or more	case by case	case by case

Activities that will be considered for indirect mitigation credit and their associated credit amounts are included in Table 9f-2. Indirect mitigation activities have been assigned credits based on baseflow augmentation (e.g., by promoting stormwater recharge during storms), habitat improvement,

watershed protection improvements, or other benefits that could offet the impacts of a withdrawal. Credits were assigned as follows:

1. The activity will not benefit the improvement category = 0 credits
2. The activity will have a partial benefit to the improvement category = 5 credits
3. The activity will benefit the improvement category = 10 credits

The credit values for specific activities displayed in Table 9f-2 are based on best professional judgment and are intended to provide a starting point for discussion with the applicant. All indirect mitigation projects will be reviewed on a case by case basis during the agency consultation process and the total score may be adjusted based on site specific information such as the location or scale of the activity.

Table 9f-2: Indirect Mitigation Activities and Potential Credits

During agency consult total score may be adjusted based on site specific information such as the location or scale of the activity.

Category	Mitigation Action	Instream Flow Improvement (max 10)	Aquatic Habitat[1] Improvement (max 30)			Water Supply Protection (max 10)	Generic Total Score
			Water Quality[2] Improvement (max 10)	Habitat Improvement (max 10)	Stream Continuity Improvement (max 10)		
Habitat Improvement	Remove a dam or other flow barrier[3]	5	5	5	10		25
Habitat Improvement	Culvert replacement to meet stream crossing standards		5	5	10		20
Habitat Improvement	Streambank restoration		5	10			15
Habitat Improvement	Stream channel restoration			10	5		15
Habitat Improvement	Stream buffer restoration		5	10			15
Habitat Improvement	Other habitat restoration project			10			10
Habitat Improvement	Install and maintain a fish ladder[3]				10		10
Habitat Protection	Acquire property in Zone I or II					10	10
Stormwater	Stormwater bylaw with recharge requirements	5	5				10
Stormwater	Stormwater utility meeting environmental requirement[4]	5	5				10
Stormwater	Implement MS4 requirements[4]		10				10
Habitat Improvement	Establish/contribute to aquatic habitat restoration fund			5			5
Habitat Protection	Acquire property for other natural resource protection		5				5
Wastewater	Infiltration/Inflow removal program	5					5
Optimization	Surcharged Reach	10					10
Demand Controls	Private Well Bylaw	10					10
TBD	Other project proposed by applicant	TBD	TBD	TBD	TBD	TBD	TBD
		40	45	55	35	10	185

1) Aquatic habitat improvement can include instream water quality improvement, stream corridor habitat improvement, stream continuity improvement and cold water fishery improvement.

2) Water quality improvement can include reduction in cultural-source sediments, reduction in other pollutants, or - for CFR - mitigation of thermal impacts

3) More credits can be considered if on a coldwater fishery resource

4) Must result in increased recharge to get credit

9g Mitigation Plan Implementation Timeline

An applicant's mitigation plan, if applicable, must be submitted as part of its permit application and must include an implementation timeline. The implementation timeline may be phased provided that any volumes withdrawn over baseline are mitigated prior to when those volumes are withdrawn.[9] The permittee may delay implementation of the mitigation plan for as long as withdrawals remain below baseline. All WMA permits in a basin are reviewed every five years, with the permits reviewed at year 5, year 10, and year 15 based on the permit expiration date for that basin. At the beginning of the first 5-year period in which demand (i.e., withdrawals) is expected to exceed baseline, the permittee must implement mitigation activities to offset the anticipated withdrawal volume over baseline for that 5-year period.

Mitigation Plan Adjustments

Under certain circumstances a permittee's mitigation plan will need to be adjusted during the course of the 20-year permit. Circumstances that could result in the Department requiring that a permittee adjust or revise the mitigation plan may include, but are not limited to, the following:

1. If water savings from enhanced demand management do not reduce demand to the extent anticipated in the mitigation plan, or if for any other reason demand over baseline is higher than was anticipated when the mitigation plan was approved by the Department, the permittee will need to propose how they intend to mitigate the additional volumes. Alternatively, if demand management strategies are more successful than anticipated, portions of the mitigation plan may not need to be implemented.
2. If, during the 20-year WMA permit period, significant wastewater adjustment volumes (volume returned to groundwater through septic systems and permitted groundwater discharges) are instead sewered, the permittee's wastewater adjustment volumes will need to be recalculated. Once the wastewater adjustment volume has been recalculated, the mitigation volume will also need to be recalculated. Any mitigation volumes not addressed in the permittee's initial mitigation plan will need to be addressed in a revised mitigation plan that must be approved by the Department.

9h Mitigation and Cost Feasibility Guidance

The regulations require mitigation to the greatest extent feasible, and the term feasible includes consideration of cost. Upon the completion of a mitigation plan, an applicant may request that the Department review the ability of the applicant to afford their mitigation =plan as proposed (i.e., review the cost feasibility). Applicants who are not required to mitigate are not eligible for a cost feasibility assessment by the Department. Applicants who are not eligible or do not want the Department to

[9] The Department will make reasonable allowances, as necessary, for the first few years of the permit period for suppliers whose withdrawals are already above baseline at the time a permit is issued or renewed.

review their ability to finance their mitigation plan as proposed should skip to Section 10 of this document.

Cost Feasibility Assessment

This cost feasibility assessment is optional and will be initiated at the request of the applicant. The following assessment will assist the Department in determining if the applicant has proposed a plan to meet the conditions of its WMA permit that is feasible for the applicant to finance over the term of its permit. This assessment is intended to capture both the applicant's ability to finance proposed capital projects and any increased operating costs necessary to meet the conditions of its WMA permit. The assessment is based on a series of review thresholds. These thresholds will be used by the Department as guidance to determine if the applicant has shown that implementing its WMA permit will likely result in financial hardship for the community. The applicant's mitigation plan and 10-year budget, as described below, will be reviewed by the Department and discussed during the applicant's consultation(s) with the agencies. Applicants may also, but are not required to, submit a minimization plan for review as part of this cost feasibility assessment. See Section 6 for additional information on minimization and Section 9 for additional information regarding mitigation and mitigation planning.

Documents required to be submitted to the Department when requesting a cost feasibility assessment:

- Proposed mitigation plan,
- 10-year budget
    - Specifying ***WMA Project Costs,***
- Approved operating budgets for the previous five years, and a
- Minimization plan (optional).

10-Year Budget

Applicants requesting a cost feasibility assessment by the Department must submit a 10-year budget along with their mitigation plan to the Deparment. Submission of a minimization plan is optional; applicants who submit their minimization plan would do so in order for the Department to consider the individual project costs of implementing minimization measures, rather than integrating the cost and revenue lost resulting from minimization activitiesinto their operating budget. If minimization costs are not specifically identified in the budget, the Department will assume that all costs and potential losses in revenue resulting from implementing minimization measures are captured in the operating costs included 10-year budget. The Department or the permittee may ask for a review of this 10-year budget in preparation of a 5-year permit review or upon alterations to the permittee's mitigation plan.

The Department has provided a budget template, *EPA's Asset Management and Debt Capacity Tool,* that can be found on the Department's website, http://www.mass.gov/eea/agencies/massdep/water/watersheds/water-management-act-program.html. The template budget is comprised of two worksheets, an asset managment worksheet and a debt capacity worksheet. Applicants who choose to use this budget template should complete, at

the minimum, the debt capacity worksheet. Applicants are not required to use this template, but should consult the directions associated with the template when preparing a budget.The budget should serve as both a capital improvement plan and an operations and maintenance forecast.

The minimum types of information that need to be included in the budget in order for the Department to complete an assessment include:

- Operating costs (salaries and wages, fringe benefits, and other personnel costs),
- Non-capital maintenance costs,
- Revenue (including proposed rate increases and grant funding for projects),
- Ongoing replacement or rehabilitation of infrastructure,
- Planned capital improvement projects (both those projects proposed to meet the conditions of the WMA permit and other planned capital projects and upgrades),
- Applicant reserves and special funds,
- Existing debt service, and
- Proposed additional debt service to cover planned expenses.

WMA Project Costs are any costs included in the budget that specifically address the applicant's mitigation and minimization plans and cannot be attributed to meeting other state or federal requirements (e.g., a municipal separated storm sewer (MS4) permit, Safe Drinking Water Act requirements, a National Pollutant Discharge Elimination System (NPDES) permit, or other permit). These costs should be clearly itemized and identified in the 10-year budget as ***WMA Project Costs.*** The applicant should also indicate the proposed source of funding for each item (e.g., grant, capital reserves, rates, borrowed funds (whether through a SRF loan or other source), etc.). ***WMA Project Costs*** will be considered independently in the cost feasibility assessment (see cost feasibility thresholds for more information). Examples of WMA-specific projects may include, but are not limited to:

  - Developing a new source or interconnection,
  - Aquifer storage and recharge,
  - The entire cost of a dam removal project proposed as part of the applicant's mitigation plan,
  - Enhanced implementation of a pipe replacement program, and
  - Enhanced implementation of an existing I/I program.

Applicants may submit a budget for just the PWS, or they may also integrate the operations,maintenance, and capital improvement budget for the community's wastewater utility into the 10-year budget submitted for review. Applicants who provide budgets that incorporate budgets for both the drinking water wastewater utility will be evaluated using different threshold values (as described in the next Section) than those applicants who submit a budget for only the PWS.

Applicants should also provide the Department with approved budgets for the previous 5 years (the budgets should be comparable in scope to the 10-year budget provided by the applicant. For example, if the 10-year budget only covers the PWS, the historic budgets should only be for the PWS).

Cost Feasibility Thresholds

The Massachusetts Water Infrastructure Finance Commission (WIFC) assessed a range of costs, with benchmarks at 1.00%, 1.25%, 1.5%, 2.0%, and 2.5%. The WIFC's final report, *Massachusetts Water Infrastructure: Toward Financial Sustainability, February 7, 2012* concludes that "… a [Median Household Income] MHI ratio of 1.25 is a reasonable number to use as a measure of local commitment and contribution for each water and sewer rates."

The WIFC further estimated that the statewide average water bill is 0.52% of MHI and the statewide average sewer bill is 0.75% of MHI. These estimates were based on the 2010 state-wide average MHI of $64,081 and the average water rates taken from the 2010 Tighe and Bond water rates survey assuming an adjusted typical household water use of 70,000 gallons per year.

The Department has identified several thresholds against which to determine cost feasibility of a proposed mitigation plan for an applicant. While their use is described in more detail in the following section, these thresholds include:

- **Threshold 1**: The average water bill as a percentage of MHI based on the Tighe and Bond rate survey adjusted for a typical household water use of 70,000 gallons per year. This threshold will be adjusted bi-annually based on the most recent Tighe and Bond rate study. For example, in 2010, Threshold 1 was 0.52%. If the wastewater utility is included in the budget provided to the Department, Threshold 1 would be a sum of the statewide average water and sewer bills as a percentage of MHI, or 1.27% for 2010. If the Tighe and Bond rate study is not available, the applicant may recommend a comparable substitute for calculating the water and/or sewer rates.
- **Threshold 2**: ***WMA Project Costs*** will independently result in an annual rate increase of 2% or more.
- **Threshold 3**: WIFC's MHI to water rate ratio of 1.25%. If the wastewater utility is included in the budget provided to the Department, Threshold 3 would be 2.5%.

Assessment

The mitigation and minimization plans, financial information, and supporting documentation submitted to the Department by the applicant will be evaluated according to the following three-step process. If at any point the Department determines that the proposed plan may cause the applicant financial hardship, the Department will work with the applicant to identify additional funding sources or alternative mitigation projects.

Step 1:

If the applicant's cost feasibility assessment submittal meets all of the following criteria, the mitigation and minimization plans are presumed to be financially feasible for the applicant and no further review will be conducted by the Department. If any of the three criteria identified are not met, the applicant will proceed to Step 2 of the assessment.

Table 9h-1: Schematic of Step 1 of the Cost Feasibility Assessment Review		
1. In the year the application is received, the applicant's average residential annual bill is less than the value for **Threshold 1** for the most recent year that the Tighe and Bond rate survey was completed.	No→	Move to Step 2
Yes ↓		
2. ***WMA Project Costs*** can be spread out over some portion of the 20-year WMA permit period.	No→	
Yes ↓		
3. The applicant's average residential annual bill is less than the value for **Threshold 1** throughout the 10-year budget provided by the applicant.	No→	
Yes ↓		
The proposed plans are considered financially feasible and the cost assessment is complete.		

Step 2:

If the applicant's cost feasibility assessment submittal meets all four of the following criteria, the mitigation and minimization plans are presumed to be financially feasible for the applicant and no further review will be conducted by the Department. If any of the four criteria identified below are not met, the applicant will proceed to Step 3.

Table 9h-2: Schematic of Step 2 of the Cost Feasibility Assessment Review		
1. In the year the application is received, the applicant's average annual bill as a percentage of MHI is less than **Threshold 3**.	No→	Move to Step 3
Yes ↓		
2. ***WMA Project Costs*** can be spread out over some portion of the 20-year WMA permit period.	No→	
Yes ↓		
3. ***WMA Project Costs*** will not independently result in an annual rate increase of more than 2.0% of the previous year's rates (**Threshold 2**).	No→	
Yes ↓		
4. Rates, as a percentage of MHI, at the end of the 10-year budget provided by the applicant are less than **Threshold 3**.	No→	
Yes ↓		
The proposed plan is considered financially feasible and the cost assessment is complete.		

Step 3:

The Department will work with the applicant to identify additional potential funding sources and alternative mitigation projects. The Department will also work with the applicant to revise the timeline for implementing the mitigation plan where necessary. Revised mitigation plans will be subject to review and approval by the Department.

10. Data Refinement and Site Specific Study

Data Refinement Options

Any applicant may submit refinements to the data used to develop the BC and GWC for the subbasin(s) in which its withdrawal(s) is located, and to the data/assumptions used for the assessment of cumulative impacts. If the applicant's refinements are approved by the Department, they will be included in the WMA permit requirements.

Applicants and interested parties may submit, for review and approval by the Department, refinements to the data used to develop the BC and GWC for any subbasin, including but not limited to:

(a) Calculation of the August groundwater pumping volume during the 2000 to 2004 study period. Information used to refine this calculation include:
   1. Wells assumed to be in use were not in use;
   2. Wells were pumping at significantly different rates than assumed; or
   3. Significant reductions in groundwater withdrawals since the 2000-2004 study period due to:
      a. Wells that have been abandoned; or
      b. A public water supply that has transferred withdrawals from its own withdrawal points to a different source(s).

(b) Information used to make an adjustment to the delineated subbasin boundaries include:
   1. Subbasin drainage boundaries do not coincide with documented groundwater boundaries; or
   2. Subbasin boundaries occur within water bodies rather than at outlet points.

(c) Hydrologic/geologic considerations:
   1. Confined aquifers; or
   2. Pumping that causes documented groundwater impacts across subbasin boundaries.

(d) Refinements, demonstrated through groundwater modeling, to the assumed 1:1 August Pumping to August Stream Depletion ratio. The modeling must demonstrate that the impacts from ground water withdrawals to August streamflow are less than 1:1, assuming the year-round pumping pattern of the groundwater sources.

(e) WMA permit applicants may refine the Department's assessment of cumulative impacts to the subbasin (described in Section 4) by demonstrating that the entire permitted groundwater withdrawal request above baseline cannot be withdrawn from one subbasin either by documenting the system's constraints (i.e., pumping capacity limit), or by agreeing to conditions that limit pumping from sources in that subbasin. The applicant must provide the Department with a breakdown of its total request above baseline by subbasin and this would become a permit condition that the specified amounts would not be exceeded on a subbasin basis.

To ensure that the data refinements are incorporated into the cumulative impact analysis at the beginning of the permit period, specific deadlines are established in 310 CMR 26.20(2) for submitting this information. The Department will make changes to the BC and GWC maps as appropriate based on any approved data refinements. Applications for new WMA permits filed subsequent to the first expiration date in a basin may include proposed data refinements for the subbasin(s) in which the proposed withdrawals are located.

Site Specific Fish Community Assessment

A Tier 1 applicant with a withdrawal point(s) in a subbasin(s) that is more than 25% August net groundwater depleted may conduct a site-specific fish community assessment during the first 5-year permit period to demonstrate that the observed fish population in the subbasin(s) exceeds the expected number of fish for the applicant's GWC. The applicant's assessment must be designed, in consultation with EEA Agencies, to examine the fish community downstream of a well or well field. The geographically referenced point at which the impact of the withdrawal point(s) will be assessed will be determined in consultation with EEA Agencies. In order to calculate the GWC for the well or well field location, the applicant will calculate the percent alteration of August median flow from groundwater withdrawals in accordance with the methods used in USGS SIR 2011-5193.

Table 10 below describes typical survey methodologies used by DFW to sample fish communities in wadeable streams and rivers.

Table 10: Protocols for Surveying Wadeable Streams and Rivers and for Determining the Inventory of Fish in Waterbodies
DFW uses a range of equipment to sample for fish communities, depending on the stream or river habitat to be sampled. The type of equipment used is determined by the habitat to be sampled, but includes electrofishing methods (backpack, barge, or boat electrofishing units) as well as the use of gillnets and seines. Almost all of DFW's fish community sampling in wadeable streams and rivers is conducted using backpack and barge electrofishing methods.
A. Sampling for Fish using Backpack and Barge Electrofishing DFW typically collects fish samples using this method from June 1 to October 1.
Backpack Electrofishing: Backpack shockers, such as a Smith-Root BP-4, are best used in streams that are narrow (i.e., with an average width less than 8 meters) and shallow (i.e., an average depth less than 0.5 meters) streams. In streams that are wider than 8 meters on average but shallow, 2 or more backpack units can be used to increase efficiency.
1. Crews of 3 to 5 people conduct single pass electrofishing surveys, moving from the downstream end of the sampling reach to the upstream end.
2. The beginning and ending points will be marked on USGS 1:25,000 topographical maps. The sample reach length and average width will be measured with by meter tape.

Table 10: Protocols for Surveying Wadeable Streams and Rivers and for Determining the Inventory of Fish in Waterbodies
3. The standard reach length should be at least 100 meters, but optimal reach lengths will be roughly 30 times the stream width, which may include a variety of habitat types (riffle, pool, run, etc.) within the sample reach.
4. All portions of and habitats in the stream will be sampled, including habitat features such as woody debris, submerged aquatic vegetation, undercut banks, and overhanging vegetation.
5. Fish will be sampled by pulsed DC current electrofishing.
6. Backpack sampling will consist of a single upstream pass.
7. The crew member wearing the backpack to electroshock fish will use 2 ring probes (when average stream width exceeds 3 meters), or a ring probe anode and rattail cathode (when average stream width is less than 3 meters). If the backpack electrofishing unit being used is not capable of 2 ring probe configuration, then 2 backpack units should be used when stream width exceeds 3 meters.
8. The rest of the crew members will carry buckets and/or dipnets to collect fish that are influenced by the electric current.
9. Crews will begin at the downstream end of a sampling site and shock to the upstream ending point. Crewmembers will use dipnets to capture fish that roll off the bottom or rise to the surface.
10. All fish will be kept alive in five-gallon buckets.
11. Where appropriate, livecages should be positioned in the water along the sample reach to reduce the potential for significant fish mortality.
12. Crew members will place all fish from the buckets into the live cages as often as is appropriate.
Barge Electrofishing: For larger streams and rivers, it is more suitable to use an electrofishing barge capable of producing DC pulsed current, such as a Smith-Root, Inc. electrofishing barge with 2.5 GPP generator. The methods for collecting the fish samples are essentially the same for barge electrofishing as for backpack electrofishing, except that the crew will consist of a minimum of 3 people (1 barge operator and 2 shockers/netters). However, more crew members should be used in wider streams and rivers with the optimum crew consisting of 1 operator, 3 members netting fish and manning probes, and 3 members netting fish only and transferring them to the livewell.
B. Documenting the Fish Sampling The *Biological Survey of Waters: Fish Sampling Log* and *Fish Species and Length Frequency Information* data sheets, Field Sampling Log Instructions and a list of common fish names and abbreviations can be found at www.website.
Captured fish will be identified to species and measured to length. Species and length are recorded on the *Fish Species and Length Frequency Information* data sheet. If more than 100 fish of a species are captured, only the first 100 of each species will be measured to length, the remaining fish will be identified to species and tallied on the *Fish Species and Length Frequency Information* data sheet. The total length of each fish will be measured from the tip of snout to tip of tail (with the lobes of the tail compressed to represent a maximum length) to the nearest millimeter, except for American eels and sea lampreys which will be measured to the nearest centimeter. If more than 100 fish of one species are captured, they will be tallied and recorded on the data sheet discussed below, but are not measured to

Table 10: Protocols for Surveying Wadeable Streams and Rivers and for Determining the Inventory of Fish in Waterbodies
length.
No more than 2% and no less than two individuals (or one if only a single specimen is collected) of each species captured can be preserved in 10% formalin for confirmation of identification by laboratory analysis. Live fish that are not retained for preservation will be returned to the sample site.
The fish sampling data collected will be recorded on the following DFW data sheets. • The *Biological Survey of Waters: Fish Sampling Log* is used to record the sample locations and information on the collection effort. The specific instructions and standards for completing the Fish Sampling Log are contained on page 2 of this data sheet. All units will be metric. • The *Fish Species and Length Frequency Information* is used to record the species and lengths of all fish captured. Fish species abbreviations, to be used on the form, appear on page two of this data sheet. All units will be metric.

The applicant will then conduct the site-specific fish community assessment using protocols based on those used to collect fish community data for the USGS study and approved by DFW. The fish sampling and collection protocol shall, at a minimum, require that fish community sampling be conducted by the applicant once per year for 5 years at 3 locations and include the methods, times of year, and effort requirements for the sampling. The applicant must first obtain a fish collection permit from DFW, which will include the fish sampling and collection protocol. During the assessment period, the applicants will be required to submit annual monitoring reports to DFW and DEP.

At the conclusion of the 5-year monitoring period, DEP, in consultation with the EEA Agencies, will compare the average fluvial fish relative abundance at that location over the 5-year monitoring period to the fluvial fish relative abundance found at all fish community sampling sites within the same GWC. If the average at the applicant's location is greater than the 75th percentile for fish sampling locations within the same GWC, then the applicant will not be required to implement minimization measures typically required of permittees in subbasins with groundwater depletion greater than 25% in August.

11. Permitting Tools and Resources

WMA Permitting Tool

The WMA permitting tool is an Access database that provides the data necessary to determine potential WMA permitting requirements. Permittees, consultants, watershed groups, government agencies and others can use the permitting tool to assess potential impacts due to increases in withdrawals from new or existing supply wells. The permitting tool contains the data and equations to determine BC, GWC and August NGD. The user can enter the rate of increased water use and output the resulting changes in streamflow, and potential changes to BC, GWC and August NGD. The WMA permitting tool is used in conjunction with the Department's interactive map, both of which are available at

(http://www.mass.gov/eea/agencies/massdep/water/watersheds/water-management-act-program.html).

The WMA permitting tool is organized into two main views, PWS and subbasins. The PWS view contains data for each of the approximately 240 PWS systems regulated under the WMA: 20-Year Water needs forecast volumes from DCR, baseline rate, WMA authorized rates, actual annual use since 2006, and 5-year block permitted rates for those PWS permits that have been renewed for 20 years. The PWS view also lists the PWS wells, surface water sources, and other water use points (e.g., NPDES discharge points, groundwater discharge points, wells of non-PWS entities such as golf courses, and wells of non-WMA PWS entities such as restaurants) for each subbasin in which the PWS has one or more sources.

The subbasin view displays data for the 1400-scale subbasins of the MWI Report (USGS report SIR-2009-5272). The MWI data are "nested," meaning that data for a subbasin includes the cumulative area of the subbasin and all upstream subbasins contributing to it. Likewise, the percentage of impervious cover (IC) of a subbasin represents the percent IC of the subbasin and all upstream subbasins. For example, the streamflow of the subbasin containing the Charles River dam in Boston (the outlet of the Charles River to Boston Harbor) represents the basin's entire streamflow.

The subbasin view displays data from the USGS MWI Report: estimated unaffected August median streamflow; August groundwater pumping rates; impervious cover percentage; area in square miles; and wastewater discharge rates. The estimated streamflow was simulated by USGS using actual 1961 to 2004 daily stream gage data at index gages.

The subbasin view also displays existing GWC, BC and August NGD, and calculates potential changes in GWC, BC and NGD based on user-input increases or decreases in groundwater pumping.

GWC is a statistical category calculated from the percent of August estimated unaffected streamflow that is pumped from all wells in or upstream of the subbasin. For example, if a subbasin's estimated August unaffected streamflow is 2 million gallons per day (mgd) and the total August groundwater pumping in and upstream of the subbasin is 1 mgd, then August well pumping is 50% of the August streamflow. This subbasin is therefore a GWC-4, which has a range of 25-55% of August well pumping as a percentage of unaffected streamflow.

Biologic Category (BC) is a statistical category of the health of the riverine fish community in the subbasin. BC is calculated using a regression equation with the following variables: impervious cover, channel slope, percent wetland in the buffer zone of the river, and the percent of August streamflow that is pumped as groundwater.

Net Groundwater Depletion (NGD) is a measure of the influence of all groundwater withdrawals and discharges on streamflow. It is calculated by comparing a subbasin's unaffected August streamflow to all groundwater discharges (septic systems plus DEP-regulated groundwater discharge facilities) and

groundwater withdrawals (public water supply wells, non-PWS wells such as industrial wells, and private domestic wells). NGD is expressed as a percent change in the unaffected August streamflow due to all groundwater withdrawals and discharges. For example if a subbasin has an August unaffected stream flow of 8 mgd, total groundwater withdrawals of 4 mgd and total groundwater discharges of 2 mgd, then the NGD is 25%: 8 – (8 – 4 + 2) = 2; (2/8) x 100 = 25%). This subbasin is 25% Net Groundwater Depleted because the net rates of groundwater withdrawals and discharges is 25% of the unaffected August streamflow.

The user can change the groundwater pumping rate by inputting a positive rate (increased pumping) or negative rate (decreased pumping). The resulting change in NGD, BC, and GWC is calculated and displayed. It is important to note that the user-input rates are not calculated for downstream subbasins, even though changing pumping rates impacts downstream subbasins. To determine the effect on NGD, BC, and GWC in downstream subbasins from changes in groundwater pumping, the user must input the changes in pumping rate to each downstream subbasin of interest. The downstream subbasins can be identified using the SWMI interactive map at http://www.mass.gov/eea/agencies/massdep/water/watersheds/sustainable-water-management-initiative-swmi.html.

DATA SUMMARY:

Data for the PWSs regulated under the WMA:

- Baseline rate, defined as the larger of the 2003-2005 average rate plus 5% or the 2005 volume plus 5%. Baseline cannot be (1) less than the registered rate, (2) more than the authorized rate allocated in 2005. The database identifies the methodology for the baseline rate of each PWS.
- Authorized rates (registered plus permitted).
- 20-year WNF, if available.
- Actual annual water use from 2006 onward.
- The unique subbasin ID numbers in which the PWS has sources.
- All reported water use points in the subbasins in which the PWS has sources: PWS groundwater and surface water sources (both WMA-regulated and non-WMA regulated), non-PWS groundwater and surface water sources (golf courses, industries, etc.), surface water discharge (NPDES permits), and permitted groundwater discharges.

Data for the 1400-scale subbasins:

- Identification of the water use points listed above for each subbasin.
- Cumulative area (the subbasin and all upstream subbasins).
- Cumulative percent impervious cover.
- Cumulative August groundwater pumping rates:
    - 2000-2004 average for PWS wells and commercial wells;

    - private wells estimated from U.S. Census data.
- Cumulative 2000-2004 August groundwater discharge rate:
    - cumulative 2000-2004 August surface water discharge rate;
    - cumulative August septic system discharge rate estimated from U.S. Census data August NGD percentage.
- Presence/absence of CFR (not including upstream subbasins).
- Presence/absence of surface water withdrawals (including upstream subbasins).
- BC.
- GWC.
- Net groundwater depletion percentage.

Massachusetts Department of Environmental Protection's Website

Interactive Map

http://www.mass.gov/eea/agencies/massdep/water/watersheds/sustainable-water-management-initiative-swmi.html

This interactive geographic information systems (GIS) map presents a graphic display of BC and GWC developed through the SWMI process for the MWI 1400-scale subbasins. The webpage also includes links to the relevant USGS scientific investigation reports and supporting documents presented and summarized in the maps. The webpage and the map are works in progress, which will evolve to support stakeholders.

Links to relevant reports

http://www.mass.gov/eea/agencies/massdep/water/watersheds/water-management-act-program.html

The Department's website also includes an extensive set of links to relevant studies and databases.

Appendix A: USGS Background Studies

Summary of USGS scientific studies used to develop the Biological Category (BC) and Groundwater Withdrawal Category (GWC) in Water Management Act permitting

The following is a brief summary of four U.S. Geological Survey Scientific Investigations Reports (USGS SIR) that form the scientific basis for the Water Management Act permit requirements. Each report builds upon the results of the previous one, and collectively they form the basis for the categorization of Massachusetts streams and rivers according to the predicted condition of riverine fish populations. The term describing near-natural streamflow varies in the reports; it is referred to as unimpacted streamflow, unaffected streamflow, unregulated streamflow and least altered streamflow.

Index Gage Report (USGS SIR 2007-5291)

The USGS operates hundreds of streamflow gages in New England, some of which have more than 50 years of daily stream flow records. The USGS "Index Gage Report" analyzed streamflow records to determine which gages represented the "least altered" streams in Massachusetts. Although all streams in Massachusetts have likely been altered to at least a small degree due to human activity, streamflow conditions at gages range from near-natural ("least altered") to highly altered. The Index Gage Report identified those gages ("index gage") located on streams having least-altered conditions. Based on statistical analysis of 1960 to 2004 daily stream flow records at 61 index gages, four types of rivers were identified: high-gradient runoff-dominated rivers, northern runoff-dominated rivers, southern runoff-dominated rivers, and baseflow-dominated rivers. The daily streamflow data from the index gages were used to develop the Sustainable Yield Estimator (described below).

Armstrong, D.S., Parker, G.W., and Richards, T.A., 2008, Characteristics and Classification of Least Altered Streamflows in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2007-5291, 113 pp.

http://pubs.usgs.gov/sir/2007/5291/

Sustainable Yield Estimator (USGS SIR 2009-5227)

The Sustainable Yield Estimator (SYE) is a software package developed by the USGS to simulate streamflow at any point on a stream or river in Massachusetts except for: the mainstems of the Connecticut and Merrimack rivers, small coastal tidally-influenced rivers, and groundwater-dominated streams of the Plymouth-Carver and Cape Cod aquifers. The SYE converts actual daily streamflow measured at a USGS index gage from 1960 to 2004 into simulated daily streamflow for any point on a stream without a gage ("ungaged stream"). To generate the simulated daily flows for an ungaged stream, the SYE selects the index gage with basin characteristics most similar to the ungaged stream's basin. SYE then adjusts the daily flows from the selected index gage to generate daily flows for the

ungaged stream, based on differences in basin characteristics such as drainage area, percent sand and gravel, percent wetlands, and average annual precipitation.

SYE simulates unimpacted ("unaffected") and impacted ("affected") daily flows from October 1, 1960 to September 30, 2004 (44 hydrologic years) and calculates median average monthly streamflow, annual 7-day minimum flow, and August median flow. The SYE package contains water withdrawal and wastewater discharge volumes reported to the Department or USEPA from 2000 to 2004. To obtain affected streamflow, the SYE adjusts the simulated unaffected daily flows downward by the average amount of water pumped from the drainage area of the stream and/or upward by the amount of wastewater discharged to the drainage area of the stream. Both the affected and unaffected SYE-generated daily flows can be imported into widely available software such as The Nature Conservancy's Indicators of Hydrologic Alteration (IHA), to calculate additional flow statistics, beyond those generated by SYE.

Archfield, S.A., Vogel, R.M., Steeves, P.A., Brandt, S.L., Weiskel, P.K., and Garabedian, S.P., 2010, The Massachusetts Sustainable Yield Estimator: A Decision Support Tool to Assess Water Availability at Ungaged Sites in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2009-5227, 41 pp.

http://pubs.usgs.gov/sir/2009/5227/

Massachusetts Water Indicators (USGS SIR 2009-5272)

The USGS "Mass. Water Indicators" (MWI) study used the SYE to simulate unaffected and affected streamflow at the outlet of 1,395 pre-delineated subbasins in Massachusetts. An important feature of the subbasins is that they are "nested" so that the drainage area of a subbasin includes the area (and withdrawal and discharge volumes) of all the subbasins that drain to it. The MWI estimated the affected flow at each subbasin outlet by taking into account the reported water supply withdrawals and wastewater discharges from 2000 to 2004 included in the SYE, estimated private well withdrawals, and estimated septic system discharge. It is important to note that MWI included estimated private well and septic system volumes estimated from U.S. Census data, in addition to the reported water and wastewater volumes in the SYE. The MWI also estimated the percent of impervious cover in each (nested) subbasin, which in the USGS "Fish and Habitat" study (described below) was determined to have significant negative correlation with the health of river fish populations.

For each of the 1,395 subbasins, the MWI report includes unaffected and affected flow values, the withdrawal and discharge rates used to calculate affected flow, and percent impervious cover. The daily streamflow values are provided as an annual average value and as January, April, August and October medians (representing seasonal flow variation needed for healthy riverine fish habitat in Massachusetts). The annual values of altered flow account for surface water and groundwater withdrawals, but the monthly values only include groundwater withdrawals. Surface water withdrawals were excluded from the monthly affected flow calculations because the impacts of monthly reservoir

withdrawals on monthly subbasin outflows is reservoir-specific and could not be accurately characterized in this study. Both annual and monthly affected flow values include wastewater discharges, because discharges immediately affect streamflow and therefore could be added to the monthly unaffected flow.

Weiskel, P.K., Brandt, S.L., DeSimone, L.A., Ostiguy, L.J., and Archfield, S.A., 2010, Indicators of Streamflow Alteration, Habitat Fragmentation, Impervious Cover, and Water Quality for Massachusetts Stream Basins: U.S. Geological Survey Scientific Investigations Report 2009-5272, 70 pp.

http://pubs.usgs.gov/sir/2009/5272/

Fish and Habitat Study (USGS SIR 2011-5193)

The USGS "Fish and Habitat" study used SYE analyses and fish sampling data from the MA Division of Fisheries and Wildlife (DFW) to determine the response of riverine or fluvial fish communities to human activities (water and land use) and natural conditions (e.g., basin slope and wetlands) in Massachusetts. Riverine fish are fish that depend on flowing water for part or all of their life cycle and were used in the Fish and Habitat study as an indicator of the overall health of a river's aquatic ecosystem. The study compared fish community data collected by DFW under a variety of streamflow and land use variables to determine which were most closely related to changes in riverine fish characteristics. The results indicate that of all the factors tested, the two human activities that have the most impact on fish populations are percent impervious cover within the watershed and the rate of groundwater withdrawal (expressed as a percent of unaffected August streamflow). Impervious cover includes roadways, sidewalks, parking lots and building roofs. Higher amounts of impervious surface and groundwater withdrawal were both associated with declines in riverine species and numbers.

The Fish and Habitat study produced an equation that can be used to show the response of riverine fish population at any point in a stream to increases in impervious cover and groundwater withdrawal. The equation was used to show the difference in fish community characteristics under two scenarios: (1) no groundwater pumping in August and impervious cover at 1% (representing near-natural conditions) and; (2) at the MWI 2000 to 2004 average August groundwater pumping rate and actual percent impervious cover (representing existing conditions). 1% impervious cover was chosen for the "unaffected" condition because there are essentially no subbasins completely absent of impervious cover. Zero groundwater pumping was used for the "unaffected" condition because many MWI subbasins have no groundwater withdrawals.

Armstrong, D.S., Richards, T.A., and Levin, S.B., 2011, Factors Influencing Riverine Fish Assemblages in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2011-5193, 59 pp.

http://pubs.usgs.gov/sir/2011/5193/

Categorization of Massachusetts Streams and Rivers

Subsequent to the Fish and Habitat study, nested MWI subbasins were classified two ways based on the predicted decline in riverine fish population due to groundwater pumping and percent impervious cover: Biological Category (BC) and Groundwater Withdrawal Category (GWC). The Biological Category considers both August pumping and impervious cover and ranges from the healthiest predicted fish populations (BC-1, 0% to 5% decline in the range of riverine fish, and a disproportionate loss of sensitive species or life stages) to the least healthy (BC-5, more than 65% decline in the range of riverine fish, loss in species, and marked decline in sensitive species or life stages). The Groundwater Withdrawal Category (GWC) holds impervious cover at a constant (1%) in order to isolate the effects of pumping groundwater on the fish population. Each GWC corresponds to the percent of groundwater withdrawal that, in the absence of increases in impervious cover, would result in a change in BC. GWC ranges from GWC-1 (0% to 3% August groundwater pumping as a percent of unaffected August streamflow) to GWC-5 (more than 55% August groundwater pumping as a percent of unaffected August streamflow).

Appendix B: Surcharged Subbasins

In certain situations, withdrawals above baseline from significantly surcharged subbasins may qualify for an adjustment, which could offset the mitigation required for the increased withdrawal. An initial screening by the Department indicates that the following major basins contain surcharged reaches with subbasins that could be eligible for an adjustment: the Blackstone, Concord, South Coastal, Taunton, and Ten Mile. The table below provides additional information about the eligible subbasins and associated volumes. Surcharge offset adjustments will be made at the discretion of the Department.

Appendix B Table: Subbasins with Surcharged Reaches

Major Basin	Subbasin unique ID	Municipalities with land area in these subbasins
Blackstone	23038	Millbury
Blackstone	23043	Millbury
Blackstone	23040	Millbury
Blackstone	23049	Millbury, Sutton
Blackstone	23046	Sutton, Grafton
Blackstone	23048	Grafton
Blackstone	23053	Grafton
Blackstone	23071	Northbridge, Uxbridge
Concord	12007	Sudbury
Concord	12035	Marlborough, Sudbury
Concord	12009	Northborough
Concord	12014	Northborough, Westborough
Concord	12020	Westborough
South Coastal	22017	Rockland, Hanover
Taunton	24011	West Bridgewater, East Bridgewater
Taunton	24012	East Bridgewater
Taunton	24020	East Bridgewater
Taunton	24034	Bridgewater
Taunton	24106	East Bridgewater, Bridgewater
Ten Mile	24046	Attleboro

Appendix C: Permit Renewal Schedule

	Initial Permits Issued	Renewal Date
Hudson Basin	August 31, 1988	August 31, 2008
Blackstone Basin	February 28, 1989	February 28, 2009
Charles Basin	February 28, 1989	February 28, 2009
Ipswich Basin	August 31, 1989	January-March 2015*
North Coastal Basin	August 31, 1989	August 31, 2009
Boston Harbor Basin	February 28, 1990	February 28, 2015*
Taunton Basin	February 28, 1990	February 28, 2015*
South Coastal Basin	August 31, 1990	August 31, 2015*
Cape Cod Basin	November 30, 1990	November 30, 2014*
Islands Basin	February 28, 1991	February 28, 2015*
Buzzards Bay Basin	May 31, 1991	May 31, 2015*
Concord Basin	August 31, 1991	August 31, 2015*
Ten Mile Basin	November 30, 1991	November 30, 2015*
Deerfield Basin	February 29, 1992	February 29, 2016*
Housatonic Basin	May 31, 1992	May 31, 2016*
Farmington Basin	August 31, 1992	August 31, 2016*
Westfield Basin	November 30, 1992	November 30, 2016*
Millers Basin	February 28, 1993	February 28, 2017*
Chicopee Basin	May 31, 1993	May 31, 2017*
Quinnebaug Basin	August 31, 1993	August 31, 2017*
Connecticut Basin	November 30, 1993	November 30 2017*
Nashua Basin	February 28, 1994	February 28, 2018*
French Basin	May 31, 1994	May 31, 2018*
Shawsheen Basin	August, 31, 1994	August 31, 2018*
Merrimack Basin	November 30, 1994	November 30, 2018*
Parker Basin	February 28, 1995	February 28, 2019*
Narragansett Basin	May 31, 1995	May 31, 2019*

*Expiration date extended by 4 years by Chapter 240 of the Acts of 2010, as amended by Chapter 238 of the Acts of 2012, collectively known as the Permit Extension Act.

Glossary

The following glossary is intended to provide a quick reference section for readers to avoid the need to go back through the text in search of a definition or an acronym. It includes both:

- key concepts from the SWMI Framework and a brief background on how the concept was developed and/or a description of how the concept is used in Water Management Act permitting; and
- a simple listing of common terms that appear and are then abbreviated in the text of this guidance.

Aquatic Base Flow (ABF) is a statistical method of determining the natural flows necessary for the protection and propagation of aquatic life. It is expressed as the median of monthly mean flows, and is calculated for each month using estimated near-natural daily flow values.

August median flow means the median of the August median flows for the period of record described 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).

August net groundwater depletion means the unimpacted median monthly flow for August minus 2000-2004 groundwater withdrawals plus 2000-2004 groundwater returns described 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).

Authorized withdrawal means:

(a) that volume of water that is registered, permitted or both; or
(b) that volume of water for which a nonconsumptive use statement has been accepted by the Department.

The volume of an authorized withdrawal in a registration statement or permit is expressed as an annual average daily volume calculated by dividing the total annual withdrawal by the number of days of operation during the year.

Baseline means the volume of water withdrawn during calendar year 2005 plus 5%, or the average volume withdrawn from 2003 through 2005 plus 5%, whichever is greater, provided that:

(a) baseline cannot be less than a permittee's registered volume;

(b) baseline cannot be greater than the permittee's authorized volume for 2005; and
(c) if, during the period from 2003 to 2005, the permittee's withdrawals from the water source were interrupted due to contamination of the source or construction of a treatment plant, the Department will use best available data to establish a baseline volume from the water source.

Biological Category (BC) for each subbasin is based on the simulated 2000-2004 existing condition of aquatic habitat using fluvial fish community characteristics as the surrogate variable. Each biological category represents the percent alteration within the range of these fluvial fish community characteristics as a function of the following subbasin parameters: 1) impervious cover; 2) cumulative groundwater withdrawal as a portion of the unimpacted August median flow; 3) stream channel slope; and 4) percent wetland within the stream buffer area.

Simulated Alteration of Fluvial Fish Community Characteristics
Biological Category 1: 0% to 5%
Biological Category 2: >5% to15%
Biological Category 3: >15% to 35%
Biological Category 4: >35% to 65%
Biological Category 5: >65%

Bioperiod means specified periods during the year that correspond to fish life stages or critical biological processes (e.g., spawning, incubation, rearing, growth, migration, overwintering) based on Characteristics and Classifications of Least Altered Streamflows in Massachusetts (Armstrong et al., 2008, USGS SIR 2007-5291).

Coldwater fish resources (CFR) means waters that the MA Division of Fisheries and Wildlife has identified support cold water fish in accordance with 321 CMR 5.00 (once promulogated).

Department of Conservation and Recreation, Office of Water Resources (DCR OWM)

Department of Environmental Protection (DEP)

Department of Fish and Wildlife (DFW)

Executive Office of Energy and Environmental Affairs (EEA)

Feasible means suitable for implementation taking into consideration the anticipated environmental improvement, cost, available technology and the permittee's legal authority to implement the alternative or action.

Firm yield means a simulated estimate of the water volume available in a reservoir or reservoir system during drought conditions, as approved by the Department. Firm yield is determined using the response of the reservoir to the drought of record. If the applicant has a drought management plan that details specific steps to be taken in response to droughts and the means to measure results, the Department will consider the response of the source(s) to the best approximation of a 1-in-20 year drought. The reservoir system's firm yield derived from this analysis will then become the basis for permitting maximum annual withdrawals from the reservoir(s).

Fluvial fish means fish living in a stream or river that are dependent upon flow during one or more stages in their life cycle.

Functional Equivalence Plan (FEP) means a plan prepared by a permittee who has been unable to meet the RGPCD or UAW Performance Standards within the timeframes outlined in their permit. A FEP includes a timetable for implementing required best management practices for meeting the Performance Standard(s).

Groundwater Withdrawal Category (GWC) for each subbasin is based on the ratio of the 2000-2004 groundwater withdrawal volume to the unimpacted median monthly flow for August and represents conditions during the late summer bioperiod (July-September). Each groundwater withdrawal category represents the range of this ratio that would result in the biological category of the same number under conditions of low (1%) impervious cover.

Simulated Groundwater Withdrawal Ratio for the Late Summer Bio-Period
Groundwater Withdrawal Category 1: 0% to 3%
Groundwater Withdrawal Category 2: >3% to 10%
Groundwater Withdrawal Category 3: >10% to 25%
Groundwater Withdrawal Category 4: >25% to 55%
Groundwater Withdrawal Category 5: >55%

Location Adjustment Factor (LAF) accounts for the reduced environmental benefit of returning water outside of the major basin from which it was withdrawn.

Million gallons per day (MGD)

Minimization means measures that reduce withdrawals from, or return groundwater to, the subbasin or river basin from which a withdrawal is made, or other management measures intended to improve streamflow.

Mitigation means activities undertaken that offset the impacts of ground or surface water withdrawals by improving streamflow or aquatic habitat.

Net Groundwater Depletion (NGD)

Permit tier means a tier to which a permit application is assigned based on the size of the requested withdrawal volume relative to the applicant's baseline, and the potential for any increase in withdrawal above the applicant's baseline to contribute to a change in the biological category or groundwater withdrawal category of the subbasin(s) from which the withdrawal is made.

For groundwater withdrawals:

- Tier 1 - The applicant requests no withdrawal greater than baseline;
- Tier 2 - The applicant requests a withdrawal greater than baseline, but the requested withdrawal will not result in a change in the biological category, groundwater withdrawal category or seasonal groundwater withdrawal category of the subbasin(s) from which it is made;
- Tier 3 - The applicant requests a withdrawal greater than baseline, and the requested withdrawal will result in a change in the biological category, groundwater withdrawal category or seasonal groundwater withdrawal category of the subbasin(s) from which it is made.

For surface water withdrawals:

- Tier 1 - The applicant requests no withdrawal greater than baseline;
- Tier 2 - The applicant requests a withdrawal greater than baseline.

For withdrawals in the groundwater-driven basins (i.e.: the southern portion of South Coastal, Cape Cod, Islands, and portions of Buzzards Bay):

- Tier 1 - The applicant requests no withdrawal greater than baseline;
- Tier 2 - The applicant requests a withdrawal greater than baseline.

Public water supplier (PWS)

Residential gallons per capita day (rgpcd) is a measure of residential water use, both indoor and outdoor, per person.

Safe yield means the maximum dependable withdrawals that can be made continuously from a water source including ground or surface water during a period of years in which the probable

driest period or period of greatest water deficiency is likely to occur; provided, however, that such dependability is relative and is a function of storage and drought probability. The Department's method for calculating and applying safe yield is described at 310 CMR 36.13.

Seasonal Groundwater Withdrawal Categories (SGWC) for each subbasin are based on the ratio of the 2000-2004 groundwater withdrawal volume to the unimpacted median monthly flow for the 4 bioperiods listed below.

	Oct-Nov	Dec-Feb	March-April	May-June
Seasonal Category 1:	0% to 3%	0% to 3%	0% to 3%	0% to 3%
Seasonal Category 2:	>3% to 5%	0% to 3%	0% to 3%	>3% to 5%
Seasonal Category 3:	>5% to 15%	>3% to 10%	>3% to 10%	>5% to 15%
Seasonal Category 4:	no numeric criteria			
Seasonal Category 5:	no numeric criteria			

Streamflow criteria are established by the biological, groundwater withdrawal and seasonal groundwater withdrawal categories for each subbasin. Withdrawals that contribute to a subbasin changing to a more altered category do not meet streamflow criteria and will only be permitted if the permittee demonstrates that there is no feasible alternative available to meet demonstrated water needs, and the permittee undertakes mitigation commensurate with the impacts of the withdrawal to the greatest extent feasible.

Subbasin means 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), unless otherwise specifically provided.

Sustainable Water Management Initiative (SWMI), which was created in 2010, established an Advisory Committee and a Technical Subcommittee comprised of a wide range of stakeholders to advise EEA and its agencies on sustainable management of water resources that balance human, economic and ecological needs. See Section 2 of this document for a more detailed description.

Unaccounted for water (UAW) is defined as the residual resulting from the total amount of water supplied to a distribution system as measured by master meters, minus the sum of all amounts of water measured by consumption meters in the distribution system, and minus confidently estimated and documented amounts used for certain necessary purposes.

Unimpacted median monthly flow means the estimated near natural median monthly streamflow over a simulated 44-year period generated by The Massachusetts Sustainable Yield

Estimator: A Decision Support Tool to Assess Water Availability at Ungaged Stream Locations in Massachusetts (Archfield et al., 2009, USGS SIR 2009-5227).

Water Management Act (WMA) means the Massachusetts Water Management Act, M.G.L. c. 21G.