

Prepared for:
MassDOT Highway Division
Boston, MA

NPDES Storm Water Management Plan for MassHighway Owned and Operated Highways

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Prepared for:
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Prepared By

Reviewed By

Document No.: 60137197-0101

Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, I certify that the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Luisa Paiewonsky, Administrator
MassDOT, Division of Highways*

Signature Date

*MassHighway was integrated into the new Massachusetts Department of Transportation ("MassDOT"), Division of Highways, effective November 1, 2009. See St. 2009, c. 25, § 8

This Stormwater Management Plan (SWMP) relates only to the former MassHighway roads and not all MassDOT roads.

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1.0 Introduction

A primary objective of state and municipal transportation departments throughout the Commonwealth is to provide a safe, efficient, and cost-effective highway system. The development and maintenance of a transportation system, providing mobility and access to major geographic areas, is necessary to the economic well-being of Massachusetts. Likewise, quality of life and economic prosperity also require protection and enhancement of our natural resources. Therefore, construction and operation of our highway system must balance the public goals of environmental protection, such as storm water management, with those of safety, access, and mobility.

1.1 NPDES Phase II Storm Water Regulations

The U.S. Environmental Protection Agency (EPA) published the regulation entitled "National Pollutant Discharge Elimination System – Regulations for Revision of the Water Pollution Control Program Addressing Storm Water Discharges; Final Rule" on December 8, 1999 in the Federal Register. This program is often referred to as the National Pollutant Discharge Elimination System (NPDES) Phase II program.

Under the Phase II regulations [40 CFR Parts 9, 122, 123, and 124], portions of the highway drainage system owned and operated by MassHighway meet the definition of regulated Municipal Separate Storm Sewer Systems (MS4s). According to 40 CFR 122.26(b)(8), "municipal separate storm sewer" is defined as a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

- (i) "Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act that discharges into waters of the United States;
- (ii) Designed or used for collecting or conveying storm water;
- (iii) Which is not a combined sewer; and
- (iv) Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2."

Federal and State-operated small MS4s can include universities, prisons, hospitals, roads (i.e. departments of transportation), military bases (e.g. State Army National Guard), parks and office buildings/complexes. Therefore, MassHighway Department is considered a regulated MS4.

Operators of regulated small MS4s are required to:

- Apply for National Pollutant Discharge Elimination System (NPDES) permit coverage by submitting a Notice of Intent (NOI);
- Develop a storm water management program which includes the six minimum control measures;
- Implement the storm water management program using appropriate storm water management controls, or "best management practices" (BMPs), by the end of the permit term;
- Develop measurable goals for the program; and
- Periodically evaluate effectiveness of the program.

EPA Region 1 developed the "NPDES General Permit for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems" for the New England region. The permit was issued in the Federal Register

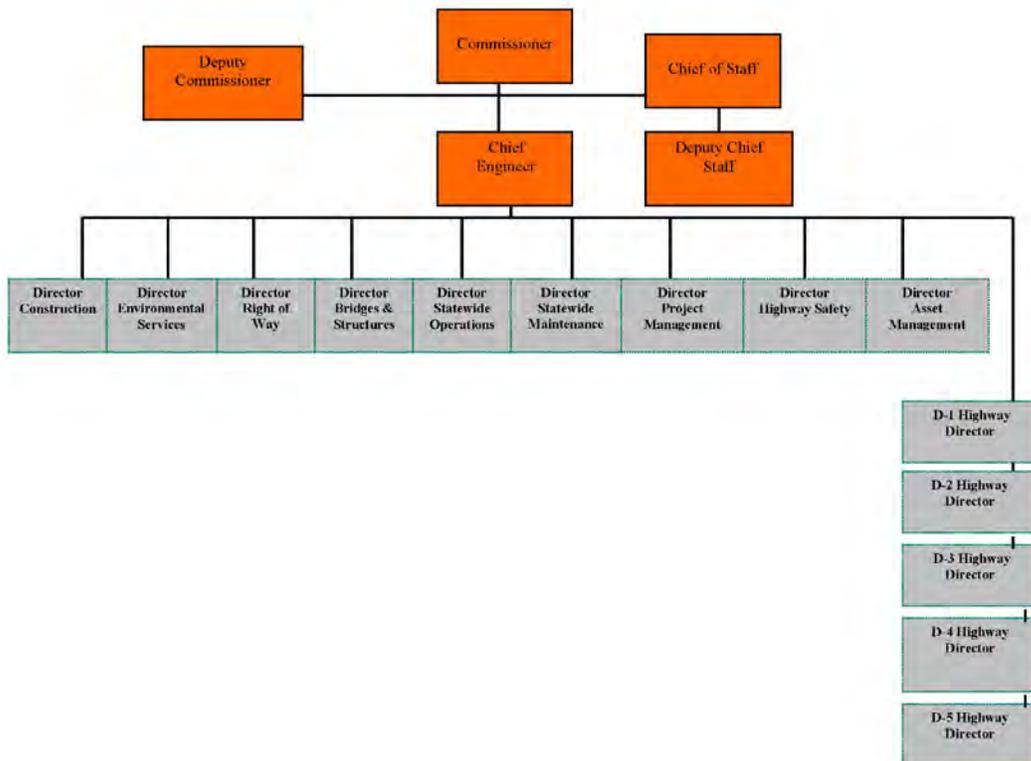
on May 1, 2003. Although the permit expired on May 1, 2008 it has been administratively extended until a new permit is issued. In Massachusetts, the general permit has been issued jointly by EPA and Massachusetts DEP. The permit is issued as a NPDES permit under the Federal Clean Water Act by EPA and as a state Section 401 Water Quality Certification for MA DEP. In recognition of the differences between federal or state-operated MS4 and their municipal counterparts, the general permit includes separate requirements for Massachusetts Small MS4s, New Hampshire Small MS4s (including Indian Lands in MA, CT and RI), Non-Traditional MS4s (e.g., schools, prisons, hospitals) and Transportation MS4s.

The Notice of Intent which serves as the application to be authorized to discharge storm water under the general permit was due no later than July 30, 2003. MassHighway received authorization in April 2007. This Storm Water Management Program, described in this document, has been prepared to comply with the overall general permit, specifically Part V - Transportation MS4 Storm Water Management Program, and address public and EPA comments received during the permit term. This revision includes changes requested by the Conservation Law Foundation (CLF) et al. vs MassHighway Department lawsuit decision. Only those additions required have been added, the overall SWMP has not been updated or revised significantly. An overall update and revision of the SWMP will occur once a general permit is issued and MassHighway must reapply for coverage under the new permit.

1.2 Mass Highway Department Structure

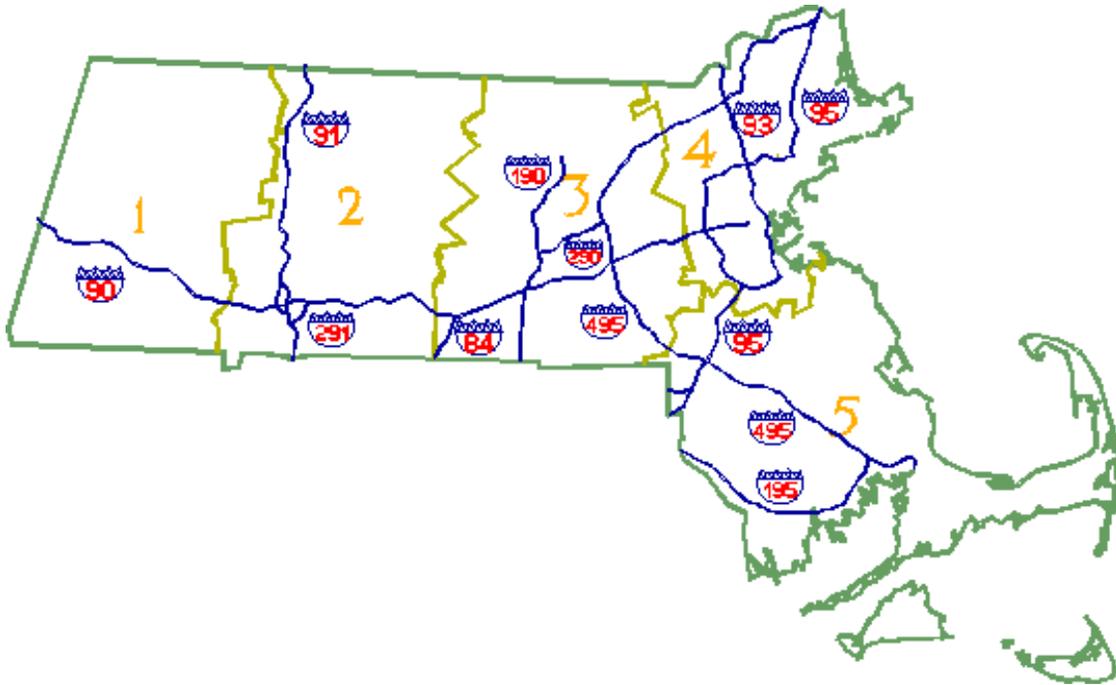
MassHighway is separated into several sections/ divisions. Figure 1-1 summarizes the Department's organizational chart. The Environmental Section has been responsible for developing this SWMP and applying for authorization to discharge under the general permit. The Environmental Section will continue to work with the other sections to implement new programs and maintain existing programs which are part of the SWMP.

Figure 1-1 MassHighway Organizational Chart



The Department is divided into five districts for operation and maintenance purposes. Figure 1-2 depicts the five districts.

Figure 1-2 MassHighway Maintenance Districts



1.3 Urbanized Areas

EPA has required that the SWMP must include all separate storm sewer systems within urbanized areas owned and operated by MassHighway. "Urbanized Area" is defined as a land area comprising one or more places —central place(s)— and the adjacent densely settled surrounding area — urban fringe — that together have a residential population of at least 50,000 and an overall population density of at least 1,000 people per square mile. The urbanized area (UA) designation is based on the results of the latest census – the 2000 Census for this permit. For the 2000 Census, the urbanized area delineations constitute a "zero-based" approach that requires no "grandfathering" of urbanized area boundaries from the 1990 Census. Because of the more stringent density requirements (and the less restrictive extended place criteria), some territory that was classified as urbanized for the 1990 census has been reclassified as rural.

As indicated in Table 1-1, the area classified as urbanized within Massachusetts increased significantly between the 1990 and 2000 census, both in percentage of the state classified as urbanized and the regional spread of these areas. MassHighway anticipates that this trend will continue in future census. Therefore, we have focused most of the proposed programs (as budget and personnel allow) to address storm water on a statewide basis instead of just in the areas currently designated as urbanized. Table 1-2 summarizes the urbanized area road miles by MassHighway District.

Table 1-1 Massachusetts' Urbanized Areas (UA) in 1990 and 2000 Census

MassHighway District	District Area (acres)	1990 Census Urbanized Area		2000 Census Urbanized Area	
		(acres)	(%)	(acres)	(%)
District 1	1,042,971	31,092	3	43,896	4
District 2	1,037,485	168,138	16	187,618	18
District 3	1,097,818	268,534	24	478,232	44
District 4	722,125	498,770	69	559,209	77
District 5	1,279,236	341,970	27	709,411	55
Statewide	5,179,635	1,308,503	25	1,978,366	38

Table 1-2 Road Miles within Urbanized Areas by Maintenance District¹

MassHighway District	Estimated Road Miles	Estimated Road Miles	
		within Urbanized Areas	% within Urbanized Area
District 1	360	22	6
District 2	608	193	32
District 3	885	507	57
District 4	1,205	1,021	85
District 5	1,408	832	59
Statewide	4,466	2,575	58

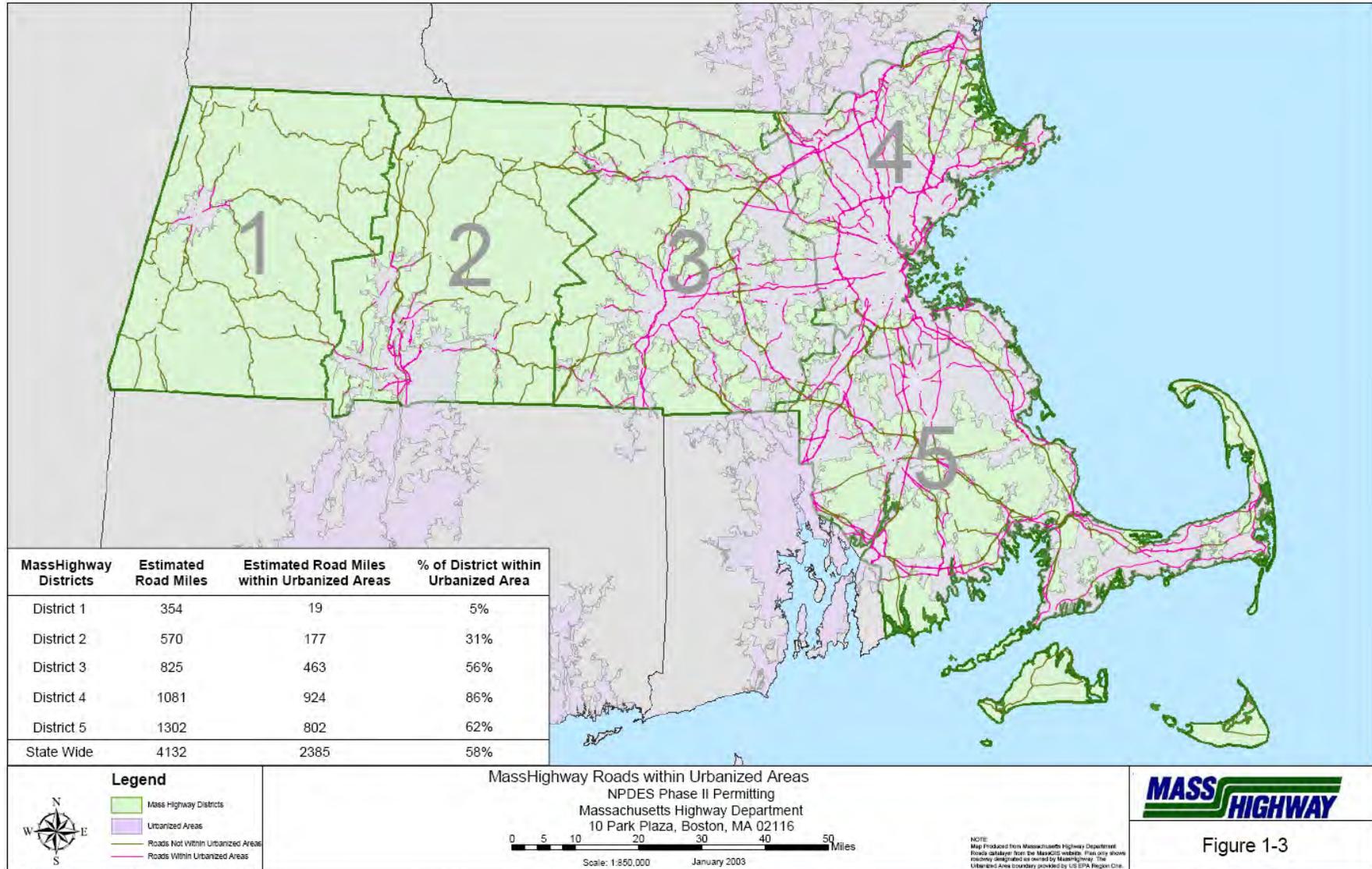
¹ 2000 Census and 2005 MassHighway Road file

Interactive maps which illustrate the roads owned and operated by MassHighway is available at <http://www.eot.state.ma.us/default.asp?pgid=planning/interactiveMaps&sid=about> (choose the jurisdiction view from the drop down menu and then zoom in to area in question). Figure 1-3 illustrates the urbanized area roads owned and operated by MassHighway.

In addition, as of 2005, MassHighway has taken over the winter maintenance responsibility for certain urban arteries managed by the Massachusetts Department of Conservation and Recreation (DCR). These Greater Boston roads, comprising approximately 40% of DCR's roadways, include the following: Centre Street, Fellsway, Fresh Pond Parkway, Jamaica Way, McGrath Highway, Mystic Valley Parkway, O'Brien Highway, Revere Beach Parkway, Storrow Drive, and the VFW Parkway.

When MassHighway turns the ownership of a road over to a town or municipality, a discontinuance agreement is developed to provide legal documentation of the transaction.

Figure 1-3 MassHighway Roadways within Urbanized Areas



1.4 SWMP Submittal History

The following is a summary of the MassHighway submittals to EPA to receive coverage and the response and resubmittal history:

July 28, 2003	MassHighway submitted original SWMP and NOI for coverage under NPDES Phase II MS4 General Permit
October 27, 2003	MassHighway submitted SWMP and NOI with additional material
February 3, 2004	EPA issued letter notifying MassHighway that their NOI was administratively deficient and required modifications
March 9, 2004	Meeting with EPA, MA DEP and MassHighway to discuss deficiency letter
April 30, 2004	MassHighway submitted Permit Year 1 Annual Report
August 24, 2004	Letter from EPA received
September 28, 2004	Letter from MassHighway Commissioner John Cogliano outlining the proposed responses to EPA's August 24 th letter
January 19, 2005	Meeting with EPA, MassHighway and DEP staff to discuss SWMP and NOI
March 4, 2005	MassHighway submitted revised SWMP and NOI
April 25, 2005	MassHighway submitted Permit Year 2 Annual Report
February 17, 2006	EPA Public Hearing regarding MassHighway SWMP and NOI
April 27, 2006	MassHighway submitted Permit Year 3 Annual Report
June 30, 2006	Letter from EPA with additional comments and deficiencies to be addressed before receiving coverage under the permit
July 25, 2006	Meeting with EPA and MassHighway to discuss June 30 th letter and MassHighway response
August 18, 2006	MassHighway submitted revised SWMP and NOI to address comments in June 30, 2006 letter
August 18, 2006	Letter from EPA with required SWMP modifications and obligations under the public review process
October 10, 2006	Letter from EPA regarding SWMP and Snow & Ice Control GEIR
November 30, 2006	MassHighway submits letter to EPA responding to August 18, 2006 and October 10, 2006 letters from EPA, and Extension Request for SWMP/NOI resubmittal
December 1, 2006	MassHighway submits Status of Outstanding Deficiencies to Receiving Authorization including drafts of Table 1 and 2 which summarize the actions taken to address EPA comments (Table 1) and public hearing (Table 2) comments

December 26, 2006	MassHighway submits NOI for authorization to discharge outside of the Connecticut and Merrimack River basins (areas without endangered species habitat since decision from NMFS still pending)
January 26, 2007	Partial Authorization received from EPA (all urbanized areas outside of Merrimack and Connecticut River mega-basins)
February 9, 2007	Re-submittal of data for review by National Marine Fisheries Service (NMFS) to document that discharges do not have a negative impact on short nose sturgeon habitat in Merrimack and Connecticut River
April 27, 2007	Complete Authorization to Discharge received from EPA
January 11, 2008	MassHighway submits SWMP to address August 18, 2006 and October 10, 2006 letters from EPA and public notice comments
November 20, 2009	MassHighway submits a draft SWMP to CLF for review with changes to address requirements from Conservation Law Foundation (CLF) et al. lawsuit decision
December 23, 2009	MassDOT Highway Division submits SWMP to court in compliance with CLF et al. lawsuit decision

During the interim period between these letters and responses, there were many telephone conversations between MassHighway and EPA to discuss the comments and proposed changes to the SWMP and NOI. MassHighway is committed to developing a Storm Water Management Plan which fully complies with the MS4 General Permit.

1.5 Storm Water Pollution Prevention Team

MassHighway staff created a working committee to prepare the Storm Water Management Plan (SWMP). The committee included staff from each of the districts and the maintenance, environmental and construction sections. The committee worked diligently to create a SWMP that reflected the many on-going storm water related programs and policies and to propose programs that were reasonable within the tight budget and staff constraints of the department. This working committee will continue to lend their expertise and experience to the SWMP during implementation by continuing their role as the MassHighway Storm Water Pollution Prevention Team.

The Team will be responsible for:

- Annual evaluation of the continued applicability of the measurable goals for each of the six minimum control measures with input from the MassHighway section/ division(s) responsible for the measurable goal. Based on this evaluation, the annual report may include a recommendation for revising, adding, or deleting measurable goals from the Storm Water Management Plan.
- Preparation and submittal of annual reports to EPA. Annual reports will include a narrative and/or numerical summary of how MassHighway has met the measurable goals for each of the six minimum controls over the last year, and an evaluation of current BMPs and measurable goals.
- The Chairman will be responsible for the overall coordination of the Storm Water Management Program.

Implementation and coordination of each of the measures described in the Storm Water Management Plan will be the responsibility of the Section/ Division(s) indicated in the SWMP summary schedule.

The following individuals currently serve on the MassHighway Storm Water Pollution Prevention Team:

<p>Henry Barbaro, Supervisor of Wetlands & Water Resources – Chairman MassDOT – Environmental Section 10 Park Plaza - Room 4260 Boston, MA 02116 (617) 973-7419 phone (617) 973-8879 fax Henry.Barbaro@state.ma.us</p>	<p>Patricia Trombly, Director of Environmental Programs MassDOT – Construction Division 10 Park Plaza - Room 4260 Boston, MA 02116 (617) 973-7309 phone (617) 973-8040 fax patricia.trombly@state.ma.us</p>
<p>Paul Kelly, District Environmental Engineer MassDOT – District 1 270 Main Street Lenox, MA 01240 (413) 637-1750 phone (413) 637-0309 fax paul.kelly@state.ma.us</p>	<p>Timothy Meyer, District Environmental Engineer MassDOT – District 2 811 North King Street Northampton, MA 01060 (413) 584-1611 phone (413) 584-8194 fax timothy.meyer@state.ma.us</p>
<p>Bill Clougherty, District Environmental Engineer MassDOT – District 3 403 Belmont Street Worcester, MA 01604 (508) 929-3911 phone (508) 799-9763 fax william.clougherty@state.ma.us</p>	<p>Robert Boone, District Environmental Engineer MassDOT – District 4 519 Appleton Street Arlington, MA 02174 (781) 641-8472 phone (781) 646-5115 fax robert.boone@state.ma.us</p>
<p>Thomas McGuire, District Environmental Engineer MassDOT – District 5 1000 County Street Taunton, MA 02780 (508) 884-4250 phone (508) 880-6102 fax thomas.mcguire@state.ma.us</p>	<p>John Gendall, Facilities Engineer MassDOT – Operations 10 Park Plaza – Room 7410 Boston, MA 02116 (617) 973-7305 (phone) gendall.john@state.ma.us</p>

1.6 SWMP Certification

According to Part 1.E.1.i of the permit, the following certification must be signed by MassHighway:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, I certify that the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A signed certification of this Storm Water Management Plan is found immediately following the title page of this document.

1.7 Storm Water Management Program

The remainder of the document describes MassHighway's Storm Water Management Program. MassHighway currently implements many practices, policies, guidelines and programs that relate to pollution prevention and storm water management. This plan outlines each of these ongoing activities and discusses future activities, which have been or will be implemented in the five-year permit term. The program covers all of the department's highways, roadways, bridges, rest areas, weigh stations and maintenance facilities including construction and storm water system maintenance related to these sites within the urbanized areas.

2.0 Minimum Control Measures

The following section describes control measures MassHighway will implement to satisfy conditions of the National Pollution Discharge Elimination System (NPDES) Phase II permit requirements for transportation MS4s. EPA requires compliance with six minimum control measures including:

- Public education and outreach;
- Public involvement/participation;
- Illicit discharge detection and elimination;
- Construction site runoff controls;
- Post-construction runoff controls; and
- Pollution prevention/good housekeeping.

The permit requires that the permittee identify for each minimum control measure:

- The person(s) or department responsible for the minimum control measure.
- Best Management Practices (BMPs) for the minimum control measure. Time lines and milestones for implementation of BMPs.
- Measurable goals for each BMP and, if appropriate, an overall goal for each measure.

The BMPs and measurable goals for each control measure are addressed in detail within this section.

2.1 Public Education and Outreach

EPA Minimum Control Requirement: According to the NPDES Phase II permit, in order to meet the Public Education and Outreach minimum control requirement, the operator of the transportation MS4 "...must implement a public education program to distribute educational material to the community. For the purposes of this permit, a community consists of the people who use the facility. For a transportation agency, this would include employees, contractors, and general public. The public education program must provide information concerning the impact of storm water discharges on water bodies. It must address steps and/or activities that the community can take to reduce the pollutants in storm water runoff.

The following should be included in education and outreach efforts:

- (a) Information regarding activities that occur within the facility, including illegal dumping into storm drains.
- (b) Coordinate activities with local groups (i.e. watershed associations, or schools).
- (c) Materials for outreach/education may include, but are not limited to, pamphlets; fact sheets; brochures; public service announcements; storm drain stenciling and newspaper advertisements.
- (d) Encourage cooperative efforts with neighboring municipalities, watershed associations and others."

MassHighway Programs: Public education efforts implemented or supported by MassHighway may reduce pollutant loads discharged via MassHighway storm drains. MassHighway participates in programs that provide storm water related education to staff, municipal DPWs, and the general public. MassHighway plans to comply with the public education and outreach minimum control measure by continuing the current programs and by implementing additional programs during the permit term. The current and proposed programs or activities, which provide public education and outreach, include:

BMP 1A - MassHighway Training Assistance Program (MTAP) - MassHighway funds training programs through the MassHighway Training Assistance Program (MTAP). This program provides training to MassHighway and municipal DPW staff and includes workshops and seminars addressing storm water management, wetland protection, hazardous waste, and related issues. MassHighway has recently provided training on the MassHighway Storm Water Handbook through the MTAP program.

Measurable Goals: 1) MTAP will facilitate one training program related to storm water and/or snow and ice control as a means of reducing source pollution during each year of the permit term. 2) MassHighway will document the attendance numbers at the seminars and include in each annual report.

BMP 1B - Baystate Roads Program - MassHighway funds training programs through the MassHighway Baystate Roads Program (Baystate). This program provides training to MassHighway and municipal DPW staff and includes workshops and seminars addressing storm water management, wetland protection, hazardous waste, and related issues.

Measurable Goals: 1) Baystate Roads will provide one training program for MassHighway employees and one for municipal DPW snowplow drivers related to snow and ice control as a means of reducing source pollution during each year of the permit term. 2) MassHighway will document the number of employees/ DPW members in attendance at the seminars and include in each annual report.

BMP 1C - MassHighway Web Site – MassHighway currently maintains a web site that provides interested parties with information regarding the MassHighway organization, alternative transportation, special environmental programs and projects. MassHighway has expanded their web site to provide the public additional access to information by adding an Environmental Section web page. The web page is used to solicit public input and publicize storm water related initiatives. Emails received are reviewed and directed to the appropriate department for follow up.

Measurable Goals: 1) Add Environmental Section web page to MassHighway web site. 2) Maintain a link for contacting the Highway Department via e-mail. Review and direct emails received to the appropriate department. 3) Evaluate the MassHighway web page annually and revise as necessary.

BMP 1D - Storm Water Training – This BMP is duplicative since storm water training is addressed through the programs in BMP 1A and BMP 1B above. The BMP will be removed in Annual Report 5 since it is replaced by the additional commitments made in BMP 1A and 1B.

BMP 1E - Educational Seminars for CIM Members – MassHighway provided educational seminars for Construction Industries of Massachusetts (CIM) members on Construction General Permit coverage and environmental compliance during Permit Year 1.

Measurable Goal: Provided educational seminars during Permit Year 1 for Construction Industries of Massachusetts (CIM) members on NPDES Construction General Permit (CGP) coverage and environmental compliance.

BMP 1F – Post Contact Names for Municipal Drainage Concerns on MassHighway Web Site – Municipalities have expressed that they are unsure who to contact when a drainage issue is identified and the road is owned by MassHighway. MassHighway participated in a BayState Roads Program regarding the new Phase II General Permit in May 2007. As a part of the MassHighway presentation, MassHighway distributed a flyer with contact names for each district. The contacts will be responsible for identifying the appropriate person to address the issue and following up with the municipality to make sure that the issue has been resolved. MassHighway has posted DHD contact information on the MassHighway web site to act as a contact point for drainage issues. As storm water drainage inventory information is finalized in each district, MassHighway will explore the best method for sharing this information with the municipalities including whether the information could be available on MassHighway's web site.

Measurable Goals: 1) MassHighway will distribute a flyer with contact names to municipalities during May 2007 Baystate Roads NPDES Phase II General Permit seminar. 2) MassHighway will post DHD contact name for each district on their website for municipalities to contact and maintain this link. 3) MassHighway's GIS group will work on developing a program to provide easy to use access and allow the public to identify a selected area and review the MassHighway owned roads and outfalls. MassHighway will then review alternatives for alerting towns and the public to the availability of this information.

BMP 1G - River and Streams Signs – MassHighway installs and maintains signs identifying rivers and streams crossed by MassHighway roads as requested by the Riverways Program. The installation/maintenance of the signs raises awareness of the traveling public to the resources they are crossing.

Measurable Goal: Maintain signs identifying stream crossings annually, as requested by the Riverways Program, until crossing of all named rivers and streams are signposted.

BMP 1H - Anti-litter/ Dumping Messages on Variable Message Boards - MassHighway includes anti-litter/dumping messages on their variable message boards across the state. While MassHighway already includes these types of messages on the boards, the Department will also reevaluate whether additional messages need to be included and/or if the messages need to be added to other boards.

Measurable Goal: Maintain anti-litter/dumping messages on MassHighway permanent variable message boards.

BMP 1I - Anti-litter/ Dumping Literature at Visitors Centers - MassHighway will develop literature or identify existing literature that discusses the public's impact on storm water, with an emphasis on anti-litter/ anti-dumping. The document will encourage the public to find additional information on MassHighway and EPA's web site. The developed documents will be placed in kiosks at visitors centers across the state. MassHighway will maintain the stock of literature in the visitor's centers.

Measurable Goals: 1) Work with EOEEA Think Blue Campaign to identify appropriate brochures for use in visitor's centers. 2) Distribute literature to appropriate visitor centers and track number of brochures distributed annually.

BMP 1J - New England DOT Coordination - Staff members from the New England DOT's have met and coordinate via email to discuss on-going issues and programs being faced by the DOT's. The meetings/ emails are focused on wetlands (e.g., mitigation) and water resources (e.g., erosion control and storm water management).

Measurable Goal: Coordinate with New England DOTs to discuss on-going issues and programs being faced by the DOT's including wetland mitigation, storm water and erosion controls. .

BMP 1K - Storm Water Coordinator – MassHighway will hire and fund the position for a Storm Water Coordinator. This position will be involved in all aspects of MassHighway's Storm Water Management Program and the implementation of the SWMP. Specific tasks include coordinating IDDE efforts at the District level, tracking the status of stormwater BMPs for annual reporting, responding to TMDL reports by DEP, public outreach and addressing related issues and managing the drainage inventory databases.

Measurable Goal: Fund a full-time stormwater coordinator position each year.

Public education measures are also provided in BMPs included in other minimum controls measures such as BMP 3E, 3F, 4H, 4L-1, 4M, 4N and 4R.

2.2 Public Participation/ Involvement

EPA Minimum Control Requirement: According to the NPDES Phase II permit “all public involvement activities must comply with state public notice requirement.

- (a) The permittee must provide opportunity for the public to participate in the development, implementation and review of the storm water management program. In Massachusetts, the public notice requirements are at Chapter 39, Section 23B.”

MassHighway Programs: State and local public notice requirements allow for significant public involvement opportunities as part of transportation planning and project review. MassHighway also encourages public involvement in the pollution reduction activities sponsored by the department. The public is an important part of both source reduction and clean up. The current and proposed programs or activities, which address the public participation/involvement minimum requirement, include

BMP 2A - Project Related Public Notice/ Public Participation - As a public agency, MassHighway complies with state public notice requirements. Public notice and participation also are an integral part of the requirements of the Massachusetts Wetland Protection Act (WPA), Clean Water Act’s (CWA) Water Quality Certification (401 permit), Army Corps of Engineers 404 permit, and Massachusetts Environmental Policy Act (MEPA). Almost all MassHighway projects are subject to at least one of these regulations. Notices of public hearings are posted on the MassHighway web site.

Measurable Goals: 1) Continue compliance with federal and state notification requirements including, but not limited to, Wetlands Protection Act, Clean Water Act 401 Water Quality Certification, Army Corps of Engineers 404 Permit, and MEPA/NEPA. 2) Post notice of all public hearings on the MassHighway web site.

BMP 2B - Adopt-a-Highway Program – This program is a nationwide program whereby organizations and businesses adopt a stretch of highway or rest area/ visibility site, and participate in litter control and other enhancement projects. Each volunteer team “adopts” a two mile section of highway and removes litter at least once a month. The program kicks off each year in conjunction with Earth Day activities and continues through mid-November. The program provides an opportunity for environmentally conscious groups and corporations to participate in keeping Massachusetts roads litter-



free. In recognition of the volunteer efforts, MassHighway installs a sign recognizing the adopting group for their contribution toward keeping Massachusetts clean. The program includes the “Adopt-a-Rest Area”, “Sponsor-a-Highway” and “Adopt–a-Highway” programs. These programs are an extremely effective program for involving the public in the fight to keep the highways clean and educating them on the impacts of littering and illegal dumping.

Measurable Goal: 1) MassHighway will maintain this program.

BMP 2C – 511 Massachusetts Traveler Information System - Keeping our roadways clean is a high priority at MassHighway. In addition to providing signage within the highway right-of-way that supports litter law enforcement, MassHighway encourages roadway users to notify us of litter and debris along the roadway through the new 511 Massachusetts traveler information system. By calling 511 on a cellular phone or 617-374-1234 on a standard phone, people can act as roving patrollers and keep MassHighway informed of unsightly litter and debris. MassHighway crews are then dispatched to clean up the litter or to take other necessary actions.

Measurable Goal: 1) Maintain the existing 511 System.

BMP 2D - MassHighway Web Site - MassHighway currently maintains a web site that provides interested parties with information regarding the MassHighway organization, alternative transportation, special environmental programs and projects. This web site also provides the public with access to MassHighway's Storm Water Management Plan and Annual Reports.

Measurable Goals: 1) Post the latest version of the Storm Water Management Plan (SWMP) within 30 days of submittal. 2) Post annual reports on the web site within 30 days of submittal.

BMP 2E - Complete AASHTO's Center for Environmental Excellence on "Strategies & Approaches to Complying with NPDES Phase II Survey" - MassHighway's Environmental Section completed the Center for Environmental Excellence survey during Permit Year 3.

Measurable Goal: Complete the Center for Environmental Excellence survey during Permit Year 3.

Public participations measures are also a portion of BMPs included in the other minimum controls measures such as BMP 4O and BMP 1K.

2.3 Illicit Discharge Detection and Elimination

EPA Minimum Control Requirement: The NPDES Phase II permit indicates that the permittee must develop, implement and enforce a program to detect and eliminate illicit discharges. An illicit discharge is any discharge to a municipal separate storm sewer system (MS4) that is not composed entirely of storm water. Exceptions are discharges that have been previously permitted under NPDES, allowable non-storm water discharges described at Part I.F (see Table 2-1 for examples) and discharges resulting from fire fighting activities. The minimum control measures include:

- (a) show the location of all outfalls and the names of all waters that receive discharges from those outfalls. Due to the magnitude of a transportation agency's drainage system, identification of outfalls may be done on a district basis, and as part of construction and redevelopment projects.

Additional elements may be included on the map, such as, location of catch basins, location of manholes, and location of pipes within the system. Initial mapping should be based on all existing information available to the permittee including project plans, agency records, city records, and drainage maps. Field surveys may be necessary to verify existing records and locate all outfalls.

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

The permittee should evaluate existing procedures, policies and authorities pertaining to connections to its separate storm sewer system. If an illicit discharger fails to comply with procedures or policies established by the agency, the permittee may seek assistance from EPA or the state environmental agency in enforcing this provision of the permit.

- (c) The permittee must develop and implement a plan to detect and address non-storm water discharges, including illegal dumping, into the system. The illicit discharge plan must contain the following elements:
 - i. Procedures to identify priority areas. This includes areas suspected of having illicit discharges, for example: older areas of a city, areas of high public complaints, and areas of high recreational value or high environmental value such as beaches and drinking water sources.

- ii. Procedures for locating illicit discharges (i.e. visual screening of out falls for dry weather discharges, dye or smoke testing).
 - iii. Procedures for locating the source of the discharge and procedures for the removal of the source.
 - iv. Procedures for documenting actions and evaluating the impact on the sewer system subsequent to the removal.
- (d) The permittee must inform users of the system and the general public of hazards associated with illegal discharges and improper waste disposal. The permittee must train field inspectors to recognize illicit discharges.
- (e) The non-storm water discharges listed in EPA's Part I.F. (see Table 2-1 for examples) must only be addressed if they are identified as significant contributors of pollutants.

Table 2-1 EPA Allowable Non-Storm Water Discharges*

• Water line flushing;	• Irrigation water;
• Landscape irrigation;	• Springs;
• Diverted stream flows;	• Water from crawl space pumps;
• Rising groundwaters;	• Footing drains;
• Uncontaminated groundwater infiltration (e.g. highway subdrains);	• Lawn watering;
• Uncontaminated pumped groundwater;	• Individual resident car washing;
• Discharges from potable water sources;	• Flows from riparian habitats and wetlands;
• Foundation drains;	• Dechlorinated swimming pool discharges;
• Air conditioning condensation;	• Street wash water; and
• Residential building wash waters, without detergents.	

* *MassHighway requirements may be more restrictive.*

Discharges or flows from fire fighting activities occur during emergency situations. The permit does not require that fire fighting discharges be evaluated with regard to pollutant contributions. They are authorized as non-storm water discharges by the permit unless identified by EPA as significant sources of pollutant to Waters of the United States.

According to the EPA regulations, MS4s must inventory all storm water systems within "urbanized areas" (UA). Figure 1-3 illustrates the MassHighway-owned roadways within urbanized areas. Approximately 2,575 miles of MassHighway roads are subject to the inventorying analysis.

MassHighway Programs: Between 1997 and 2000 (prior to the permit term), MassHighway undertook a detailed outfall mapping and inspection program in the lower Charles River watershed, including the Charles River below the South Natick Dam and primary tributaries. Of the 299 drainage outfalls inspected, MassHighway's consultant observed dry weather flows at 27 outfalls (9% of the total outfalls). Follow-up investigations determined that none of the suspect dry weather flows were related to physical illicit connections. Instead, MassHighway's consultant noted two instances of one-time release into storm drains and the remaining were groundwater inflows to the pipes. One release was a minimal discharge of gasoline or oil, potentially associated with a vehicle accident or breakdown, and the other a turbid discharge possibly related to construction vehicle wash down.

Also, MassHighway prepared an emergency response atlas for the section of Route 128 and Route 2 that is located along the Cambridge Reservoir. The atlas includes a series of maps illustrating the drainage system including flow direction. In the event of a spill entering the drainage system, the maps provide emergency response personnel with the capability of locating the spill flow path and capturing it before being discharged to the Reservoir. Cambridge Reservoir now maintains and updates this atlas.

The above projects describe some of the measures taken by MassHighway in the past to inventory drainage and identify potential illicit connections. Similar strategies will be used during the permit term to review additional areas and map outfall locations for systems subject to this permit. The following current and proposed programs will meet the drainage inventory requirement and Illicit Discharge Detection and Elimination minimum control measure:

BMP 3A - Rest Area Leases – MassHighway developed new drainage system submittal requirements that are incorporated into Rest Area lease agreements where the site is to be redeveloped. The drainage requirements require tenants to provide an electronic inventory of all drainage structures (e.g., catch basins, pipes, detention basins and outfalls) as well as drainage boundaries, sheet flow direction, and pipe flow directions. This drainage information will be incorporated into the outfall inventory by MassHighway.

Measurable Goals: 1) Include drainage system submittal requirements in all new rest area leases where the site is to be redeveloped. 2) Summarize new rest area leases issued each year in the annual report.

BMP 3B-1 - Drainage Inventory Specification – MassHighway will develop a Drainage Inventory Specification which will require the submittal of drainage as-builts by the Contractor upon completion of the project. This specification will be included in all new construction and redevelopment projects which impact drainage.

Measurable Goals: 1) Develop a drainage inventory specification. 2) Include specification into all future construction and redevelopment projects.

BMP 3B-2 - Drainage Inventory – MassHighway will inventory drainage system outfalls within urbanized areas. The inventory will include locating outfalls from plans or in the field. The drainage inventory will be completed by the end of the permit term. A summary of progress towards meeting this goal will be included in each year's annual report.

Measurable Goals: 1) By the end of the permit term complete a drainage inventory of discharges from MassHighway roads in urbanized areas. 2) Each annual report will include a summary or progress towards meeting this goal.

BMP 3C-1 - Drainage Connection Policy – MassHighway has created a Drainage Connection Policy prohibiting illicit discharges to the MassHighway storm water system. This policy was issued and posted on June 26, 2006 by the Chief Engineer.

Measurable Goals: 1) Issue Drainage Connection Policy. 2) Post copy of policy on MassHighway web site. 3) Enforce the provisions through referrals to the Attorney General. 4) Summarize actions taken in annual report.

BMP 3C-2 - Drainage Tie-In Standard Operating Practice - MassHighway is in the process of reviewing the Standard Operating Practice (SOP) regarding drainage tie-ins. The Drainage Tie-In SOP is being revised to regulate connection to the MassHighway drainage system by private landowners and to prohibit non-storm water discharges except as allowed in the NPDES general permit. The SOP will include discharges from existing sites as well and construction sites which disturb more than one acre of land. The Policy will also include procedures for receipt and consideration of information submitted by the public for all construction activities that disturb greater than 1-acre of land and result in the discharge of stormwater into MassHighway's regulated MS4.

Measurable Goals: 1) Issue a revised Drainage Tie-In SOP. 2) Annual reports will summarize the drainage tie-in permits applications and permits issued.

BMP 3D - Illicit Connection Review Program – MassHighway will review discharges each permit year for potential illicit connections. The discharges reviewed will be based on dry weather flows identified during the field inventories or by MassHighway staff during routine operations. Dry weather flows will be sampled. A summary of the discharges reviewed will be included in that year's annual report.

MassHighway is currently developing an RFR to identify and retain a consultant who will perform illicit discharge review for prioritized roads. MassHighway will develop a priority list of roads to review for illicit discharges. The priorities will be based on observations from District personnel, with a focus on more highly urbanized areas which have a greater potential for illicit connections. Impaired waterbodies or other priority resource areas will also receive additional attention. The prioritized list will include a review of the entire contributing drainage system for 10% of the urbanized area roads each year (~240 miles). By providing a comprehensive review of a smaller length of drainage systems, MassHighway can focus its efforts and budgets on the systems that are most likely to have illicit discharges and/or where removal of illicit discharges potentially will have the most impact on impaired waterbodies. The RFR will include developing and finalizing an Illicit Discharge Detection Protocol (IDDP) that describes a drainage system screening and monitoring methodology and reporting procedures; and implementation of the IDDP throughout MassHighway MS4's tributary to waters on the prioritized list.

In addition, MassHighway is reaching out to the municipalities through an email to ask for their input regarding MassHighway roads with known or suspected illicit connections. Feedback from this email will help prioritize those areas with increased likelihood of illicit connections. These areas will be included in the consultant's scope for work for review as budgets allow.

Once an illicit connection is identified, MassHighway staff may perform additional investigation if necessary; including further site visits, dye testing, and/or smoke testing to determine the source of the dry weather flows. Once an adjacent property is identified as the source, the property owner will be notified of the problem by MassHighway and requested to remedy the problem or apply for a permit. If the property owner fails to correct the problem in a timely fashion and effective manner, MassHighway will coordinate with the municipal DPW and disconnect the connection. If the source of the flow is from a MassHighway property, correcting the illegal connection will become a priority project within the District.

Measurable Goals:

- 1. Permit Year 3 – Identify known potential illicit connections from District personnel and/ or public. Review discharges in field. Summarize review, sample results and actions taken for any potential illicit connections in Year 3 Annual Report.*
- 2. Permit Year 4 – Address on-going complaints/ potential IDDEs from District personnel, discharges identified during the drainage inventory and/ or public throughout the year. Review discharges in field. Summarize review, sample results and actions taken for any potential illicit connections in Year 4 Annual Report.*
- 3. Permit Year 5 – Develop prioritized list for IDDE and include in Permit Year 5 Annual Report. Release RFR for development and implementation of IDDE program for watersheds on prioritized list. Field review complaints/ potential IDDEs identified by District personnel, during the drainage inventory, in response to municipal email requesting suspect areas and/ or from public throughout the year.*
- 4. 2008 - 2010 – Award contract and finalize IDDE protocol. Perform comprehensive dry weather review of 10% of urbanized area roads each year and summarize outcome in annual reports. Field review complaints/ potential IDDEs identified by District personnel, during the drainage inventory, in response to municipal email requesting suspect areas and/ or from public throughout the year. Provide summary of IDDE activity in annual report.*

5. Include IDDE methodology in District EMS compliance training annually.

BMP 3E - RE Illicit Connection Training – The 2007 Resident Engineer training program will include a segment on the Drainage Connection Policy, together with a review of standard methods for searching for and identifying illicit discharges during drainage system construction and reconstruction. The training segment will be based on the October 2004 publication "*Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*" prepared by the Center for Watershed Protection.

Measurable Goals: 1) Include training regarding Drainage Connection Policy and awareness during the 2007 Resident Engineer training program. 2) Summarize number of attendees in Permit Year 4 Annual Report.

BMP 3F - Maintenance Staff Illicit Connection Training – The annual Environmental Awareness training program will include a segment on the Drainage Connection Policy, together with a review of standard methods for searching for and identifying illicit discharges during drainage system construction, reconstruction and maintenance. The training segment will be based on the October 2004 publication "*Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*" prepared by the Center for Watershed Protection.

Measurable Goals: 1) Provide training on drainage connection policy, illicit connection identification, and protocol to MassHighway maintenance personnel during the 2007 Environmental Awareness training program. 2) Summarize number of attendees in Permit Year 4 Annual Report.

Illicit discharge detection measures are also a portion of BMPs included in the other minimum controls measures such as BMP 1H, 1I, 1K and 4Q.

2.4 Construction Site Runoff Control

EPA Minimum Control Requirement: According to the NPDES Phase II permit, "the permittee must develop, implement, and enforce a program to reduce pollutants in any storm water runoff to the MS4 from construction activities that result in a land disturbance of greater than or equal to one acre." The permittee must include disturbances of less than one acre if they are part of a larger common plan.

At a minimum, the program must include:

- (a) To the extent allowable under state law, a regulatory mechanism to require sediment and erosion control at construction sites. If such a mechanism does not exist, development and adoption of a mechanism must be part of the program. If attempts to enforce this part of their program are ineffective, the permittee may seek assistance from EPA or the state agency for enforcement of this provision.
- (b) Sanctions to ensure compliance with the program. Sanctions may include either monetary or non-monetary penalties. The transportation agency can consider withholding payment to contractors who fail to implement appropriate sediment and erosion control plans.
- (c) Requirements for construction site operators to implement a sediment and erosion control program that includes best management practices that are appropriate for the conditions at the construction site. The Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas may be used as a tool to implement this provision.
- (d) Requirements for the control of wastes, including but not limited to, discarded building materials, concrete truck wash out, chemicals, litter, and sanitary wastes.

- (e) Procedures for site plan review including procedures which incorporate consideration of potential water quality impacts. The site plan review should include procedures for pre-construction review.
- (f) Procedures for receipt and consideration of information submitted by the public. This may include the opportunities for public comment during the project development process.
- (e) Procedures for inspections and enforcement of control measures at construction sites.

MassHighway Programs: MassHighway is responsible for the construction and maintenance of state highways. It is important to note that not all major roadways or numbered routes are under the jurisdiction of the MassHighway Department. A portion of these roadways and routes are under the jurisdiction of other state agencies, such as the Department of Conservation and Recreation (DCR) and the Massachusetts Turnpike Authority. A large number of roadway segments, including numbered routes, are under the jurisdiction of the municipalities. Interactive maps that illustrate the roads owned and operated by MassHighway is available at <http://www.eot.state.ma.us/default.asp?pgid=planning/interactiveMaps&sid=about> (choose the jurisdiction view from the drop down menu and then zoom in to area in question). However, MassHighway may oversee design and construction on these roadways if they are eligible for certain federal and/or state funds.

The following current and proposed programs address construction site runoff in all MassHighway projects including highways, roadways, bridges, rest areas, weigh stations and maintenance facilities:

BMP 4A - MassHighway Department Project Development & Design Guide - MassHighway issued the Project Development and Design Guide (Guidebook) in January 2006, to provide direct guidance on how to advance a MassHighway project from planning to construction. This Guidebook replaces the 1987 Massachusetts Highway Design Manual. The purpose of the Guidebook is to provide designers and decision-makers with a framework for incorporating context sensitive design and multi-modal elements into transportation improvement projects. Context sensitive design involves a collaborative, interdisciplinary approach that includes careful consideration of environmental resources, in addition to other parameters affecting highway design development. The guide is available at <http://www.mhd.state.ma.us/default.asp?pgid=content/designGuide&sid=about>.

As stated in Chapter 1 of the Guidebook, it should be followed if one or more of the following situations exist:

- When MassHighway is the proponent; or
- When MassHighway is responsible for project funding (state or federal-aid projects); or
- When MassHighway controls the infrastructure (projects on state highway).

MassHighway encourages the use of the Guidebook by other proponents and constituents involved in the development and design of roadway and bridge projects.

The Guidebook provides overall guidance for project development and design. Additional detailed analysis and design procedures are found in other MassHighway manuals and technical references. The *MassHighway Storm Water Handbook for Highways and Bridges (Storm Water Handbook)* comprises one such manual. Chapter 8 of the Guidebook addresses drainage and erosion control and states that the *Storm Water Handbook*, along with the *MassHighway Drainage Manual*, are companion volumes, and should be used by designers when developing roadway drainage designs. MassHighway recognizes the vital importance of drainage in the proper design of highways both from a safety and environmental impact point. The design of a particular drainage system is almost entirely dependent upon physical site conditions and cost.

The *Storm Water Handbook* was prepared for roadway designers and others involved in the design, review, permitting, and implementation of highway and bridge improvement projects. Its objective is to provide the controlling guidance relative to compliance with the DEP Stormwater Management Policy. It also contains

guidance pertinent to meeting the requirements of the NPDES program, and has been referenced in MassHighway's Storm Water Management Plan.

Measurable Goal: Drainage systems for MassHighway roadways will be designed in accordance with Chapter 8 of the MHD Highway Design Guide and companion manuals.

As standard practice, MassHighway employs the use of sediment and erosion control measures throughout its construction projects. Associated regulatory programs include the following:

BMP 4B - MA DEP Stormwater Management Policy - Most new construction and redevelopment activities undertaken by MassHighway are currently subject to the Massachusetts DEP's Stormwater Management Policy and Performance Standards through the Wetlands Protection Act and Clean Water Act Section 401 Water Quality Certification. The DEP Stormwater Management Policy meets the minimum requirements set forth by the EPA for construction runoff control.

Measurable Goals: 1) New construction and redevelopment activities will comply with Massachusetts DEP's Stormwater Management Policy and Performance Standards under the Wetlands Protection Act and Clean Water Act Section 401.

BMP 4C - NPDES Storm Water Construction General Permits - In Massachusetts, the EPA is the delegated authority for NPDES construction permits. MassHighway and the Contractors each file a Notice of Intent (NOI) with EPA for new projects. The key condition of the Construction General Permit is the development and implementation of a construction Storm Water Pollution Prevention Plan (SWPPP). EPA encourages multiple operators at a construction site to develop a comprehensive SWPPP.

For projects which are advertised for construction by MassHighway and which disturb one acre or more, the construction contract includes a Bid Item and Special Provision requiring the Contractor to prepare a SWPPP in accordance with the current NPDES Construction General Permit and MassHighway Guidance Manual. The provision also requires each Contractor to comply with the conditions of the general permit including the performance of inspections and perform all corrective actions as necessary to comply with the General Permit, SWPPP, and any federal and state environmental permits issued to the project. District Environmental and Construction offices verify that the General Permit item is included when the contract is awarded. For any projects which have not included the item but trigger the one acre threshold, an Extra Work Order is processed to produce the SWPPP.

Measurable Goals: 1) File NOIs for new projects which disturb more than one acre. 2) Summarize NOIs issued to MassHighway in annual report.

BMP 4D - Other State and Federal Environmental Regulations or Policy - The Wetland Protection Act, Water Quality Certification, and Army Corps of Engineers 404 permit regulations all require appropriate erosion controls to be in place and maintained throughout the life of the project.

Measurable Goal: Projects will continue to be designed and constructed in accordance with all applicable state and federal environmental regulations or policy (e.g. Wetlands Protection Act, 404).

BMP 4E - MassHighway Storm Water Handbook – MassHighway has recently completed an extensive effort in preparing a Stormwater Handbook for roadway designers, public works personnel, and other persons involved in the design, permitting, review, and implementation of highway and bridge improvement projects in the Commonwealth of Massachusetts. The objective of this Handbook is to provide guidance in the development of cost-effective storm water management strategies for highway projects to comply with the DEP Stormwater Management Policy. The Handbook focuses on the unique constraints of existing roadways. It provides guidance for storm water management practices readily and reasonably applicable to highway

improvement projects and new construction. In order to comply with NPDES Phase II requirements, MassHighway has expanded the use of the Handbook within the Department to include all urbanized areas regulated under the NPDES general permit. This change extends compliance with the Storm Water Policy to projects within urbanized areas, in addition to those subject to the Wetlands Protection Act. The Handbook was released in 2002. MassHighway requires that all new construction or redevelopment activities undertaken by others that are funded in whole or in part by MassHighway comply with the Handbook. The Handbook was ratified by Massachusetts DEP on May 7, 2004.

Measurable Goals: 1) Develop MassHighway Storm Water Handbook. 2) All new construction and redevelopment projects must comply with the Handbook.

BMP 4F - MassHighway Standard Specifications for Highways and Bridges - All projects advertised for construction by MassHighway require the Contractor to follow the Standard Specifications for Highways and Bridges. Section 7.0 of the Specifications, entitled "Legal Relations and Responsibility to the Public" establishes general requirements for erosion control and protection of water quality. Subsection 7.02, entitled "Prevention of Water Pollution," establishes general standards and authorizes the MassHighway Engineer to order specific actions to control erosion and prevent pollution of water resources from the construction activities.

Measurable Goal: Continue to include Subsection 7.02 "Prevention of Water Pollution" of the Standard Specification for Highways and Bridges in MassHighway funded construction projects.

BMP 4G - MassHighway Research Needs Program - MassHighway contracts with the University of Massachusetts for various research projects pertinent to the Department's responsibilities. Several research projects have been conducted which are applicable to storm water control and pollution prevention, including an analysis of street sweepings from various categories of roadways. Based on this study, the Massachusetts Department of Environmental Protection was able to promulgate a Policy for Beneficial Use of Street Sweepings from specific categories of roadways. This has led to significant cost savings for both the state and the municipalities and has reduced the need for landfill disposal of this material. Currently, a proposal to study the use of composted wood chip filter berms for erosion control has been incorporated into the Research Needs Work Program. MassHighway is an active member of the research committee to evaluate this proposal. MassHighway is also involved in the research committee which is studying the measurement of pollutant removal efficiencies of Stormwater Treatment Units.

Measurable Goal: Continue funding the MassHighway Research Needs Program.

BMP 4H - Pre-Construction Meeting Review of NPDES Requirements – District Environmental Staff review NPDES requirements at the applicable pre-construction meetings. These meetings outline the requirements of the Construction General Permit and identify the roles and responsibilities of MassHighway and the Contractor.

Measurable Goal: District Environmental Staff will review NPDES requirements at pre-construction meetings for applicable projects.

BMP 4I - Contract Bid Item and Special Provisions - A Special Provision/ Pay Item is included in all new construction contracts to cover the preparation of the Storm Water Pollution Prevention Plan (SWPPP) by the Contractor. District Environmental and Construction offices verify that the General Permit item is included when the contract is awarded. For any projects which have not included the item, but trigger the one acre threshold, an Extra Work Order is processed to produce the SWPPP.

Measurable Goals: A Special Provision/ Pay Item will be included in new construction contracts to cover the preparation of a SWPPP.

BMP 4J - Field Guide on Erosion Prevention and Sediment Control - Finalize and disseminate a Field Guide on Erosion Prevention and Sediment Control to MassHighway Resident Engineers. The purpose of this field guide will be to provide information on the range of site conditions which require erosion and sediment control, provide technical detail on the individual controls, including proper installation, maintenance and removal. The guide will also provide a matrix matching typically encountered site conditions with erosion controls proven to be effective. The intent of the guide is not to substitute as a manual on pollution prevention and water quality, but rather provide the field personnel overseeing construction with a readily available tool to identify what conditions need to be addressed and what controls work effectively for those conditions.

Measurable Goal: A Field Guide on Erosion Prevention and Sediment Control will be finalized and disseminated to Resident Engineers.

BMP 4K - Storm Water Pollution Prevention Plan (SWPPP) Guidance for Contractors - MassHighway has developed a Storm Water Pollution Prevention Plan (SWPPP) Guidance for Contractors manual for use by contractors on MassHighway construction projects. The manual provides requirements regarding the information which needs to be included in the SWPPP and provides consistency in submission by MassHighway contractors.

Measurable Goal: SWPPP Guidance for Contractors document completed and in use by Contractors on MassHighway projects.

BMP 4L-1 - Annual Erosion Prevention/ Sediment Control Training – MassHighway conducts annual erosion prevention/sediment control training for MassHighway Construction personnel. MassHighway performs construction contract oversight through five District offices. Each winter, as projects shut down or work is limited, workshops are provided to construction personnel on various topics of concern. These topics include technical and engineering topics as well as regulatory information. Workshops provided have covered water quality regulatory programs, including NPDES, and information on proper erosion control techniques.

Measurable Goals: 1) Conduct annual erosion prevention/sediment control training for MassHighway personnel. 2) Summarize # of attendees and topics covered in annual report.

BMP 4L-2 - Non-Traditional Erosion Control Specifications – The Landscaping and Construction Section will develop specifications for non-traditional erosion controls to encourage their use. MassHighway will evaluate research being conducted by other state DOTs that can be accepted by MassHighway Research and Materials Section. As new technologies/ techniques are developed, they will be tested and, if accepted, a specification will be developed.

Measurable Goals: 1) Develop specifications for non-traditional erosion controls and evaluate research being conducted by other state DOTs that can be accepted by MassHighway Research and Materials Section. 2) As new technologies are developed, review and develop specifications for additional erosion controls.

BMP 4M - Erosion and Sediment Control Field Tests – MassHighway will perform field tests of new erosion and sediment control materials on MassHighway projects. A memo summarizing materials effectiveness and whether it is recommended for use at additional sites will be prepared upon completion of each field test and internally circulated.

Measurable Goals: 1) Perform field tests for at least one new erosion control materials during the permit term. 2) Prepare and circulate an internal memo on the effectiveness of the new measure.

BMP 4N - Annual Construction Bulletins - MassHighway issues annual construction bulletins to each District regarding storm water issues. These bulletins include information pertinent to the NPDES program and storm water management, such as new or updated regulations or policies, erosion prevention and sediment control

research, and water quality BMPs. These bulletins are used to disseminate information from the other programs discussed in this minimum control measure to the appropriate parties within MassHighway.

Measurable Goal: Issue an annual construction bulletin to each District regarding storm water issues.

BMP 4O - Solicit Construction Activity Feedback from Public – Information on all MassHighway construction sites is available through the MassHighway internet site: <http://www.mhd.state.ma.us>. The internet site provides a general e-mail contact form to MassHighway. In addition, an e-mail contact form for individual construction projects is provided through the link "Projects Under Design and Construction." This link allows users to access a list of all active construction projects by city/town. Clicking on the project of interest, information on project description, status, resident engineer, and other project information is available. Clicking on the contact icon following the Resident Engineer's name provides a form for submittal of information, comments and/or questions regarding the project.

Measurable Goals: 1) Include contact information for all ongoing construction areas on the MassHighway web site. 2) Respond to any concerns in a timely manner.

BMP 4P - MassHighway Enforcement Provisions Relative to Construction Site Runoff Requirements - Enforceability provisions are included in the MassHighway Standard Specifications for Highways and Bridges and consist primarily of withholding payments until work is in compliance with regulations and the Engineer's directives.

For all construction projects conducted by outside contractors, a project-specific, binding legal contract between the Commonwealth, as party of the first part, and the construction contractor is in place. In addition to special provisions established in the contract for the particular project, the contract also states that the Massachusetts Highway Department Standard Provisions and Standard Special Provisions apply to all work. Standard Provisions, Division I, Section 7.02 - Prevention of Water Pollution - states in part "*The work shall also consist of temporary control measures ordered by the Engineer during the life of the Contract to control water pollution, through the use of berms, dikes, dams, sediment basins, crushed stone, gravel, mulches, grasses, waterways, and other erosion control devices or methods....If, in the judgment of the Engineer the surface area of erodible earth material exposed has the potential for causing water pollution, the Engineer shall direct the Contractor to cease the applicable operations until satisfactory temporary or permanent erosion control measures are taken. In the event of conflict between these requirements and pollution control laws, rules or regulations of other federal, State or local agencies, the more restrictive laws, rules or regulations shall apply. Standard Provisions, Division I, Section 9.04 addresses payment for work under a contract, stating "The Engineer shall biweekly make an estimate of the total amount of work done from one estimate to the next...No such estimates or payment shall be made when, in the Engineer's judgment, the work is not proceeding in accordance with the provisions of the Contract,...."* These provisions have been successfully enforced with respect to lack of contractor response to erosion control issues. Non-compliance with the CGP and SWPPP as well as non-compliance with any applicable environmental permits will be addressed through the District Construction personnel and District Highway Director and can include monetary penalties where included in contracts and deductions or delays in payment, when warranted.

Measurable Goal: 1) If MassHighway site engineer determines that a construction project is not complying with local, state, or federal pollution control laws, biweekly payment may be withheld until the problem has been rectified. 2) Summarize actions taken in annual report.

BMP 4Q - Standard Practices Memo – MassHighway had originally planned to prepare and issue a Standard Practices memo to District Construction Engineers on the protocol for Illicit Discharge Detection and Elimination during construction projects. The District Construction offices were provide with a memo dated June 16, 2006 regarding the procedures to follow on discovery of any illicit discharges during construction and referencing the June 2006 Prohibition Policy. Winter Resident Engineering training included discussion of the policy and procedures to follow (BMP 3E). Therefore, MassHighway feels that a separate Standard Practices memo is not warranted.

Measurable Goal: MassHighway issued a memo dated June 16, 2006 regarding procedures to follow on discovery of any illicit discharges during construction.

BMP 4R - Contractor Inspector Training - MassHighway's Construction Section will be modifying the NPDES SWPPP Item to require that all proposed contractor inspectors must attend a half-day training session on erosion control and NPDES requirements. MassHighway will develop and provide training programs.

Measurable Goal: Modify NPDES SWPPP item to include half day training requirement. Provide training programs.

Construction control measures are also a portion of BMPs included in the other minimum controls measures such as BMP 1E and 2A.

2.5 Post-Construction Runoff Control

EPA Minimum Control Requirement: According to the general permit, "the permittee must develop, implement and enforce a program to address storm water runoff from new development and redevelopment projects that disturb greater than one acre and discharge into the MS4. The program must include projects less than one acre if the project is part of a larger common plan of development."

At a minimum, the program must include:

- (a) To the extent allowable under state law, a regulatory mechanism to address post construction runoff from new development and redevelopment. If such a mechanism does not exist, development and adoption of a mechanism must be part of the program. If attempts to enforce this provision of the program are ineffective, the permittee may seek assistance from EPA or the state agency in enforcing this provision.
- (b) Procedures to ensure adequate long term operation and maintenance of best management practices.
- (c) Procedures to ensure that any controls that are in place will prevent or minimize impacts to water quality.
- (d) The Massachusetts Highway Department may use the approved Storm Water Management Handbook as a tool to implement this provision.

MassHighway Programs: MassHighway currently own and operates approximately 4,132 linear (i.e., centerline, as measured in one direction only) miles or 13,286 lane-miles of multi-directional roadway, including breakdown lanes and ramps, throughout the State (as of Spring 2004, based on field surveys by District personnel). MassHighway is responsible for the care and maintenance of these roads and the associated drainage systems. Interactive maps that illustrate the roads owned and operated by MassHighway are available at <http://www.eot.state.ma.us/default.asp?pgid=planning/interactiveMaps&sid=about> (choose the jurisdiction view from the drop down menu and then zoom in to area in question).

MassHighway does not generally accept storm water from adjacent properties in the fashion that municipal MS4s accept drainage from properties within the municipality.

Construction within MassHighway property including projects associated with highways, roadways, bridges, rest areas, weigh stations and maintenance facilities are subject to the following programs addressing post-construction runoff control:

BMP 5A-1- MassHighway Storm Water Handbook for Highways and Bridges – MassHighway has completed an extensive effort in preparing a Storm Water Handbook for roadway designers, public works personnel, and other persons involved in the design, permitting, review, and implementation of highway and bridge improvement projects in the Commonwealth of Massachusetts. The objective of this Handbook is to provide guidance in the development of cost-effective storm water management strategies for highway projects to comply with the DEP Stormwater Management Policy. The Handbook focuses on the unique constraints of existing roadways. It provides guidance for storm water management practices readily and reasonably applicable to highway improvement projects and new construction. In order to comply with NPDES Phase II requirements, MassHighway has expanded the use of the Handbook within the Department to include new construction or redevelopment activities undertaken by others that are funded in whole or in part by MassHighway all urbanized areas regulated under the NPDES general permit. This change extends compliance with the Storm Water Policy to projects within urbanized areas, in addition to those subject to the Wetlands Protection Act.

Measurable Goals: 1) Secure DEP ratification for MassHighway Storm Water Handbook. 2) Require all new construction or redevelopment activities funded by MassHighway to comply with the Handbook.

BMP 5A-2 - Revise Chapter 4 of the Stormwater Handbook for Highways and Bridges - Chapter 4 of the Handbook includes a screening process (including worksheets) for assessing BMPs for application on any particular project. The process includes an evaluation both "feasibility" and "suitability". The "feasibility" analysis component determines whether BMPs can be implemented given the particular project site characteristics and constraints (physical, regulatory, operational, etc.). Just as importantly, the "suitability" analysis component assesses the capability of each candidate BMP to achieve stormwater management objectives (flood control, TSS removal, infiltration). The suitability analysis component already includes a category "special objective" to include assessment of whether a BMP will contribute to an objective such as reducing a specific pollutant. MassHighway will revise this section to specifically identify the need to define "special objective" pollutants of concern when the discharge from a BMP will be to an impaired water body and or subject to a TMDL, and to include such pollutants of concern in the suitability analysis for each candidate BMP. The Chapter 4 screening process is seen as a very useful tool in selection of BMPs that accomplish the specific stormwater management objectives associated with a particular project.

Measurable Goals: 1) Revise Chapter 4 within 9 months of DEP's SW Policy Handbook update being released. 2) Reissue MassHighway Handbook to Designers within 1 year of DEP's document being released.

BMP 5A-3 - Revise Chapter 5 of the Stormwater Handbook for Highways and Bridges - To promote consistency between MassHighway practice and DEP Stormwater Management Policy, MassHighway proposes to review the updated BMP document when it is issued, and if warranted, then update the MassHighway Stormwater Handbook for Highways and Bridges, Chapter 5. The MassHighway update would include information to either cross reference the DEP manual, or to incorporate specific BMPs into the MassHighway catalog of candidate BMPs, to address the types of pollutants of concern that are being encountered in the impaired waters/TMDL waters that receive drainage from MassHighway facilities.

Measurable Goal: 1) Revise Chapter 5 within 9 months of DEP's SW Policy Handbook update being released. 2) Reissue MassHighway Handbook to Designers within 1 year of DEP's document being released.

BMP 5B – MassHighway Maintenance Program – MassHighway will continue to implement the maintenance program outlined in Appendix E of this document. The maintenance program includes inspection and maintenance schedules for drainage infrastructure, as well as table with specific commitments made in TMDL watersheds (also included in Appendix E). Maintenance is performed as outlined in the MassHighway Maintenance Manual's chapter on drainage systems, in the Environmental Facility Handbook and the AASHTO Maintenance Manual for Roadways and Bridges [dated 2007].

Measurable Goal: Continue to implement MassHighway maintenance program as outlined in the maintenance schedule and in accordance with TMDL watersheds specific agreements.

BMP 5C - Technology Acceptance and Reciprocity Partnership (TARP) - TARP is a program developed to help states analyze the many innovative environmental technologies available in the marketplace today. The performance of new technologies has the potential to contribute to state environmental protection efforts, but few if any standardized methods have been established to guide the collection and evaluation of technology performance. To address this problem, a consortium of six states created TARP. The theory behind the program is to provide uniform methods for collecting and evaluating data on technology performance and cost, so that states can share scientifically credible, reliable data which enhance their ability to make scientifically sound and defensible decisions. DEP no longer encourages outside groups to be part of this discussion, therefore MassHighway is no longer part of the discussion except on their own with DEP.

Measurable Goals: 1) Continue to work with DEP to develop review protocol for innovative stormwater BMPs. 2) Summarize meeting(s) attended and agenda in annual report.

BMP 5D - Southeast Expressway BMP Effectiveness Project - MassHighway has completed a study aimed at determining the effectiveness of water quality inlets (WQIs) and catch basins in removing suspended particulate matter in highway runoff. Two types of structural BMPs, a deep-sumped hooded catch basin and three 1,500-gallon offline water quality inlets were investigated, to assess their effectiveness in reducing highway contaminant concentrations along the Southeast Expressway in Boston, Massachusetts. The temporal and spatial variability in suspended sediment transport through each structural BMP was characterized using automatic monitoring techniques. The effectiveness of each BMP in reducing suspended sediment loads was assessed using a mass balance approach.

The results of the study indicated:

- More than half of the suspended sediment in highway runoff is material less than 0.062 mm in diameter (sand silt/break).
- An average of 74 percent of the sediment particles retained in the WQIs were greater than 0.062 mm in diameter.
- An average of 92 percent of the sediment particles retained in the catch basins were greater than 0.062 mm in diameter.
- The 14-month sediment-removal efficiency was 35 percent for one WQI and 28 percent for the second WQI.
- The sediment-removal efficiency for individual storms during the 14-month monitoring period for the deep-sumped hooded catch basin was 39 percent.
- In the combined-treatment system, where catch basins provided primary suspended-sediment treatment, the WQIs reduced the mass of the suspended sediment from the pavement by about an additional 18 percent (beyond the catch basins 39 percent).
- Sweepers were successful in removing particles larger than 0.5 mm in diameter. Because the highway lacks curbing that would provide a physical boundary to trap debris and sediment, and the equipment was inefficient in trapping particles less than 0.062 mm in diameter, pavement sweeping provided few water-quality benefits for the Southeast Expressway. Moreover, the roadway edge was made up of unconsolidated soil – vulnerable to being dislodged by the sweeper's brush and subsequently eroded onto the pavement.
- The capture efficiency of suspended sediment was further reduced by resuspension of fine-grained sediments within the WQIs, as well as from high flows bypassing the WQIs.
- Floatable debris was not indefinitely retained within the offline water quality inlets.

- The primary factor for controlling suspended sediment removal efficiency was residence time.
- The average relative percent difference (RPD) between concentrations of trace metals in storm water samples from the inlets and the outlets of the water quality inlets ranged from 15 to 30 percent.
- The average RPD for concentrations of organic constituents was commonly less than about 10 percent and negative in several cases.
- The separators did not affect the concentrations of dissolved solids as they passed through the chambers.

Measurable Goal: Conduct study of the effectiveness of WQIs and catch basin at removing suspended sediments from highway runoff.

BMP 5E - Highway Runoff Contaminant Model - Develop a model that will characterize and estimate contaminant loading from highway runoff, as a follow up to the Southeast Expressway project. This model could be used to effectively estimate pollutant loading from highway property. The model will characterize the concentrations of a broad range of contaminants (e.g., nutrients, metals, hydrocarbons, and bacteria) in highway runoff and adequately account for rainfall intensity, antecedent conditions, particle sizes, traffic volume, pavement area and flow. This model could then be used by MassHighway as one of its tools for evaluating impacts in watersheds affected by TMDL studies.

Measurable Goal: Develop and calibrate a model to characterize and estimate contaminant loading from highway runoff.

BMP 5F BMP Maintenance Manual – Will be removed in Permit Year 5 Annual Report since changes to BMP 5B narrative include the manual used as guidance by maintenance staff while performing drainage system maintenance.

BMP 5G - Right-of-Way Parcel Evaluation – MassHighway has developed a methodology for evaluating parcels, which are candidates for disposal (i.e., sale) by MassHighway, for the potential to locate storm water BMPs on the site. This provides MassHighway with a right of first refusal for the property before it is sold. The methodology includes developing a site inspection form to be used during field reconnaissance work by personnel from MassHighway's Right-of-Way Division to aid the Environmental Section in determining the storm water BMP sitting potential.

Measurable Goals: 1) Develop a methodology for evaluating parcels, which are candidates for disposal, for their storm water management potential. 2) Implement methodology.

BMP 5H-1 - Post Construction Runoff Enforcement – Illicit Discharge Prohibition - On June 26, 2006, Policy Directive No. P-06-002 was adopted to clarify how MassHighway should treat unauthorized connections to its drainage systems. Under this policy, no unauthorized connections are allowed unless a permit has been granted pursuant to the provisions of Massachusetts General Laws, Chapter 81, section 21, which provides for fines and/or civil penalties of up to one thousand dollars per day for each violation. As part of its SWMP MassHighway will not allow flows that do not meet NPDES conditions to be added to or remain connected to its drainage system. This approach will be enforced through referrals to the Attorney General for enforcement of Chapter 81, Section 21 orders and/or to enjoin a trespass which such unpermitted flows would constitute.

Measurable Goals: 1) Develop policy for addressing unauthorized connections to the MassHighway's drainage system. 2) Enforce the provisions through referrals to the Attorney General. 3) Summarize actions taken in annual report.

BMP 5H-2 - Post Construction Runoff Enforcement – Drainage Tie-In Policy - As discussed in BMP 3C-2, MassHighway will prepare a permitting process for adjacent parcels which want to tie-in to the MassHighway

drainage system. The permitting process will require the permittee to demonstrate that the water discharged to MassHighway's MS4 will meet the MA Stormwater Policy and the NPDES General Permit requirements.

Measurable Goals: 1) Develop permitting process for adjacent properties that would like to tie into the MassHighway drainage system. 2) Implement permitting process. 3) Summarize permits applied for, reviewed and actions taken in annual report.

BMP 5H-3 - Post Construction Runoff Enforcement – Offsite Pollution to MassHighway Drainage System - On June 26, 2006, Policy Directive No. P-06-002 was adopted to clarify that unauthorized connections to it drainage systems are prohibited. Runoff which does not meet the NPDES MS4 requirements, is reaching the MassHighway MS4 and is not covered under 5H-1 or 5H-2 may be considered trespassing and referred to the Attorney General's office by MassHighway counsel at the District Highway Directors (DHDs) discretion.

Measurable Goal: Runoff not meeting the NPDES MS4 requirements, which is reaching the MassHighway MS4 and is not covered by BMP 5H-1 or 5H-2, may be considered trespassing and referred to the AG's office by MassHighway counsel at the DHD's discretion. Summarize actions taken under this BMP in annual report.

BMP 5I - Rest Area Redevelopment to Meet Stormwater Management Handbook Standards – MassHighway will add language to new lease agreements requiring lessees, who redevelop or build new buildings on rest area property leased from MassHighway, to meet the standards within the Storm Water Management Handbook and the SWMP requirements.

Measurable Goal: Add language to new lease agreements requiring lessees, who redevelop or build new buildings on rest area property leased from MassHighway, to meet the standards within the Storm Water Management Handbook and the SWMP requirements.

BMP 5J - Transportation Evaluation Criteria - In the project development process, MassHighway and the Metropolitan Planning Organizations (MPO's) use Transportation Evaluation Criteria to assess the need for and priority of proposed projects and to determine their suitability for state and federal funding. Environmental Effect is one of eight such criteria considered for all projects. If there is a federal-funded project of which an element may be storm water management, the MPO review/ evaluates the project based on the Transportation Evaluation Criteria. The Transportation Evaluation Criteria process considers the environmental effects of the project. Within the Environmental Effects subcategory there are the following elements which are evaluated;

- air quality/climate effects,
- water quality/supply effects;
- wetlands effects,
- historical and cultural effects and
- effect of wildlife habitat and
- endangered species.

Each of these criteria are scored (-3 to +3). The combined score is used as an additional source of information by the MPO in their deliberation and prioritization of projects. As MassHighway carries out its road and bridge program, we will install proper BMPs (e.g., swales, basins) as part of the drainage work scheduled along the respective highway. Note: While there are slight regional variations to the criteria, all of the MPOs include the environmental component in their evaluation procedures.

Measurable Goal: Continue to include environmental considerations in the funding prioritization evaluation.

BMP 5K - Federal Enhancement Funding – MassHighway continues to explore opportunities for using Federal enhancement funding for environmental restoration and pollution abatement projects. Allocating and programming enhancement funding is under the purview of each of the State's 13 Metropolitan Planning Organizations, and is contingent upon the project being approved by the Enhancements Steering Committee (membership includes State and regional agencies, and meets quarterly).

Measurable Goal: Explore opportunities for using Federal enhancement funding for environmental restoration and pollution abatement projects. Participate in quarterly committee meetings.

Post-construction control measures are also a portion of BMPs included in the other minimum controls measures such as BMP 1K, 3B-1, 3C-1, 3C-2, 4A and 4E.

2.6 Pollution Prevention/Good Housekeeping

EPA Minimum Control Requirement: In recognition of the benefits of pollution prevention practices, the NPDES Phase II permit requires an operator of a regulated transportation MS4 to:

- (a) Develop and implement a program with a goal of preventing and/or reducing pollutant runoff from transportation facility operations. The program must include an employee-training component.
- (b) Include, at a minimum, maintenance activities for the following: rest areas along interstates; weigh stations; material storage yards; new construction and land disturbance; roadway drainage system maintenance, and storm water system maintenance.
- (c) Develop schedules for maintenance activities described in paragraph (b) above.
- (d) Develop inspection procedures and schedules for long term structural controls.

MassHighway Programs: In the context of a highway drainage system pollution prevention or good housekeeping measures may include:

- **Source Control:** Implementation of control measures to reduce or eliminate the discharge of pollutants – that is providing source control (e.g., programs that encourage recycling or litter control, minimize vehicle emissions or usage, minimize pesticide use, or improve highway safety).
- **Training:** Training MassHighway personnel regarding proper maintenance procedures and source control.
- **Maintenance:** Maintenance and inspection of structural and non-structural controls to reduce floatables and other pollutants discharging from the drainage system.
- **Waste Disposal:** Development and implementation of procedures for disposal of waste removed from separate storm sewers or structural and non-structural control devices.
- **Snow and Ice Control GEIR:** A review of environmental issue related to deicing programs.

Many existing programs and activities undertaken by MassHighway and other transportation agencies address this minimum control requirement. The following is a summary of those programs:

2.6.1 Source Control

Source control measures (e.g., reducing vehicle use, reducing the potential for accidental spills, controlling litter, and minimizing chemical use) are effective at minimizing the accumulation on and wash off of pollutants from the roadway surface. Current programs which provide such controls include:



BMP 6A-1 - 511 Massachusetts Traveler Information System - In addition to providing signage within the highway right-of-way that supports litter law enforcement, MassHighway encourages roadway users to notify us of litter and debris along the roadway through the new 511 Massachusetts traveler information system. By calling 511 on a cellular phone or 617-374-1234 on a standard phone, people can act as roving patrollers and keep MassHighway informed of unsightly litter and debris. MassHighway crews are then dispatched to clean up the litter or to take other necessary actions.

Measurable Goal: 1) Maintain the existing 511 System.

BMP 6A-2 - Adopt-a-Highway – A nationwide program whereby organizations and business adopt a stretch of highway, and participate in litter control and other enhancement projects. The program provides an opportunity for environmentally conscious groups and corporations to participate in keeping Massachusetts roads litter-free. The litter picked up by the groups provides source control along the highways since then the litter will not come into contact with rain and will not end up in streams and ponds. In recognition of the volunteer efforts, MassHighway installs a sign recognizing the adopting group for their contribution toward keeping Massachusetts clean.

Measurable Goal: 1) MassHighway will continue to support this program by maintaining signs in areas where the program is active. 2) Summarize number of road miles cleaned by Adopt-a-Highway each year in annual report.

BMP 6A-3 - Deicing Programs and Reduced Salt Areas – MassHighway has addressed environmental issues related to deicing programs through the Generic Environmental Impact Report (GEIR) for deicing practices. Salt and sanding operations are completed in accordance with procedures approved in the GEIR. Specific recommendations include: optimize the management of road sand for snow and ice control operations by using sand only where it is most effective, such as intersections, low volume roads, and steep grades, and by pre-wetting sand so that smaller amounts can be applied to achieve maximum effectiveness. In addition, the DEP Snow Removal Policy provides additional guidance for winter maintenance practices, including a recommendation to avoid Zone II well protection areas for the stockpiling of snow.

The state of the art in snow and ice removal is anti-icing, or the prevention of the bond of snow and ice to the pavement. The preferred method of anti-icing is the use of liquids prior to, or at the beginning of, a storm. MassHighway utilizes liquid calcium chloride (LCC) as an anti-icer. MassHighway has continued to reduce the amount of sand applied to state roadways. All of MassHighway's salt is stored under cover.

Chemical spreaders are equipped with ground speed control and are required to be calibrated at the start of each season and are randomly checked during the season to make certain the spreader is dispensing the correct amount of material.

MassHighway maintains over 1,700 lane miles of "Reduced Salt Areas" in an effort to protect water supplies and other environmentally sensitive areas adjacent to state roadways.

Measurable Goal: Continue to support deicing and reduced salt programs.

BMP 6A-4 - Highway Emergency Locator Program (HELP) - As many people know all too well, roadway breakdowns are not only a headache, but oftentimes hazardous. Fortunately, MassHighway has a solution to

HELP people who break down on the side of the road - send a HELP Van or Tow Truck. MassHighway has 22 HELP vans and tow trucks statewide to patrol the roads during the peak hours and offer assistance to people with car trouble. MassHighway can HELP with everything from a flat tire, to an empty gas tank, to minor repairs. By providing this service MassHighway decreases the chance of spills from vehicle breakdowns.

Measurable Goal: Continue to provide 22 HELP vans and/or tow trucks.

BMP 6A-5 - Vegetation Management –The MassHighway Vegetation Management Program is intended to establish the criteria whereby MassHighway controls vegetation along state roads and highways in compliance with the Rights of Way Management Regulations (333 CMR 11.00). Under this regulatory program, MassHighway has prepared both a 5-Year Vegetation Management Plan (VMP) and a Yearly Operational Plan (YOP) for Vegetation Management. The provisions of MassHighway's VMP are summarized below.

Integrated Roadside Vegetation Management

MassHighway's VMP incorporates Integrated Roadside Vegetation Management (IRVM) methods which include roadside development (active planting to encourage appropriate competing vegetation, non-organic barriers), mechanical (mowing, hand cutting, selective trimming), and chemical (low volume foliar herbicide treatments).

One goal of the VMP is to minimize the use of chemical controls, through minimizing areas of application, quantity of chemicals, and frequency of application. Chemical control techniques shall be limited to use on high traffic volume, high speed interstate and primary roadways in the Commonwealth where safety of motorists, MassHighway employees, and contractors precludes the use of mechanical methods. Using IRVM methods, MassHighway will employ only two types of herbicide application: Foliar treatment and cut stump surface treatment.

- *Foliar Treatments* involve the selective application of approved herbicides and adjuvants diluted in water, to the foliage and stems of the target vegetation. The foliar treatment used shall be low pressure, below 60 psi at the nozzle, with a normal working pressure of 40 psi for application at volumes of less than 50 gallons/acre.
- *Cut Stump Surface Treatment* is the application of an herbicide to the cut surface of a stump immediately following or during a cutting operation, to prevent re-sprouting.

Identifying and Protecting Sensitive Areas

Sensitive areas are defined as areas within rights-of-way in which public health, environmental or agricultural concerns warrant special protection to further minimize risks of unreasonable adverse effects (of herbicides) and include public groundwater supplies, public surface water supplies, private drinking water supplies, surface waters, wetlands, rivers, inhabited areas and agricultural areas.

All herbicides used by MassHighway have been researched, tested and approved by the Department of Food & Agriculture for use in Sensitive Areas. The MassHighway VMP provides descriptions and procedures for how Sensitive Areas will be identified for required protection, summarizes the restrictions and no-spray zones associated with application of herbicides within the right of way, and describes how no-spray zones will be identified and flagged.

In addition, MassHighway prepares its Yearly Operational Plan which includes the provisions of the VMP and proposed spray locations by route and municipality. A copy of the YOP are sent to the Conservation Commission, Board of Health (or designated health agent), and to the head of government (Mayor, City Manager, Chair of the Board of Selectmen) of each municipality where herbicides are to be applied along the rights of way during the calendar year.

Source Control and Operational Guidelines for Herbicide Applicators

The MassHighway VMP provides operational guidelines for applicators to properly manage herbicides. Source Control measures provided in the VMP include:

- Mixing and loading of herbicides at the maintenance facility in limited amounts of herbicide necessary to carry out only that day's work.
- Spray vehicles will be equipped with a clipboard log of the herbicides on board, a bag of adsorbent, activated charcoal, plastic bats, a broom and a shovel in case of a minor spill.
- Applicators to roadside rights of way must hold a valid pesticide certification from the Department of Food and Agriculture.
- Herbicide application will be restricted during certain adverse weather conditions, such as rain or wind.
- Low-pressure foliar application equipment will be calibrated to maintain pressure not exceeding 60 pounds per square inch at the nozzle.
- Monitoring will include project record keeping to maintain timely information on the nature, timing, and location of actions taken, including project location, weather conditions, miles completed, amount of material used, worker and equipment hours devoted to the project, and persons responsible for activity and follow-up evaluation.
- Chemically treated areas shall be monitored after the necessary translocation period of the herbicide to determine the effectiveness of the applications and to monitor any off target injury and migration of the spray solution.
- MassHighway will conduct training for District staff in methods of vegetation management, employee safety and record keeping.
- The VMP includes a Remedial Plan to address potential spills and related accidents.

Alternatives to Chemical Herbicide Study

MassHighway, in collaboration with the Federal Highway Administration, funds a research project at the University of Massachusetts to seek alternatives to chemical herbicides for roadside weed control. With the assistance of the UMass Department of Soil Sciences, MassHighway is experimenting and testing alternative research, chemicals, and non-conventional control methods.

MassHighway is committed to actively pursue testing and evaluation of alternative methods of vegetation control. Other methods for investigation of management of roadside vegetation under guardrails include hand mowing, steaming, flaming, mulching with organic materials, and mulching with sheeting made from recycled products such as tires or plastic bottles. MassHighway continues to monitor the progress, provide updated information, notification, and assist the University of Massachusetts with the study. MassHighway will constantly monitor and evaluate the success of the vegetation management program and integrate appropriate new methods into the VMP and Yearly Operational Plans (YOP).

Measurable Goal: 1) Develop a generic Vegetation Management Plan (VMP) which outlines methods of minimizing the discharge of pollutants related to the storage and application of pesticides, herbicides, and fertilizers. 2) Prepare a Yearly Operational Plan (YOP) by April of each year. 3) Post YOP on web site within 30 days. 4) Summarize actions taken in previous year in annual report.

BMP 6A-6 - Ridesharing -- MassHighway promotes ridesharing through a variety of activities, including operation and maintenance of approximately two dozen park-and-ride-lots throughout the state, three HOV lanes on I-93 (one north, one south of Boston), and, together with the Executive Office of Transportation, support of MassRIDES, the statewide travel options program providing free assistance to commuters,

employers, students, and other traveler markets. Through all these activities, MassHighway is helping to reduce traffic congestion and vehicle pollution.

Measurable Goal: Continue participation in ridesharing activities through the duration of the permit term.

BMP 6A-7 - Alternative Transportation - MassHighway supports bicycling and walking through funding of both on-road facilities, such as bike lanes and shoulders, and off-road facilities, such as shared use paths and sidewalks. In addition, MassHighway's *Project Development and Design Guide* and the annual statewide *Moving Together* conference provide a thorough basis for technical assistance. Bicycling and walking reduce the source of pollution on roadways and bridges. Funding levels for bicycling and walking improvements are always in flux but the current Administration has committed to expanding the budget for bicycling and walking infrastructure by \$2 million in FY2009. In addition, approximately \$1.3 million will be made available for bicycling and walking infrastructure improvements as part of the Safe Route to School (SRTS) Program.

Measurable Goal: Provide technical assistance and funding for bicycling and walking, including on-road and off-road improvements, at the local level.

BMP 6A-8 - Highway Safety – Accident prevention is the single most effective control measure available to minimize pollution from accidental spills to the highway drainage system. Existing programs that address highway safety include:

Safety Design Standards – MassHighway incorporates safety measures into its highway design. Examples include, design requirements for guardrail when slope and vertical drop criteria are met, standards for adequate sight distances at intersections, and acceleration and deceleration lanes at entrances and exits, measures to sustain pavement integrity, and effective roadway drainage.

Hazard Signage/Information – As part of its design practices, signage is provided to warn of tipping hazards on interchanges, steep grades, or other vehicle hazards to reduce the occurrence of accidents. MassHighway follows strict standards for signage and traffic control in construction work zones to help improve worker safety and to warn motorists of potential hazards and variable travel conditions.

Electronic Variable Message Signs (VMS) – MassHighway has installed Variable Message Signs (VMS) on selected roadways to improve driver awareness regarding road conditions ahead.

Other Physical Safety Measures – MassHighway policy requires rumble strips, raised pavement markers, and wide pavement marking lines to help combat driver fatigue and to enhance safety. These types of evolving safety technologies are routinely employed by MassHighway as they are developed. They have all helped to reduce the number and severity of crashes on roadways in Massachusetts.

Measurable Goals: 1) Incorporate safety measures into all new highway designs. 2) Provide signage to warn of vehicle hazards including tipping hazards and steep grades. 3) Install VMS on selected roadways to improve driver awareness. 4) Include evolving safety technologies as part of future highway design projects as they are developed.

BMP 6A-9 - Toxics Use Reduction (TURA) – MassHighway has created a Pollution Prevention Task Force (PPTF) as part of the Environmental Management System Implementation Plan to reduce risk and improve the overall environmental quality at department facilities through toxins use reduction. MassHighway created a Pollution Prevention Task Force (PPTF) as part of its Environmental Management System Implementation Plan to reduce risk and improve the overall environmental quality at Department facilities through toxic use reduction. The PPTF is made up of Boston and District Environmental personnel who, in cooperation with certain District Operations personnel, lead the pollution prevention efforts. The PPTF supports MassHighway's

efforts to research environmentally preferable products intended to minimize waste, conserve energy and water, and reduce the amount of toxics disposed or consumed by construction, maintenance, and facilities operations. MassHighway continues to undertake efforts to prevent pollution through conservation and reduction programs relating to construction and maintenance projects and to operations at maintenance facilities.

While addressing a wide range of environmental media, many of these pollution prevention efforts are effective Storm Water Source Control measures which minimize the accumulation of pollutants on, and wash off from, roadways. Ongoing pollution prevention initiatives relative to Source Control include, but are not limited to, the following:

Water Conservation and Pollution Prevention - To reduce water use and associated wastewater discharges, MassHighway has installed, at several designated maintenance facilities, indoor vehicle wash bays equipped with wash water recycling units and industrial wastewater holding tanks.

Toxics Use Reduction- The PPTF has prepared technical evaluations of products and made recommendations for reduction of the following substances: petroleum-based hydraulic and lubricating oils; automotive parts cleaning solvents and associated cleaning systems; perchlorethylene cleaning solvent and miscellaneous automotive lube/cleaning products. In response to these recommendations, MassHighway switched to non-chlorinated solvent brake cleaner; eliminated solvent parts cleaner tanks in some districts, and; reduced automotive fluid use through the leasing and out-servicing of fleet vehicles.

Ongoing Initiatives- While much has been accomplished, MassHighway continues to identify, evaluate, and implement pollution prevention initiatives. Source Control pollution prevention opportunities and activities under consideration include:

- eliminating solvent parts cleaners statewide;
- upgrading maintenance garages to include state-of-the-art automated oil dispensing and quick drain capabilities;
- purchasing low volume high pressure washers for vehicle/equipment cleaning to reduce water use;
- use of vegetable-based hydraulic oil, and
- use of neutral pH, non-oil emulsifying vehicle degreasing/washing detergents to eliminate caustic detergents and improve effectiveness of oil/water separators.

Measurable Goal: 1) Maintain an active PPTF throughout the permit term. 2) Provide summary of actions taken on each pollution prevention initiatives summarized above in the annual report.

2.6.2 Training

MassHighway conducts a significant amount of training for its staff through a series of programs.

BMP 6B-1 – MassHighway Training Assistance Program (MTAP) and Baystate Roads Program - MassHighway funds training programs through the MassHighway Training Assistance Program (MTAP) and Baystate Roads program. These programs provide training to MassHighway and Municipal DPW staff and include workshops and seminars addressing storm water management, wetland protection, hazardous waste, and related issues. MassHighway has provided training on the MassHighway Stormwater Handbook through the MTAP program.

Measurable Goal: Continue to support MTAP and Baystate Roads program.

BMP 6B-2 – Environmental Awareness Training – Annual training is provided to MassHighway maintenance facility personnel regarding good housekeeping practices and spill prevention.

Measurable Goal: Provide annual training to at least 300 maintenance facility personnel regarding good housekeeping/ spill prevention.

BMP 6B-3 - Snow and Ice Program Training – Training is provided to MassHighway supervisors and drivers annually internally and through Bay State Roads (MTAP) programs on the latest techniques, equipment and material available for snow and ice removal.

Measurable Goal: Provide annual training to at least 200 supervisors and drivers annually on the latest on snow and ice removal.

BMP 6B-4 - Equipment and Vehicle Safety Training – MassHighway personnel are trained on the proper use of equipment and vehicles to minimize the potential for spills and accidents.

Measurable Goal: Ensure all equipment and vehicle operators have received training on the proper operation of the equipment and vehicles they operate.

Pollution prevention/ good housekeeping control measures are also a portion of BMPs included in the other minimum controls measures such as BMP 1A and 1B.

2.6.3 Maintenance

BMP 6C-1 - Maintenance Program – MassHighway implements roadway maintenance programs on a statewide basis. MassHighway is responsible for maintenance on all roads and facilities owned and operated by MassHighway. Through MassHighway's maintenance privatization program, outside contractors complete much of the highway maintenance, though in-house personnel complete some work. Highway maintenance programs have typically included:

- Maintenance of road surfaces (repaving/pot hole repair);
- Correction of drainage problems;
- Correction of safety problems;
- Repair or replacement of failed or malfunctioning drainage outlets;
- Catch basin cleaning; and
- Street sweeping.

The maintenance schedule in Appendix E summarizes the roadway scheduled maintenance activities as outlined in the MassHighway Stormwater Handbook. The current catch basin cleaning SOP is included as an appendix.

MassHighway is developing an Asset Management System which, once in place and fully implemented, will allow for the documentation and easy reporting of maintenance activities that have occurred each permit year.

When MassHighway constructs new or redevelopment projects, Standard 9 of the DEP Stormwater Management Policy requires the storm water management system to have an operation and maintenance plan to ensure that the system functions as designed. The plan identifies the system owner, the parties responsible for operation and maintenance, a schedule for inspection and maintenance and the maintenance tasks to be undertaken.

Measurable Goal:

1. *Continue to implement maintenance schedule outlined in Appendix E.*
2. *Comment on progress of Asset Management System.*
3. *Once Asset Management System is in place, report on maintenance activities in greater detail in annual report.*

BMP 6C-2 - Maintenance/ Material Storage Yards – Starting in 1994, MassHighway began to develop and implement several media-specific Management System Improvement and Implementation Plans. Together these plans outlined the programs and funding needed to achieve and maintain environmental compliance at MassHighway maintenance facilities. Compliance programs include:

- Hazardous Waste,
- Wetlands,
- Hazardous Materials,
- Underground Storage Tanks,
- Water Quality,
- Solid Waste, and
- Asbestos.

The Water Quality program provided for facility improvements such as septic system upgrades/installation, sewer connections, floor drain upgrades and the installation of wash water recycling systems.

To support these initiatives, MassHighway prepared and published a Facility Environmental Handbook for use at its material storage/ maintenance yards. This Handbook is a reference document that provides guidance on conducting operations in compliance with environmental requirements. It contains Standard Operating Procedures (SOPs) and Facility Maps to identify, among other things, water quality and drainage structures and environmentally sensitive areas such as wetlands and waterway buffer zones.

MassHighway also recognized that continued environmental improvement is dependent upon the development of clear lines of authority, responsibility, and accountability for environmental management and identification and allocation of adequate funding. Therefore, to further the achievements of its Management System Improvement and Implementation Plans, MassHighway developed an Environmental Management System (EMS) Manual to document environmental requirements and aspects associated with its maintenance facilities and the lines of authority and the respective roles and responsibilities within the Department. The EMS Manual also provides the framework to instill an operating awareness at all organizational levels of the importance of integrating sound environmental management practices into Department operations. The EMS Manual is available at

http://www.mhd.state.ma.us/downloads/projDev/environmental_management_system/ems_frameset.htm.

Additional details on MassHighway’s Facility Environmental Handbook and EMS Manual are provided below.

MassHighway Facility Environmental Handbooks

The Facility Environmental Handbook is a key component of the MassHighway Environmental Management System (EMS) and serves as a reference tool for facility personnel in maintaining environmental compliance at MassHighway’s facilities. The Handbook is used to train MassHighway personnel on an annual basis and raise the level of environmental awareness. It provides basic information on how to conduct facility activities in an environmentally sensitive manner and in compliance with applicable environmental laws, regulations, and policies. Facility Environmental Handbooks are located at all District Headquarters, maintenance facilities, and the Highway Operations and Environmental Boston offices to support MassHighway’s EMS. Two versions of the handbook are available, general and facility-specific. Both versions contain descriptive text on regulatory programs, copies of the Environmental SOPs and the Emergency Response Spill Plan. The generic version of the Handbook, primarily for use in Boston and the District Headquarters, contains a list of facilities with general information. The Handbook is posted on MassHighway’s web site at http://www.mhd.state.ma.us/downloads/projDev/environmental_management_system/ems_right.htm

The facility-specific version of the Handbook resides at each maintenance facility and contains a Facility Profile Sheet specific to that facility. Additionally, Facility Maps detailing existing environmental and operating conditions at these facilities are available separately and are included with the Handbook. The Facility Maps detail environmental information including, but not limited to, solid waste collection areas, wetlands and buffer zones, hazardous materials storage areas, utilities related to water quality, above ground and under ground storage tank locations and associated piping and pumps, and storage sheds for sand and salt storage. The following Regulatory Program sections are included as sections in the Facility Environmental Handbook:

- | | |
|------------------------|----------------------------------|
| 1. Hazardous Waste | 2. Universal Waste |
| 3. Hazardous Materials | 4. Asbestos Containing Materials |
| 5. Solid Waste | 6. Roadside Issues |
| 7. Tanks | 8. Water Quality |
| 9. Wetlands | 10. Recordkeeping |
| 11. Inspections | |

Water Quality issues are addressed in the following Handbook Sections:

Handbook Section	Reference Location	Description
Hazardous Materials	Section p. 3.2-3.3	Provides for the proper storage of hazardous materials, including sand and salt, to prevent exposure to elements.
Solid Waste	Section p. 5-4	Provides for the proper management of empty containers to protect from exposure from the elements.
Water Quality	Entire Section	Provides information on how MassHighway manages wastewater and stormwater at facilities including information on the types of wastewater, discharge options, oil/water separators, holding tanks, septic systems, floor drains, preventative measures for stormwater runoff, and vehicle washing.

Handbook Section	Reference Location	Description
Wetlands	Entire Section	Provides information on wetlands and waterways and how they are protected at MassHighway Facilities, including work in buffer zones and riverfront areas.
Record Keeping	Documentation to be Maintained p. 10-1 through 10-3	Summarizes record keeping requirements for environmental management at MassHighway facilities, including: <ul style="list-style-type: none"> • permits for drainage ditch cleaning • oil/water separator, septic system, and wastewater holding tank pump-outs and maintenance
Water Quality SOPs	Appendix A	SOPs define roles and responsibilities, policies and minimum performance criteria for managing environmental compliance issues at MassHighway facilities. Current MassHighway Water Quality SOPs include: <ul style="list-style-type: none"> • ENV-01-08: Handling and Storage of Sand and Deicing Chemicals • ENV-01-13: Handling and Disposal of Empty Oil/Chemical Drums • ENV-01-15: Protection of Wetland Resources • ENV-01-17: Maintenance of Subsurface Sewage Disposal Systems • ENV-01-18: Maintenance of Wastewater Holding Tanks and Proper Disposal of Accumulated Wastewater • ENV-01-19: Inspection and Maintenance of Storm Water Catch Basins • ENV-01-22: Vehicle Washing • ENV-01-27: Inspection and Maintenance of Oil/Water Separators
Emergency Response Plan (Facility Spill Plan)	Appendix B	Identifies the procedures for responding to spills at MassHighway facilities.

MassHighway EMS Manual

The MassHighway EMS Manual is divided into two sections. Section I provides a description of roles and responsibilities of each Division, Section, and District. Procedures for implementing each component of the system as well as a description of an employee’s specific role and responsibility is described in further detail in Section II of the Manual. The MassHighway EMS Manual consists of specific components which serve separate and distinct purposes but are integrated to become part of the overall system. The Handbook is available on MassHighway’s web site. Sections in the EMS Manual that address Storm Water Quality include the following:

Component Section	Reference Location	Description
Funding	Capital Spending & Operational Spending Plans	Provides mechanisms for funding of environmental awareness training programs including water quality training Provides mechanisms for operational funding for water quality devices such as industrial wastewater holding tanks, oil/water separators cleaning, etc.
Environmental Requirements	Environmental Requirements List – 2 nd Paragraph	MassHighway maintains an Environmental Requirements List which identifies federal and state environmental regulations applicable to MassHighway Maintenance Facilities. This list covers a wide variety of environmental compliance areas including Water Pollution Control and Water Quality.
Emergency Preparedness	Emergency Preparedness Section Whole Section	Establishes the procedures for planning for and responding to spills at MassHighway maintenance facilities. The procedures are documented in two types of written plans: (1) the Emergency Response Spill Plan for MassHighway Facilities which establishes procedures for responding to minor and major spills, and (2) Spill Prevention Control and Countermeasure Plans (SPCC Plans) developed for facilities that store oil in quantities triggering written plan requirements under 40 CFR 112. Effective spill response is essential to protecting water quality.
Standard Operating Procedures	SOP Section Whole Section	Documents the method for the development and revision of MassHighway's Environmental Standard Operating Procedures (SOPs). SOPs define roles and responsibilities, policies and minimum performance criteria for managing environmental compliance issues at MassHighway facilities. Current MassHighway Water Quality SOPs are located in the Facility Environmental Handbooks.
Facility Environmental Handbook and Facility Maps	Facility Environmental Handbook and Facility Maps Section 1 st Paragraph	Provides a description of the roles and responsibilities for carrying out the process of making revisions to the Facility Environmental Handbook and Facility Maps. Facility Maps detailing existing environmental and operating conditions at these facilities are available separately and are included in the Handbook. Facility Maps detail environmental information including, water quality structures, wetlands and waterway buffer zones, and sand and salt storage areas.
Training	Training Section Training Program Table - Environmental Awareness Training BMP	Establishes the procedures for identifying, planning, delivering and tracking Environmental Training. Maintenance facility employees are trained on the materials and procedures contained within the Facility Environmental Handbook. Topics covered during this Environmental Awareness Training include Water Quality, Wetlands, Record Keeping, and Inspections.
Self-Auditing	Self Auditing Section 1st paragraph	Describes the procedures used by MassHighway for its Self-Audit Program. The Program is designed to reflect the compliance themes contained in the Facility Environmental Handbook across eight major compliance areas covering multi-media federal and state environmental regulatory programs, MassHighway SOPs, and best management practices (BMPs), including water quality BMPs.

Measurable Goals: 1) Reviewed each of the maintenance and material storage yards and creates a site specific facility handbook that provides information on necessary steps to environmental compliance. 2) Post EMS Manual on MassHighway website for public information. 3) Post generic Facility Handbook on website for public information.

BMP 6C-3: Maintenance Record and Data Management Work Management System – MassHighway will develop a maintenance record and data management program for the drainage infrastructure within final TMDL watersheds as part of the work management system the Department is developing. The system will be used to record and track inspection and cleaning of the infrastructure.

Measurable Goals: 1) Develop work management system. 2) Populate program with infrastructure information from inventory (BMP 7R). 3) Implement system and begin to record maintenance activities in these watersheds.

BMP 6E - Catch Basin Accumulation Project– MassHighway has developed a project work plan for the catch basin accumulation project. The project will include the following steps in order to collect data for future use in developing catch basin cleaning protocols and schedules. The goal is to track the accumulation of sediment in selected catch basins and use the information to create an appropriate cleaning schedule for MassHighway roadways.

- MassHighway will collect data on the accumulation of debris (including the frequency of cleaning catch basins and any drainage problems) for representative types of roads, and determine if the current inspection and cleaning schedule should be altered for particular road types. The catch basins selected for this study are intended to represent a variety of locations so that generalizations can be made based on the analysis of collected data. The catch basins included in the monitoring will reflect different drainage conditions (characterized by grade, roadway use and condition, traffic volume, adjacent land use, topography, tree cover and typical sections). The catch basins selected will also be characterized by their location on the road (e.g., bottom of ramp, mid-point along grade, proximity to intersection), which will help determine how location might affect sediment accumulation rates. The data collection will continue for three years to capture seasonal variation and to determine whether there is a relationship between certain catch basin characteristics (e.g. reduced salt areas) and the rate of sediment accumulation. Data will be collected and analyzed monthly and modifications to the study will be made, if necessary.
- Next, the cleaning schedule will be revised to target areas that are in greatest need of cleaning while corresponding to MassHighway's limited maintenance budgets. Statistics performed during the study will enable MassHighway to make generalizations based on catch basin characteristics.
- Upon completion of the review, the Standard Operating Procedure (SOP) for catch basin cleaning will be updated, as necessary.
- The revised schedule will be implemented within each of the five districts.

Measurable Goals: 1) Provide annual report on progress each December and include summary in annual report. 2) Complete a study of debris accumulation in catch basins. 3) Based on the results of the study, revise the existing cleaning schedule and SOP for catch basin cleaning.

2.6.4 Waste Disposal

BMP 6D: Waste Disposal - MassHighway properly disposes of waste materials removed from drainage structures and storm water BMPs during maintenance. Materials removed from catch basins are currently disposed of according to the "Reuse and Disposal of Contaminated Soil at Massachusetts Landfills" DEP Policy #COMM-97-001.

MassHighway reuses street sweepings is in accordance with "DEP/Bureau of Waste Prevention Final Policy #BWP-94.092 Reuse and Disposal of Street Sweepings." Street sweepings from roads are almost always brought to landfills for daily cover. In a few cases street sweepings have been used for slope stabilization and incorporation as fill into the roadway embankments, in compliance with the DEP Policy, and subsequently stabilized (e.g., covered with loam and seed).

Measurable Goals: 1) Street sweeping waste will be reused in appropriate slope stabilization and road work projects in compliance with SOP, when appropriate. 2) Street Sweeping material which can not be reused will be disposed of at landfills as daily cover. 3) Waste material from drainage structures and storm water BMPs removed during maintenance will be disposed of according to "Reuse and Disposal of Contaminated Soil at Massachusetts Landfills" DEP Policy #COMM-97-001.

(Note: BMP 6E Good Housekeeping/ Pollution Prevention Program Evaluation has been removed (and the subsequent BMPs renumbered) since the addition of BMP 6F through 6Q provide a better use of resources with an increased impact on meeting the good housekeeping and pollution prevention minimum control measure. The change was made in Annual Report for Permit Year 5.)

2.6.5 Snow and Ice Control Generic Environmental Impact Report (GEIR)

MassHighway has addressed environmental issues related to deicing programs through the Generic Environmental Impact Report (GEIR) for deicing practices. Salt and sanding operations are completed in accordance with procedures approved in the GEIR. MassHighway seeks to maintain an acceptable balance between the benefits of the snow and ice control program on mobility, public safety, the economy of the commonwealth and the costs of the program in terms of environmental consequences and fiscal expenditure. The report summarizes the findings of a periodic review of the environmental effects of the program and updates the previous GEIRs. The GEIR is available on MassHighway's web site at (<http://www.mhd.state.ma.us/default.asp?pgid=content/envpublications02&sid=about>)

BMP 6F - Policy and Program Review:

MassHighway currently conducts snow and ice operations during winter storm events on approximately 4,132 linear miles or 13,286 lane-miles of multi-directional roadway, including breakdown lanes and ramps, throughout the state. In addition, as of 2005, MassHighway has been given the winter maintenance responsibility for certain urban arteries managed by the Massachusetts Department of Conservation and Recreation (DCR). During a statewide snow event, up to 4000 pieces of snow fighting equipment (e.g. spreaders, plows, loaders, etc) and a similar number of operators are mobilized and coordinated within an hour or less. Additional vehicles and personnel monitor and patrol roadway conditions prior, during and following each storm event. MassHighway predominately uses hired equipment and labor (about 90%) supplemented with state equipment and employees (10%). The hired equipment is called upon when the duration or severity of a forecasted or prevailing storm is such that the state equipment alone is inadequate to perform the necessary task.

MassHighway utilizes a systematic management structure and procedures defined in its Maintenance Manual to insure that the snow and ice operations are carried out in a timely and standardized manner across the state and to maintain accountability for the proper use of equipment and deicing materials. MassHighway's District personnel contained in each of the five districts across the state are primarily responsible for initiating and conducting snow and ice control operations. To provide geographic coverage, personnel and equipment are located in 118 local maintenance facilities or depots in five districts throughout the State.

The overall goal of the Snow and Ice Control Program is to provide reasonably safe travel conditions for the entire roadway network in a cost-effective manner. This goal is achieved by measures that work to prevent the pavement-ice bond from occurring by utilizing anti-icing and deicing chemicals, personnel, and equipment. Anti-icing efforts work towards preventing the pavement-ice bond; deicing efforts are required once this bond has occurred. A much greater amount of deicing effort is usually needed to break up and remove this bond of ice or packed snow to the pavement than is required to prevent bonding.

Guidelines for MassHighway's snow and ice control methods, including salt application, are described in the MassHighway Maintenance Manual. The type and quantity of deicing material applied may vary depending on local environmental, roadway and weather conditions. For most multi-lane roadway sections as well as secondary roads, the deicing applications consist of salt (straight sodium chloride (NaCl)) or Pre-mix, which is a mixture of sodium chloride and calcium chloride at a 4 to 1 ratio. MassHighway also uses liquid calcium chloride (CaCl₂) as either a pre-wetting agent or it is applied directly to the pavement prior to the storm. The policy for the salt application rate initially was 350 lbs/ln-mile. After the 1976 GEIR, the application rate was reduced to 300 lbs/ln-mile; this value was reduced further in 1995 to the current rate of 240 lbs/ln-mile.

MassHighway has also updated its equipment. The use of automated spreaders has led to increased efficiency of application.

A mixture of sand and sodium chloride is sometimes used, particularly on roadway sections with steep grades, ramp sections, and intersections. MassHighway established a policy of reduced winter sanding during FY 2002, which resulted in the ratio of sand to salt use dropping from between 1:2 and 1:4 to 1:10. This policy was prompted by various concerns about using sand for snow and ice control, including its effectiveness, cost, and impact to the environment.

A program to reduce salt use in selected environmentally sensitive areas was initiated in 1983. MassHighway has experimented with various non-salt chemical deicers, as well as pavement and abrasive alternatives, and reducing salt levels. The reduced salt areas were determined due to environmental conditions, including proximity to natural resources and drinking water resources. These areas are costly to maintain and often endure a reduced level of service, and so are only chosen when a legally and scientifically defensible study has determined that reduced salting is an appropriate remedial activity.

Measurable Goals: MassHighway will continue to at least biannually evaluate its snow and ice control policies and operational programs in order to make adjustments based on data and experience, and to respond to changing conditions.

BMP 6G - Salt Remediation Program:

Since the early 1960s, MassHighway has conducted a salt complaints program to respond, investigate and remediate environmental impacts to water supplies resulting from the use of deicing chemicals. In 1982, MassHighway formalized the Salt Remediation Program to investigate, prioritize and remediate salt complaints. A formal Standard Operating Procedure (SOP) to respond to salt contamination complaints was promulgated in 1996. Beginning in January 2003, the Program has been administered by the Environmental Section of the Projects Division. The Program currently consists of a Program Supervisor, a Salt Complaints Coordinator, and a representative from the Chief Counsel's office. MassHighway also utilizes an Interdepartmental Service Agreement (ISA) with the University of Massachusetts to assist with well replacement, sample collection, analysis and organization of data to support the Program.

From 1983 through 2003, MassHighway spent about \$3.2 million on remedial measures to minimize salt contamination of private wells. Table 2-4 presents a summary of the remedial measures used between 1983 and 2003 for private wells, which include well replacement, water treatment, a connection to public water supply, roadway drainage modifications, reduced salting, the use of alternative deicers, and financial settlement.

In remediating contaminated private wells, selecting the most cost-effective remedial measure depends on a number of factors. These include: whether or not the well is an isolated case or is linked to a cluster of contaminated wells; and whether a connection to a public water system is available. Connection to a public water supply is generally the preferred measure if a water main exists near the property. If connection to a public water supply is not possible, MassHighway will next explore installation of a replacement well including abandonment of the existing well. A less frequently used remedial measure is the installation of a reverse-osmosis water treatment system. This is usually only used as an interim solution when additional time (i.e., a year or more) is needed to develop a permanent remedy.

If there is a cluster of contaminated wells along a certain roadway segment, then a reduced salt area, an extension of a public water main, a connection to a municipal water system, and/or well replacement are the remedial measures used. In several cases where clusters of wells are involved, the contamination has been at least partially due to outside salt storage practices at certain maintenance depots (all MassHighway salt storage facilities are now enclosed). One example of a successful reduced-salt program is in the Town of Goshen where a reduced salt area was established in 1983 to alleviate salt contamination in forty-five private wells along Route 9. Annual salt applications were reduced to 3.3 tons per ln-mile from 14.3 tons per ln-mile.

Subsequently, sodium concentrations dropped by nearly 66 percent on average (Pollock, 1991). Even though less salt is applied, reduced salt areas require greater operating costs due to increased supervision and road condition monitoring and the added cleanup costs related to sand applications.

There are approximately 80 private wells that are being investigated or in the process of being resolved according to the most recent list of active salt contamination complaints (January 2005). The investigations are summarized in Table 2-2 below. As development density increases and particularly when residential homes are constructed in close proximity to roadways, the potential for salt contamination occurrences increase. Most of the private wells on the current active list are located along two-lane, "secondary" State roads such as Routes 1, 2, 9, 20, 119, 140 and 146. Most of the residential development is occurring along these roads. Another particularly troublesome area in the State consists of an area around the maintenance depot and near Route 20 in the Town of Charlton. As many as 50 private wells have been monitored in this area in order to investigate the extent of contamination.

In terms of public water supplies, salt complaints have been received from about 25 communities. Some of these water supplies are currently being investigated and/or remediated. In general, reduced salt areas are the most effective measure used to alleviate salt contamination of municipal water supplies. There are nearly thirty different reduced salt areas throughout the state that were established to protect private, industrial, and municipal water supplies. One of the largest reduced salt areas involves a segment of Route 128/95 near Hobbs Brook and Stony Brook Reservoirs, which is the water supply for the City of Cambridge.

In one particular contamination case involving a public supply well in the Town of Yarmouth, the selected remedial measure included a scavenger well that was installed between a source (i.e., maintenance depot) and a supply well to remove a lens of salt contaminated groundwater. The scavenger well was located about 100 feet from the salt storage area and was pumped continuously at a rate of 150 gallons per minute (gpm) and discharged outside the contribution zone of a public well. In less than one year, the scavenger well had pumped out most of the salt that was in the groundwater near the maintenance facility and the sodium concentrations in the nearby public supply well were lowered to previous background levels. To prevent any additional salt from entering the groundwater, all salt was subsequently stored in specially constructed buildings and maintenance personnel were instructed to sweep up the salt loading area after every storm (Pollock 1988).

Table 2-2 Public Water Supply Complaints Summary

Table 2-2 Public Water Supply Complaints Summary

<i>Property Owner</i>	<i>Owner/Town</i>	<i>Address</i>	<i>Date of Initial Complaint</i>	<i>Last Data Point (mg/l)</i>	<i>General Comment Section</i>
Clarksburg	Golden Eagle Restaurant	John Morris, President 1935 Mohawk Trail Clarksburg, MA 01247	correspondence dated 5/10/06- Enviro rec'd 5/12/06	from owner: 1/8/07; Na = 1260, Cl = 2291, Ca = 320	Sent 30 day notice 12/11/06. Sent PWDF, ROE, data, etc. to UMASS 1/18/07 to begin investigation and schedule site visit. Initial site visit scheduled for 2/5/2007. MassHighway has issued a release agreement for installation of a test boring. Need to coordinate with DEP. Golden Eagle counsel requested additional information. Response was provided via 1/08 letter.
Sandra Smith	Upton	Wildwood Lounge Route 140 64 West Main Street Upton, MA 508.529.7782	4/11/2001- referred to MDEP	2/6/08 sample: Na = 26, Cl= 4	Investigation Complete. Classified as a public water supply and all actions need to be coordinated w/ MaDEP. MassHighway Counsel finalized a settlement agreement with owner in September 2005. DEP issued permit for siting of test well on July 14, 2006. First well replacement attempt failed due to hydraulic connection to Lake Wildwood, which would have required small PWS to meet Surface Water Treatment rule. Second attempt constructed in January 2007. This well was connected in November 2007. We will need to conduct additional micro-particulate analysis per MaDEP requirements.
Andover	Andover	Jack Petkus, Director Department of Public Works 397 Lowell Street Andover, Ma 01810-4416 Telephone (978) 623-8750	2/22/2000	April 3, 2008, Na = 45, Cl = 92 raw water	Poly style storage was constructed in 2001 where there previously was no outside storage from 1998 through 2001. Based on monthly sampling, Town requested a reduced salt zone along I-93 and I-495 and relocation of the salt storage shed via July 2004 correspondence. Section of I-495 and 93 has been designated as a reduced salt zone. Reduced salt zone first implemented in 2005-2006 winter season.
Cambridge	Cambridge Reservoir	Chip Norton, Watershed Manager Cambridge Water Dept. 250 Fresh Pond Parkway Cambridge, MA 02138 (671) 349-4781	Regular monitoring began 1987	June 2006, Finish water Na= 71, Cl = 121	Reservoir is adjacent to 128 in Towns of Lexington, Lincoln, Waltham, and Weston. There is a designated reduced salt zone for this area covering 24.6 linear miles and 177.8 lane miles in the vicinity covering sections of Route 2, 2A and 128.

Table 2-2 Public Water Supply Complaints Summary

<i>Property Owner</i>	<i>Owner/Town</i>	<i>Address</i>	<i>Date of Initial Complaint</i>	<i>Last Data Point (mg/l)</i>	<i>General Comment Section</i>
Dedham/ Westwood	Dedham/Westwood	Nan Crossland Executive Director Dedham-Westwood Water Dept. 50 Elm Street, Dedham, MA 02027-9137 Telephone (781) 329-7090	File alluded to 3/7/88 correspondence from DWWD requesting MHD refrain from using salt along sections of Rt 128. 12/19/97 telecon b/w Sam Pollock and Mark Hollowell of Anderson-Nichols regarding DEP req'd monthly monitoring and concerns for White Lodge Well #5	2/5/2008-Well #5 Na = 92, Ca = 23, Cl = 155	Concern is over one Municipal Well located to the North of I-95/128 near University Avenue. The well is located in Fowl Meadow Aquifer that recharges White Lodge Well No. 5. Correspondence written in March 2004 indicating that we would monitor salt application. MassHighway with UMass has installed monitoring wells and stormwater outfall monitors to evaluate NaCl sources to Fowl Meadow. MassHighway and UMass have been conducting monthly sampling of well network.
North Chelmsford	North Chelmsford	Bruce J. Harper Superintendent North Chelmsford Water District 64 Washington Street PO Box 655 North Chelmsford, MA 01863-0655 Telephone (978) 251-3931	mid 1980s	10/07, Well No. 1 Na = 297 Cl = 445, Well No. 2 Na = 62 Cl = 93, Well No. 3 Na = 173 Cl = 185, Well No. 4 Na = 215, Cl = 300	There is a reduced salt zone in East and North Chelmsford for 153 lane miles consisting of section of Route 3, 3A, 4 and Lowell Connector. High arch gambrel salt shed is under design. Anticipate 100% plans will be ready summer 2008.
Eastman-Gelatin Corp.	Peabody	Paul Carter, Services Mgr. 227 Washington St. Peabody, MA 01960 (978) 573-3757	~1965	3/08 Bleachery Pumphouse Cl = NM, Pump House 11A Cl = 198, Pump House 12A Cl = 253, Pump House 2 Cl = NM, Pump House 2A Cl = 128, Pump House 4A Cl = 142, Pump House 5A Cl = 150	Eastman-Gelatin industrial wells in close proximity to I-95. This area is within a reduced salt zone. Monthly data is collected by Eastman-Gelatin.

Table 2-2 Public Water Supply Complaints Summary

<i>Property Owner</i>	<i>Owner/Town</i>	<i>Address</i>	<i>Date of Initial Complaint</i>	<i>Last Data Point (mg/l)</i>	<i>General Comment Section</i>
Wilmington DPW	Wilmington	Michael Wood 121 Glen Road Wilmington, MA 01887 (617) 291-8916	4/29/2005	1/05 Sargent Water Treatment Plant ~100 mg Na/L. 3/04 Browns Crossing Wellfield = 118 mg Na/L, Salem Street Well = 56 mg Na/L, Barrows Wellfield = 127 mg Na/L, & Sargent Water Treatment Plant = 103 mg Na/L	Contacted by DEP, Jim Persky about potential sodium issue in 2 wells located near I-93. Performed initial site visit w/ UMass on 6/28/05. Additional data provided and UMass will copy and evaluate for data collection/mass balance. MassHighway received draft sampling plan for review January 2007, which was forwarded to Wilmington DPW for their consideration. Wilmington has not expressed further interest in participating in the program.
Manchester	Manchester	Robert Moroney 10 Central Street Manchester-By-The Sea, MA 01944 (978) 526-1242	8/15/2003	info provided verbally by Bob Moroney on 2/15/05 indicated Lincoln Well at 32-34 mg Na/L & Treatment Plant at 14-17 mg Na/L. 7/29/03; Lincoln St Well Na = 37, Gravelly Pond WTP Na = 18	No additional response from Town. Bob Maroney indicated he would need to check budget to support sample collection and analysis. Contacted by Lisa Press (Con Comm agent) on 2/2/05 to discuss sampling program and that a citizens group has volunteered to provide funding for the monthly sampling. Town did not follow up with funding and coordination for proposed sampling locations.
Hanover	Hanover	Alen Alan, Water Supervisor Hanover Water Dept. 40 Pond Street Hanover, MA 02339 (781) 826-3189	Being sampled for baseline data because of potential roadway project	2/7/08, Pond Street well Raw water Na = 66, Cl = 101	MassHighway is collecting baseline sodium and chloride data in preparation of construction of additional travel lanes along Route 53. If after the widening the sodium chloride levels increase significantly in the municipal wells then MassHighway will evaluate remedial options.
Kingston	Kingston	Mary Lou Joyce, Office Administrator Board of Water Commissioners 22 Elm Street Kingston, MA 02364	Being sampled for baseline data because of potential roadway project	2/12/08 Trackle Pond Na = 26, Cl = 40; Grassy Hole Na = 9, Cl = 14; Winthrope St Na = 221, Cl = 313	Potential source may be application along new Route 44 after it opens in late 2004. MassHighway is collecting baseline sodium and chloride data in preparation for the opening of the new section of Route 44. If there is a significant increase of sodium and chloride after construction then MassHighway will evaluate remedial options. It should be noted that the Winthrope Street well is near town roads and is not near the Rt 44 relocation.

Table 2-2 Public Water Supply Complaints Summary

<i>Property Owner</i>	<i>Owner/Town</i>	<i>Address</i>	<i>Date of Initial Complaint</i>	<i>Last Data Point (mg/l)</i>	<i>General Comment Section</i>
Middleboro	Middleboro	Richard E. Tinkham, Water Superintendent Dept. of Public Works 48 Wareham Street Middleboro, MA (508) 946-2482	8/15/1989 & 2/91	3/4/08 Miller Na = 29 Cl = 50, Rock 1 Na = 54 Cl = 125, Rock 2 Na = 50 Cl = 109 Plympton Na = 47 Cl = 82	3/20/06 mtg between District 5 and Env. Personnel to discuss town wells and operational improvements. 3/29/06 letter forwarded to water district. MassHighway continues to implement reduced salt zone in the area for 40 lane miles of Route 28 and 495.
Norwell	Norwell	Jack McInnis, Superintendent Norwell Water Dept. 345 Main Street Norwell, MA 02061 (781) 659- 8076	Being sampled for baseline data because of potential roadway project	2/12/08 South St. treated Na = 76 Cl = 119, South St. Sta 1 Na = 96 Cl = 142, South St. Sta 6 Na = 51 Cl = 81	Potential sources are the MassHighway Maintenance facility and salt applications on Route 53 and 3. MassHighway is collecting baseline sodium and chloride data in preparation of construction of additional travel lanes along Route 53.
Onset	Onset	Bill Gay, Superintendent Onset Fire District 15 Sand Pond Road Onset, MA 02558 (508) 295-0603	Result of reduced salt zone along section of Route 25 and court action for Mann cranberry bog	2/5/08, Red Brook Sta 3 Na = 20 Cl = 29, Sta 4 Na = 18 Cl = 27, Sta 5 Na = 12 Cl = 8, Sta 6 Na = 8 Cl = 12	
Plymouth	Plymouth	Paul Wohler, Superintendent Plymouth Water Department Town Hall 11 Lincoln Street Plymouth, MA 02360 508-830-4155	Being sampled for baseline data because of roadway project	1/30/08, N. Plymouth well raw Na = 28, Cl = 46; Darby Pond raw Na = 14, Cl = 18; Federal Furnace raw Na = 7, Cl = 8	Potential source may be application along new Route 44 after it opens in late 2004. MassHighway is collecting baseline sodium and chloride data in preparation for the opening of the new section of Route 44. If there is a significant increase of sodium a remedy will be identified such as a reduced salt zone and increased use of liquid de-icers.
Yarmouth	Yarmouth	Rick Tierney Superintendent Willow Street West Yarmouth, MA 02673 (508) 771-7921		2/1/08, Town Hall Sink Tap Na = 23, Cl = 34; Higgins Crowell Rd, Sta 1 Na = 101 Cl = 163, Sta 2 Na = 103 Cl = 168, Sta 3 NM	Source of salt is MassHighway salt application along Route 6 in Yarmouth and salt storage area at Willow Street. Remediation included improved salt storage and handling practices at the maintenance facility, and installation and operation of a scavenger well.

In certain situations, constructing special roadway drainage systems can also be an effective measure. This method is generally only cost-effective with new roadway construction or when a major improvement project is planned for an existing roadway. One primary example is the construction of Route 25 in the Town of Bourne near the Cape Cod Canal. When this four-lane roadway was constructed in the mid-1980s; this project was designed to protect a groundwater resource area along the proposed roadway segment that contributed to several public water supply well sources. The drainage system included closed drainage with snow berms along the outside shoulders and median. The term "snow-berm" refers to an underlying layer of impermeable material that prevents salt-laden runoff and snowmelt from snow banks from entering the groundwater. The snow berm redirects runoff to beyond the contributing area of the water supply well(s). The "snow berm" concept was relatively new at that time and has been shown to be extremely effective in preventing salt contamination of groundwater.

For private wells, one of the reasons that a salt contamination complaint is investigated is if the chloride concentration in the water is near or above 250 mg/L (milligrams per liter). If so, water samples are collected from the water source of concern on a monthly basis for at least one year. Table 2-4 presents a summary of the remedial measures used between 1983 and 2003 for private wells, which include well replacement, water treatment, a connection to public water supply, roadway drainage modifications, reduced salting, the use of alternative deicers, and financial settlement. When public water supplies are involved, the detailed investigation and the resolution of the salt complaint are carried out in cooperation with the Massachusetts Department of Environmental Protection (DEP). The extent of the additional sampling and hydrogeologic studies varies depending on the water supply involved.

Measurable Goal: Continue to provide the Salt Remediation Program with a funding level appropriate to quickly address salt related complaints.

BMP 6H - Clean Well Initiative

In order to enhance the responsiveness of the Salt Remediation Program, MassHighway recently (January 2005) established the Clean Well Initiative for resolving outstanding salt contaminated well complaints. The response to well complaint cases is being accelerated by hiring additional qualified personnel through the University of Massachusetts in Amherst. This in turn will allow MassHighway to identify and construct appropriate remedial actions in a more timely and effective manner. Program elements for expediting well replacement are summarized as follows:

- Initiate a new Interdepartmental Service Agreement with UMass;
- Adopt proposed revisions to the Salt Contamination Complaint Policy to allow issuance of release agreement language prior to a 12-month sampling period;
- Hire additional field personnel to oversee well construction and perform sample collection on behalf of MassHighway;
- Procure additional services from designated certified well drilling companies;
- Add an Environmental Section staff person to help oversee the program;
- Secure timely processing and signing of release agreements by property owners.

Due to the fate and transport characteristics of salt in the environment, the number of salt complaints has varied widely from year to year. Experience has shown that the number of salt complaints depends on such factors as winter severity, adherence to Standard Operating Procedures, and public awareness of the Salt Remediation Program.

Measurable Goal: Provide a continued level of funding that will allow MassHighway to complete up to 20 replacement wells per year.

BMP 6I - Salt Management and Storage

MassHighway has 216 permanent salt storage structures at 115 locations in the state. Where MassHighway cannot build those structures, such as under arteries and ramps and on leased land, salt piles are stored under impervious structures (i.e., ramps and highways). This accounts for an additional six sites. MassHighway, through its environmental compliance programs and ongoing environmental review, takes measures to study and control the risk of salt contamination from salt storage to water supplies. The 1995 GEIR stated that 15 MassHighway storage piles and 33 seasonal storage areas were uncovered. All MassHighway salt storage facilities are now covered. The storage structures are largely rectangular. There are only a handful of dome type storage structures in the state. Two replacement structures are proposed in Chelmsford and Bourne. MassHighway's program for new salt storage facility construction consists of designs that allow for the loading of salt under cover.

Table 2-3 MassHighway Salt Structure Capacity by District

District	Sub-District	Capacity (tons)	Totals (tons)
District 1	1A	8,500	19,300
	1B	10,800	
District 2	2A	23,650	41,800
	2B	18,150	
District 3	3A	30,850	71,800
	3B	22,625	
	3C	18,325	
District 4	4A	11,400	96,700
	4B	27,300	
	4C	25,100	
	4D	32,900	
District 5	5A	33,700	77,400
	5B	29,600	
	5C	14,100	
Total			307,000

Groundwater recharge areas that supply public water systems are protected under the Massachusetts Wellhead Protection Program. The Division of Water Supply of DEP administers this program. There are 11 salt storage facilities located within the Zone IIs of Public Drinking Water Supplies. Zone II is the primary recharge area to a well; it is the area that recharges a well under the most severe recharge and pumping conditions that can be realistically anticipated. Several salt storage facilities are associated with nearby water supply wells.

Measurable Goal: MassHighway will continue to replace or repair inadequate salt storage sheds, as well as cover sand piles and/or move them out of wetland buffer zones.

Review sheds: *Increased capacity of some sheds may be justified because salt storage needs have grown over time and/or because the shed is in a sensitive area and the salt loading operations call for better containment. In sensitive areas, consideration should be given to the use of Gambrel style*

sheds that provide for the entire operation to be conducted under cover to minimize salt spillage outside of the shed. MassHighway will continue to prioritize the identification and selection of parcels being considered for new salt storage facilities, considering operational needs and the environmental setting.

Review Sand Piles: *MassHighway will strive to locate sand piles outside wetland buffer zones whenever space allows. However, when this is not possible the department will work towards storing sand piles under cover, especially during the non-winter months. This could be accomplished by storing sand within sheds or, more likely, using a heavy-gauge polyethylene tarp. The tarp could be peeled back once, before winter operations, and then covered again at the end of the season.*

Personnel: *In October 2006, MassHighway hired a Director of Snow & Ice Operations, with over 20 years of experience in winter operations, to improve salt management and supervision of deicing operations. .*

Table 2-4 Remedial Measures and Annual Costs to Mitigate Contaminated Wells (1983 and 2003)

Year	Total private wells under investigation ²	Well replacement	Public supply connection	Water treatment	Drainage change	Financial settlement	Chlorides below 250 mg/l ***	Claim denied	Cost (\$)
1983	*	2			1		*		26,500
1984	*	1					*		85,200
1985	*	0	34				*		423,000
1986	*	1					*	1	4,500
1987	*	7	14				*	3	134,000
1988	*	9	7	5 INTERIM			*	2	173,000
1989	*	4	10	4 INTERIM			*	2	209,000
1990	*	3		3 INTERIM		1	*	1	249,000
1991	*	3	4	1 INTERIM		1	*	3	73,900
1992	*	5		2 INTERIM		1	*		72,900
1993	*	4	3	3 INTERIM			*	18	200,800
1994	*	4		2 INTERIM			*	3	47,500
1995	*	2	2	2 INTERIM			*	2	40,000
1996	114	1	7	1 INTERIM	1	3	6	6	505,000
1997	144	3	21	1 PERMANENT****	1	1	47	14	441,000
1998	155	8	49	****		2	43	9	303,500
1999	124	7	1	****		1	37	10	110,000
2000	119	5	1	****		1	15	8	60,000
2001	76	3#		****			35		32,000
2002	61	2	1	****		1	15	2	47,000
2003	57	2	1	****		2	5	1	152,500
TOTAL		73	155	9**	3	14	203	85	3,237,800

¹ Costs do not include those associated with the investigation of complaints (e.g., sample collection and analyses).

² These well counts may carry over from one year to the next.

* Data Not Routinely Recorded Prior to Formal Approval of Salt Contamination Complaint Policy in 1996

** Some Temporary Treatment Systems Were Operated For Several Years

*** Refer To **MassHighway** Salt Contamination Complaint Policy

**** Ongoing Maintenance Of Two Systems, Per Agreements

#Two Wells Were Unsuccessful

Mg/L = Milligrams Per Liter

BMP 6J - Salt Storage Best Management Practices/ Pollution Prevention

In 1997, the Bureau of Resource Protection (Drinking Water Program), in association with MassHighway, issued Guidelines on Deicing Chemical (Road Salt) Storage. In addition to describing the prohibitions and restrictions outlined in the guidelines, it also describes the Salt Storage BMP(s). The components of an “environment-friendly” roadway deicing salt storage facility include:

- The right site = a flat site;
- Adequate space for salt piles;
- Storage on a pad (impervious/paved area);
- Storage under a roof; and
- Runoff collection/containment with an appropriate discharge site for the runoff.

MassHighway also has developed a Standard Operating Procedure (issued May 1999) for the Management of Sand and Deicing Chemicals at MassHighway Facilities. Other references for describing management practices for salt storage include *The Salt Storage Handbook*, published by the Salt Institute.

A Facility Environmental Handbook was issued April of 1999 as part of MassHighway’s Environmental Management System. The Handbook provides facility employees with a visually enhanced reference guide to environmental compliance. It contains information regarding all MassHighway environmental policies and standard operating procedures, including emergency situation responses and employee roles and responsibilities.

Due to the large amount of salt and grease and oil that is typically present on MassHighway vehicles, vehicle-washing residues (contaminated water, detergent, etc.) are no longer allowed to be disposed of freely into the environment. Alternatives include disposal as sewage (where sewer connections are available), oil/water separation and subsequent wastewater and hazardous waste disposal, or the utilization of recycling systems, which allow for water purification and reuse.

Measurable Goal: Continue to implement salt storage in compliance with DEP Guidelines on Deicing Chemical Storage. Continue to follow MassHighway SOP for the Management of Sand and Deicing Chemicals at MassHighway Facilities. Continue to follow Facility Environmental Handbook guidelines at maintenance facilities.

BMP 6K - Equipment Improvements

MassHighway has instituted a number of equipment upgrades to improve the accuracy and uniformity of deicing chemical applications. In the mid-1990s, MassHighway essentially replaced its entire fleet of spreader trucks by purchasing 124 new spreader/plowing vehicles that are equipped with computerized spreader controls linked to ground speed sensors that can apply accurate and uniform applications regardless of truck speed. Since 1994, MassHighway has required all hired spreaders to be equipped with calibrated automatic controls as well. Vendors must have their spreading machinery calibrated prior to the beginning of the winter storm season and provide MassHighway with a Calibration Certificate from an approved Calibration Vendor. All spreaders hired by MassHighway are required to have an automated ground speed control device. In addition, the majority of MassHighway’s spreader/plow units, and about half of those hired, are equipped with pre-wetting systems.

MassHighway has also recently purchased approximately 50 vehicle-mounted and a dozen hand-held infrared pavement temperature sensors in order to improve the ability to predict when the initial road salt applications may be necessary to prevent ice bonding or buildup. These sensors help District snow and ice engineers and maintenance foremen to better determine when application of deicing chemicals may be necessary, particularly because pavement temperatures generally differ from air temperatures.

Measurable Goal: MassHighway will continue to expand the use of anti-icing as a standard tool for snow and ice control. .

BMP 6L - Enhanced Weather Forecasting Information: MassHighway has utilized a weather forecasting contractor to provide up-to-date and local weather information. The contractor provides frequent weather updates to headquarters and District personnel to help determine when to mobilize equipment and personnel and commence anti-icing and deicing operations. With these tools, predicting and tracking the onset of storms and the potential precipitation amounts across the State is readily accomplished, thus improving the efficiency of mobilizing equipment and the timing of road salt applications.

Measurable Goal: Continue to provide sufficient funding to use weather forecasting contractor to provide up-to-date and local weather information during snow and ice season.

BMP 6M- Road Weather Information System: MassHighway has implemented a Road Weather Information Sensor (RWIS) System, which provides real-time data of pavement temperature and moisture conditions from remote locations. It provides remote access to relevant meteorological information and is another tool for determining when deicing chemicals are required and can prevent unnecessary chemical applications. District and headquarters personnel can retrieve real-time data over existing phone lines that are connected to their computers. In addition, the meteorological contractor can also use the data along with standard forecast data to provide pavement forecasts. The pavement forecasts focus on trying to pinpoint when freezing conditions may occur and at what locations it may first happen. The advantage to using the RWIS system is that it allows maintenance staff to closely monitor real-time, pavement conditions over time and within specific regions.

Measurable Goal: MassHighway will ensure that these stations will be maintained so as to remain fully functional.

BMP 6N - Alternative Technologies

Research in the area of snowplow efficiency has focused mainly on improving the cutting edges of the snowplow blades. The introduction of new spreader/applicator technology has exploded in the past few years, with heavy competition between vendors to provide state-of-the-art equipment and remain competitive. One of the most effective measures for reducing chemical application has been the use of computerized calibrated spreaders using an optimal application rate (EPA, 1999). Ground speed controllers base the rate of material delivery on the speed of the truck. Most ground speed controllers are a type of radar with a speed sensor connected to an on-board computer that adjusts the application rate to compensate for the truck speed. All MassHighway hired spreaders are required to have an automated ground speed control device. These devices are calibrated every year. In addition, the majority of the State's spreader/plow units, and about half of those hired, are equipped with pre-wetting systems.

MassHighway uses snow fences in areas of blowing and/or accumulating snow. These snow fences can keep some snow off the road and therefore reduce removal costs.

Measurable Goal: MassHighway will continue to maximize the use of Premix and liquid calcium chloride, as alternative deicers, to reduce the quantity of granular sodium chloride, and should closely monitor reduced salt zones during storms to ensure the proper timing of salt applications and to minimize the potential for overuse of deicing chemicals.

BMP 6O – Research

In order to better evaluate its snow and ice control operations, MassHighway will pursue one or more research programs designed to collect data and analyze the findings. Examples include the following:

- Salt Impact to Groundwater and Surface Water Supplies Model – MassHighway will investigate a standard methodology or computer model for analyzing and predicting salt impact from proposed

major highway expansion or widening projects to groundwater and surface water supplies. Outcome of investigation and recommendation for action shall be included in the next biannual review of GEIR.

- Plot data pertaining to the snow and ice control program (e.g., salt usage, application rates, salt alternatives, as well as locations of salt contamination sites, salt storage facilities, municipal water supplies, ramps, and salt spreader routes) onto GIS layers. This exercise could help determine the critical operational factors that affect road salt usage and could suggest specific steps for improving salt management (e.g., eliminating possible salt spreading routes that overlap), thereby increasing cost savings in deicing materials. In addition, specific problem areas may be identified and prioritized, which could lead to a reduction in well contamination complaints and costs for mitigation.
- Develop a field study that monitors road salting operations during a statistically-valid number of winter storms (i.e., road salting events). Winter maintenance operations could be evaluated through any or all of the following parameters: measuring salt spreader calibrations and quantities applied, tabulating the numbers of runs taken by snow-fighting equipment (i.e., plows and spreaders) per storm, the performance of temperature sensors, the effectiveness of pre-wetting and anti-icing, the role of weather forecasting, and the need for snow fencing. Moreover, this study could investigate the potential of on-board GPS units (discussed in Section 3.2.12) for providing additional information that would enhance MassHighway's ability to manage its snow and ice control program. The findings from this study also may support a variety of operational changes, such as increased inspections of spreader equipment to ensure proper calibration, and/or deployment of additional plows to reduce the need for salt applications.
- Explore the potential for funding a "pooled fund study" through FHWA's Transportation Pooled Fund Program. To qualify, MassHighway would most likely need to collaborate with one or more DOTs from New England. Study topics include: evaluation of different classes of alternative deicers; optimization of salt application rates; and investigation of snow-fighting equipment (e.g., speed controlled spreaders, infra-red temperature sensors, plow blades). MassHighway has joined "Clear Roads" Clear Roads is a pooled funded research project that tests and evaluates winter maintenance materials, equipment and methods that are used by winter maintenance crews. The project was started in 2004 and currently has membership of 15 states including; Wisconsin DOT, Iowa DOT, Minnesota DOT, Missouri DOT, Indiana DOT, Michigan DOT, Ohio DOT, Colorado DOT, Illinois DOT, Utah DOT, Wyoming DOT, Virginia DOT, New York DOT, MassHighway and FHWA. Annual membership is \$25,000 and includes the cost of research projects, administrative management, and travel for Technical Advisory Committee members to attend meetings. States can use 100% federal funds (SPR) to cover membership costs. MassHighway would also gain access to all prior research that the committee has performed. The program and project reports may be found on the website www.clearroads.org.

Measurable Goal: MassHighway has joined Clear Roads program and will continue to explore moving forward on other projects. A summary of research performed by Clear Roads will be included in the SWMP annual report.

3.0 Additional Requirements

3.1 General

Parts I, V and IX of the General Permit include additional requirements beyond the minimum control measures discussed in Section 3.0. MassHighway will comply with many of the additional requirements by continuing the use of the Storm Water Handbook and implementing the Environmental Site Data Form and Instructions (part of the Construction SWPPP Template) and drainage inventory program. Each of these programs is discussed below:

BMP 4E - MassHighway Storm Water Handbook – MassHighway has recently completed an extensive effort in preparing a Stormwater Handbook for roadway designers, public works personnel, and other persons involved in the design, permitting, review, and implementation of highway and bridge improvement projects in the Commonwealth of Massachusetts. The objective of this Handbook is to provide guidance in the development of cost-effective storm water management strategies for highway projects to comply with the DEP Stormwater Management Policy. The Handbook focuses on the unique constraints of existing roadways. It provides guidance for storm water management practices readily and reasonably applicable to highway improvement projects and new construction. In order to comply with NPDES Phase II requirements, MassHighway has expanded the use of the Handbook within the Department to include all urbanized areas regulated under the NPDES general permit. This change extends compliance with the Storm Water Policy to projects within urbanized areas, in addition to those subject to the Wetlands Protection Act. The Handbook was released in 2002. MassHighway requires that all new construction or redevelopment activities undertaken by others that are funded in whole or in part by MassHighway comply with the Handbook. The Handbook was ratified by Massachusetts DEP on May 7, 2004.

Measurable Goals: 1) Develop MassHighway Storm Water Handbook. 2) All new construction and redevelopment projects must comply with the Handbook.

BMP 7D - Environmental Site Data Form – MassHighway will develop a site specific data form which the project designer will complete regarding project and site information. This template will include environmental permitting requirements from the NPDES General Permit for MS4s and the Construction General Permit and will be submitted by the designer once 25% Design is complete. By including information required for both the Construction and MS4 permit, MassHighway will be minimizing the duplication of effort to comply with these two regulations. The checklist will include review of the project for potential discharges to water bodies included on the 303(d) list and identifying the pollutant of concern if the water body is impaired. The designers will be required to identify the BMPs which will be incorporated to address the pollutant of concern as recommended in the MassHighway Storm Water Handbook. By reviewing at 25% Design, MassHighway will make sure that the designer is incorporating the appropriate BMPs into the site design and reducing the pollutant load to the receiving water appropriately. The data form will include review of the project for:

- potential adverse effects to state or federally listed endangered species habitat;
- potential adverse effects to historic properties;
- discharge(s) to water quality impaired waters;
- discharge(s) to waterbodies with approved Total Maximum Daily Load (TMDL);
- discharge(s) to coastal waters with public swimming beaches;
- discharge(s) to basins designated as “high” or “medium” in the most recent Massachusetts Water Resource Commission’s *Stressed Basins in Massachusetts* report;
- discharge(s) to public drinking water sources and their protection areas (Class A and B surface waters used for drinking water and well head protection areas);

- discharge(s) to Class A waters, Zone 1 wellhead protection areas, and the sanitary radius to supply wells;
- discharge(s) to Outstanding Resource Waters (as designated in 314 CMR 4.00);
- discharge(s) to shell fishing areas (open versus closed areas);
- discharge(s) to cold water fishery segments as identified in 314 CMR 4.00;
- discharge(s) to federal Wild and Scenic River; and
- discharge(s) to state scenic river.

In order to provide the designer with further guidance when completing the Environmental Site Data Form, MassHighway will create a set of instructions to guide the designer to the regulations, which must be met if priority areas are identified on the checklist.

Measurable Goal: Develop an environmental site data form for developing SWPPPs for construction projects.

Drainage Inventory (BMP 3B-2) - Drainage inventories of the discharges within urbanized areas will include review of discharges for potential impacts to the resources listed under BMP 7D above. The outcome of these reviews will be summarized in each year's annual report and maintained in the drainage inventory database. The drainage inventory will include:

- review of discharges for compliance with the additional requirements,
- documentation of the outcome of any agency or internal review, and
- inclusion of this information in the inventory database.

Measurable Goals: 1) By the end of the permit term a drainage inventory of discharges from MassHighway roads in urbanized areas will be completed. 2) All Annual Reports will include a summary or progress towards meeting this goal.

The following sections describe in greater detail each of the additional requirements and how MassHighway will comply with the requirements during the permit term.

3.2 Endangered Species Act

General Permit Requirement: According to Part I.B.2(a), discharges or discharge related activities can only be covered by this permit if they meet the following requirements:

- i. Coverage under this permit is available only if the storm water discharges, allowable non-storm water discharges, and discharge related activities are not likely to jeopardize the continued existence of any species that are listed as endangered or threatened ("listed") under the ESA or result in the adverse modification or destruction of habitat that is designated as critical under the ESA ("critical habitat"). Submission of a signed NOI will be deemed to constitute certification of eligibility.
- ii. "Discharge related activities" include: activities which cause, contribute to, or result in storm water point source pollutant discharges; and measures to control storm water discharges, including the siting, construction and operation of best management practices (BMPs) to control, reduce or prevent storm water pollution.

- iii. In order to demonstrate eligibility, the permittee must use the most recent Endangered and Threatened Species County-Species List available from EPA. Eligibility must be determined prior to submission of the NOI. The most current list is available at <http://www.epa.gov/npdes/>. The permittee must meet one or more of the criteria described below for the entire term of the permit. The information used to determine eligibility must be maintained as part of the Storm Water Management Program.
- Criteria A: No endangered or threatened species or critical habitat are in proximity to the MS4 or the point where authorized discharges reach the receiving waters; or
 - Criteria B: In the course of a separate federal action involving the MS4, formal or informal consultation with the Fish and Wildlife Service (FWS) and/or the National Marine Fisheries Service (NMFS) under Section 7 of the ESA has been concluded and that consultation:
 - Addressed the effects of the MS4 storm water discharges, allowable non-storm water discharges, and discharge related activities on listed species and critical habitat; and
 - The consultation resulted in either a no jeopardy opinion or a written concurrence by FWS and/or NMFS on a finding that the storm water discharges, allowable non-storm water discharges, and discharge related activities are not likely to adversely affect listed species or critical habitat; or
 - Criteria C: The activities are authorized under Section 10 of the ESA and that authorization addresses the effects of the storm water discharges, allowable non-storm water discharges, and discharge related activities on listed species and critical habitat; or
 - Criteria D: Using best judgment and knowledge, the effects of the storm water discharges, allowable non-storm water discharges, and discharge related activities on listed species and critical habitat have been evaluated. Based on those evaluations, a determination is made by the permittee that there is no reason to believe that the storm water discharges, allowable non-storm water discharges, and discharge related activities will jeopardize the continued existence of any species or result in the adverse modification or destruction of critical habitat; or
 - Criteria E: The storm water discharges, allowable non-storm water discharges, and discharge related activities were already addressed in another operator's certification of eligibility which includes the MS4 activities. If certification is under this criterion, the permittee agrees to comply with any measures or controls upon which the other operator's certification was based.
- iv. The permitting authority may require any permittee or applicant to provide documentation of the determination of eligibility for this permit where the EPA or the FWS and/or NMFS determines that there is a potential impact on listed species or critical habitat.
- v. A discharge is not authorized if the discharge or discharge related activities cause a prohibited "take" of endangered or threatened species (as defined under Section 3 of the ESA and 50 CFR 17.3), unless such actions are authorized under sections 7 or 10 of the ESA.
- vi. Discharges are not authorized where the discharge or discharge related activity are likely to jeopardize the continued existence of any species that are listed as endangered or threatened under the ESA or result in the adverse modification or destruction of habitat that is designated as critical under the ESA.

MassHighway has satisfied the ESA eligibility provision under Criterion D (Small MS4 Permit, Addendum B) with regard to the dwarf wedgemussel in all areas tributary to its habitat in the Connecticut River Basin (See Appendix B for consultation correspondence with U.S. Fish and Wildlife Service). MassHighway has satisfied the eligibility criteria with regard to the short nose sturgeon in all areas tributary to its habitat in the identified portions of the Connecticut and Merrimack River Basins (See Appendix B for consultation correspondence with National Marine Fisheries Service). MassHighway has satisfied the ESA eligibility provisions under Criterion A (Small MS4 Permit, Addendum B) with regard to the dwarf wedgemussel and short nose sturgeon in all areas not tributary to the identified portions of the Connecticut and Merrimack River Basins.

In addition to the agency review, MassHighway will implement or continue to implement the following programs which address endangered species habitat:

BMP 7A - Wetland Protection Act Compliance – Most projects undertaken by MassHighway are subject to the Wetland Protection Act (WPA). As required by the Wetland Protection Regulations under this Act, the MassHighway Environmental Section submits a Notice of Intent for review by the local Conservation Commission and DEP. Part of this submittal includes compliance with the Massachusetts Endangered Species Act (MESA). MassHighway routinely contacts Massachusetts Natural Heritage Program (NHP) and US Fish and Wildlife to review the projects if they are in the vicinity of endangered species habitat in order to assess whether the project could potentially impact federal or state endangered species habitat. If a potential impact is identified, MassHighway works with the agencies to design the project to minimize the impacts.

Measurable Goals: 1) All MassHighway projects will comply with the WPA and MESA. 2) When potential impacts are identified, MassHighway will work with the appropriate agencies to design the project to minimize the impacts.

BMP 7B - 401 Water Quality Certification – Certain bridge projects are exempt from the Wetland Protection Act but are subject to the state 401 Water Quality Certification. As part of this certification application, MassHighway must review compliance with MESA. The projects are reviewed with Massachusetts Natural Heritage Program (NHP) and US Fish and Wildlife if endangered species habitat is mapped in the vicinity of the project. If the agencies identify a potential impact, MassHighway works with the agencies to modify the project design to minimize the impacts.

Measurable Goal: Massachusetts's 401 Water Quality certification requirements, which include review of the project by MA Natural Heritage program and US Fish and Wildlife if endangered species habitat is mapped in the project vicinity, will be complied with whenever they are applicable.

BMP 7C - Categorical Exclusion (CE) Checklist – Designers of MassHighway projects that include federal funds must complete the categorical exclusion checklist (under the National Environmental Policy Act) at 25% Design. The checklist includes determining if the site is in an area where there are federally listed endangered species or critical habitat. If the site is within such an area, it does not qualify for a Programmatic Categorical Exclusion and an Individual Categorical Exclusion is required by the Federal Highway Administration (FHWA).

Measurable Goals: Complete a Categorical Exclusion Checklist for all MassHighway projects that utilize federal funds.

BMP 7D - Environmental Site Data Form – MassHighway will develop a site specific data form which the project designer will complete regarding project and site information. This template will include environmental permitting requirements from the NPDES General Permit for MS4s and the Construction General Permit and will be submitted by the designer once 25% Design is complete. By including information required for both the Construction and MS4 permit, MassHighway will be minimizing the duplication of effort to comply with these two regulations. The checklist will include review of the project for potential discharges to water bodies included on the 303(d) list and identifying the pollutant of concern if the water body is impaired. The designers will be required to identify the BMPs which will be incorporated to address the pollutant of concern as recommended in the MassHighway Storm Water Handbook. By reviewing at 25% Design, MassHighway will make sure that the designer is incorporating the appropriate BMPs into the site design and reducing the pollutant load to the receiving water appropriately.

In order to provide the designer with further guidance when completing the Environmental Site Data Form, MassHighway will develop a set of instructions to guide the designer to the regulations which must be met if “priority areas” are identified on the checklist.

Measurable Goal: Develop an environmental site data form for review by designers with Environmental staff at 25% Design. Implement on all projects.

BMP 5E - Highway Runoff Contaminant Model - Develop a model that will characterize and estimate contaminant loading from highway runoff, as a follow up to the Southeast Expressway project. This model could be used to effectively estimate pollutant loading from highway property. The model will characterize the concentrations of a broad range of contaminants (e.g., nutrients, metals, hydrocarbons, and bacteria) in highway runoff and adequately account for rainfall intensity, antecedent conditions, particle sizes, traffic volume, pavement area and flow. This model could then be used by MassHighway as one of its tools for evaluating impacts in watersheds affected by TMDL studies.

Measurable Goal: Develop and calibrate a model to characterize and estimate contaminant loading from highway runoff.

3.3 Essential Fish Habitat

General Permit Requirement: According to Part I.B.2(f), discharges whose direct or indirect impacts would jeopardize any Essential Fish Habitat will not be permitted.

MassHighway Program: According to EPA's *Response to Comments* (dated 5/16/03) document, EPA has determined that essential fish habitat is not jeopardized by discharges in Massachusetts. No further action is necessary by MassHighway to comply with this requirement.

3.4 National Register of Historic Places Properties

General Permit Requirement: According to Part I.B.2.(g), discharges, or implementation of a storm water management program, which adversely effects properties listed or eligible to be listed on the National Register of Historic Places will not be authorized by this permit. Discharges may be eligible for coverage under this permit if the permittee is in compliance with requirements of the National Historic Preservation Act and has coordinated any necessary activities to avoid or minimize impacts. These requirements must be coordinated with the State Historic Preservation Officer. Information used to determine eligibility must be maintained as part of the Storm Water Management Program.

MassHighway Programs:

MassHighway has satisfied the eligibility criteria for protection of historic properties by obtaining concurrence from the Massachusetts Historical Commission (MHC) regarding MassHighway's opinion that there are presently no known storm water discharges from its roadways located in urbanized areas and within 500-feet of any historic property identified in MassGIS's historic properties data layer (see Appendix C for correspondence with the MHC).

In addition to the review by MHC, MassHighway will implement the following programs when reviewing a new discharge.

BMP 7C - Categorical Exclusion (CE) Checklist –The project designer on MassHighway projects with federal funds must complete this checklist and submit at 25% Design. The checklist includes reviewing the site for significant impacts to properties protected by Section 4(f) of the DOT act or Section 106 of the National Historic Preservation Act. In order to qualify for a programmatic Categorical Exclusion the project can not have a determination of adverse effect by the Sate Historic Preservation Officer. If the preservation officer determines that an adverse effect will occur, the designer must complete and Individual CE for approval by the Federal Highway Administration (FHWA).

Measurable Goal: Complete a Categorical Exclusion Checklist for all MassHighway projects that rely on federal funds.

BMP 8A - Cultural Resources Review – The Cultural Resources Department of the Environmental Section at MassHighway reviews all projects for impacts to historic properties at the 25% Design stage. If a potential impact is found, the Department works with the designer (MassHighway or consultant) and Massachusetts Historical Commission to alter the design to mitigate or prevent adverse effects.

Measurable Goal: Review all projects for impacts to historic properties at the 25% design phase. If a potential impact is found, the Department works with the designer (MassHighway or consultant) and Massachusetts Historical Commission to alter the design to mitigate or prevent adverse effects.

BMP 7D - Environmental Site Data Form – MassHighway will develop a site specific data form which the project designer will complete regarding project and site information. This template will include environmental permitting requirements from the NPDES General Permit for MS4s and the Construction General Permit and will be submitted by the designer once 25% Design is complete. By including information required for both the Construction and MS4 permit, MassHighway will be minimizing the duplication of effort to comply with these two regulations. The checklist will include review of the project for potential discharges to water bodies included on the 303(d) list and identifying the pollutant of concern if the water body is impaired. The designers will be required to identify the BMPs which will be incorporated to address the pollutant of concern as recommended in the MassHighway Storm Water Handbook. By reviewing at 25% Design, MassHighway will make sure that the designer is incorporating the appropriate BMPs into the site design and reducing the pollutant load to the receiving water appropriately.

In order to provide the designer with further guidance when completing the Environmental Site Data Form, MassHighway will develop a set of instructions to guide the designer to the regulations that must be met if potential adverse effects to historic properties are identified on the checklist.

Measurable Goal: Develop an environmental site data form for review by designers with Environmental staff at 25% Design. Implement on all projects.

3.5 Discharges to Water Quality Impaired Waters

General Permit Requirement: Part I.C of the permit indicates that if a discharge from the transportation MS4 discharges is within the watershed of a 303(d) listed water body the permit requires that MassHighway evaluate the discharge for a series of additional requirements including the following:

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

Waters listed on the 303d list have been determined by Massachusetts DEP to be impaired based on monitoring data. The DEP is then responsible for creating a "pollution budget" designed to restore the health of the impaired waterbody in accordance with the Federal Clean Water Act. This pollution budget is also referred to as a Total Maximum Daily Load budget (TMDL) and includes identifying the causes (types of pollutant) and source(s) (where the pollutants come from) of the pollutant from direct discharges (point

sources) and indirect discharges (non-point sources), determining the maximum amount of the pollutant that can be discharged to a specific water body to meet water quality standards, and developing a plan to meet that goal.

MassHighway Programs:

As described below, MassHighway is taking a number of steps to address discharges to impaired waters. These include a drainage inventory that identifies discharges to impaired waters in Appendix A and a SWMP BMPs table which address impaired waterbody pollutant of concern table in Appendix I.

In addition to the important steps taken in developing the impaired waterbody list and identifying the programmatic BMPs which will address the impairment, new projects which impact drainage will be designed in accordance with the MassHighway Storm Water Handbook which will be updated to include BMPs which are specific for the impairment of the waterbody. This Handbook describes which BMPs are appropriate for reducing the loads of various pollutants. Based on this information, MassHighway will select appropriate BMPs to ensure that discharges from new construction do not contribute water quality violations. MassHighway believes that, in combination with the other BMPs in this SWMP, these measures are a significant step towards ensuring that discharges of storm water from MassHighway properties are not leading to the impairment of Massachusetts waterbodies.

To ensure that this new requirement of designing BMPs to address the impairment is met by MassHighway designers and consultants, a requirement will be added to the Environmental Site Data form (BMP 7D) to document how a project stormwater system has been designed to treat the pollutant(s) of concern. MassHighway will then summarize these water quality improvements measures in each annual report.

MassHighway's policy is to give "critical" waters (which includes Class A waters and Zone I Wellhead Protection Areas, as defined by the DEP Stormwater Policy) higher priority in terms of implementing storm water BMPs. The policy is stated in the MassHighway Storm Water Handbook (May 2004, p.4-13): "*In general, roadway improvements in [critical] areas warrant additional efforts to protect water quality (i.e., a higher standard for "practicability") than may apply in other less sensitive areas. Designers should carefully consider candidate BMPs, and the provision of space to site these BMPs (including potential additional right-of-way acquisition), to achieve storm water management objectives in these areas.*"

The Cambridge drinking water reservoirs serve as the most noteworthy example of MassHighway's additional efforts to protect water quality. During the past seven years, MassHighway has implemented a significant network of storm water BMPs (i.e., 15 detention basins and water quality swales) along the highways that fall within the reservoir watershed. MassHighway's extraordinary effort is commensurate with the proximity of the highways to the reservoirs, the high number of lane-miles (which translates into large storm water volumes) and, with more than 100,000 customers, the reservoirs' high degree of sensitivity to storm water discharges.

BMP 4B - MA DEP Stormwater Management Policy - Most new construction and redevelopment activities undertaken by MassHighway are currently subject to the Massachusetts DEP's Stormwater Management Policy and Performance Standards through the Wetlands Protection Act and Clean Water Act Section 401 Water Quality Certification.

Measurable Goal: New construction and redevelopment activities will comply with Massachusetts DEP's Storm Water Management Policy and Performance Standards under the Wetlands Protection Act and Clean Water Act Section 401.

BMP 4E - MassHighway Storm Water Handbook – MassHighway has recently completed an extensive effort in preparing a Stormwater Handbook for roadway designers, public works personnel, and other persons involved in the design, permitting, review, and implementation of highway and bridge improvement projects in the Commonwealth of Massachusetts. The objective of this Handbook is to provide guidance in the development of cost-effective storm water management strategies for highway projects to comply with the

DEP Stormwater Management Policy. The Handbook focuses on the unique constraints of existing roadways. It provides guidance for storm water management practices readily and reasonably applicable to highway improvement projects and new construction. In order to comply with NPDES Phase II requirements, MassHighway has expanded the use of the Handbook within the Department to include all urbanized areas regulated under the NPDES general permit. This change extends compliance with the Storm Water Policy to projects within urbanized areas, in addition to those subject to the Wetlands Protection Act. The Handbook was released in 2002. MassHighway requires that all new construction or redevelopment activities undertaken by others that are funded in whole or in part by MassHighway comply with the Handbook. The Handbook was ratified by Massachusetts DEP on May 7, 2004.

Designs which include BMPs recommended in the Handbook should not require any additional BMPs to meet the requirement to control the discharge of the pollutant(s) of concern to the impaired waterbody.

Measurable Goals: 1) Develop MassHighway Storm Water Handbook. 2) Require all new construction and redevelopment projects to comply with the Handbook.

BMP 5A-2 - Revise Chapter 4 of the Stormwater Handbook for Highways and Bridges - Chapter 4 of the Handbook includes a screening process (including worksheets) for assessing BMPs for application on any particular project. The process includes an evaluation both "feasibility" and "suitability". The "feasibility" analysis component determines whether BMPs can be implemented given the particular project site characteristics and constraints (physical, regulatory, operational, etc.). Just as importantly, the "suitability" analysis component assesses the capability of each candidate BMP to achieve stormwater management objectives (flood control, TSS removal, infiltration). The suitability analysis component already includes a category "special objective" to include assessment of whether a BMP will contribute to an objective such as reducing a specific pollutant. MassHighway will revise this section to specifically identify the need to define "special objective" pollutants of concern when the discharge from a BMP will be to an impaired water body and or subject to a TMDL, and to include such pollutants of concern in the suitability analysis for each candidate BMP. The Chapter 4 screening process is seen as a very useful tool in selection of BMPs that accomplish the specific stormwater management objectives associated with a particular project.

Measurable Goals: 1) Revise Chapter 4 within 9 months of DEP's SW Policy Handbook update being released. 2) Reissue MassHighway Handbook to Designers within 1 year of DEP's document being released.

BMP 5A-3 - Revise Chapter 5 of the Stormwater Handbook for Highways and Bridges - To promote consistency between MassHighway practice and DEP Stormwater Management Policy, MassHighway proposes to review the updated BMP document when it is issued, and if warranted, then update the MassHighway Stormwater Handbook for Highways and Bridges, Chapter 5. The MassHighway update would include information to either cross reference the DEP manual, or to incorporate specific BMPs into the MassHighway catalog of candidate BMPs, to address the types of pollutants of concern that are being encountered in the impaired waters/TMDL waters that receive drainage from MassHighway facilities.

Measurable Goals: 1) Revise Chapter 5 within 9 months of DEP's SW Policy Handbook update being released. 2) Reissue MassHighway Handbook to Designers within 1 year of DEP's document being released.

BMP 7D - Environmental Site Data Form – MassHighway will develop a site specific data form which the project designer will complete regarding project and site information. This template will include environmental permitting requirements from the NPDES General Permit for MS4s and the Construction General Permit and will be submitted by the designer once 25% Design is complete. By including information required for both the Construction and MS4 permit, MassHighway will be minimizing the duplication of effort to comply with these two regulations. The checklist will include review of the project for potential discharges to water bodies included on the 303(d) list and identifying the pollutant of concern if the water body is impaired. The designers will be required to identify the BMPs which will be incorporated to address the pollutant of concern as

recommended in the MassHighway Storm Water Handbook. By reviewing at 25% Design, MassHighway will make sure that the designer is incorporating the appropriate BMPs into the site design and reducing the pollutant load to the receiving water appropriately.

In order to provide the designer with further guidance when completing the Environmental Site Data Form, MassHighway will develop a set of instructions to guide the designer to the regulations which must be met if the project will potentially have discharges to water bodies on the 303(d) list.

Measurable Goal: Develop an environmental site data form for review by designers with Environmental staff at 25% Design. Implement on all projects.

BMP 3B-2 - Drainage Inventory - Drainage inventories of the discharges within urbanized areas will include a review of whether the discharges within urbanized areas drain to an impaired waterbody. The drainage inventory is being completed district by district and once a district's inventory is completed will be summarized in the following year's annual report. The inventory will include a review of discharges to impaired waterbodies using the latest Integrated List of Waters available on MA GIS.

Measurable Goals: 1) By the end of the permit term a drainage inventory of discharges from MassHighway roads in urbanized areas will be completed. 2) Annual reports will include a summary of progress towards meeting this goal and data for districts completed. 3) Annual reports will include an updated list of waterbodies with discharges including whether the waterbodies are impaired.

BMP 7R TMDL Watershed Review – MassHighway has reviewed Final TMDLs to determine the actions MassHighway must take to provide compliance with the TMDL report. A summary of the current final TMDL reports, the impairment, whether a waste load allocation is identified and BMPs recommendations which may relate to MassHighway roadways is summarized in Table K-1 of Appendix K. For those watersheds with waste load allocations (WLA) and BMP recommendations related to MassHighway in Table K-1, MassHighway has begun to further review the watersheds to take steps to meet the TMDL recommendations and load allocations. MassHighway will develop a program to review each Final TMDL which meets certain criteria (e.g drainage outfall(s) within a set buffer from the impaired water or tributary) and develop individual modeling or monitoring programs to assess compliance with the TMDL.

MA Department of Environmental Protection (DEP) reviewed the current TMDL reports and identified those waterbodies that are impaired for pollutants of concern due, in a significant part, to stormwater. This list was published as part of MA DEP draft Regulated Impervious Area (RIA) permit. MassHighway used this list, with their roadway GIS layer and the drainage outfall inventory, to identify TMDL watersheds for initial assessment along with other TMDLs completed within Massachusetts. Based on a review of these TMDLs, an initial assessment of MassHighway outfalls within the watershed, and preliminary field efforts, MassHighway has developed a prioritized list of watersheds to review (Table K-2 of Appendix K).

Table K-2 identifies the number of urbanized area MassHighway road miles within each watershed and the number of outfalls according to the drainage outfall inventory overall and within 500 feet of the receiving water and tributaries. MassHighway then reviewed each of the individual TMDL reports to identify those that recommended urban and highway stormwater BMPs by identifying the watersheds with the most discharges within a certain distance to the stream and/or tributaries and where highway BMPs are recommended, we have prioritized these watersheds for further detailed review and action. As more information is learned about each watershed it is likely that this prioritization will change. MassHighway's goal is to prioritize areas where BMPs will have the greatest and most immediate impact on water quality.

MassHighway will then assess the existing BMPs and where appropriate, MassHighway will use the USGS Highway Runoff Contaminant Model or other similar water quality model to estimate contaminant loading from MassHighway roads into the TMDL waterbody. In addition, as a part of the draft RIA permit, MA DEP indicated that structural BMPs designed and constructed in accordance with DEP's Stormwater Policy are deemed to have presumed pollutant removal effectiveness as stated in the Policy, and therefore do not require

monitoring. This presumption will be used in identifying and designing appropriate stormwater controls where determined necessary to comply with the TMDL report. If this assessment indicates that additional measures are necessary, MassHighway will work with the corresponding District Office to develop a conceptual design and implementation schedule for measures to address the pollution.

Measurable Goal:

1. *Develop prioritized list of TMDL watersheds to assess based on pollutants and MassHighway drainage outfalls.*
2. *Assess 20% of applicable watersheds with TMDLs as listed in Goal #1 above each year once the USGS Contaminant Model is completed (scheduled for winter 2009/2010). Summarize assessment and outcome, including implementation schedules for BMPs if determined necessary, in each annual report.*
3. *As new TMDL reports are completed, review their potential contribution and update the table to include an action plan for that waterbody, if determined necessary, within 9 months of the TMDL report being issued by EPA.*

BMP 7T Review of Specific Sites for Water Quality Exceedance in Response to Conservation Law Foundation (CLF) et al. Lawsuit - In response to a civil action suit brought by the Conservation Law Foundation (CLF) et al., MassHighway focused stormwater analysis and improvements on three sites identified as potential contributors to water quality (copper, lead and zinc) exceedances experienced by the Charles and Nashua Rivers. The lawsuit required that MassHighway implement BMPs at each of the sites "that will contain the occasional instream exceedance of water quality standards."

MassHighway's stormwater consultant, AECOM, performed individual site visits at each of the three sites. Field staff identified flow patterns, stormwater infrastructure, and existing mitigation measures. AECOM used this information to populate a water quality exceedance model. The model identifies the peak pollutant concentration from highway runoff in a three year span and compares that value to EPA's water quality exceedance criteria.

The model results indicate that existing BMPs located at each of the sites provide adequate retention of the stormwater volume so that the minimal flows which are not treated by the BMPs at each of these crossing do not lead to an exceedance of the water quality standards. A report summarizing the model and assumptions is included as Appendix J.

Measurable goal:

1. *Analyze each of the three sites identified in the CLF lawsuit. Develop summary report with modeling methodology and summary of results.*
2. *For the sites which are determined to contribute to the exceedance of water quality at the stream crossing, construct BMPs to address MassHighway related exceedance by December 2010.*
3. *Submit a remedial plan to the courts by January 2010.*

3.6 Discharge to Waterbodies with an Approved TMDL

General Permit Requirement: According to Part I.D of the permit, if a discharge drains to a listed waterbody for which a Total Maximum Daily Load (TMDL) has been developed and approved by EPA, the permittee must comply with the requirements below:

1. Determine whether the approved TMDL is for a pollutant likely to be found in storm water discharges from the MS4.

2. Determine whether the TMDL includes a pollutant waste load allocation (WLA), BMP recommendations or other performance requirements for storm water discharges. This storm water WLA may be expressed in the TMDL as a gross allotment for the impaired water body. Or, provided no specific WLA for the MS4 exists, determine if a Performance Agreement or Memorandum of Understanding has been established between the MS4, EPA, and MA DEP or NH DES which modifies the BMPs or performance standards of the TMDL. Such Memoranda are posted on the TMDL websites. The Massachusetts site is: <http://www.state.ma.us/dep/brp/wm/tmdl.html>.
3. If the MS4 is required to implement storm water waste load allocation provisions of the TMDL, the permittee must assess whether the WLA is being met through implementation of existing storm water control measures or if additional control measures are necessary. The permittee's assessment of whether the WLA is being met is expected to focus on the adequacy of the permittee's storm water controls (implementation and maintenance), not on the response of the receiving water.
4. Highlight in the storm water management program and annual reports all control measures currently being implemented or planned to be implemented to control pollutants of concern identified in approved TMDLs. Also include a schedule of implementation for all planned controls. Document the assessment which demonstrates that the WLA will be met including any calculations, maintenance log books, or other appropriate controls.

MassHighway Programs:

BMP 4B - MA DEP Stormwater Management Policy- Most new construction and redevelopment activities undertaken by MassHighway are currently subject to the Massachusetts DEP's Stormwater Management Policy and Performance Standards through the Wetlands Protection Act and Clean Water Act Section 401 Water Quality Certification.

Measurable Goals: 1) New construction and redevelopment activities will comply with Massachusetts DEP's Stormwater Management Policy and Performance Standards under the Wetlands Protection Act and Clean Water Act Section 401.

BMP 4E - MassHighway Storm Water Handbook - MassHighway completed a Storm Water Handbook for roadway designers, public works personnel, and other persons involved in the design, permitting, review, and implementation of highway and bridge improvement projects in the Commonwealth of Massachusetts. The objective of this Handbook is to provide guidance in the development of cost-effective storm water management strategies for highway projects to comply with the DEP Stormwater Management Policy and NPDES Phase II. The Handbook focuses on the unique constraints of existing roadways. It provides guidance for storm water management practices readily and reasonably applicable to highway improvement projects and new construction. In order to comply with NPDES Phase II requirements, MassHighway has expanded the use of the Handbook within the Department to include urbanized areas regulated under the NPDES general permit. This change extends compliance with the Stormwater Policy to projects within urbanized areas, in addition to those subject to the Wetlands Protection Act.

MassHighway feels that by extending the DEP Policy requirements to all projects within urbanized areas, no additional BMPs will be necessary to meet the TMDL requirements if a Waste Load Allocation (WLA) is not included.

Measurable Goals: 1) Develop MassHighway Storm Water Handbook. 2) All new construction and redevelopment projects within urbanized areas must comply with the Handbook.

BMP 5E - Highway Runoff Contaminant Model – As discussed in Minimum Control Measure 5, MassHighway will develop a model that will characterize and estimate contaminant loading from highway runoff, as a follow-up to the Southeast Expressway project. By accounting for rainfall intensity, antecedent conditions, particle sizes, traffic volume, pavement area and flow, and characterizing the concentrations of a broad range of

contaminants (e.g., nutrients, metals, hydrocarbons, and bacteria) in highway runoff, the model will be used to generate scientifically defensible estimates of pollutant loading from highway property. These estimates could then be used to support selecting appropriate storm water BMPs, with an emphasis on source control measures.

Measurable Goal: Develop and calibrate a model to characterize and estimate contaminant loading from highway runoff.

BMP 7D - Environmental Site Data Form – MassHighway will develop a site specific data form which the project designer will complete regarding project and site information. This template will include environmental permitting requirements from the NPDES General Permit for MS4s and the Construction General Permit and will be submitted by the designer once 25% Design is complete. By including information required for both the Construction and MS4 permit, MassHighway will be minimizing the duplication of effort to comply with these two regulations. The checklist will include review of the project for potential discharges to water bodies included on the 303(d) list and identifying the pollutant of concern if the water body is impaired. The designers will be required to identify the BMPs which will be incorporated to address the pollutant of concern as recommended in the MassHighway Storm Water Handbook. By reviewing at 25% Design, MassHighway will make sure that the designer is incorporating the appropriate BMPs into the site design and reducing the pollutant load to the receiving water appropriately.

In order to provide the designer with further guidance when completing the Environmental Site Data Form, MassHighway will develop a set of instructions to guide the designer to the regulations which must be met if potential discharges to water bodies with an approved TMDL are identified on the checklist.

Measurable Goal: Develop an environmental site data form for review by designers with Environmental staff at 25% Design. Implement on all projects.

BMP 3B-2 - Drainage Inventory - Drainage inventories of discharges within urbanized areas will include review of whether the discharges within urbanized areas drain to a waterbody with an approved TMDL. The outcome of these reviews will be summarized in each year's annual report and maintained in the drainage inventory database. The drainage inventory will include review of discharges within urbanized areas to:

- identify discharges which drain to a water body with an approved TMDL,
- if TMDL includes a WLA, determine whether it is being met through implementation of existing storm water control measures,
- if WLA is not being met currently, document proposed plan for meeting WLA, and
- document the outcome of any agency or internal review.

Measurable Goals: 1) By the end of the permit term a drainage inventory of discharges from MassHighway roads in urbanized areas will be completed. 2) Annual reports will include a summary or progress towards meeting this goal.

BMP 7E - TMDL Recommendations Summary Table Update – MassHighway has reviewed Final TMDLs to determine the actions MassHighway must take to provide compliance with the TMDL report. A summary of the current final TMDL reports, the impairment, whether a waste load allocation is identified and BMPs recommendations which may be relate to MassHighway roadways is summarized in Table K-1 of Appendix K. The table also summarizes the actions taken by MassHighway to meet the TMDL recommendations and whether further actions are necessary for compliance.

As a part of each annual report, MassHighway will update Table K-1 to reflect TMDL reports which have been finalized in the previous permit year. The table will also reflect progress by MassHighway on implementing related measurable goals.

Information regarding control measures being implemented to address pollutants identified in the TMDL is available at the district office and includes calculations, maintenance logs, and other appropriate controls. These measures are indicated in Table K-1 of Appendix K of this report and included as appendices in the annual report as appropriate. MassHighway is developing an Asset Management System which, once in place and fully implemented, will allow for the documentation and easy reporting of maintenance activities that have occurred each permit year.

Measurable Goal:

1. *Table K-1 Preliminary Review of Applicability of TMDLs to MassHighway will be updated annually to reflect which TMDL reports have been finalized in the previous permit year and include progress on any related measurable goals.*
2. *Comment on progress of Asset Management System.*

BMP 7F - Route 28 Roadway Drainage – Frost Fish Creek - As part of the next Route 28 reconstruction project, the Massachusetts Highway Department will work with the Town to mitigate the Route 28 roadway drainage in the immediate area by installing practicable best management structures, or operational practices, as warranted by the magnitude of contaminant loading to Frost Fish Creek.

Measurable Goal: Install BMPs or operational practices to mitigate the impacts of drainage from Route 28 to Frost Fish Creek when reconstruction is planned for Route 28.

BMP 7G - Route 28 Roadway Drainage – Muddy Creek - As part of the next Route 28 reconstruction project, the Massachusetts Highway Department will determine the Route 28 roadway drainage area discharging to Muddy Creek and install practicable best management structures, or operational practices, as warranted by the magnitude of contaminant loading to Muddy Creek.

Measurable Goals: 1) Determine the area of Route 28 that drains to Muddy Creek by when reconstruction is planned for Route 28. 2) Include practicable BMPs or implement operational practices as warranted by the magnitude of contaminant loading in the design.

BMP 7H - Chicopee Basin Impaired Waterbodies TMDL - MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue.

Measurable Goal: Review projects within the Chicopee Basin for opportunities to include additional BMPs to help address pollutant loading issues.

BMP 7I - Connecticut Basin Impaired Waterbodies TMDL - MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue.

Measurable Goal: Review projects within the Connecticut Basin for opportunities to include additional BMPs to help address pollutant loading issues.

BMP 7J - French Basin Impaired Waterbodies TMDL - MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue.

Measurable Goal: Review projects within the French Basin for opportunities to include additional BMPs to help address pollutant loading issues.

BMP 7K - Indian Lake Impaired Waterbodies TMDL - MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue.

Measurable Goal: Review projects within the Indian Lake watershed for opportunities to include additional BMPs to help address pollutant loading issues.

BMP 7L - Leesville Pond Impaired Waterbodies TMDL - MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue.

Measurable Goal: Review projects within the Leesville Pond watershed for opportunities to include additional BMPs to help address pollutant loading issues.

BMP 7M - Miller River Basin Impaired Waterbodies TMDL - MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue.

Measurable Goal: Review projects within the Miller River Basin for opportunities to include additional BMPs to help address pollutant loading issues.

BMP 7N - Northern Blackstone Impaired Waterbodies TMDL - MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue.

Measurable Goal: Review projects within the Northern Blackstone watershed for opportunities to include additional BMPs to help address pollutant loading issues.

BMP 7O - Salisbury Pond Impaired Waterbodies TMDL - MassHighway has committed to DEP in its January 23, 2002 letter that streets will be swept at least once a year (usually in spring) and more often if necessary. All sumped drainage structures will be inspected twice a year and cleaned as determined necessary. MassHighway will inspect/ clean drainage outlet locations where sediment build-up is evident. MassHighway will inspect and repair damaged and/ or clogged drainage conveyances.

Measurable Goals: 1) Streets in the Salisbury Pond watershed will be swept at least once a year. 2) All sumped drainage structures will be inspected twice a year and cleaned as determined necessary. 3) MassHighway will inspect and repair damaged and/or clogged drainage conveyances as determined necessary.

BMP 7P - Lake Quinsigamond and Flint Pond Impaired Waterbodies TMDL - MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue.

MassHighway has "stepped up" their maintenance activities in this watershed as outlined in the letter included in Appendix.

Measurable Goal: 1) Review projects within the Lake Quinsigamond and Flint Pond watersheds for opportunities to include additional BMPs to help address pollutant loading issues. 2) Continue to maintain level of staffing and funding to provide maintenance frequencies as outlined in 6-19-02 letter in Appendix E and the maintenance activities table.

BMP 7Q - Neponset River Impaired Waterbodies TMDL - MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue.

Measurable Goal: Review projects within the Neponset River watershed for opportunities to include additional BMPs to help address pollutant loading issues.

BMP 7R TMDL Watershed Review – For those watersheds with waste load allocations (WLA) and BMP recommendations related to MassHighway as identified in Table K-1, MassHighway has begun to further review the watersheds to take steps to meet the TMDL recommendations and load allocations. MassHighway will develop a program to review each Final TMDL which meets certain criteria (e.g drainage outfall(s) within a set buffer from the impaired water or tributary) and develop individual modeling or monitoring programs to assess compliance with the TMDL.

MA Department of Environmental Protection (DEP) reviewed the current TMDL reports and identified those waterbodies that are impaired for pollutants of concern due, in a significant part, to stormwater. This list was published as part of MA DEP draft Regulated Impervious Area (RIA) permit. MassHighway used this list, with their roadway GIS layer and the drainage outfall inventory, to identify TMDL watersheds for initial assessment along with other TMDLs completed within Massachusetts. Based on a review of these TMDLs, an initial assessment of MassHighway outfalls within the watershed, and preliminary field efforts, MassHighway has developed a prioritized list of watersheds to review (Table K-2 of Appendix K).

Table K-2 identifies the number of urbanized area MassHighway road miles within each watershed and the number of outfalls according to the drainage outfall inventory overall and within 500 feet of the receiving water and tributaries. MassHighway then reviewed each of the individual TMDL reports to identify those that recommended urban and highway stormwater BMPs by identifying the watersheds with the most discharges within a certain distance to the stream and/or tributaries and where highway BMPs are recommended, we have prioritized these watersheds for further detailed review and action. As more information is learned about each watershed it is likely that this prioritization will change. MassHighway's goal is to prioritize areas where BMPs will have the greatest and most immediate impact on water quality.

MassHighway will then assess the existing BMPs and where appropriate, MassHighway will use the USGS Highway Runoff Contaminant Model or other similar water quality model to estimate contaminant loading from MassHighway roads into the TMDL waterbody. In addition, as a part of the draft RIA permit, MA DEP indicated that structural BMPs designed and constructed in accordance with DEP's Stormwater Policy are deemed to have presumed pollutant removal effectiveness as stated in the Policy, and therefore do not require monitoring. This presumption will be used in identifying and designing appropriate stormwater controls where determined necessary to comply with the TMDL report. If this assessment indicates that additional measures are necessary, MassHighway will work with the corresponding District Office to develop a conceptual design and implementation schedule for measures to address the pollution.

Measurable Goal:

- 1. Develop prioritized list of TMDL watersheds to assess based on pollutants and MassHighway drainage outfalls.*
- 2. Assess 20% of applicable watersheds with TMDLs as listed in Goal #1 above each year once the USGS Contaminant Model is completed (scheduled for winter 2009/2010). Summarize assessment and outcome, including implementation schedules for BMPs if determined necessary, in each annual report.*
- 3. As new TMDL reports are completed, review their potential contribution and update the table to include an action plan for that waterbody, if determined necessary, within 9 months of the TMDL report being issued by EPA.*

BMP 7T Review of Specific Sites for Water Quality Exceedance in Response to Conservation Law Foundation (CLF) et al. Lawsuit - In response to a civil action suit brought by the Conservation Law Foundation (CLF) et al., MassHighway focused stormwater analysis and improvements on three sites identified as potential contributors to water quality (copper, lead and zinc) exceedances experienced by the Charles and Nashua

Rivers. The lawsuit required that MassHighway implement BMPs at each of the sites “that will contain the occasional instream exceedance of water quality standards.”

MassHighway’s stormwater consultant, AECOM, performed individual site visits at each of the three sites. Field staff identified flow patterns, stormwater infrastructure, and existing mitigation measures. AECOM used this information to populate a water quality exceedance model. The model identifies the peak pollutant concentration from highway runoff in a three year span and compares that value to EPA’s water quality exceedance criteria.

The model results indicate that existing BMPs located at each of the sites provide adequate retention of the stormwater volume so that the minimal flows which are not treated by the BMPs at each of these crossing do not lead to an exceedance of the water quality standards. A report summarizing the model and assumptions is included as Appendix J.

Measurable Goal:

1. *Analyze each of the three sites identified in the CLF lawsuit. Develop summary report with modeling methodology and summary of results.*
2. *For the sites which are determined to contribute to the exceedance of water quality at the stream crossing, construct BMPs to address MassHighway related exceedance by December 2010.*
3. *Submit a remedial plan to the courts by January 2010.*

TMDL related BMPs are also a portion of programs included in the other minimum controls measures such as BMP 1K, 3B-1, 3B-2, 4B and 5E.

3.7 Part V – Additional Resources

Part V of the General Permit includes three requirements that will be addressed by MassHighway current or proposed programs outlined in this section.

1. Discharges to Coastal Waters with Public Swimming Beaches

Part V.A.8 of the permit indicates that MS4s which discharge to coastal waters with public swimming beaches should consider these waters a priority in implementation of the storm water management program.

2. Groundwater Recharge and Infiltration

In accordance with Part V.A.9 of the permit, the permittee should consider opportunities for groundwater recharge and infiltration in the implementation of the minimum control measures described in Section 3 of this report. The permittee must evaluate physical conditions, site design, and best management practices to promote groundwater recharge and infiltration where feasible in the implementation of the control measures described above. During the implementation of the storm water management program, the permittee must address recharge and infiltration for the minimum control measures as well as any reasons for electing not to implement recharge and infiltration. Loss of annual recharge to groundwater should be minimized through the use of infiltration measures to the maximum extent practicable.

Permittees in areas identified as “high” or “medium” in the most recent Massachusetts Water Resources Commission’s *Stressed Basins in Massachusetts* report in effect at the time the permittee submits a Notice of Intent and accompanying storm water management program, must minimize the loss of annual recharge to groundwater from new development and redevelopment, including but not limited to drainage improvements done in conjunction with road improvements, street drain improvement projects and flood mitigation projects, consistent with Standard 3 of the Storm Water Management Policy in areas both within and outside of the jurisdiction of the Massachusetts’ Wetlands Protection Act.

3. Public Drinking Water Supplies

According to Part V.C of the permit,

- MS4s which discharge to public drinking water sources and their protection areas (Class A and B surface waters used for drinking water and well head protection areas) should consider these waters a priority in implementation of the storm water management program.
- Discharges to public drinking water supply sources and their protection areas (wellhead protection areas, Class A and Class B waters) should provide pretreatment and spill control capabilities to the extent practicable.
- Discharges to Class A waters, Zone 1 wellhead protection areas, and the sanitary radius to supply wells should be avoided to the extent feasible.

MassHighway Programs Which Address the Three Requirements Above:

BMP 4B - MA DEP Stormwater Management Policy -- Most new construction and redevelopment activities undertaken by MassHighway are currently subject to the Massachusetts DEP’s Stormwater Management Policy and Performance Standards through the Wetlands Protection Act and Clean Water Act Section 401 Water Quality Certification.

- Standard 3 of the Policy requires that the permittee meet certain requirements to minimize the loss of recharge to groundwater from a site.

- Standard 6 of the Policy provides additional protection for critical areas including ORWs (which include surface drinking water supplies) and public swimming beaches.

Measurable Goals: New construction and redevelopment activities will comply with Massachusetts DEP's Stormwater Management Policy and Performance Standards under the Wetlands Protection Act and Clean Water Act Section 401.

BMP 4E - MassHighway Storm Water Handbook - MassHighway has recently completed a Storm Water Handbook for roadway designers, public works personnel, and other persons involved in the design, permitting, review, and implementation of highway and bridge improvement projects in the Commonwealth of Massachusetts. The objective of this Handbook is to provide guidance in the development of cost-effective storm water management strategies for highway projects to comply with the DEP Stormwater Management Policy and NPDES Phase II. The Handbook focuses on the unique constraints of existing roadways. It provides guidance for storm water management practices readily and reasonably applicable to highway improvement projects and new construction. In order to comply with NPDES Phase II requirements, MassHighway has expanded the use of the Handbook within the Department to include urbanized areas regulated under the NPDES general permit. This change extends compliance with the Stormwater Policy to projects within urbanized areas, in addition to those subject to the Wetlands Protection Act.

By meeting the nine standards of the Policy, including Standard 3 which discusses recharge criteria and Standard 6 which provides additional protection for critical areas, MassHighway will comply with the recharge provisions of Section V.B.9 of the General Permit.

Measurable Goals: 1) Develop MassHighway Storm Water Handbook. 2) All new construction and redevelopment projects within urbanized areas must comply with the Handbook.

BMP 6A-5 - Vegetation Management – The MassHighway Vegetation Management Program is intended to establish the criteria whereby MassHighway controls vegetation along state roads and highways in compliance with the Rights of Way Management Regulations (333 CMR 11.00). Under this regulatory program, MassHighway has prepared both a 5-Year Vegetation Management Plan (VMP) and a Yearly Operational Plan (YOP) for Vegetation Management. The provisions of MassHighway's VMP are summarized below and discussed in further detail in Section 3.6.

Integrated Roadside Vegetation Management

MassHighway's VMP incorporates Integrated Roadside Vegetation Management (IRVM) methods which include roadside development (active planting to encourage appropriate competing vegetation, non-organic barriers), mechanical (mowing, hand cutting, selective trimming), and chemical (low volume foliar herbicide treatments).

One goal of the VMP is to minimize the use of chemical controls, through minimizing areas of application, quantity of chemicals, and frequency of application. Chemical control techniques shall be limited to use on high traffic volume, high speed interstate and primary roadways in the Commonwealth where safety of motorists, MassHighway employees, and contractors precludes the use of mechanical methods. Using IRVM methods, MassHighway will employ only two types of herbicide application: Foliar treatment and cut stump surface treatment.

Identifying and Protecting Sensitive Areas

Sensitive areas are defined as areas within rights-of-way in which public health, environmental or agricultural concerns warrant special protection to further minimize risks of unreasonable adverse effects (of herbicides) and include public groundwater supplies, public surface water supplies, private drinking water supplies, surface waters, wetlands, rivers, inhabited areas and agricultural areas.

All herbicides used by MassHighway have been researched, tested and approved by the Department of Food & Agriculture for use in Sensitive Areas. The MassHighway VMP provides descriptions and procedures for how Sensitive Areas will be identified for required protection, summarizes the restrictions and no-spray zones associated with application of herbicides within the right of way, and describes how no-spray zones will be identified and flagged.

In addition, MassHighway prepares its Yearly Operational Plan which includes the provisions of the VMP and proposed spray locations by route and municipality. A copy of the YOP are sent to the Conservation Commission, Board of Health (or designated health agent), and to the head of government (Mayor, City Manager, Chair of the Board of Selectmen) of each municipality and water suppliers where herbicides are to be applied along the rights of way during the calendar year.

Source Control and Operational Guidelines for Herbicide Applicators

The MassHighway VMP provides operational guidelines for applicators to properly manage herbicides. Source Control measures provided in the VMP include:

- Mixing and loading of herbicides at the maintenance facility in limited amounts of herbicide necessary to carry out only that day's work.
- Spray vehicles will be equipped with a clipboard log of the herbicides on board, a bag of adsorbent, activated charcoal, plastic bats, a broom and a shovel in case of a minor spill.
- Applicators to roadside rights of way must hold a valid pesticide certification from the Department of Food and Agriculture.
- Herbicide application will be restricted during certain adverse weather conditions, such as rain or wind.
- Low-pressure foliar application equipment will be calibrated to maintain pressure not exceeding 60 pounds per square inch at the nozzle.
- Monitoring will include project record keeping to maintain timely information on the nature, timing, and location of actions taken, including project location, weather conditions, miles completed, amount of material used, worker and equipment hours devoted to the project, and persons responsible for activity and follow-up evaluation.
- Chemically treated areas shall be monitored after the necessary translocation period of the herbicide to determine the effectiveness of the applications and to monitor any off target injury and migration of the spray solution.
- MassHighway will conduct training for District staff in methods of vegetation management, employee safety and record keeping.
- The VMP includes a Remedial Plan to address potential spills and related accidents.

Alternatives to Chemical Herbicide Study

MassHighway, in collaboration with the Federal Highway Administration, funds a research project at the University of Massachusetts to seek alternatives to chemical herbicides for roadside weed control. With the assistance of the UMass Department of Soil Sciences, MassHighway is experimenting and testing alternative research, chemicals, and non-conventional control methods.

Measurable Goal: 1) Develop a generic Vegetation Management Plan (VMP) which outlines methods of minimizing the discharge of pollutants related to the storage and application of pesticides, herbicides, and fertilizers. 2) Prepare a Yearly Operational Plan (YOP) by each year. 3) Post YOP on website. 4) Summarize actions taken in previous year in annual report.

BMP 7D - Environmental Site Data Form – MassHighway will develop a site specific data form which the project designer will complete regarding project and site information. This template will include environmental permitting requirements from the NPDES General Permit for MS4s and the Construction General Permit and will be submitted by the designer once 25% Design is complete. By including information required for both the Construction and MS4 permit, MassHighway will be minimizing the duplication of effort to comply with these two regulations. The checklist will include review of the project for potential discharges to water bodies included on the 303(d) list and identifying the pollutant of concern if the water body is impaired. The designers will be required to identify the BMPs which will be incorporated to address the pollutant of concern as recommended in the MassHighway Storm Water Handbook. By reviewing at 25% Design, MassHighway will make sure that the designer is incorporating the appropriate BMPs into the site design and reducing the pollutant load to the receiving water appropriately. The checklist will require determination of whether the project includes discharges to:

- public swimming beaches;
- a “medium” or “high” stressed basin; (By highlighting the location of the project, partially or completely, within such a basin early on in the process, the consultant or MassHighway designer will be aware of the need to meet the recharge criteria.); and
- public drinking water sources and their protection areas (i.e. Class A and B surface waters used for drinking water, Zone I and II well head protection areas and the sanitary radius to private water supply wells).

In order to provide the designer with further guidance when completing the Environmental Site Data Form, MassHighway will develop a set of instructions to guide the designer to the regulations which must be met if the project will potentially have discharges to any of the resources listed above.

Measurable Goal: Develop an environmental site data form for review by designers with Environmental staff at 25% Design. Implement on all projects.

BMP 3B-2 - Drainage Inventory - Drainage inventories of discharges within urbanized areas will include a review of whether discharges within urbanized areas drain to any of the above resources. The drainage inventories will be completed District by District and as Districts are completed the finding will be summarized in the following year’s annual report and maintained in the drainage inventory database. The drainage inventory will include review of whether outfalls discharge to a:

- coastal water with public swimming beaches,
- basin with a “medium” or “high” stressed classification and if the discharge is within such a basin what measures were taken to comply with Standard 3 of the MA DEP Stormwater Policy,
- public surface drinking water sources and their protection areas (Class A and B surface waters used for drinking water);

- public drinking water well sources and their protection areas (Zone 1 and II wellhead protection areas), and/or
- the sanitary radius to private water supply wells;
- and inclusion of this information in the inventory database.

Measurable Goals: 1) By the end of the permit term a drainage inventory of discharges, including overlay of these resource areas, from MassHighway roads in urbanized areas will be completed. 2) All Annual Reports will include a summary of progress towards meeting this goal and data for districts completed. 3) Review methods to make outfall inventory available to the public so public drinking water supplies can access outfall inventory.

BMP 5J - Transportation Evaluation Criteria - In the project development process, MassHighway and the Metropolitan Planning Organizations (MPO's) use Transportation Evaluation Criteria to assess the need for and priority of proposed projects and to determine their suitability for state and federal funding. Environmental Effect is one of 8 such criteria considered for all projects.

Measurable Goal: Continue to include environmental considerations in the funding prioritization evaluation.

BMP 7S - Salt Remediation Program – The Salt Remediation Program requires the water suppliers to submit a formal complaint to MassHighway and provide preliminary salt concentration data. If concentrations exceed certain thresholds, MassHighway then will monitor water quality and determine the source(s) of the salt contamination, and ultimately remediate if warranted.

Measurable Goal: Continue to provide the Salt Remediation Program with a funding level appropriate to quickly address salt related complaints.

3.8 Part IX - Resource Areas Required for Priority Consideration

MA DEP Requirement: According to Part IX – 401 Water Quality Certification Requirements Section D of the permit, the permittee shall identify discharges to the following resource areas as a priority and indicate in their storm water management programs how storm water controls will be implemented. Identified priority areas include:

- public water supplies,
- public swimming beaches,
- Outstanding Resource Waters (as designated in 314 CMR 4.00),
- shell fishing areas (open versus closed areas)
- rivers, ponds, lakes and coastal waters which area on the Department 303d list of impaired waters, and
- cold water fishery river segments as identified in 314 CMR 4.00.

MassHighway Programs:

BMP 4E - MassHighway Storm Water Handbook - MassHighway has recently completed a Storm Water Handbook for roadway designers, public works personnel, and other persons involved in the design, permitting, review, and implementation of highway and bridge improvement projects in the Commonwealth of

Massachusetts. The objective of this Handbook is to provide guidance in the development of cost-effective storm water management strategies for highway projects to comply with the DEP Stormwater Management Policy and NPDES Phase II. The Handbook focuses on the unique constraints of existing roadways. It provides guidance for storm water management practices readily and reasonably applicable to highway improvement projects and new construction. In order to comply with NPDES Phase II requirements, MassHighway has expanded the use of the Handbook within the Department to include urbanized areas regulated under the NPDES general permit. This change extends compliance with the Stormwater Policy to projects within urbanized areas, in addition to those subject to the Wetlands Protection Act.

The Policy identifies the following as critical areas subject to stricter standards (Standard 6):

- recharge areas for public water supplies including Zone A (400 feet from a surface water reservoir) and 100 feet from its tributaries, and Zone II and Interim Wellhead Protection Areas for groundwater supplies;
- public swimming beaches;
- Outstanding Resource Water (ORWs);
- shellfish growing areas; and
- cold water fisheries.

Measurable Goals: 1) Develop MassHighway Storm Water Handbook. 2) All new construction and redevelopment projects must comply with the Handbook.

BMP 7D - Environmental Site Data Form – MassHighway will develop a site specific data form which the project designer will complete regarding project and site information. This template will include environmental permitting requirements from the NPDES General Permit for MS4s and the Construction General Permit and will be submitted by the designer once 25% Design is complete. By including information required for both the Construction and MS4 permit, MassHighway will be minimizing the duplication of effort to comply with these two regulations. The checklist will include review of the project for potential discharges to water bodies included on the 303(d) list and identifying the pollutant of concern if the water body is impaired. The designers will be required to identify the BMPs which will be incorporated to address the pollutant of concern as recommended in the MassHighway Storm Water Handbook. By reviewing at 25% Design, MassHighway will make sure that the designer is incorporating the appropriate BMPs into the site design and reducing the pollutant load to the receiving water appropriately. The checklist will include designating whether the project includes discharges to:

- public water supplies,
- public swimming beaches,
- Outstanding Resource Waters (as designated in 314 CMR 4.00),
- shell fishing areas (open versus closed areas)
- rivers, ponds, lakes and coastal waters which area on the Department 303d list of impaired waters,
- cold water fishery river segments as identified in 314 CMR 4.00, and
- wild and scenic rivers.

In order to provide the designer with further guidance when completing the Environmental Site Data Form, MassHighway will develop a set of instructions to guide the designer to the regulations that must be met if the project will potentially have discharges to any of the resources listed above.

Measurable Goal: Develop an environmental site data form for review by designers with Environmental staff at 25% Design. Implement on all projects.

BMP 3B-2 - Drainage Inventory – Drainage inventories of discharges within urbanized areas will include a review for discharges within urbanized areas that potentially impact any of the resource areas indicated above. The outcome of these reviews will be summarized in each annual report and maintained in the drainage inventory database. The drainage inventory will include:

- identifying discharges which drain to a resource area listed above,
- documentation of the outcome of any agency or internal review, and
- inclusion of this information in the inventory database.

Measurable Goals: 1) By the end of the permit term a drainage inventory of discharges from MassHighway roads in urbanized areas will be completed. 2) All Annual Reports will include a summary or progress towards meeting this goal.

4.0 Evaluation and Assessment

This section describes procedures for evaluation and assessment of plan implementation and effectiveness against the identified measurable goals, as well as reporting and record retention requirements.

4.1 Plan Evaluation

The Pollution Prevention Team will evaluate program compliance with the required minimum control standards, the appropriateness of the identified best management practices, and progress towards achieving the identified measurable goals on an on-going basis as part of implementation of programs and during preparation of the annual report.

4.2 Plan Updates

If upon evaluation, improved, additional or different controls are deemed necessary to meet the required standards or provide a more effective program, MassHighway will update the storm water management program plan and submit revisions to the EPA and DEP. The submission will meet the following permit requirements:

- (a.) Changes adding (but not subtracting or replacing) components, controls or requirements to the SWMP may be made at any time upon written notification to EPA and MADEP.
- (b.) Changes replacing an ineffective or unfeasible BMP specifically identified in the SWMP with an alternative BMP may be requested in writing to EPA and MA DEP at any time. Unless denied, changes proposed in accordance with the criteria below shall be deemed approved and may be implemented 60 days from submittal of the request. If the request is denied, EPA or MA DEP, as applicable, will send a written explanation of the denial.
- (c.) Modification requests, must include the following information:
 - an analysis of why the BMP is ineffective or infeasible (including cost prohibitive),
 - expectations on the effectiveness of the replacement BMP, and
 - an analysis of why the replacement BMP is expected to achieve the goals of the BMP to be replaced.

Change requests or notifications will be in writing and signed in accordance with the signatory requirements of the permit.

The permit allows EPA or MADEP to require changes to the SWMP as needed to:

- (a.) Address impacts on receiving water quality caused or contributed to by discharges from the MS4;
- (b.) Include more stringent requirements necessary to comply with a new Federal statutory or regulatory requirement; or
- (c.) Include such other conditions deemed necessary to comply with the goals and requirements of the CWA.

According to the permit, any changes requested by EPA or MADEP will be in writing and will set forth the time schedule for the permittee to develop the changes and offer the opportunity to propose alternative program changes to meet the objective of the requested modification.

4.3 Record Keeping

Records required by the NPDES Phase II permit and related to the implementation of this Storm Water Management Plan will be maintained at Ten Park Plaza, Boston, MA. The records will include information used in the development of the storm water management program, any monitoring, copies of reports and all data used in the development of the notice of intent. MassHighway will retain these records for at least five (5) years. MassHighway will make such records accessible to the public at reasonable times during regular business hours. A reasonable fee may be charged for copying requests. MassHighway will not submit records to the EPA or DEP unless specifically requested to do so, except as summarized in the annual reports.

4.4 Annual Reports

Annual reports will be prepared and submitted to Region 1 EPA and MA DEP. In accordance with the general permit, the report will include:

- A self assessment review of compliance with the permit conditions;
- An assessment of the appropriateness of the BMPs included in the current plan;
- An assessment of the progress towards achieving the selected measurable goals for each minimum control measure;
- A summary of results of any information collected and analyzed (including any type of data);
- A summary of the storm water activities planned for the next reporting cycle;
- A discussion of any changes in identified Best Management Practices or measurable goals for each minimum control measure; and
- A notice of reliance on another governmental entity to satisfy some of the permit obligations (if applicable).

The initial annual report shall be submitted by April 30, 2004 and annually thereafter. The annual report shall summarize the activities of the previous calendar year. The reports shall be submitted to the following addresses:

United States Environmental Protection Agency

Water Technical Unit
P.O. Box 8127
Boston, MA 02114

Department of Environmental Protection

Division of Watershed Management
627 Main Street
Worcester, MA 01608

5.0 Storm Water Management Plan Schedule

This section provides a matrix of the current and proposed programs MassHighway will use to meet each of the six minimum control measures. The matrix also indicates the MassHighway Section/ Division(s) responsible for implementing the program and a schedule for implementation of milestones on each program.



Table 5-1 Storm Water Management Plan Schedule

TABLE 5-1: STORM WATER MANAGEMENT PLAN SUMMARY MATRIX

BMP ID #	BMP	MEASURABLE GOALS	RESPONSIBLE DEPARTMENT	Permit Year One				Permit Year Two				Permit Year Three				Permit Year Four				Permit Year Five				Next Permit			
				Spring 03	Summer 03	Fall 03	Winter 03-04	Spring 04	Summer 04	Fall 04	Winter 04-05	Spring 05	Summer 05	Fall 05	Winter 05-06	Spring 06	Summer 06	Fall 06	Winter 06-07	Spring 07	Summer 07	Fall 07	Winter 07-08				
Minimum Control #1: Public Education and Outreach																											
1A	MTAP	Fund one pollution reduction training regarding storm water and/or snow and ice control for MassHighway and DPW staff annually. Document attendance in annual report.	MTAP					X Annual Report					X Annual Report					X Annual Report					X Annual Report				
1B	Baystate Roads	Provide one pollution reduction training regarding snow and ice control for MassHighway employees and one for DPW snowplow drivers annually. Document attendance in annual report.	Baystate Roads					X Annual Report					X Annual Report					X Annual Report					X Annual Report				
1C	MassHighway Website	1) Add Environmental Division web page to MH web site. 2) Add link for contacting Env. Section via email. 3) Evaluate web page annually and revise as necessary.	IT/Environmental				X																				
1C	MassHighway Website		IT/Environmental																						X		
1C	MassHighway Website		IT/Environmental				X				X					X											X
1E	Educational Seminars for CIM members	Provide educational seminars for CIM members on CGP Permit coverage and environmental compliance.	Construction Division				X																				
1F	Post Contact Names for Municipal Drainage Concerns on MassHighway Web Site	1) Include contact names and addresses in handout for municipal DPW staff who attend NPDES Phase II seminar. 2) Post DHD contact names on MH website and maintain link. 3) Research methods for sharing drainage outfall inventory with municipalities in a timely manner.	Environmental/Districts																				X Handout @ Phase II mtg			X Post Contact (DHD) Names	X Research method for sharing drainage outfall inventory
1G	River and Stream Signs	Install signs identifying rivers and streams crossed by MassHighway roads, until all named rivers and streams are signposted.	Traffic Operations					X Annual Report					X Annual Report				X Annual Report					X Annual Report					
1H	Anti-litter/ Dumping Messages on Variable Message Boards	Maintain anti-litter messages on permanent Variable Message Boards.	Operations																					X Annual Report			
1I	Anti-litter/ Dumping Literature at Rest Areas and Visitors Centers	1) Work with EOEEA Think Blue Campaign to identify appropriate brochures for use in visitor's centers. 2) Distribute literature to visitor centers and track number of brochures distributed annually.	Maintenance																					X Discuss program w/ EOEEA		X Distribute	
1J	New England DOT Coordination	Coordinate with New England DOTs to discuss on-going issues and programs being faced by the DOT's including wetland mitigation, storm water and erosion controls.	Environmental	X				X					X				X										
1K	Storm Water Coordinator	Fund a full-time storm water coordinator position each year.	Environmental																							X	
<p><i>Programs which are listed under other minimum control measures also include public education aspects (e.g. BMP# 3E, 3F, 4H, 4L-1, 4M, 4N and 4R).</i></p>																											
Minimum Control #2: Public Participation and Involvement																											
2A	Project Related Public Notification and Public Participation Requirements	1) Continue compliance with federal and state public notification and public participation requirements. 2) Post notice of all public hearings on MassHighway website.	Environmental																								
2B	Adopt-a-Highway	Install signs supporting Adopt-a-Highway Program in active program areas.	Adopt-a-Highway																								
2C	511 Massachusetts	Maintain the existing 511 project.	Operations																								
2D	MassHighway Web Site	1) Within thirty days of submission, post latest version of the Storm Water Management Plan on the website.	IT/Environmental				Original							3/2/05 Version									8/21/06 Version	11/30/06 Version		January 2008 Version	
2D	MassHighway Web Site	2) Within thirty days of submission, post the annual report on the website	IT/Environmental					X Annual Report 1					X Annual Report 2				X Annual Report 3					X Annual Report 4					

TABLE 5-1: STORM WATER MANAGEMENT PLAN SUMMARY MATRIX

BMP ID #	BMP	MEASURABLE GOALS	RESPONSIBLE DEPARTMENT	Permit Year One				Permit Year Two				Permit Year Three				Permit Year Four				Permit Year Five				Next Permit	
				Spring 03	Summer 03	Fall 03	Winter 03-04	Spring 04	Summer 04	Fall 04	Winter 04-05	Spring 05	Summer 05	Fall 05	Winter 05-06	Spring 06	Summer 06	Fall 06	Winter 06-07	Spring 07	Summer 07	Fall 07	Winter 07-08		
4E	MassHighway Storm Water Handbook	1) Develop and issue MH SW Handbook (completed in May 2004). 2) Require that all new construction and redevelopment activities undertaken by MassHighway, or by others that are funded in whole or in part by MassHighway, comply with the Handbook.	Environmental/Construction/Projects					Ratified by DEP																	
4F	Standard Specification for Highway and Bridges	Continue to include Subsection 7.02 "Prevention of Water Pollution" of the Standard Specification for Highway and Bridges in all MassHighway funded construction projects.	Environmental/Construction/Projects																						
4G	MassHighway Research Needs Program	Continue funding the program.	Environmental/Construction																						
4H	Pre-Construction Meeting Review of NPDES requirements	District Env. Staff will review NPDES requirement at pre-construction meetings for all projects.	District Environmental Staff																						
4I	Contract Bid Item and Special Provision for SWPPPs	A Special Provision/ Pay Item is included in all new construction contracts to cover the preparation of the SWPPP by the Contractor.	Construction Division/ Contracts			X Pay Provision Finalized	X Annual Report					X Annual Report				X Annual Report				X Annual Report					
4J	Field Guide on Erosion Prevention and Sediment Control	1) Finalize field guide. 2) Issue to Resident Engineers.	Construction Division/ Chief Engineer										X Draft										X Final		
4K	Storm Water Pollution Prevention Plan Guidance Manual	SWPPP Guidance for Contractors document completed and in use by Contractors on MassHighway projects.	Construction Division											X Document Complete											
4L-1	Training	1) Conduct annual Erosion Prevention and Sediment Control Training for Construction Personnel. 2) Summarize # of attendees and topics covered in annual report.	Construction Division			X Training	X Annual Report			X Training	X Annual Report			X Training	X Annual Report			X Training	X Annual Report			X Training			
4L-2	Non-Traditional Erosion Control Specifications	1) Develop specifications for non-traditional erosion controls. 2) As new technologies/ techniques are developed, they will be tested and, if accepted, a spec will be developed.	Bay State Roads/Construction Division															X Specs Complete							
4M	Erosion and Sediment Control Field Tests	1) Perform field tests of at least one new E&S materials on MassHighway projects. 2) Create and distribute internal memo summarizing materials effectiveness and recommended use.	Construction Division/ Districts/Landscaping										X literature search				X lab work			X memo distributed					
4N	Construction Bulletins	Issue annual construction bulletin to each District regarding storm water issues.	Construction Division					X April 2004						X Oct 2006				X March 2007					X		
4O	Solicit Construction Activity Feedback from Public	1) Include contact info for all ongoing construction projects on MH web site. 2) Respond to concerns in a timely manner.	Construction Division/ IT									X Contact info added				X Annual Report				X Annual Report					
4P	Construction Runoff Control Enforcement	1) If MH Site Engineer determines that a construction project is not complying with local, state or federal pollution control laws, biweekly payment will be withheld until the problem is rectified. 2) Summarize actions taken in annual report.	Construction Division/ Districts												X Annual Report				X Annual Report						
4Q	Standard Practices Memo	MassHighway issued a memo dated June 16, 2006 regarding procedures to follow on discovery of any illicit discharges during construction.	Construction											X Draft	X 6/16/06 Issued										
4R	Contractor Inspector Training	MH will modify NPDES SWPPP contract bid item to include half day training requirement.	Construction																				X Inclusion in Special Provision. First training sessions.		
<p>Programs which are listed under other minimum control measures also include construction site runoff controls aspects (e.g. BMP 1E and 2A)</p>																									

TABLE 5-1: STORM WATER MANAGEMENT PLAN SUMMARY MATRIX

BMP ID #	BMP	MEASURABLE GOALS	RESPONSIBLE DEPARTMENT	Permit Year One				Permit Year Two				Permit Year Three				Permit Year Four				Permit Year Five				Next permit	
				Spring 03	Summer 03	Fall 03	Winter 03-04	Spring 04	Summer 04	Fall 04	Winter 04-05	Spring 05	Summer 05	Fall 05	Winter 05-06	Spring 06	Summer 06	Fall 06	Winter 06-07	Spring 07	Summer 07	Fall 07	Winter 07-08		
Minimum Control Measure #5: Post Construction Runoff Control																									
5A-1	MassHighway Storm Water Handbook	1) Secure DEP ratification. 2) Require all new construction or redevelopment activities funded by MH to comply with Handbook.	Environmental					Ratified 5/7/04																	
5A-2	Revise Ch.4 of SW Handbook	1) Complete revision of Ch.4. 2) Reissue Handbook to designers and internal staff.	Environmental																						X Handbook 1 year after DEP issues revised Policy
5A-3	Revise Ch.5 of SW Handbook	1) Complete revision of Ch.5 within 1 year of release of revised stormwater policy. 2) Reissue Handbook to designers and internal staff.	Environmental																						X Handbook 1 year after DEP issues revised Policy
5C	TARP	1) Continue to work with DEP to develop review protocol for innovative stormwater BMPs. 2) Summarize in annual report.	TARP					X Annual Report					X Annual Report				X Annual Report				X Annual Report				
5D	Southeast Expressway BMP Effectiveness Study	Conduct study of WQI and CB effectiveness at TSS removal from highway runoff (Completed 2002).	Environmental																						
5E	Highway Runoff Contaminant Model	Develop and calibrate model.	Env. Div. Consultant																						Complete Study Dec. 2008
5G	Right of Way Parcel Evaluation	1) Develop methodology for evaluating parcels which are candidates for disposal for their storm water management potential. 2) Implement methodology.	Environmental										X Methodology Completed												
5H-1	Post Construction Runoff Enforcement - Illicit Discharge Prohibition	1) Develop policy for addressing unauthorized connections to the MassHighway's drainage system. 2) Enforce the provisions through referrals to the Attorney General. 3) Summarize actions taken under this BMP in annual report.	Legal/ Environmental														X Policy Completed				X Annual Report				
5H-2	Post Construction Runoff Enforcement - Drainage Tie In Policy	1) Develop permitting process for adjacent properties that would like to tie into the MassHighway drainage system. 2) Implement permitting program. 3) Summarize actions taken under this BMP in annual report.	Legal/ Environmental/ Districts																		X Draft				X Final
5H-3	Post Construction Runoff Enforcement - Off-Site Pollution to MassHighway Drainage System	Runoff not meeting the NPDES MS4 requirements which is reaching the MH MS4 and is not covered under 5H-1 or 5H-2 may be considered trespassing and referred to the AG's office by MassHighway counsel at the DHD's discretion.	Legal/ Environmental																						
5I	Rest Area Leases	1) Include drainage system requirements in all new rest area leases; 2) Summarize new rest area leases in annual report.	Environmental/ Right-of-Way					X Complete Lease Req.					X Annual Report				X Annual Report				X Annual Report				
5J	Transportation Evaluation Criteria	Continue to include environmental considerations in the funding prioritization evaluation.	Planning/ MPOs																						
5K	Federal Enhancement Funding	Continue to participate in quarterly meetings of enhancement committee.	Planning																						
<p>Programs which are listed under other minimum control measures also include post-construction site runoff controls aspects (e.g. BMP# 1K, 3C-1, 3C-2, 4A and 4E)</p>																									
Minimum Control Measure #6: Pollution Prevention/Good Housekeeping																									
6A-1	Source Control: 511 Massachusetts	Maintain the existing 511 project.	Operations																						
6A-2	Source Control: Adopt a Highway	1) Continue to support Adopt-a-Highway program by installing signs where program is active. 2) Summarize number of road miles cleaned each year in annual report.	Adopt-a-Highway														X Report				X Report				
6A-3	Source Control: Deicing Programs and Reduced Salt Areas	Continue to support deicing and reduced salt areas programs.	Operations																						
6A-4	Source Control: HELP	Continue to provide 22 HELP vans and tow trucks to provide assistance to people with car trouble.	Operations														X Report				X Report				

TABLE 5-1: STORM WATER MANAGEMENT PLAN SUMMARY MATRIX

BMP ID #	BMP	MEASURABLE GOALS	RESPONSIBLE DEPARTMENT	Permit Year One				Permit Year Two				Permit Year Three				Permit Year Four				Permit Year Five				Next Permit	
				Spring 03	Summer 03	Fall 03	Winter 03-04	Spring 04	Summer 04	Fall 04	Winter 04-05	Spring 05	Summer 05	Fall 05	Winter 05-06	Spring 06	Summer 06	Fall 06	Winter 06-07	Spring 07	Summer 07	Fall 07	Winter 07-08		
6A-5	Source Control: Vegetation Management	1) Develop a generic Vegetation Management Plan (VMP) outlining methods of minimizing the discharge of pollutants related to the storage and application of pesticides, herbicides and fertilizers. 2) Prepare Yearly Operational Plan (YOP). 3) Post YOP on website. 4) Summarize actions taken in previous year in annual report.	Environmental				X VMP Issued					X YOP				X YOP				X YOP					
6A-6	Source Control: Ridesharing	Continue participation in ridesharing activities.	Planning																						
6A-7	Source Control: Alternative Transportation	Continue to support alternative transportation through technical funding and assistance.	Planning																						
6A-8	Source Control: Highway Safety	1) Incorporate safety measures into all new highway designs 2) Provide signage to warn of vehicle hazards including tipping hazards and steep grades. 3) Install VMS on selected roadways to improve driver awareness. 4) Include evolving safety technologies as part of future highway design projects as they are developed.	Highway Design																						
6A-9	Source Control: Toxics Use Reduction	Maintain an active PPTF throughout the permit term. 2) Provide summary of actions taken on each pollution prevention initiatives in annual report.	Environmental					X Annual Report				X Annual Report			X Annual Report					X Annual Report					
6B-1	Employee Training: MTAP and Baystate Roads Program Training	Continue to support MTAP and Baystate Roads program.	Environmental					X Annual Report				X Annual Report			X Annual Report					X Annual Report					
6B-2	Employee Training: Environmental Awareness Training	1) Provide annual training to at least 300 maintenance facility personnel regarding good housekeeping - spill prevention. 2) Summarize attendance and topics covered in annual report.	Environmental				X Training	X Annual Report			X Training	X Annual Report			X Training	X Annual Report			X Training	X Annual Report			X Training		
6B-3	Employee Training: Snow and Ice Program	1) Provide annual training to 200 of supervisors and drivers annually on the latest on snow and ice removal. 2) Summarize attendance and topics covered in annual report.	Operations				X Training	X Annual Report			X Training	X Annual Report			X Training	X Annual Report			X Training	X Annual Report			X Training		
6B-4	Employee Training: Equipment and Vehicle Safety Training	Ensure all equipment and vehicle operators have received training on the proper operation of the equipment and vehicles they operate. 2) Summarize training in annual report.	Operations															X Training					X Training		
6C-1	Maintenance Program	Continue maintenance activities for storm water system as indicated in Appendix E of the SWMP.	Districts																						
6C-2	Maintenance/ Material Storage Yards	1) Review maintenance and material storage yards and create a facility handbook for each that provides information on necessary steps to environmental compliance. Completed 1995	Districts																						
6C-2	Maintenance/ Material Storage Yards	2) Post EMS Manual on MassHighway website for public information.	Districts																	X					
6C-2	Maintenance/ Material Storage Yards	3) Post generic Facility Handbook on website for public information.	Districts																				X		
6C-3	Maintenance Record and Data Management Program	1) Develop work management system. 2) Populate program with infrastructure information from inventory (BMP 7R). 3) Implement system and begin to record maintenance activities in TMDL watersheds.	Environmental																						
6D	Waste Disposal	1) Street sweeping waste will be reused in appropriate slope stabilization and road work projects in compliance with MH SOP. 2) Material which can not be reused will be disposed of according to "Reuse and Disposal of Contaminated Soil at Massachusetts Landfills" DEP Policy #COMM-97-001.	Districts																						
6E	Catch Basin Accumulation Project	Complete a study of debris accumulation in catch basins by November 2009. Include summary in annual report. Based on the results of the study, revise the existing cleaning schedule and SOP for catch basin cleaning by June 2010.	Districts														X Finalize CB to Include in Study	X Work Plan Finalized/ Train MH staff	X Initial Monitor/ Monthly Monitoring to Begin	X Annual Report	X 6 month qualitative analysis			X Year 1 Data Summary Report	X Completed Dec. 2009
6F	Snow and Ice Control GEIR – Policy Program Review	MassHighway will continue to at least biannually evaluate its snow and ice control policies and operational programs in order to make adjustments based on data and experience, and to respond to changing conditions.	Environmental												X GEIR Issued										
6G	Snow and Ice Control GEIR – Salt Remediation Program	Continue to provide the Salt Remediation Program with a funding level appropriate to quickly address salt related complaints.	Environmental/ Maintenance/ Districts																						
6H	Snow and Ice Control GEIR – Clean Well Initiative	Provide a continued level of funding that will allow MassHighway to complete up to 20 replacement wells per year.	Environmental																	X Annual Report					

TABLE 5-1: STORM WATER MANAGEMENT PLAN SUMMARY MATRIX

BMP ID #	BMP	MEASURABLE GOALS	RESPONSIBLE DEPARTMENT	Permit Year One				Permit Year Two				Permit Year Three				Permit Year Four				Permit Year Five				Next Permit
				Spring 03	Summer 03	Fall 03	Winter 03-04	Spring 04	Summer 04	Fall 04	Winter 04-05	Spring 05	Summer 05	Fall 05	Winter 05-06	Spring 06	Summer 06	Fall 06	Winter 06-07	Spring 07	Summer 07	Fall 07	Winter 07-08	
7E	TMDL Recommendation Summary Table Update	Update table to include TMDL reports finalized within previous year and progress on implementation of any related measurable goals in annual report.	Environmental					X Annual Report				X Annual Report				X Annual Report				X Annual Report				
7F, 7G, 7H, 7I, 7J, 7K, 7L, 7M, 7N, 7P, 7Q	Impaired Waterbodies TMDL	MH will review projects which discharge to impaired waterbodies for opportunities to include additional BMPS within proposed projects if MassHighway determines they will help address the pollutant loading issue.	Environmental/ Planning/ District																					
7O	Salisbury Pond Impaired Waterbody TMDL	Sweep streets in this watershed at least once a year (usually in spring) and more often if necessary. All sumped drainage structures will be inspected and cleaned if necessary, twice a year and more often if necessary. MassHighway will inspect/ clean drainage outlet locations where sediment build-up is evident. MassHighway will inspect and repair damaged and/ or clogged drainage conveyances	Environmental/ Planning/ District 3																					
7P	Lake Quinsigamond and Flint Pond Impaired Waterbodies TMDL	Continue to maintain level of staffing and funding to provide maintenance frequencies as outlined in 6-19-02 letter in App. E.	District 3																					
7R	TMDL Watershed Review	Review 20% of MassHighway roads contributing to TMDL watersheds each year and develop conceptual plan for BMPs if review indicates potential contribution to impairment.	Environmental																					
7S	Salt Remediation Program	Continue to provide the Salt Remediation Program with a funding level appropriate to quickly address salt related complaints.	Environmental																					
7T	Review of Specific Sites for Water Quality Exceedance in Response to Conservation Law Foundation (CLF) et al. Lawsuit	1. Analyze each of the three sites identified in the CLF lawsuit. Develop summary report with modeling methodology and summary of results. 2. For the sites which are determined to contribute to the exceedance of water quality at the stream crossing, construct BMPs to address MassHighway related exceedance by December 2010. 3. Submit a remedial plan to the courts by January 2010.	Environmental																					
8A	Cultural Resources Review	Reviews all projects for impacts to historic properties at the 25% Design stage.	Cultural Resources																					
<p><i>Programs which are listed under other minimum control measures which address additional resources include BMP# 1K, 3B-1, 3B-2, 4B and 5E.</i></p>																								
Reporting																								
	Storm Water Management Plan/ NOI	Prepare Storm Water Management Plan (SWMP) and Notice of Intent (NOI) Application (BRP WM 08A)	SWPPP Team																					
		Submit SWMP and NOI to EPA and DEP	SWPPP Team					X (7/25/03)																
	Annual Report	Prepare annual report summarizing the status of meeting each of the measurable goals.	Environmental/ Construction/ IT/ SWPPP Team																					
		Submit annual report to EPA and DEP.	Environmental					X				X				X				X				
	Storm Water Management Plan Evaluation	MassHighway will evaluate the SWMP on an ongoing basis as part of the implementation and annual reporting process.	SWPPP Team																					
		If upon evaluation, improved, additional or different controls are deemed necessary to meet the required standards, MassHighway will update the SWMP and submit revisions to the EPA and DEP.	SWPPP Team																					
	Storm Water Management Plan Reapplication	MassHighway will reapply for coverage under the general permit, depending upon when permit is issued.	SWPPP Team																					

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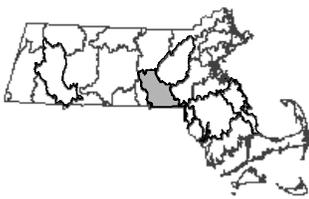
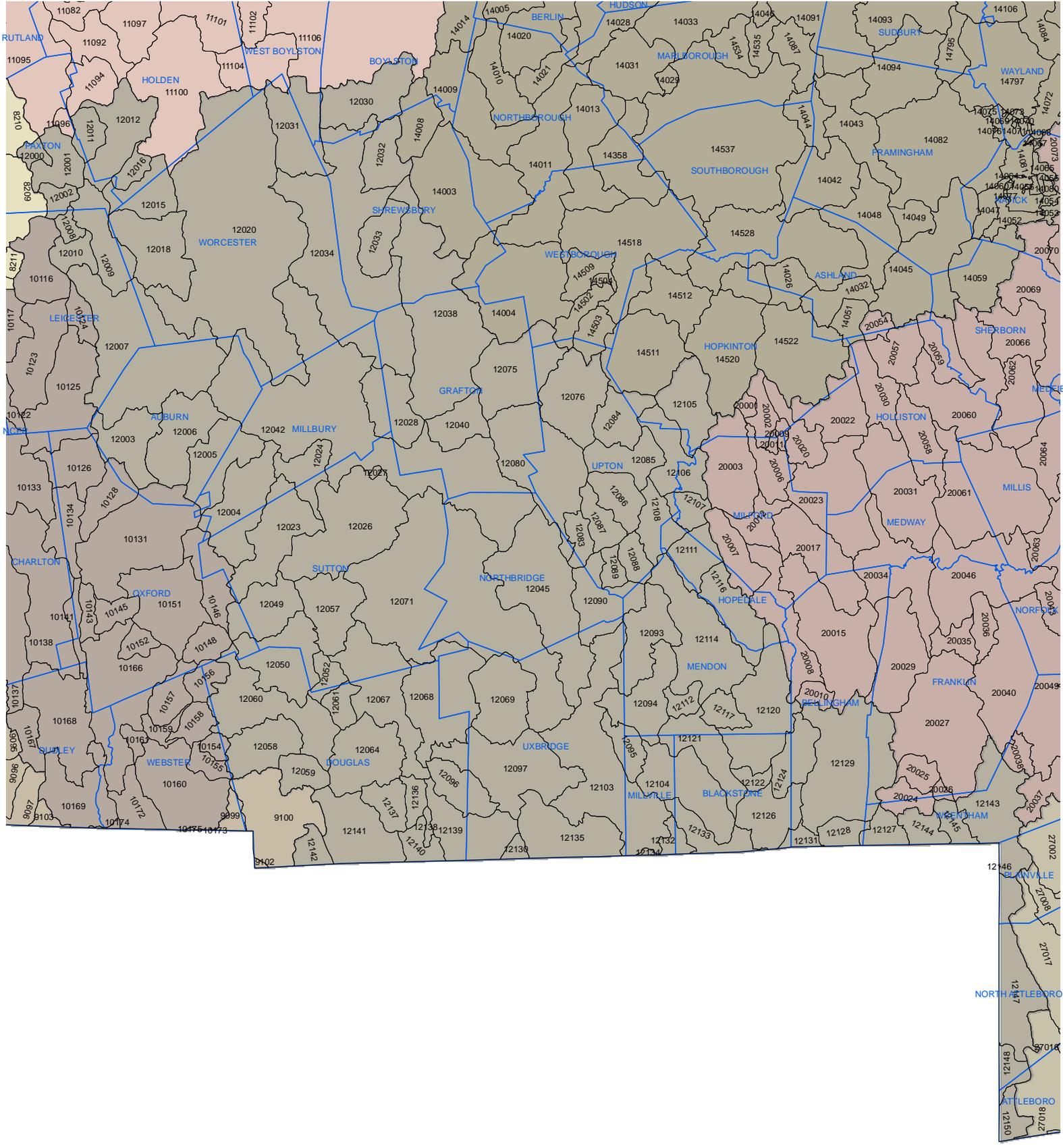
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Appendix A

Table of Receiving Waterbodies for Mass Highway Urbanized Area Road Runoff

**Table A: Receiving Waterbodies for MassHighway
Urbanized Area Road Runoff**



Appendix A
Sub-Basin
Identification Maps:
BLACKSTONE



Table A1. Blackstone Basin

Sub-basin ID	Mass Highway Road Miles In Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
12001	1.03	Unknown	Kettle Brook Reservoir No. 4	MA51082_2002		
12002	0.06	Unknown	Kettle Brook	MA51-19_2002		
			Kettle Brook Reservoir No. 3	MA51081_2002		
			Kettle Brook Reservoir No. 4	MA51082_2002		
12003	1.78	Unknown	Dark Brook Reservoir	MA51035_2002		
			Tinker Hill Pond	MA51036_2002		
				MA51167_2002		
12005	0.22	Unknown	Pondville Pond	MA51120_2002		
			Ramshorn Brook			
			Stone Brook			
12006	15.45	Unknown	Auburn Pond	MA51004_2002		
			Dark Brook	MA51-16_2002	X	-Cause Unknown
			Eddy Pond	MA51043_2002		
			Pondville Pond	MA51120_2002		
12007	8.49	Unknown	City Pond	MA51021_2002		
			Dark Brook	MA51-16_2002	X	-Cause Unknown
			Kettle Brook	MA51-01_2002	X	-Cause Unknown -Nutrients -Organic enrichment/Low DO -(Flow alteration*) -Pathogens
			Kettle Brook Reservoir No. 1			
			Kinnear Brook			
			Leesville Pond	MA51087_2002		
			Lynde Brook			
			Lynde Brook Reservoir	MA51090_2002		
			Smiths Pond	MA51156_2002	X	-Turbidity [5/2/2002-CN070.1]
			Stoneville Pond	MA51160_2002		
			Stoneville Reservoir	MA51161_2002		
			Waite Pond	MA51170_2002	X	-Metals
12009	1.17	Unknown	Lynde Brook			
			Lynde Brook Reservoir	MA51090_2002		
			Southwick Pond	MA51157_2002	X	-Noxious aquatic plants [5/2/2002-CN070.1]
12015	0.15	Unknown	Cook Pond	MA51027_2002		
			Holden Reservoir 2	MA51064_2002		
			Tatnuck Brook	MA51-15_2002	X	-Cause Unknown -(Other habitat alterations*) -Turbidity -(Objectionable deposits*)
12018	1.35	Unknown	Coes Reservoir	MA51024_2002		
			Patch Reservoir	MA51118_2002		
			Smith Pond			
			Tatnuck Brook	MA51-15_2002	X	-Cause Unknown -(Other habitat alterations*) -Turbidity -(Objectionable deposits*)

Table A1. Blackstone Basin

Sub-basin ID	Mass Highway Road Miles In Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
12020	40.52	Unknown	Beaver Brook	MA51-07_2002	X	-Cause Unknown -(Other habitat alterations*) -Pathogens -(Objectionable deposits*)
			Bell Pond	MA51009_2002		
			Blackstone River	MA51-03_2002	X	-Unknown toxicity -Priority organics -Metals -Unionized Ammonia -Chlorine -Nutrients -Organic enrichment/Low DO -(Flow alteration*) -(Other habitat alterations*) -Pathogens -Suspended solids -Turbidity -(Objectionable deposits*)
			Coes Reservoir	MA51024_2002		
			Crystal Pond			
			Curtis Ponds	MA51032_2002		-Siltation -Noxious aquatic plants [5/2/2002-CN070.1]
			Green Hill Pond	MA51033_2002	X	
			Indian Lake	MA51056_2002	X	-Turbidity [5/2/2002-CN070.1]
				MA51073_2002	X	-Organic enrichment/Low DO [6/28/2002-CN116.0] -Noxious aquatic plants [6/28/2002-CN116.0]
			Kettle Brook	MA51-01_2002	X	-Cause Unknown -Nutrients -Organic enrichment/Low DO -(Flow alteration*) -Pathogens
			Middle River	MA51-02_2002	X	-Cause Unknown -Unknown toxicity -Metals -Nutrients -pH -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Turbidity -(Objectionable deposits*)
			Salisbury Pond	MA51142_2002	X	-Taste, odor and color -Noxious aquatic plants [6/28/2002-CN114.0] -Turbidity [6/28/2002-CN114.0]
			Unnamed Tributary	MA51-08_2002	X	-Priority organics -Metals -Unionized Ammonia -Nutrients -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Oil and grease -Taste, odor and color -Suspended solids -Turbidity -(Objectionable deposits*)
						Weasel Brook
12024	2.14	Unknown	Brierly Pond	MA51010_2002		
			Mayo Pond			
			Shiner Hole			
			Singletary Pond	MA51152_2002		
			Slaughterhouse Pond			

Table A1. Blackstone Basin

Sub-basin ID	Mass Highway Road Miles In Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
12026	0.74	Unknown	Aldrich Pond	MA51002_2002	X	-Noxious aquatic plants -(Exotic species*)
			Bond Hollow Swamp			
			Casey Brook			
			Cedar Swamp			
			Clark Reservoir	MA51022_2002		
			Cold Spring Brook			
			Girard Pond	MA51053_2002		
			Marble Pond	MA51093_2002	X	-Noxious aquatic plants -(Exotic species*)
			Sibley Reservoir	MA51148_2002		
			Spring Brook			
Woodbury Pond	MA51185_2002	X	-Noxious aquatic plants -(Exotic species*)			
12030	0.91	Unknown	Pout Pond	MA51122_2002		
			Sewall Brook			
			Sewall Pond	MA51191_2002		
12031	0.50	Unknown	Spruce Pond			
			City Farm Pond	MA51020_2002	X	-Siltation -Noxious aquatic plants
12032	6.11	Unknown	Great Brook			
			Poor Farm Brook	MA51-17_2002		
12033	3.33	Unknown	Slocum Meadow			
			West Brook			
12034	17.35	Unknown	Meadow Brook			
			Peat Meadow			
			Brooklawn Parkway Pond	MA51195_2002		
			Burncoat Park Pond	MA51012_2002	X	-Noxious aquatic plants -Turbidity
			Flint Pond	MA51050_2002 MA51188_2002		
			Green Hill Pond			
			Hovey Pond	MA51068_2002		
			Jordan Pond	MA51078_2002	X	-Turbidity [5/2/2002-CN070.1]
			Lake Quinsigamond	MA51125_2002		
			Mill Pond	MA51105_2002	X	-Turbidity [5/2/2002-CN070.1]
			Newton Pond	MA51110_2002		
			Poor Farm Brook	MA51-17_2002		
			Quinsigamond River	MA51-09_2002		
			Shirley Street Pond	MA51196_2002	X	-Noxious aquatic plants [5/2/2002-CN070.1]
12038	9.17	Unknown	Axtell Brook			
			Big Bummet Brook			
			Hayes Pond	MA51060_2002	X	-Noxious aquatic plants -(Exotic species*)
			Lake Ripple	MA51135_2002	X	-Noxious aquatic plants -(Exotic species*)
			Pratts Pond	MA51124_2002		
			Quinsigamond River	MA51-09_2002		
			Summet Brook			
Windle Pond	MA51184_2002					
12040	1.45	Unknown	Fisherville Pond	MA51048_2002		
			Quinsigamond River	MA51-09_2002		

Table A1. Blackstone Basin

Sub-basin ID	Mass Highway Road Miles In Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
12042	12.37	Unknown	Blackstone River	MA51-03_2002	X	-Unknown toxicity -Priority organics -Metals -Unionized Ammonia -Chlorine -Nutrients -Organic enrichment/Low DO -(Flow alteration*) -(Other habitat alterations*) -Pathogens -Suspended solids -Turbidity -(Objectionable deposits*)
				MA51-04_2002	X	-Unknown toxicity -Priority organics -Metals -Nutrients -Organic enrichment/Low DO -(Flow alteration*) -Pathogens -Taste, odor and color -Suspended solids -Turbidity
			Broadmeadow Brook			
			Cronin Brook			
			Diversion Channel			
			Dorothy Brook			
			Dorothy Pond	MA51039_2002		
			Fisherville Pond	MA51048_2002		
			Hathaway Pond	MA51059_2002		
			Howe Pond	MA51069_2002		
			Howe Reservoirs	MA51070_2002		
				MA51071_2002	X	-Noxious aquatic plants [5/2/2002-CN070.1]
			Quinsigamond River	MA51-09_2002		
			Riverlin Street Pond	MA51137_2002		
			Slaughterhouse Pond	MA51153_2002		
			Woolshop Pond	MA51186_2002	X	-Noxious aquatic plants -Turbidity -(Exotic species*)

Table A1. Blackstone Basin

Sub-basin ID	Mass Highway Road Miles In Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
12045	3.36	Unknown	Blackstone Canal Blackstone River	MA51-04_2002	X	-Unknown toxicity -Priority organics -Metals -Nutrients -Organic enrichment/Low DO -(Flow alteration*) -Pathogens -Taste, odor and color -Suspended solids -Turbidity
				MA51-05_2002	X	-Unknown toxicity -Priority organics -Metals -Nutrients -pH -(Flow alteration*) -Pathogens -Taste, odor and color -Suspended solids -Turbidity
			Ellis Pond Mumford River	MA51-14_2002	X	-Metals -pH -Organic enrichment/Low DO -Pathogens
			Pout Pond Rice City Pond	MA51131_2002	X	-Priority organics -Siltation -Turbidity
			Riverdale Impoundment	MA51136_2002	X	-Priority organics -Turbidity
12057	0.32	Unknown	Dark Brook	MA51034_2002		
			Dark Brook Pond	MA51-13_2002		
			Mumford River Tuckers Pond	MA51169_2002		
12067	0.25	Unknown	Caswell Brook	MA51072_2002		
			Hunt Pond	MA51095_2002		
			Martin Street Pond	MA51-13_2002		
			Mumford River	MA51159_2002		
			Southwick Brook			
			Stevens Pond Weeks Pond			
12068	0.45	Unknown	Gilboa Brook Gilboa Pond	MA51052_2002	X	-Noxious aquatic plants -(Exotic species*)
			Hunt Pond	MA51083_2002		
			Lackey Pond	MA51-13_2002		
			Mumford River	MA51-14_2002	X	-Metals -pH -Organic enrichment/Low DO -Pathogens
12069	0.03	Unknown	Cold Spring Brook			
			Farrell Brook			
			Rivulet Pond	MA51138_2002		

Table A1. Blackstone Basin

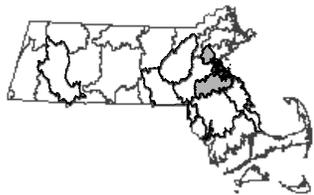
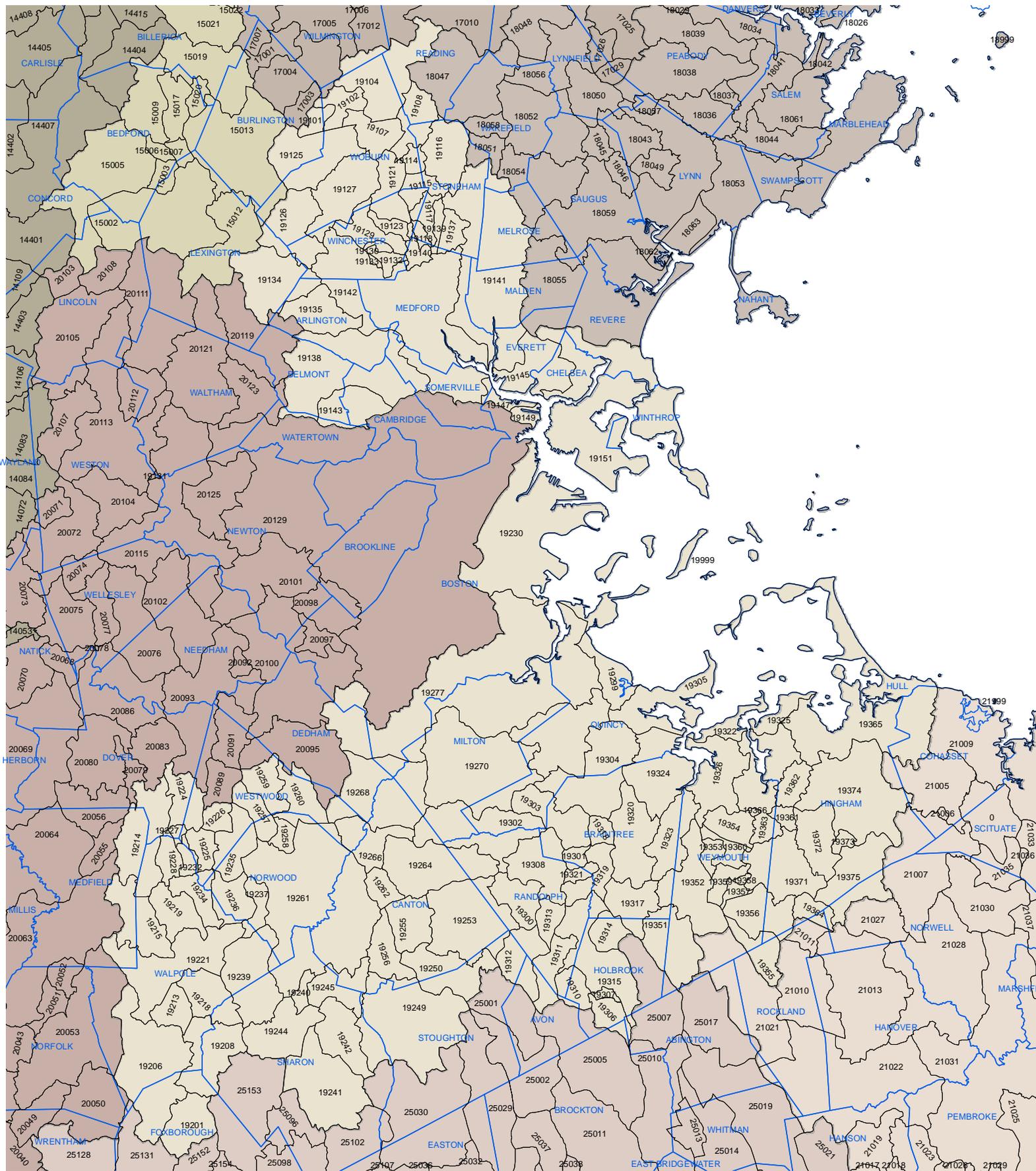
Sub-basin ID	Mass Highway Road Miles In Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
12071	4.44	Unknown	Allen Brook	MA51003_2002	X	-Noxious aquatic plants -(Exotic species*)
			Arcade Pond			
			Caprons Pond	MA51014_2002	X	-Noxious aquatic plants -(Exotic species*)
			Carpenter Reservoir	MA51015_2002		
			Fish Pond	MA51047_2002		
			Linwood Pond	MA51088_2002		
			Meadow Pond	MA51193_2002	X	-Noxious aquatic plants -(Exotic species*)
			Mumford River	MA51-14_2002	X	-Metals -pH -Organic enrichment/Low DO -Pathogens
			Purgatory Brook	MA51128_2002		
			Reservoir No. 4			
			Reservoir No. 5			
			Reservoir No. 6	MA51134_2002	X	-Turbidity
			Riley Pond			
			Rivulet Pond	MA51164_2002		
Smith Pond						
Steamburg Brook						
Swans Pond						
Whitin Pond	MA51178_2002					
Whitins Pond	MA51180_2002					
12075	0.75	Unknown	Cider Millpond	MA51019_2002		
12080	2.29	Unknown	Miscoe Brook			
			Baker Pond	MA51019_2002		
			Cider Millpond			
			Lake Wildwood			
			Silver Lake			
			Warren Brook			
West River	MA51-11_2002	X	-pH -Organic enrichment/Low DO -Pathogens			
				MA51-12_2002	X	-Metals -Nutrients -pH -Organic enrichment/Low DO -Salinity/TDS/chlorides
			Zachary Pond			
12086	0.84	Unknown	Center Brook			
12093	0.37	Unknown	Long Meadow			
			Rock Meadow Brook			
12097	0.01	Unknown	Bazely Pond	MA51008_2002		
			Doctors Pond	MA51194_2002		
			Emerson Brook	MA51067_2002		
			Happy Hollow Brook			
			Houghton Pond			
			Joels Pond			
			Lee Pond	MA51076_2002		
			Lee Reservoir			
			Peabody Pond			
			Sawmill Pond	MA51086_2002		
Scadden Brook	MA51119_2002					

Table A1. Blackstone Basin

Sub-basin ID	Mass Highway Road Miles In Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
12103	5.42	Unknown	Blackstone River	MA51-05_2002	X	-Unknown toxicity -Priority organics -Metals -Nutrients -pH -(Flow alteration*) -Pathogens -Taste, odor and color -Suspended solids -Turbidity
			Cedar Swamp Mansfield Pond Pout Pond West River	MA51121_2002 MA51-12_2002	X	-Metals -Nutrients -pH -Organic enrichment/Low DO -Salinity/TDS/chlorides
			West River Pond	MA51177_2002	X	-Noxious aquatic plants -(Exotic species*)
12104	0.30	Unknown	Blackstone River Crane Pond Fox Brook Reilly Pond	MA51030_2002		
12105	1.56	Unknown	Mill River	MA51-10_2002	X	-Priority organics -Metals
			North Pond	MA51112_2002		
12107	0.49	Unknown	Fiske Millpond	MA51049_2002	X	-Noxious aquatic plants -(Exotic species*)
			Little Field Pond Mill Pond Mill River	MA51102_2002 MA51-10_2002	X	-Priority organics -Metals
			Silver Hill Pond	MA51149_2002		
12108	0.22	Unknown	Hopedale Pond Mill River	MA51065_2002 MA51-10_2002	X	-Priority organics -Metals
12111	1.09	Unknown	Hopedale Pond Mill River	MA51065_2002 MA51-10_2002	X	-Priority organics -Metals
12114	0.30	Unknown	Muddy Brook Spring Brook			
12116	0.00	Unknown	Mill River	MA51-10_2002	X	-Priority organics -Metals
			Spindleville Pond	MA51158_2002	X	-Priority organics -Noxious aquatic plants
12120	0.34	Unknown	Duck Pond Fish Pond Mill River	MA51-10_2002	X	-Priority organics -Metals
12126	0.02	Unknown	Harris Pond	MA51058_2002	X	-Noxious aquatic plants -(Exotic species*)
			Mill River	MA51-10_2002	X	-Priority organics -Metals
12129	0.10	Unknown	Arnolds Brook Crystal Lake Curtis Pond Hoag Brook Jenks Reservoir Lakeview Pond Lily Hole Long Pond Peters River	MA51075_2002 MA51-18_2002	X	-Metals -Pathogens
			Silver Lake	MA51150_2002		

Table A1. Blackstone Basin

Sub-basin ID	Mass Highway Road Miles In Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
12132	0.61	Unknown	Blackstone River	MA51-05_2002	X	-Unknown toxicity -Priority organics -Metals -Nutrients -pH -(Flow alteration*) -Pathogens -Taste, odor and color -Suspended solids -Turbidity
				MA51-06_2002	X	-Priority organics -Nutrients -pH -(Flow alteration*) -Pathogens -Taste, odor and color -Suspended solids -Turbidity
12133	1.28	Unknown	Blackstone River	MA51-06_2002	X	-Priority organics -Nutrients -pH -(Flow alteration*) -Pathogens -Taste, odor and color -Suspended solids -Turbidity
12135	0.33	Unknown	Aldrich Brook Bacon Brook Card Machine Brook Ironstone Reservoir	MA51074_2002		
12143	0.46	Unknown	Burnt Swamp Brook			
12147	1.98	Unknown	Abbott Run			
12150	2.59	Unknown	Sweedens Swamp			



Appendix A
Sub-Basin
Identification Maps:
BOSTON HARBOR

Table A2. Boston Harbor Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
19102	1.86	15	Halls Brook Middlesex Canal			
19104	9.29	32	Aberjona River	MA71-01_2002	X	-Cause Unknown -Unionized Ammonia -Nutrients -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens
19107	4.14	31	Aberjona River	MA71-01_2002	X	-Cause Unknown -Unionized Ammonia -Nutrients -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens
19108	9.44	39	Aberjona River	MA71-01_2002	X	-Cause Unknown -Unionized Ammonia -Nutrients -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens
19114	2.58	18	Aberjona River	MA71-01_2002	X	-Cause Unknown -Unionized Ammonia -Nutrients -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens
19115	2.87	5	Whittemore Pond Aberjona River	MA71-01_2002	X	-Cause Unknown -Unionized Ammonia -Nutrients -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens
19117	0.66	5	Dark Hollow Pond Dixie Pond North Reservoir North Stream			
19121	0.09	0	Aberjona Pond Aberjona River	MA71-01_2002	X	-Cause Unknown -Unionized Ammonia -Nutrients -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens
19125	10.57	59	Whittemore Pond Cummings Brook Littles Brook			
19126	3.04	22	Shaker Glen Brook			
19127	1.67	11	Fowle Brook Horn Pond Sucker Brook	MA71019_2002	X	-Nutrients -Organic enrichment/Low DO -Noxious aquatic plants

Table A2. Boston Harbor Basin								
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment		
19129	0.53	4	Aberjona River	MA71-01_2002	X	-Cause Unknown -Unionized Ammonia -Nutrients -Organic enrichment/Low DO -(Other habitat alterations*)		
			Judkins Pond	MA71021_2002	X	-Pathogens -Nutrients -Organic enrichment/Low DO		
			Mill Pond	MA71031_2002	X	-Pathogens -Organic enrichment/Low DO		
			Wedge Pond	MA71045_2002	X	-Pathogens -Nutrients		
			Winter Pond	MA71047_2002	X	-Noxious aquatic plants -Cause Unknown -Nutrients -Noxious aquatic plants -Turbidity		
19134	3.55	7	Arlington Reservation Great Meadows Little Pond Mill Brook	MA71-07_2002	X	-(Other habitat alterations*) -Pathogens		
			Munroe Brook					
			19135	0.94	0	Mill Brook	MA71-07_2002	X
19137	0.80	1	Dark Hollow Pond Spot Pond					
19138	9.46	36	Alewife Brook	MA71-04_2002	X	-Metals -Nutrients -Organic enrichment/Low DO -Pathogens -Oil and grease -Taste, odor and color -(Objectionable deposits*)		
			Clay Pit Pond	MA71011_2002	X	-Pesticides		
			Hills Pond	MA71018_2002				
			Jerrys Pond Little Pond Spy Pond	MA71040_2002	X	-Nutrients -Organic enrichment/Low DO -Noxious aquatic plants -(Exotic species*)		
			19139	2.80	17	Dark Hollow Pond Dixie Pond		
19141	0.39	0	Buckman Pond Doleful Pond EII Pond	MA71014_2002	X	-Nutrients -Pathogens -Suspended solids		
			Fellsmere Pond Malden River	MA71-05_2002	X	-Organic enrichment/Low DO -Pathogens -Oil and grease -Taste, odor and color -Suspended solids -(Objectionable deposits*)		
			Quarter Mile Pond					

Table A2. Boston Harbor Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
19142	19.65	145	Aberjona River	MA71-01_2002	X	-Cause Unknown -Unionized Ammonia -Nutrients -Organic enrichment/Low DO -(Other habitat alterations*)
			Alewife Brook	MA71-04_2002	X	-Pathogens -Metals -Nutrients -Organic enrichment/Low DO -Pathogens -Oil and grease -Taste, odor and color -(Objectionable deposits*)
			Bellevue Pond	MA71004_2002		
			Brooks Pond			
			Lower Mystic Lake	MA71027_2002	X	-Cause Unknown -Organic enrichment/Low DO -Salinity/TDS/chlorides -(Other habitat alterations*)
			Mill Brook	MA71-07_2002	X	-Pathogens
			Mystic River	MA71-02_2002	X	-Metals -Nutrients -Pathogens
			Quarter Mile Pond			
			Upper Mystic Lake			
			Wellington Marsh			
Wrights Pond						
19143	0.02	0	Blacks Nook	MA71005_2002	X	-Nutrients -Noxious aquatic plants
			Fresh Pond			
19145	2.61	86	Mystic River	MA71-03_2002	X	-Priority organics -Metals -Unionized Ammonia -Other inorganics -Organic enrichment/Low DO -Pathogens -Oil and grease -Taste, odor and color
19147	0.65	15	Mystic River	MA71-03_2002	X	-Priority organics -Metals -Unionized Ammonia -Other inorganics -Organic enrichment/Low DO -Pathogens -Oil and grease -Taste, odor and color
19149	0.06	0	Boston Inner Harbor	MA70-02_2002	X	-Priority organics -Pathogens
			Mystic River	MA71-03_2002	X	-Priority organics -Metals -Unionized Ammonia -Other inorganics -Organic enrichment/Low DO -Pathogens -Oil and grease -Taste, odor and color

Table A2. Boston Harbor Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
19151	19.84	44	Boston Harbor	MA70-01_2002	X	-Priority organics
			Boston Inner Harbor	MA70-02_2002	X	-Pathogens
			Chelsea River	MA71-06_2002	X	-Priority organics
						-Unionized Ammonia
Lewis Lake	MA93-23_2002	X	-Pathogens			
Lynn Harbor						
The Basin						
19201	0.14	Unknown	Winthrop Bay	MA70-10_2002	X	-Pathogens
			Crackrock Pond	MA73010_2002	X	-Noxious aquatic plants
			Neponset Reservoir	MA73034_2002		-Turbidity
19206	4.97	Unknown	Neponset River	MA73-01_2002	X	-(Exotic species*)
			Cedar Swamp	MA73-01_2002	X	-Priority organics
						Mann Pond
Neponset River	-Nutrients					
19208	0.92	Unknown	Ruckaduck Pond	MA73037_2002	X	-Siltation
			Ganawatte Farm Pond			-Organic enrichment/Low DO
			School Meadow Brook			-Pathogens [6/21/2002-CN121.0]
19213	1.07	Unknown	Neponset River	MA73-01_2002	X	-Suspended solids
			School Meadow Brook	MA73-06_2002	X	-Noxious aquatic plants
						-Turbidity
School Meadow Brook	MA73-06_2002	X	-Pathogens [6/21/2002-CN121.0]			

Table A2. Boston Harbor Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
19218	0.01	Unknown	Clark Pond Diamond Pond Memorial Pond	MA73008_2002 MA73012_2002	X	-Noxious aquatic plants -Turbidity
19221	1.48	Unknown	Rainbow Pond Bird Pond Cobbs Pond Mine Brook Neponset River	MA73002_2002 MA73009_2002 MA73-09_2002 MA73-01_2002	X X X X	-Priority organics -Noxious aquatic plants -Nutrients -Organic enrichment/Low DO -Noxious aquatic plants -Turbidity -(Exotic species*) -Organic enrichment/Low DO -Pathogens [6/21/2002-CN121.0] -Priority organics -Metals -Nutrients -Siltation -Organic enrichment/Low DO -Pathogens [6/21/2002-CN121.0] -Suspended solids -Noxious aquatic plants -Turbidity
19230	38.00	40	Plimpton Pond Turner Pond Unnamed Tributary Boston Harbor Boston Inner Harbor Dorchester Bay Frog Pond Neponset River Pleasure Bay	MA73058_2002 MA73-10_2002 MA70-01_2002 MA70-02_2002 MA70-03_2002 MA73-04_2002 MA70-11_2002	X X X X X X	-Priority organics -Pathogens -Priority organics -Pathogens -Priority organics -Pathogens -Suspended solids -Turbidity -Priority organics -Organic enrichment/Low DO -Pathogens [6/21/2002-CN121.0] -Turbidity -(Objectionable deposits*) -Priority organics -Pathogens
19234	0.29	Unknown	Bubbling Brook Pettee Pond Unnamed Tributary Willett Pond	MA73-11_2002 MA73-13_2002 MA73-14_2002 MA73062_2002	X X X	-Pathogens [6/21/2002-CN121.0] -Metals
19236	1.22	Unknown	Ellis Pond Germany Brook Hawes Brook Unnamed Tributary	MA73018_2002 MA73-15_2002 MA73-16_2002 MA73-14_2002	X X X	-Nutrients -pH -Pathogens [6/21/2002-CN121.0] -Taste, odor and color -(Objectionable deposits*) -Pathogens [6/21/2002-CN121.0] -Taste, odor and color [6/21/2002-CN121.0] -Objectionable deposits [6/21/2002-CN121.0]

Table A2. Boston Harbor Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
19237	0.04	Unknown	Hawes Brook	MA73-16_2002	X	-Pathogens [6/21/2002-CN121.0] -Taste, odor and color [6/21/2002-CN121.0] -Objectionable deposits [6/21/2002-CN121.0]
			Neponset River	MA73-01_2002	X	-Priority organics -Metals -Nutrients -Siltation -Organic enrichment/Low DO -Pathogens [6/21/2002-CN121.0] -Suspended solids -Noxious aquatic plants -Turbidity
19239	5.87	Unknown	Traphole Brook	MA73-17_2002	X	-Pathogens [6/21/2002-CN121.0]
19244	0.09	Unknown	Beaver Brook	MA73-19_2002	X	-Cause Unknown -Organic enrichment/Low DO
19249	1.53	Unknown	Bolivar Pond	MA73005_2002	X	-Turbidity -(Exotic species*)
			Brittons Pond			
			Farringtons Pond			
			Muddy Pond			
			Pinewood Pond	MA73039_2002		
			Steep Hill Brook	MA73-18_2002		
			Town Pond	MA73056_2002		
			Unnamed Tributary	MA73-32_2002	X	-Cause Unknown -Nutrients -pH
			Woods Pond	MA73055_2002		
19250	0.98	3	Beaver Meadow Brook	MA73-20_2002	X	-Organic enrichment/Low DO -Pathogens [6/21/2002-CN121.0]
			Glen Echo Pond			
19253	3.10	16	Beaver Meadow Brook	MA73-20_2002	X	-Organic enrichment/Low DO -Pathogens [6/21/2002-CN121.0]
			Glen Echo Pond	MA73022_2002		
			Muddy Pond			
			Pequid Brook	MA73-22_2002	X	-Organic enrichment/Low DO -Pathogens [6/21/2002-CN121.0]
			York Brook			
19255	1.01	5	Pequid Brook	MA73-22_2002	X	-Organic enrichment/Low DO -Pathogens [6/21/2002-CN121.0]
			Reservoir Pond	MA73048_2002		
19257	0.09	Unknown	Fisher Meadow			
			Lymans Pond	MA73021_2002		
			Plantingfield Brook	MA73-23_2002		
19258	1.29	Unknown	Plantingfield Brook	MA73-23_2002		
19259	0.14	Unknown	Purgatory Brook	MA73-24_2002	X	-Pathogens [6/21/2002-CN121.0]
19260	7.30	18	Purgatory Brook	MA73-24_2002	X	-Pathogens [6/21/2002-CN121.0]

Table A2. Boston Harbor Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
19261	13.60	13	East Branch	MA73-05_2002	X	-Cause Unknown -Metals -Organic enrichment/Low DO -Thermal modifications -(Flow alteration*) -Pathogens [6/21/2002-CN121.0]
			East Branch Neponset River			
			Neponset River	MA73-01_2002	X	-Priority organics -Metals -Nutrients -Siltation -Organic enrichment/Low DO -Pathogens [6/21/2002-CN121.0] -Suspended solids -Noxious aquatic plants -Turbidity
				MA73-02_2002	X	-Priority organics -Metals -Organic enrichment/Low DO -Pathogens [6/21/2002-CN121.0] -Oil and grease -Turbidity -(Objectionable deposits*)
			Plantingfield Brook	MA73-23_2002		
			Purgatory Brook	MA73-24_2002	X	-Pathogens [6/21/2002-CN121.0]
			Traphole Brook	MA73-17_2002	X	-Pathogens [6/21/2002-CN121.0]
	Unnamed Tributary	MA73-33_2002	X	-Nutrients -Pathogens -Taste, odor and color		
19264	2.37	22	Duck Pond			
			Ponkapoag Pond	MA73043_2002		
			Ponkapog Brook	MA73-27_2002	X	-Pathogens [6/21/2002-CN121.0]
19266	0.45	2	Neponset River	MA73-02_2002	X	-Priority organics -Metals -Organic enrichment/Low DO -Pathogens [6/21/2002-CN121.0] -Oil and grease -Turbidity -(Objectionable deposits*)
			Pecunit Brook	MA73-25_2002		
			Ponkapog Brook	MA73-27_2002	X	-Pathogens [6/21/2002-CN121.0]
19268	5.34	37	Hemenway Pond			
			Neponset River	MA73-02_2002	X	-Priority organics -Metals -Organic enrichment/Low DO -Pathogens [6/21/2002-CN121.0] -Oil and grease -Turbidity -(Objectionable deposits*)
			Sprague Pond	MA73053_2002		

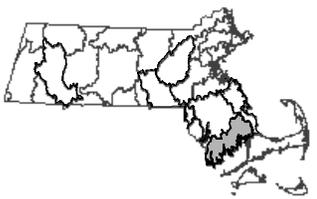
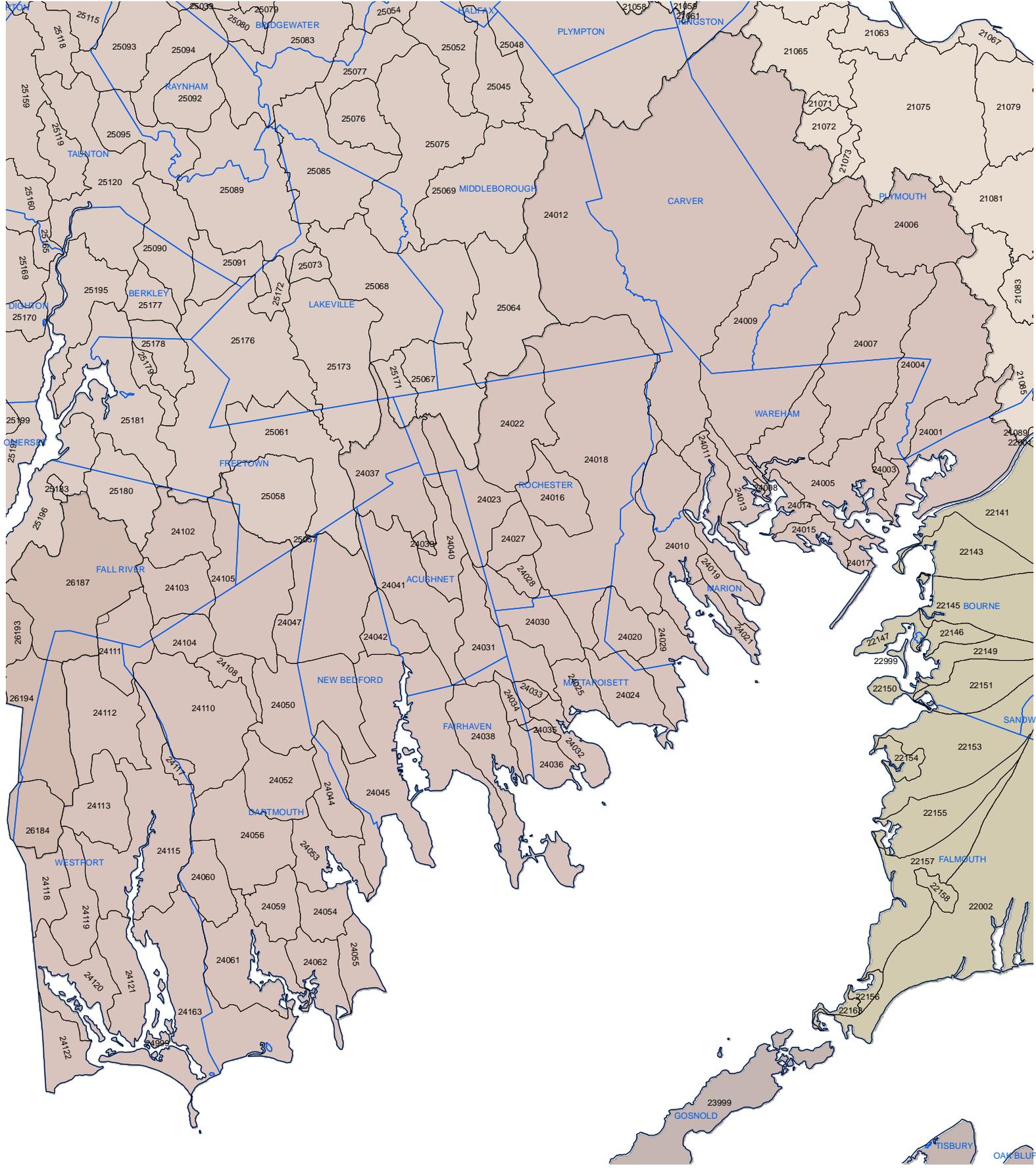
Table A2. Boston Harbor Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment			
19270	3.32	7	Balster Brook	MA73004_2002					
			Blue Hills Reservoir						
			Hemenway Pond						
			Hillside Pond						
			Pine Tree Brook				MA73-29_2002	X	-Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens [6/21/2002-CN121.0]
			Popes Pond				MA73044_2002	X	-Noxious aquatic plants -Turbidity
			Russell Pond				MA73003_2002	X	-Noxious aquatic plants -Turbidity -(Exotic species*)
Trout Brook									
19277	13.96	83	Gulliver Creek	MA73-30_2002	X	-Pathogens [6/21/2002-CN121.0]			
			Mother Brook	MA73-28_2002	X	-Nutrients -Organic enrichment/Low DO -(Flow alteration*) -Pathogens [6/21/2002-CN121.0]			
			Neponset River	MA73-02_2002	X	-Taste, odor and color -Priority organics -Metals -Organic enrichment/Low DO -Pathogens [6/21/2002-CN121.0] -Oil and grease -Turbidity -(Objectionable deposits*)			
				MA73-03_2002	X	-Priority organics -Metals -Organic enrichment/Low DO -Pathogens [6/21/2002-CN121.0] -Oil and grease -(Objectionable deposits*)			
				MA73-04_2002	X	-Priority organics -Organic enrichment/Low DO -Pathogens [6/21/2002-CN121.0] -Turbidity -(Objectionable deposits*)			
				MA73-29_2002	X	-Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens [6/21/2002-CN121.0]			
			Turners Pond	MA73059_2002	X	-Nutrients -Organic enrichment/Low DO -Turbidity			
			Unquity Brook	MA73-26_2002	X	-Nutrients -pH -Siltation -Organic enrichment/Low DO -(Flow alteration*) -(Other habitat alterations*) -Pathogens [6/21/2002-CN121.0] -(Objectionable deposits*)			

Table A2. Boston Harbor Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
19299	0.00	0	Boston Harbor	MA70-01_2002	X	-Priority organics -Pathogens
			Dorchester Bay	MA70-03_2002	X	-Priority organics -Pathogens -Suspended solids -Turbidity
			Furnace Brook	MA74-10_2002	X	-Organic enrichment/Low DO
			Quincy Bay	MA70-04_2002	X	-Priority organics -Pathogens
				MA70-05_2002	X	-Priority organics -Pathogens
19300	1.21	12	Norroy Brook Norroy Pond			
19302	8.19	102	Blue Hill River Hoosicwhisick Pond Houghtons Pond Pakomet Spring	MA74015_2002		
19303	0.67	9	Bouncing Brook Farm River Great Cedar Swamp	MA74-07_2002		
19304	16.03	74	Old Quincy Reservoir Town Brook	MA74017_2002 MA74-09_2002	X	-Cause Unknown -(Other habitat alterations*) -Pathogens
19305	0.08	0	Hingham Bay Quincy Bay	MA70-06_2002 MA70-04_2002	X X	-Pathogens -Priority organics -Pathogens
				MA70-05_2002	X	-Priority organics -Pathogens
			Town Brook	MA74-09_2002	X	-Cause Unknown -(Other habitat alterations*) -Pathogens
			Town River Bay	MA74-15_2002	X	-Organic enrichment/Low DO -Pathogens
			Weymouth Fore River	MA74-14_2002	X	-Pathogens
19306	0.85	Unknown	Trout Brook	MA74-12_2002		
19307	0.14	Unknown	Trout Brook	MA74-12_2002		
19308	1.01	5	Great Pond Norroy Brook Upper Reservoir			
19312	1.25	Unknown	Bear Swamp			
19313	0.97	0	Norroy Pond			
19314	1.08	Unknown	Tumbling Brook			
19315	0.37	Unknown	Cochato River	MA74-06_2002	X	-Pesticides -Organic enrichment/Low DO -Pathogens
			Glovers Brook			
			Ice House Pond	MA74028_2002	X	-Pesticides
			Lake Holbrook	MA74013_2002	X	-Noxious aquatic plants
			Sylvan Lake	MA74021_2002	X	-Pesticides -Priority organics
			Trout Brook	MA74-12_2002		
19318	1.01	2	Sunset Lake	MA74020_2002		

Table A2. Boston Harbor Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
19319	0.85	2	Broad Meadow Cochato River	MA74-06_2002	X	-Pesticides -Organic enrichment/Low DO -Pathogens
			Farm River Hollingsworth Pond	MA74-07_2002		
			Monatiquot River	MA74-08_2002	X	-Cause Unknown -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens
19320	7.94	42	Hollingsworth Pond Monatiquot River	MA74-08_2002	X	-Cause Unknown -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens
19322	1.60	2	Hingham Bay	MA70-07_2002	X	-Pathogens
			Weymouth Back River	MA74-13_2002	X	-Pathogens
			Weymouth Fore River	MA74-14_2002	X	-Pathogens
19323	2.41	12	Smelt Brook			
			Weymouth Fore River	MA74-14_2002	X	-Pathogens
19324	1.10	7	Monatiquot River	MA74-08_2002	X	-Cause Unknown -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens
			Weymouth Fore River	MA74-14_2002	X	-Pathogens
19325	1.51	Unknown	Hingham Bay	MA70-07_2002	X	-Pathogens
			Hingham Harbor	MA70-08_2002	X	-Pathogens
			Weymouth Back River	MA74-13_2002	X	-Pathogens
19326	0.91	2	Cranberry Pond			
			Fore River Stream			
			Mill Cove Stream			
			Mill Stream			
19352	4.79	16	Weymouth Fore River	MA74-14_2002	X	-Pathogens
			Mill River	MA74-04_2002	X	-Nutrients -Pathogens -Noxious aquatic plants
19353	4.58	27	Mill River	MA74-04_2002	X	-Nutrients -Pathogens -Noxious aquatic plants
			Whortleberry Pond			
19354	0.17	6	Mill River	MA74-04_2002	X	-Nutrients -Pathogens -Noxious aquatic plants
			Old Swamp River	MA74-03_2002	X	-Cause Unknown -Pathogens
			Whitmans Pond	MA74025_2002		
19356	1.61	Unknown	Old Swamp River	MA74-03_2002	X	-Cause Unknown -Pathogens
19357	0.81	0	Old Swamp River	MA74-03_2002	X	-Cause Unknown -Pathogens
19359	1.63	13	Old Swamp River	MA74-03_2002	X	-Cause Unknown -Pathogens
19360	3.03	7	Mill River	MA74-04_2002	X	-Nutrients -Pathogens -Noxious aquatic plants
			Old Swamp River	MA74-03_2002	X	-Cause Unknown -Pathogens
			Whortleberry Pond			

Table A2. Boston Harbor Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
19362	0.01	Unknown	Bouve Pond Brewer Pond Fresh River			
19363	0.14	0	Weymouth Back River	MA74-05_2002	X	-Organic enrichment/Low DO -Pathogens
				MA74-13_2002	X	-Pathogens
19364	3.54	Unknown	Accord Pond	MA94002_2002		
19365	7.70	Unknown	Boston Harbor	MA70-01_2002	X	-Priority organics -Pathogens
			Broad Cove Foundry Pond	MA74011_2002	X	-Nutrients -Siltation -Noxious aquatic plants
			Great Swamp			
			Hingham Bay	MA70-07_2002	X	-Pathogens
			Hingham Harbor	MA70-08_2002	X	-Pathogens
			Home Meadows			
			Hull Bay	MA70-09_2002	X	-Pathogens
			Straits Pond			
			Weir River	MA74-02_2002	X	-Nutrients -Pathogens
				MA74-11_2002	X	-Pathogens
19371	7.26	5	Plymouth River			
19375	0.84	Unknown	Accord Brook Accord Pond Hatch Pond Valley Swamp	MA94002_2002		
21028	6.30	36	Furnace Brook	MA74-10_2002	X	-Organic enrichment/Low DO
TOTAL KNOWN:		1219				



Appendix A
Sub-Basin
Identification Maps:
BUZZARDS BAY

Table A3. Buzzards Bay Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
24005	9.22	Unknown	Agawam River	MA95-28_2002	X	-Nutrients -(Other habitat alterations*) -Pathogens -Noxious aquatic plants
				MA95-29_2002		
			Bangs Bog			
			Beaver Dam Pond			
			Black Jonny Pond			
			Broad Marsh			
			Cedar Pond			
			Dicks Pond	MA95038_2002		
			Gibbs Brook			
			Onset Bay	MA95-02_2002		
			Rogers Bog			
			Sandy Pond	MA95128_2002		
			Spectacle Pond	MA95142_2002		
			Union Pond	MA95152_2002		
			Wankinco River	MA95-50_2002		
			Wareham River	MA95-03_2002		
24007	3.58	Unknown	Abner Pond	MA95001_2002		
			Agawam River	MA95-28_2002		
			Branch Maple Springs Brook			
			Cattle Pond			
			Charge Pond			
			Doctors Pond			
			Fawn Pond	MA95053_2002		
			Five Mile Pond	MA95056_2002		
			Glen Charlie Pond	MA95061_2002		
			Grassy Pond			
			Little Fivemile Pond			
			Little Long Pond	MA95089_2002		
			Maple Springs Bog			
			Maple Springs Brook			
			Mill Pond	MA95105_2002		
			New Grassy Pond			

Table A3. Buzzards Bay Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
24009	2.01	Unknown	Barrett Pond	MA95004_2002		
			Bumps Pond			
			Bumpus Bog			
			Carver Bog			
			Charge Pond	MA95025_2002		
			Cherry Pond			
			College Pond	MA95030_2002		
			Doctors Pond			
			East Head Pond	MA95177_2002		
			Fearing Pond	MA95054_2002		
			Fiske Bogs			
			Frogfoot Brook			
			Golden Field Pond			
			Grassy Pond			
			Harlow Brook			
			Hooper Pond			
			Maple Swamp			
			Mosquito Pond			
			New Long Pond	MA95112_2002		
			Parker Mills Pond	MA95115_2002		
			Raccoon Pond			
			Rose Brook			
Round Pond						
Three Cornered Pond	MA95145_2002					
Tihonet Pond	MA95146_2002	X	-Organic enrichment/Low DO			
Torrey Pond						
Walsh Bog						
Wankinco Cranberry Bog						
Wankinco River	MA95-30_2002					
			MA95-50_2002	X	-Pathogens	
24010	5.71	Unknown	Blackmore Pond			
			Blackmore Reservoir	MA95015_2002		
			Cohackett Brook			
			Hammett Cove	MA95-56_2002	X	-Nutrients -Pathogens
			Sippican Harbor	MA95-08_2002	X	-Pathogens
Sippican River	MA95-06_2002					
			MA95-07_2002	X	-Pathogens	
24011	4.34	Unknown	Beaverdam Creek	MA95-53_2002	X	-Nutrients -Pathogens
			Blackmore Pond			
			Great Swamp			
			Horseshoe Pond			
			Sippican River	MA95-07_2002	X	-Pathogens
			Wareham River	MA95-03_2002	X	-Nutrients -Pathogens
			Weweantic River	MA95-04_2002		
	MA95-05_2002	X	-Nutrients -Pathogens			

Table A3. Buzzards Bay Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
24012	3.32	Unknown	Bates Pond	MA95007_2002		
			Beaver Dam Brook			
			Benson Pond Bogs			
			Big West Pond			
			Cedar Pond			
			Cedar Swamp			
			Clear Bottom Pond			
			Clear Pond			
			Crane Brook			
			Crane Brook Bog Pond	MA95033_2002		
			Curlew Pond	MA95034_2002		
			Double Brook			
			Dunham Pond	MA95044_2002		
			East Rocky Gutter Brook			
			Federal Bogs			
			Federal Pond	MA95055_2002		
			Fresh Meadow Pond	MA95174_2002		
			Grady Pond			
			Grassy West Pond			
			Indian Brook			
			Kings Pond	MA95078_2002		
			Little Clear Pond			
			Little Micajah Pond			
			Little West Pond	MA95093_2002		
			Little Widgeon Pond			
			Manters Hole			
			Micajah Pond	MA95102_2002		
			Narragansett Pond			
			Rocky Meadow Brook			
			Rocky Meadow Brook Pond	MA95118_2002		
			Rocky Pond	MA95179_2002		
			Round Hole			
			Sampson Pond	MA95125_2002		
Smelt Pond						
South Meadow Brook						
South Meadow Brook Pond	MA95139_2002					
South Meadow Pond	MA95140_2002					
Southwest Atwood Bog Pond	MA95141_2002					
Spring Pond						
Tremont Mill Pond	MA95150_2002					
Vaughn Pond	MA95153_2002					
Wenham Pond						
West Rocky Gutter Brook						
Weweantic River	MA95-04_2002					
Widgeon Pond						
24013	2.99	Unknown	Broad Marsh River	MA95-49_2002	X	-Pathogens
			Cedar Island Creek	MA95-52_2002	X	-Pathogens
			Stones Bog			
			Stony Run			
24014	0.24	Unknown	Wareham River	MA95-03_2002	X	-Nutrients -Pathogens
			Black Jonny Pond			
24016	0.24	Unknown	Crooked River	MA95-51_2002	X	-Pathogens
			Wareham River	MA95-03_2002	X	-Nutrients -Pathogens
			Doggett Brook			
			Sherman Brook			

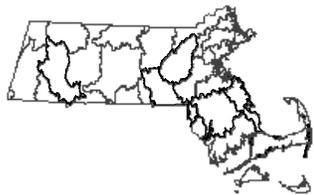
Table A3. Buzzards Bay Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
24018	1.76	Unknown	Bear Swamp Benson Brook East Branch Sippican River Forbes Swamp Haggertys Brook Haskell Swamp Hataway Pond Leonards Pond Marys Pond Mill Pond Sippican River Stewart Bog Towers Swamp West Branch Sippican River	MA95080_2002 MA95100_2002 MA95-06_2002		
24024	0.81	Unknown	Mattapoissett Harbor Pine Island Brook Pine Island Pond	MA95-35_2002	X	-Pathogens
24025	2.67	Unknown	Mattapoissett Harbor	MA95-35_2002	X	-Pathogens
24029	1.62	Unknown	Aucoot Cove Hiller Cove Sippican Harbor	MA95-09_2002 MA95-10_2002 MA95-08_2002	X X X	-Pathogens -Pathogens -Pathogens
24031	0.59	Unknown	Mattapoissett River Tinkham Brook Tinkham Pond	MA95-36_2002 MA95148_2002		
24032	0.91	Unknown	Mattapoissett Harbor Mattapoissett River	MA95-35_2002 MA95-36_2002	X	-Pathogens
24033	0.31	Unknown	Mattapoissett River	MA95-36_2002		
24034	1.15	Unknown	Swift Brook			
24037	3.41	Unknown	Acushnet River Ashley Brook Keene River New Bedford Reservoir Squam Brook	MA95-31_2002 MA95110_2002	X	-Nutrients -Siltation -Organic enrichment/Low DO -Pathogens
24038	7.33	Unknown	Nasketucket River Outer New Bedford Harbor	MA95-63_2002	X	-Priority organics -Nonpriority organics -Metals -Nutrients -Organic enrichment/Low DO -Pathogens
24042	0.23	Unknown	Acushnet River	MA95-32_2002 MA95-33_2002	X X	-Nutrients -Organic enrichment/Low DO -Pathogens -Priority organics -Metals -Nutrients -Organic enrichment/Low DO -Pathogens
24044	2.93	Unknown	Mill Pond Buttonwood Brook Buttonwood Park Pond	MA95-13_2002 MA95020_2002	X	-Pathogens

Table A3. Buzzards Bay Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
24045	17.91	Unknown	Acushnet River	MA95-33_2002	X	-Priority organics -Metals -Nutrients -Organic enrichment/Low DO -Pathogens
			Clark Cove	MA95-38_2002	X	-Priority organics -Pathogens
			New Bedford Harbor	MA95-42_2002	X	-Priority organics -Metals -Nutrients -Organic enrichment/Low DO -Pathogens
			Outer New Bedford Harbor	MA95-63_2002	X	-Priority organics -Nonpriority organics -Metals -Nutrients -Organic enrichment/Low DO -Pathogens
24047	8.22	Unknown	Acushnet Cedar Swamp Black Pond Flag Swamp Hobomock Swamp Paskamanset River Turner Pond	MA95-11_2002 MA95151_2002	X	-Metals -Turbidity
24050	15.91	Unknown	Apponagansett Swamp Paskamansett River	MA95-11_2002		
24052	3.63	Unknown	Paskamanset River	MA95-11_2002		
24108	0.39	Unknown	Colebrook Swamp Shingle Island River	MA95-12_2002		
24110	10.83	Unknown	East Branch Westport River	MA95-40_2002	X	-Pathogens
			Noquochoke Lake	MA95113_2002	X	-Priority organics -Metals -Noxious aquatic plants -Turbidity -(Exotic species*)
				MA95170_2002	X	-Priority organics -Metals -Noxious aquatic plants -Turbidity -(Exotic species*)
				MA95171_2002	X	-Priority organics -Metals -Noxious aquatic plants -Turbidity -(Exotic species*)
			Shingle Island River	MA95-12_2002		
24112	9.64	Unknown	Bread And Cheese Brook			
24115	3.20	Unknown	Allen Creek			
			East Branch Westport River	MA95-40_2002	X	-Pathogens
				MA95-41_2002	X	-Nutrients -Pathogens
			Forge Pond Snell Brook Snell Creek	MA95-44_2002 MA95-45_2002	X	-Pathogens

Table A3. Buzzards Bay Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
24117	1.19	Unknown	East Branch Westport River	MA95-40_2002	X	-Pathogens
			Forge Pond Noquochoke Lake	MA95113_2002	X	-Priority organics -Metals -Noxious aquatic plants -Turbidity -(Exotic species*)
24999	0.35	Unknown	Agawam River	MA95-29_2002	X	-Nutrients -(Other habitat alterations*) -Pathogens -Noxious aquatic plants
			New Bedford Harbor	MA95-42_2002	X	-Priority organics -Metals -Nutrients -Organic enrichment/Low DO -Pathogens
			Wankinco River	MA95-50_2002	X	-Pathogens
			Wareham River	MA95-03_2002	X	-Nutrients -Pathogens



23999
OSNOB



Appendix A
Sub-Basin
Identification Maps:
CAPE COD

Table A4. Cape Cod Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
22001	69.94	Unknown	Aunt Pattys Pond			
			Barnstable Harbor	MA96-01_2002	X	-Pathogens
			Bennett Pond			
			Black Flats			
			Blackfish Creek			
			Blueberry Pond			
			Boat Cove Creek			
			Boat Meadow Bog			
			Boat Meadow River	MA96-15_2002	X	-Pathogens
			Bound Brook			
			Brickyard Creek			
			Bridge Creek			
			Canoe Pond			
			Cape Cod Canal	MA95-14_2002	X	-Pathogens
			Cedar Pond			
			Chase Garden Creek	MA96-35_2002	X	-Pathogens
			Clapps Pond	MA96035_2002		
			Clapps Round Pond			
			Clays Creek			
			Cliff Pond	MA96039_2002		
			Cobbs Pond			
			Coles Pond			
			Dennis Pond			
			Depot Pond	MA96061_2002		
			Dexter Bog			
			Dook Creek			
			Doughnut Pond			
			Duck Creek	MA96-32_2002	X	-Pathogens
			Duck Harbor			
			Duck Pond			
			Dyer Pond			
			Eel Creek			
			Elbow Pond			
			Flax Pond			
			Freemans Pond			
			Fresh Brook			
			Fund Pond			
			Garretts Pond			
			Grassy Pond			
			Great Marshes			
			Great Pond	MA96114_2002		
				MA96115_2002	X	-Nutrients -Organic enrichment/Low DO
			Great Swamp			
			Greenough Pond			
			Griffiths Pond			
			Gull Pond	MA96123_2002		
			Hallets Millpond			
			Hatchet Creek			
			Herring Pond	MA96133_2002		
			Herring River	MA96-33_2002	X	-Pathogens
				MA96-67_2002	X	-Metals -pH
			Higgins Pond			
			Hinckley Pond			

Table A4. Cape Cod Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
22001 continued			Howes Pond			
			Hoxie Pond	MA96146_2002		
			Israel Pond			
			Jemima Pond			
			Keeler Pond			
			Kinnacum Pond			
			Lawrence Pond			
			Little Israel Pond			
			Little Namskaket Creek	MA96-26_2002	X	-Pathogens
			Lone Tree Creek			
			Long Pond	MA96179_2002		
			Lower Mill Pond	MA96188_2002	X	-Nutrients -Noxious aquatic plants -Turbidity
			Maraspin Creek	MA96-06_2002	X	-Pathogens
			Matthews Pond			
			Mill Creek	MA96-37_2002	X	-Pathogens
			Mill Pond			
			Miller Pond			
			Moon Pond			
			Myricks Pond			
			Namskaket Creek	MA96-27_2002	X	-Pathogens
			No Bottom Pond			
			Nye Pond	MA96228_2002		
			Old Harbor Creek			
			Owl Pond			
			Ox Pond			
			Pamet River	MA96-31_2002	X	-Pathogens
			Pasture Pond			
			Perch Pond			
			Pilgrim Lake			
			Pilgrim Spring			
			Pine Pond			
			Provincetown Harbor	MA96-29_2002	X	-Pathogens
			Quivett Creek	MA96-09_2002	X	-Pathogens
			Raccoon Swamp			
			Rock Harbor Creek	MA96-16_2002	X	-Pathogens
			Round Pond			
			Ruth Pond			
			Ryder Pond	MA96268_2002	X	-Nutrients -Organic enrichment/Low DO
			Salls Pond			
			Salt Meadow			
			Sandy Hill Pond			
			Scargo Lake	MA96279_2002		
			Schoolhouse Pond			
			Scorton Creek	MA96-30_2002	X	-Pathogens
			Sesuit Creek	MA96-13_2002	X	-Pathogens
			Shank Painter Pond			
			Shawme Lake			
			Shawme Lake Lower	MA96288_2002		
			Silver Spring Brook			
			Slough Pond			
			Small Pond			
			Smith Pond			

Table A4. Cape Cod Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
22002 continued			Cliff Pond	MA96039_2002		
			Coleman Pond			
			Coonamessett Pond			
			Coonamessett River			
			Cornelius Pond			
			Cotuit Bay	MA96-63_2002	X	-Nutrients -Pathogens
			Crooked Pond			
			Crowell Pond			
			Crows Pond	MA96-47_2002	X	-Nutrients
			Crystal Lake	MA96050_2002	X	-Organic enrichment/Low DO
			Dam Pond			
			Deans Pond			
			Deep Pond			
			Deer Pond			
			Depot Pond	MA96061_2002		
			Dinahs Pond			
			Duane Pond			
			Duck Pond			
			Dunns Pond			
			Dutchman'S Creek			
			Eagle Pond			
			Eel Pond			
			Elbow Pond			
			Elishas Pond			
			Emery Pond			
			Falmouth Inner Harbor	MA96-17_2002	X	-Pathogens
			Fawcetts Pond			
			Featherbed Swamp			
			Fish Creek			
			Flashy Pond			
			Flat Pond			
			Flax Pond	MA96090_2002		
			Flintrock Pond			
			Follins Pond			
			Fresh Pond			
			Frog Pond			
			Frost Fish Creek	MA96-49_2002	X	-Nutrients -Pathogens
			Fullers Marsh			
			Goose Pond	MA96106_2002		
			Gould Pond			
			Grassy Nook Pond			
			Grassy Pond			
			Great Harbor	MA96-18_2002	X	-Pathogens
			Great Pond	MA96-54_2002	X	-Nutrients -Pathogens
			Great River	MA96-60_2002	X	-Nutrients
			Green Pond	MA96-55_2002	X	-Nutrients -Pathogens
			Greenland Pond			
			Grews Pond			
			Halfway Pond			
			Halls Creek			
			Hamblin Pond	MA96126_2002	X	-Nutrients -Pathogens
				MA96-58_2002	X	-Metals

Table A4. Cape Cod Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
22002 continued			Hamblins Brook			
			Harding Beach Pond	MA96-43_2002	X	-Pathogens
			Hawes Run			
			Hawksnest Pond			
			Herring Brook			
			Herring River	MA96-22_2002	X	-Pathogens
			Higgins Pond			
			Hinckleys Pond	MA96140_2002		
			Holly Marsh			
			Horse Pond			
			Horseleech Pond			
			Hyannis Harbor	MA96-05_2002	X	-Pathogens
			Icehouse Pond			
			Jabinettes Pond			
			James Pond			
			Jehu Pond	MA96-59_2002	X	-Nutrients
			Jenkins Pond			
			Jim Pond			
			Johns Pond	MA96157_2002	X	-Metals
			Jones Pond			
			Josephs Pond			
			Joshua Pond			
			Kelleys Pond			
			Kescayo Gansett Pond			
			Kinnacum Pond			
			Labans Pond			
			Lake Elizabeth	MA96080_2002		
			Lamson Pond			
			Lawrence Pond			
			Lewis Bay	MA96-36_2002	X	-Pathogens
			Lewis Pond			
			Lily Pond			
			Little Cliff Pond			
			Little Harbor	MA96-19_2002	X	-Pathogens
			Little Israel Pond			
			Little Mill Pond			
			Little Pond	MA96-56_2002	X	-Nutrients
			Little River	MA96-61_2002	X	-Nutrients -Pathogens
			Little Sandy Pond			
			Littlefields Pond			
			Long Pond	MA96180_2002 MA96183_2002 MA96184_2002	X	-Organic enrichment/Low DO
			Lovells Pond			
			Lovers Lake			
			Lumbert Pond			
			Mares Pond			
			Marstons Mills River			
			Martha Pond			
			Mary Dunnpond			
			Mashpee Pond	MA96194_2002	X	-Metals
			Mashpee River	MA96-24_2002	X	-Nutrients -Pathogens
			Meeting House Pond			
			Micah Pond			
			Middle Pond			

Table A4. Cape Cod Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
22002 continued			Mill Creek	MA96-41_2002	X	-Pathogens
			Mill Pond	MA96-52_2002	X	-Nutrients
			Ministers Pond			
			Miss Thachers Pond	MA96258_2002		
			Moll Pond			
			Moody Pond			
			Morse Pond			
			Mud Pond			
			Muddy Creek	MA96-51_2002	X	-Pathogens
			Muddy Pond			
			Mystic Lake			
			Nauset Harbor	MA96-28_2002		
			Neck Pond			
			Nobska Pond			
			North Bay	MA96-66_2002	X	-Nutrients -Pathogens
			North Pond			
			Northeast Pond			
			Northern Simmons Pond			
			Nye Pond			
			Olivers Pond			
			Oyster Pond	MA96-45_2002	X	-Nutrients -Pathogens
				MA96-62_2002	X	-Pathogens
			Oyster Pond River	MA96-46_2002	X	-Nutrients -Pathogens
			Paddocks Pond			
			Parker Pond			
			Parkers River	MA96-38_2002	X	-Pathogens
			Pattys Pond			
			Paw Wah Pond			
			Perch Pond	MA96-53_2002	X	-Pathogens
			Peters Pond	MA96244_2002	X	-Metals
			Phinneys Bay			
			Pilgrim Lake	MA96246_2002		
			Pine Pond			
			Pinlico Pond			
			Plashes Brook			
			Plashes Pond			
			Popes Pond			
			Popponeset Bay	MA96-40_2002	X	-Nutrients
			Popponeset Creek	MA96-39_2002	X	-Pathogens
			Prince Cove	MA96-07_2002	X	-Nutrients -Pathogens
			Quaker Brook			
			Quashnet River	MA96-20_2002	X	-Nutrients -Organic enrichment/Low DO -Pathogens
			Rafe Pond			
			Randall Pond			
			Red Brook	MA96-25_2002		
			Red Lily Pond	MA96257_2002	X	-Nutrients -Pathogens -Noxious aquatic plants
			Red River			
			Robbins Pond			
			Round Pond			

Table A4. Cape Cod Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
22002 continued			Run Pond			
			Rushy Marsh Pond			
			Ruth Pond			
			Ryder Cove	MA96-50_2002	X	-Nutrients -Pathogens
			Ryders Pond			
			Sage Lot Pond			
			Salt Pond			
			Sam Pond			
			Sand Pond			
			Santuit Pond	MA96277_2002	X	-Nutrients -Noxious aquatic plants
			Santuit River			
			Saquatucket Harbor	MA96-23_2002	X	-Pathogens
			Sarahs Pond			
			Schoolhouse Pond	MA96281_2002		
			Scudder Bay			
			Seine Pond			
			Seymour Pond			
			Shallow Pond	MA96285_2002		
			Sheep Pond	MA96289_2002	X	-Metals -Organic enrichment/Low DO
			Shivericks Pond			
			Shoal Pond			
			Shoestring Bay	MA96-08_2002	X	-Nutrients -Pathogens
			Shubael Pond	MA96293_2002		
			Siders Pond			
			Simmons Pond			
			Skinequit Pond			
			Slough Pond			
			Smalls Pond			
			Snake Pond	MA96302_2002	X	-Metals
			Sols Pond			
			Southeast Pond			
			Southern Simmons Pond			
			Spectacle Pond			
			Stage Harbor	MA96-11_2002	X	-Nutrients -Pathogens
			Stewarts Creek			
			Stillwater Pond			
			Swan Pond			
			Swan Pond River	MA96-14_2002	X	-Pathogens
			Taylor's Pond	MA96-42_2002	X	-Pathogens
			Tim Pond			
			Town Brook			
			Triangle Pond			
			Uncle Harvey Pond			
			Uncle Israel's Pond			
			Uncle Seth's Pond			
			Uncle Stephans Pond			
			Wakeby Pond	MA96346_2002	X	-Metals
			Walkers Pond			
			Waquoit Bay	MA96-21_2002	X	-Nutrients -Organic enrichment/Low DO -Pathogens
			Wash Pond			

Table A4. Cape Cod Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
22002 continued			Weeks Pond Wequaquet Lake	MA96333_2002	X	-Metals -(Exotic species*)
			West Bay White Pond Williams Pond Witch Pond Woods Cove Wychmere Harbor	MA96-65_2002	X	-Nutrients
22141	2.84	Unknown	Cape Cod Canal Deep Bottom Pond Great Pond Little Halfway Pond Round Swamp	MA95-14_2002	X	-Pathogens
22143	2.31	Unknown	Back River Black River Clay Pond Donnelly Pond Eel Pond Mill Pond Phinneys Harbor	MA95-47_2002 MA95-48_2002 MA95-15_2002	X X X	-Pathogens -Pathogens -Pathogens
22145	0.70	Unknown	Freeman Pond Lily Pond Mill Pond Opening Pond Pocasset River Succonessett Pond Upper Pond	MA95-16_2002	X	-Pathogens
22146	0.88	Unknown	Flax Pond Lily Pond Red Brook Harbor	MA96087_2002 MA95-18_2002	X	-Pathogens
22149	0.29	Unknown	Lily Pond Bog Red Brook Harbor Red Brook Pond	MA95-18_2002	X	-Pathogens
22151	0.75	Unknown	Beaton Bog Cuffs Pond Long Pond Squeteague Harbor	MA95-55_2002	X	-Nutrients
22153	6.20	Unknown	Cedar Lake Dam Pond Edmunds Pond Fiddlers Cove Flax Pond Herring Brook Megansett Harbor Osborne Pond Squeteague Harbor Trout Pond Wild Harbor Wings Pond	MA96344_2002 MA95-21_2002 MA95-19_2002 MA95-55_2002 MA95-20_2002	X X X	-Pathogens -Pathogens -Nutrients
22155	4.68	Unknown	Crocker Pond Harbor Head Spectacle Pond West Falmouth Harbor	MA95-46_2002 MA95-22_2002	X X	-Pathogens -Nutrients -Pathogens
22156	1.40	Unknown	Quissett Harbor	MA95-25_2002	X	-Pathogens

Table A4. Cape Cod Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
22157	4.77	Unknown	Beach Pond			
			Crooked Pond			
			Deep Pond			
			Flax Pond			
			Flume Pond			
			Fresh Pond			
			Great Sippewisset Creek	MA95-23_2002	X	-Pathogens
			Great Sippewisset Marsh			
			Little Sippewisset Marsh	MA95-24_2002	X	-Pathogens
			Miles Pond			
Quahog Pond						
Spectacle Pond						
22158	0.05	Unknown	Long Pond			

Table A5. Charles River Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
19131	0.22	2	Unnamed Tributary	MA72-27_2002		
20003	0.94	Unknown	Chaddock Crewes Pond Huckleberry Brook Louisa Lake	MA72068_2002		
20006	1.59	Unknown	Charles River	MA72-01_2002	X	-Nutrients -Pathogens
20008	3.05	Unknown	Box Pond	MA72008_2002	X	-Nutrients -Siltation -Noxious aquatic plants
			Charles River	MA72-02_2002	X	-Metals -Nutrients -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens
				MA72-03_2002	X	-Noxious aquatic plants -Cause Unknown -Nutrients -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens
				MA72-04_2002	X	-Noxious aquatic plants -Metals -Pathogens
20015	5.29	Unknown	Beaver Brook Beaver Pond Charles River Curtis Pond	MA72-12_2002 MA72004_2002 MA72-04_2002	X	-Metals -Pathogens
20017	7.14	Unknown	Milford Pond Stall Brook			
20023	1.48	Unknown	Cedar Swamp Hopping Brook			
20027	3.08	Unknown	Beaver Pond Dix Brook Mine Brook Mine Brook Pond Spruce Pond Woodward Swamp	MA72-14_2002 MA72077_2002	X X	-Cause Unknown -(Other habitat alterations*) -Noxious aquatic plants -Turbidity
20029	6.37	Unknown	Curtis Pond Long Pond Mine Brook	MA72-14_2002	X	-Cause Unknown -(Other habitat alterations*)
20030	0.32	Unknown	Chicken Brook Waseeka Sanctuary Pond	MA72155_2002		
20031	1.30	Unknown	Chicken Brook Kirby Swamp Milk Pond			
20034	0.00	Unknown	Charles River Mine Brook	MA72-04_2002 MA72-14_2002	X X	-Metals -Pathogens -Cause Unknown -(Other habitat alterations*)
20037	2.79	Unknown	Desert Brook Lake Pearl Trout Pond	MA72092_2002		

Table A5. Charles River Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
20040	1.12	Unknown	City Mills Pond			
			Comeys Pond			
			Eagle Brook			
			Franklin Reservoir Northeast	MA72095_2002	X	-Noxious aquatic plants -Turbidity
			Franklin Reservoir Southwest	MA72032_2002	X	-Noxious aquatic plants -Turbidity
			Kingsbury Pond			
			Lake Archer	MA72002_2002		
			Lake Pearl	MA72092_2002		
			Mill River	MA72-15_2002		
			Uncas Brook Uncas Pond	MA72122_2002		
20050	2.46	Unknown	Stop River	MA72-09_2002	X	-Cause Unknown -Organic enrichment/Low DO
20053	0.80	Unknown	Bristols Pond			
			Highland Lake	MA72047_2002		
			Mann Pond			
			Stony Brook			
			Stony Brook Lake Stop River	MA72-09_2002	X	-Cause Unknown -Organic enrichment/Low DO
			MA72-10_2002	X	-Cause Unknown -Organic enrichment/Low DO -Pathogens	
20057	0.98	Unknown	Houghton Pond	MA72050_2002	X	-Noxious aquatic plants -Turbidity -(Exotic species*)
			Jar Brook			
20058	0.21	Unknown	Lake Winthrop	MA72140_2002	X	-Pesticides -Noxious aquatic plants -(Exotic species*)
20060	0.47	Unknown	Bogastow Brook	MA72-16_2002	X	-Pathogens
			Dopping Brook			
			Factory Pond	MA72037_2002	X	-Noxious aquatic plants -(Exotic species*)
			Linden Pond	MA72063_2002	X	-Noxious aquatic plants -Turbidity
			Meadow Brook			

Table A5. Charles River Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment			
20063	0.01	Unknown	Callahan Pond	MA72-05_2002	X	-Unknown toxicity -Metals -Nutrients -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Noxious aquatic plants -Turbidity			
			Charles River						
			Danielson Pond						
			Harlow Pond						
			Holt Pond						
			Horse Brook						
			Maple Swamp						
			Mccarthy Pond						
			Phillips Pond						
			Sewell Brook						
20064	0.03	Unknown	Stop River	MA72-10_2002	X	-Cause Unknown -Organic enrichment/Low DO -Pathogens			
			Walker Pond	MA72126_2002					
			Bogastow Brook	MA72-16_2002	X	-Pathogens			
20064	0.03	Unknown	Bogastow Pond	MA72-05_2002	X	-Unknown toxicity -Metals -Nutrients -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Noxious aquatic plants -Turbidity			
			Charles River						
			North Brook						
			South End Pond				MA72109_2002		
20070	0.42	Unknown	Vine Brook	MA72-05_2002	X	-Unknown toxicity -Metals -Nutrients -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Noxious aquatic plants -Turbidity			
			Charles River						
20072	0.08	Unknown	Davis Brook	MA72085_2002					
			Bogle Brook						
			Nonesuch Pond						
			Pickerel Pond						
20073	2.57	Unknown	Reed Pond	MA72053_2002	X	-(Flow alteration*) -Noxious aquatic plants			
			Jennings Pond						
20075	3.88	9	Mud Pond	MA72053_2002	X	-(Flow alteration*) -Noxious aquatic plants			
			Pickerel Pond						
			Jennings Pond						
			Lake Waban				MA72125_2002		
			Morses Pond				MA72079_2002		
			Paintshop Pond						
Reed Pond									
			Waban Brook	MA72-17_2002					

Table A5. Charles River Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
20076	1.93	3	Abbotts Pond Fuller Brook	MA72-18_2002	X	-Cause Unknown -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Noxious aquatic plants
20077	1.75	3	Fuller Brook	MA72-18_2002	X	-Cause Unknown -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Noxious aquatic plants
20093	2.28	17	Alder Brook	MA72-22_2002	X	-Cause Unknown -Nutrients -Organic enrichment/Low DO
			Charles River	MA72-06_2002	X	-Priority organics -Nutrients -Organic enrichment/Low DO -Pathogens -Noxious aquatic plants -Turbidity
				MA72-07_2002	X	-Priority organics -Nutrients -Organic enrichment/Low DO -Pathogens -Noxious aquatic plants -Turbidity -(Exotic species*)
			Noannet Pond	MA72084_2002		
			Powissett Brook	MA72-20_2002		
			Powissett Pond			
			Rock Meadow Brook	MA72-21_2002	X	-Pathogens
			Rosemary Lake			
20095	11.11	38	Little Wigwam Pond Lowder Brook Rodman Pond Weld Pond Wigwam Pond	MA72131_2002		
20097	0.02	0	Sawmill Brook	MA72-23_2002	X	-Other inorganics -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Taste, odor and color -Noxious aquatic plants

Table A5. Charles River Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
20100	10.81	50	Charles River	MA72-07_2002	X	-Priority organics -Nutrients -Organic enrichment/Low DO -Pathogens -Noxious aquatic plants -Turbidity -(Exotic species*)
			Cow Island Pond			
			Kendrick Street Pond	MA72055_2002	X	-Turbidity
			Motley Pond			
			Sawmill Brook	MA72-23_2002	X	-Other inorganics -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Taste, odor and color -Noxious aquatic plants
			Welch Pond			
			Weld Pond	MA72131_2002		
20101	13.04	14	Charles River	MA72-07_2002	X	-Priority organics -Nutrients -Organic enrichment/Low DO -Pathogens -Noxious aquatic plants -Turbidity -(Exotic species*)
			Crystal Lake	MA72030_2002		
			Lost Pond			
			New Pond			
			South Meadow Brook	MA72-24_2002	X	-Nutrients -Siltation -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Taste, odor and color -Turbidity
20102	3.67	11	Longfellow Pond			
			Rosemary Brook	MA72-25_2002	X	-Nutrients -Organic enrichment/Low DO -Pathogens -Taste, odor and color -Suspended solids -Turbidity
			Rosemary Lake			
20104	0.94	3	Norumbega Reservoir	MA72086_2002		
				MA72087_2002		
			Seaverns Brook			
			Weston Reservoir	MA72134_2002		
20107	0.70	1	Cherry Brook			
20111	23.02	154	Cambridge Reservoir	MA72014_2002		
			Cambridge Reservoir, Upper Basin	MA72156_2002	X	-Noxious aquatic plants -Turbidity
			Hobbs Brook			
20112	2.31	10	Hobbs Brook			
20113	9.62	100	Dell Brook			
			Stony Brook	MA72-26_2002		
			Stony Brook Reservoir	MA72114_2002		
			Unnamed Tributary	MA72-27_2002		
			Weston Station Pond	MA72135_2002		

Table A5. Charles River Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
20115	22.84	83	Charles River	MA72-07_2002	X	-Priority organics -Nutrients -Organic enrichment/Low DO -Pathogens -Noxious aquatic plants -Turbidity -(Exotic species*)
			Hurd Brook Maple Cove New Pond Rickridge Pond Rosemary Brook	MA72-25_2002	X	-Nutrients -Organic enrichment/Low DO -Pathogens -Taste, odor and color -Suspended solids -Turbidity
			Stony Brook Reservoir Unnamed Tributary Wights Pond	MA72-27_2002		
			<hr/>			
20119	9.34	37	Beaver Brook	MA72-28_2002	X	-Cause Unknown -Nutrients -Siltation -Organic enrichment/Low DO -(Flow alteration*) -(Other habitat alterations*) -Pathogens -Taste, odor and color -Turbidity
			Duck Pond Mill Pond			
			<hr/>			
20121	4.14	20	Beaver Brook Chester Brook Hardys Pond	MA72045_2002	X	-Nutrients -Noxious aquatic plants -Turbidity -(Exotic species*)
			Kendall Brook			
20123	0.06	1	Beaver Brook	MA72-28_2002	X	-Cause Unknown -Nutrients -Siltation -Organic enrichment/Low DO -(Flow alteration*) -(Other habitat alterations*) -Pathogens -Taste, odor and color -Turbidity
			Clematis Brook Duck Pond			

Table A5. Charles River Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
20129	23.80	62	Back Bay Fens Beaver Brook	MA72-28_2002	X	-Cause Unknown -Nutrients -Siltation -Organic enrichment/Low DO -(Flow alteration*) -(Other habitat alterations*) -Pathogens -Taste, odor and color -Turbidity
			Boston Inner Harbor	MA70-02_2002	X	-Priority organics -Pathogens
			Broad Canal	MA72010_2002		
			Brookline Reservoir	MA72011_2002	X	-Nutrients -Noxious aquatic plants
			Bulloughs Pond	MA72017_2002	X	-Nutrients -Organic enrichment/Low DO -Noxious aquatic plants
			Chandler Pond	MA72-07_2002	X	-Priority organics -Nutrients -Organic enrichment/Low DO -Pathogens -Noxious aquatic plants -Turbidity
			Charles River	MA72-08_2002	X	-(Exotic species*) -Cause Unknown -Unknown toxicity -Priority organics -Metals -Nutrients -Organic enrichment/Low DO -Pathogens -Oil and grease -Taste, odor and color -Noxious aquatic plants -Turbidity
			Cheese Cake Brook	MA72-29_2002	X	-Nutrients -Siltation -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Oil and grease -Taste, odor and color -Noxious aquatic plants
			Chestnut Hill Reservoir	MA72023_2002		
			Frog Pond			
			Halecyon Lake			
			Halls Pond	MA72043_2002	X	-Nutrients -Noxious aquatic plants
			Hammond Pond	MA72044_2002		
			Jamaica Pond	MA72052_2002	X	-Nutrients -Organic enrichment/Low DO
Leverett Pond						

Table A5. Charles River Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
20129 continued			Muddy River	MA72-11_2002	X	-Priority organics -Metals -Nutrients -Siltation -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Oil and grease -Taste, odor and color
			Sargent Pond			
			Sawins Pond			
			Scarboro Golf Course Pond	MA72107_2002		
			Turtle Pond			
			Unnamed Tributary	MA72-30_2002	X	-Cause Unknown -Nutrients -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Taste, odor and color -Turbidity
				MA72-31_2002	X	-Priority organics -Metals -(Other habitat alterations*) -Oil and grease -Taste, odor and color
				MA72-32_2002	X	-Pathogens
			Ward Pond			
			Welch Pond			
TOTAL KNOWN:		618				

Table A6. Chicopee Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
8011	0.73	Unknown	Moulton Pond	MA36098_2002		
8021	0.18	Unknown	Demond Pond Long Pond	MA36051_2002 MA36082_2002		
8132	1.45	Unknown	Bennett Street Pond Forest Lake Thompson Lake	MA36014_2002 MA36063_2002 MA36154_2002		
8209	0.24	Unknown	Moose Hill Reservoir Shaw Brook Shaw Pond	MA36179_2002 MA36138_2002		
8210	1.32	Unknown	Eames Pond	MA36056_2002	X	-Organic enrichment/Low DO -Noxious aquatic plants
			Moose Hill Reservoir Sugden Reservoir	MA36179_2002 MA36150_2002	X	-Nutrients [4/12/2002-CN118.0] -Organic enrichment/Low DO [4/12/2002-CN118.0] -Turbidity [4/12/2002-CN118.0]
			Thompsons Pond Turkey Hill Brook Turkey Hill Pond	MA36155_2002 MA36157_2002		
8218	0.83	Unknown	Cider Millpond Cranberry River Lake Whittemore Morgan Swamp Sevenmile River	MA36-20_2002 MA36165_2002 MA36-11_2002 MA36-12_2002	X X X X	-Chlorine -Turbidity -Pathogens -Pathogens
8281	0.30	Unknown	Calkins Pond Chicopee Brook Smith Pond	MA36-21_2002		
8286	0.12	Unknown	Conant Brook			
8289	0.48	Unknown	Chicopee Brook Chicopee Brook Pond Paradise Lake	MA36-21_2002 MA36031_2002 MA36116_2002		
8291	0.35	Unknown	Chicopee Brook	MA36-21_2002		
8293	2.29	Unknown	Chicopee Brook Knox Pond Quaboag River	MA36-21_2002 MA36-16_2002 MA36-17_2002	X X	-Pathogens -Taste, odor and color -Pathogens
8324	0.45	Unknown	Calkins Brook Twelvemile Brook	MA36-26_2002		
8326	0.58	Unknown	Calkins Brook Maxwell Brook Twelvemile Brook	MA36-26_2002		
8328	0.77	Unknown	Chicopee River Spectacle Pond	MA36-23_2002 MA36-24_2002 MA36142_2002	X X X	-Pathogens -Pathogens -Noxious aquatic plants [4/12/2002-CN118.0]
8329	1.65	Unknown	Chicopee River Minechoag Pond	MA36-24_2002 MA36093_2002	X X	-Pathogens -Noxious aquatic plants [4/12/2002-CN118.0]

Table A6. Chicopee Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
8331	0.07	Unknown	Chicopee River Dimmock Pond Gamache Pond Murphy Pond Pickerel Pond Wood Pond	MA36-24_2002 MA36053_2002 MA36103_2002	X	-Pathogens
8345	7.55	Unknown	Abbey Brook Chicopee River Cooley Brook Fivemile Pond Fivemile Pond South Lake Lorraine Long Pond Mona Lake	MA36-24_2002 MA36061_2002 MA36182_2002 MA36084_2002 MA36083_2002 MA36094_2002	X X X	-Pathogens -Noxious aquatic plants [4/12/2002-CN118.0] -Noxious aquatic plants [4/12/2002-CN118.0]
8347	12.00	Unknown	Bemis Pond Chicopee River	MA36011_2002 MA36-24_2002 MA36-25_2002	X X X	-Suspended solids -Pathogens -Pathogens

Table A7. Concord Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
14003	11.80	Unknown	Eaton Pond Hop Brook Little Bummet Brook Smith Pond	MA82099_2002		
14004	0.01	Unknown	Assabet River	MA82B-01_2002	X	-Nutrients -Organic enrichment/Low DO -Pathogens
			Assabet River Reservoir	MA82004_2002	X	-Metals -Noxious aquatic plants -Turbidity -(Exotic species*)
14008	3.61	Unknown	Cushing Swamp Rawson Hill Brook			
14009	3.30	Unknown	Cold Harbor Brook Rocky Pond	MA82095_2002		
14010	0.89	Unknown	Howard Brook			
14011	5.20	Unknown	Assabet River	MA82B-01_2002	X	-Nutrients -Organic enrichment/Low DO -Pathogens
				MA82B-02_2002	X	-Metals -Nutrients -Organic enrichment/Low DO -Pathogens
				MA82B-03_2002	X	-Nutrients -Pathogens
				MA82B-04_2002	X	-Cause Unknown -Metals -Nutrients -Organic enrichment/Low DO -Pathogens
			Hocomonco Pond	MA82060_2002	X	-Priority organics -Noxious aquatic plants
			Milham Reservoir Muddy Pond Solomon Pond	MA82077_2002 MA82100_2002		
14013	2.75	Unknown	Assabet River	MA82B-03_2002	X	-Nutrients -Pathogens
			Bartlett Pond Chauncy Lake Crane Swamp Little Chauncy Pond Stirrup Brook	MA82007_2002 MA82017_2002 MA82070_2002		
14014	0.28	Unknown	Clamshell Pond Wrack Meadow	MA82018_2002		
14020	0.06	Unknown	North Brook			
14021	1.81	Unknown	Barefoot Brook North Brook			
14028	3.13	Unknown	Assabet River	MA82B-04_2002	X	-Cause Unknown -Metals -Nutrients -Organic enrichment/Low DO -Pathogens
			Crystal Spring Gates Pond Gates Pond Brook Hog Swamp Muddy Pond Tripp Pond	MA82047_2002 MA82B-10_2002 MA82107_2002		
14029	1.61	Unknown	Williams Lake	MA82121_2002		

Table A7. Concord Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
14031	4.74	Unknown	Howe Pond Milham Reservoir Millham Brook Millham Brook North Branch	MA82077_2002		
14033	3.71	Unknown	Flagg Swamp Fort Meadow Brook Fort Meadow Reservoir	MA82B-11_2002 MA82042_2002	X	-Nutrients
14037	4.55	Unknown	Elizabeth Brook Horse Meadows			
14041	1.21	Unknown	Elizabeth Brook Hiley Meadows	MA82B-12_2002	X	-Cause Unknown
14042	8.58	Unknown	Foss Reservoir Framingham Reservoir #3 Willow Brook	MA82046_2002		
14043	1.90	Unknown	Birch Meadow Brook			
14044	0.25	Unknown	Framingham Reservoir #3	MA82046_2002		
14045	2.75	Unknown	Gleasons Pond Waushacum Pond	MA82048_2002 MA82112_2002		
14046	0.02	Unknown	Assabet River	MA82B-04_2002	X	-Cause Unknown -Metals -Nutrients -Organic enrichment/Low DO -Pathogens
				MA82B-05_2002	X	-Nutrients -Organic enrichment/Low DO -Pathogens
				MA82B-06_2002	X	-Priority organics -Metals -Nutrients -Organic enrichment/Low DO -Thermal modifications -Taste, odor and color -Suspended solids -Noxious aquatic plants
			Fort Meadow Brook Taylor Brook	MA82B-11_2002 MA82B-08_2002		
14047	0.64	Unknown	Beaver Dam Brook			
14048	1.42	Unknown	Bracket Reservoir Framingham Reservoir #1	MA82044_2002	X	-Metals -Noxious aquatic plants -(Exotic species*)
			Framingham Reservoir #2	MA82045_2002	X	-Metals -Turbidity
			Framingham Reservoir #3 Sudbury River	MA82046_2002 MA82A-02_2002	X	-Metals
14049	0.03	Unknown	Eames Brook	MA82A-13_2002	X	-Cause Unknown -Noxious aquatic plants -(Exotic species*)
			Farm Pond	MA82035_2002	X	-Noxious aquatic plants -Turbidity -(Exotic species*)
14050	1.29	Unknown	Guggins Brook			
14052	1.17	Unknown	Fisk Pond	MA82038_2002		
14054	0.00	Unknown	Lake Cochituate	MA82127_2002	X	-Priority organics -Organic enrichment/Low DO

Table A7. Concord Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment		
14081	1.88	Unknown	Lake Cochituate	MA82020_2002	X	-Priority organics -Organic enrichment/Low DO		
				MA82125_2002	X	-Priority organics -Organic enrichment/Low DO		
				MA82126_2002	X	-Priority organics		
				MA82127_2002	X	-Priority organics -Organic enrichment/Low DO		
14082	7.86	Unknown	Eames Brook	MA82A-13_2002	X	-Cause Unknown -Noxious aquatic plants -(Exotic species*)		
				Framingham Reservoir #1	MA82044_2002	X	-Metals -Noxious aquatic plants -(Exotic species*)	
			Learned Pond Norton Pond Saxonville Pond	MA82069_2002				
				MA82097_2002	X	-Metals -Noxious aquatic plants -(Exotic species*)		
				MA82A-02_2002	X	-Metals		
			Sudbury River	MA82A-03_2002	X	-Metals		
14083	0.57	Unknown	Haynard Brook					
14084	1.23	Unknown	Folsom Pond					
			Pine Brook	MA82A-14_2002	X	-Cause Unknown		
			Sudbury River	MA82A-03_2002	X	-Metals		
14087	0.45	Unknown	Hager Pond	MA82056_2002	X	-Nutrients -Pathogens -Noxious aquatic plants -Turbidity		
				MA82A-15_2002	X	-Nutrients -Organic enrichment/Low DO -Suspended solids -Noxious aquatic plants		
			Unnamed Tributary	MA82A-16_2002	X	-Nutrients -Organic enrichment/Low DO -Suspended solids -Noxious aquatic plants		
14091	0.29	Unknown	Carding Mill Pond	MA82015_2002	X	-Nutrients -Noxious aquatic plants		
				Crystal Lake Cutting Pond Grist Mill Pond	MA82055_2002	X	-Nutrients -Pathogens -Noxious aquatic plants	
			Hop Brook	MA82A-05_2002	X	-Nutrients -Organic enrichment/Low DO -Suspended solids -Noxious aquatic plants		
				Run Brook Stearns Mill Pond	MA82104_2002	X	-Nutrients -Noxious aquatic plants -Turbidity	
			Unnamed Tributary	MA82A-16_2002	X	-Nutrients -Organic enrichment/Low DO -Suspended solids -Noxious aquatic plants		
				MA82A-17_2002	X	-Nutrients -Organic enrichment/Low DO -Suspended solids -Noxious aquatic plants		
			Willis Lake	MA82122_2002				

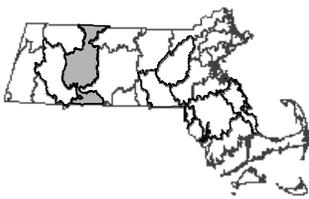
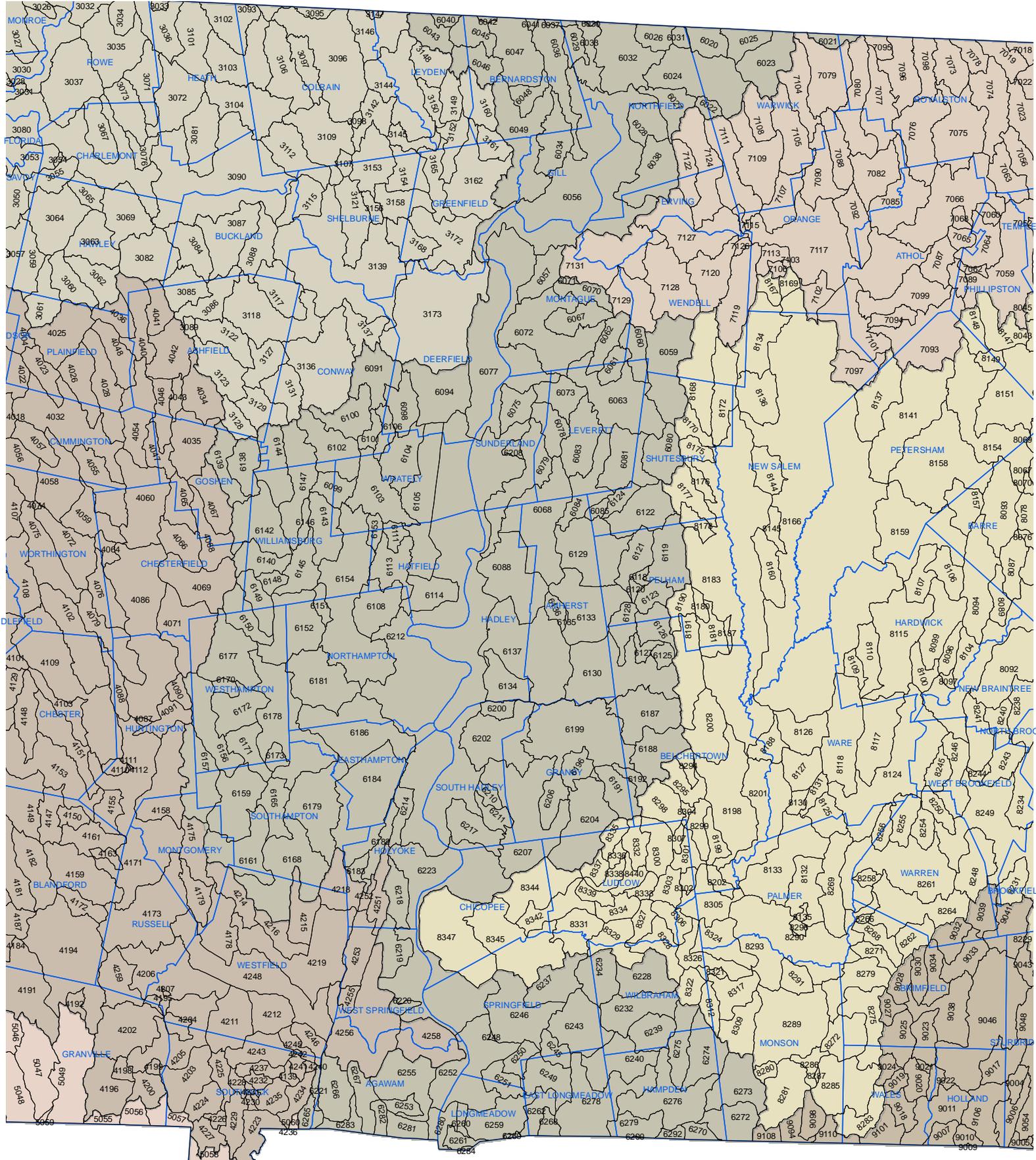
Table A7. Concord Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
14093	2.19	Unknown	Blanford Pond Carding Millpond Dudley Brook Hop Brook	MA82A-05_2002	X	-Nutrients -Organic enrichment/Low DO -Suspended solids -Noxious aquatic plants
14094	0.57	Unknown	Hop Brook	MA82A-05_2002	X	-Nutrients -Organic enrichment/Low DO -Suspended solids -Noxious aquatic plants
14109	2.92	16	Dugan Brook Fairhaven Bay Goose Pond Kennedys Pond Sudbury River Walden Pond	MA82A-04_2002 MA82109_2002	X X	-Metals -Metals -Organic enrichment/Low DO
14358	0.85	Unknown	Crane Swamp Little Chauncy Pond Little Crane Swamp Wachusett Aqueduct			
14401	2.45	7	Crosby Pond Fairyland Pond Goose Pond Little Goose Pond Mill Brook	MA82A-20_2002		
14404	3.40	0	Mill Brook Nutting Lake	MA82088_2002 MA82124_2002	X X	-Metals -(Exotic species*) -Metals
14407	0.65	0	Assabet River Concord River Great Meadows Great Meadows Pond #3 Mill Brook Sudbury River Yellow Birch Swamp	MA82B-07_2002 MA82A-07_2002 MA82053_2002 MA82A-20_2002 MA82A-04_2002	X X X	-Nutrients -Organic enrichment/Low DO -Pathogens -Metals -Nutrients -Pathogens -Metals
14408	0.86	Unknown	Elm Street Pond Evans Brook Fiske Street Pond Heart Pond Meadow Pond Pond Brook River Meadow Brook Russell Millpond Tophet Swamp Unnamed Tributary	MA82032_2002 MA82037_2002 MA82059_2002 MA82129_2002 MA82096_2002 MA82A-21_2002		
14410	10.41	94	Tadmuck Swamp			
14413	35.61	211	Farley Brook Old Middlesex Canal Putnam Brook River Meadow Brook Russell Millpond	MA82A-10_2002 MA82096_2002	X	-Pathogens

Table A7. Concord Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
14415	2.45	2	Concord River	MA82A-07_2002	X	-Metals -Nutrients -Pathogens
			Winning Pond	MA82123_2002		
14417	10.48	122	Concord River	MA82A-07_2002	X	-Metals -Nutrients -Pathogens
				MA82A-08_2002	X	-Metals -Nutrients
				MA82A-09_2002	X	-Metals -Nutrients -Pathogens
			Meadow Brook			
			River Meadow Brook	MA82A-10_2002	X	-Pathogens
14512	3.03	Unknown	Whitehall Brook	MA82A-11_2002		
14518	6.54	Unknown	Cedar Swamp			
			Piccadilly Brook			
			Rutters Brook			
			Sudbury River	MA82A-01_2002		
				MA82A-02_2002	X	-Metals
			Whitehall Brook	MA82A-11_2002		
14520	3.05	Unknown	Duck Pond			
			Hopkinton Reservoir	MA82061_2002	X	-Organic enrichment/Low DO -(Exotic species*)
			Icehouse Pond			
			Indian Brook	MA82A-12_2002	X	-Cause Unknown
14528	2.18	Unknown	Indian Brook	MA82A-12_2002	X	-Cause Unknown
			Sudbury River	MA82A-02_2002	X	-Metals
14535	0.77	Unknown	Broad Meadow Brook			
			Sudbury Reservoir	MA82106_2002	X	-Metals
14537	10.09	Unknown	Crane Meadow			
			Sudbury Reservoir	MA82106_2002	X	-Metals
			Wachusett Aqueduct			
14743	0.07	Unknown	Elizabeth Brook	MA82B-12_2002	X	-Cause Unknown
			Ministers Pond			
14755	3.12	Unknown	Fort Pond	MA82043_2002		
			Fort Pond Brook	MA82B-13_2002		
			Grassy Pond			
			Grassy Pond Brook			
			Guggins Brook			
			Long Pond	MA82072_2002	X	-Nutrients -Organic enrichment/Low DO -Noxious aquatic plants
14757	0.62	Unknown	Nagog Pond	MA82082_2002		
14760	0.13	Unknown	Heath-Hen Meadow Brook			
			Muddy Brook			
14761	7.61	Unknown	Barkers Pond			
			Coles Brook			
			Fort Pond Brook	MA82B-13_2002		
			Partridge Pond			
			Pratts Brook			
14762	11.72	Unknown	Butter Brook			
			Cobbs Pond			
			Evans Brook			
			Nashoba Brook	MA82B-14_2002		
			Nashua Brook			
			Nonset Brook			
			Vine Brook			

Table A7. Concord Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
14763	4.73	1	Conant Brook Ice House Pond Nagog Brook Nashoba Brook Nashua Brook Wills Hole	MA82066_2002 MA82B-14_2002		
14765	1.07	0	Fort Pond Brook Nashoba Brook Warners Pond	MA82B-13_2002 MA82B-14_2002 MA82110_2002	X	-Metals -Noxious aquatic plants -(Exotic species*)
14770	3.71	6	Assabet River Dakins Brook Second Division Brook Unnamed Tributary Warners Pond	MA82B-06_2002 MA82B-07_2002 MA82B-09_2002 MA82B-16_2002	X X	-Priority organics -Metals -Nutrients -Organic enrichment/Low DO -Thermal modifications -Taste, odor and color -Suspended solids -Noxious aquatic plants -Nutrients -Organic enrichment/Low DO -Pathogens
14795	0.36	Unknown	Hop Brook Wash Brook	MA82A-05_2002 MA82A-06_2002	X X	-Nutrients -Organic enrichment/Low DO -Suspended solids -Noxious aquatic plants -Nutrients -Pathogens -Suspended solids -Noxious aquatic plants
14797	0.24	Unknown	Dudley Pond Heard Pond Norton Pond Pod Meadow Sudbury River Wash Brook	MA82029_2002 MA82058_2002 MA82A-03_2002 MA82A-04_2002 MA82A-06_2002	X X X X X	-Turbidity -(Exotic species*) -Metals -Noxious aquatic plants -(Exotic species*) -Metals -Metals -Nutrients -Pathogens -Suspended solids -Noxious aquatic plants
TOTAL KNOWN:		459				

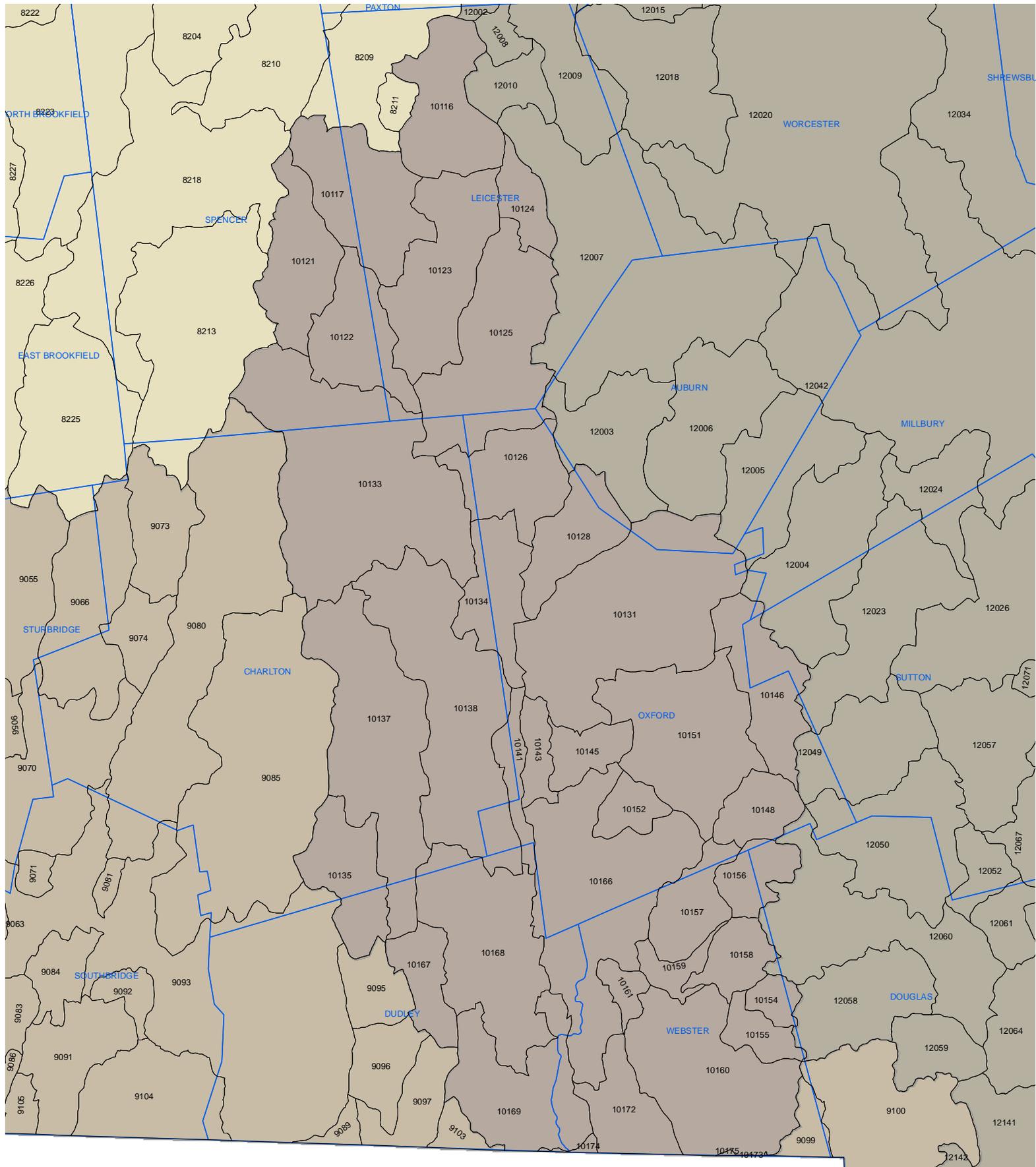


Appendix A
Sub-Basin
Identification Maps:
CONNECTICUT

Table A8. Connecticut Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
6114	4.86	Unknown	Mill River	MA34-24_2002		
6137	0.41	Unknown	Fort River Plum Brook	MA34-27_2002		
6154	1.00	Unknown	Beaver Brook Florence Pond Florence Stream Fuller Pond Grass Hill Brook Mill River Nungee Brook Nungee Swamp Potash Brook	MA34-28_2002		
6179	0.09	Unknown	Hackmatack Swamp Manhan River Manhan River South Branch Pomeroy's Meadow Potash Brook Tripple Brook	MA34-11_2002 MA34-12_2002 MA34-16_2002		
6184	0.65	Unknown	Brickyard Brook Broad Brook Lower Mill Pond Nashawannuck Pond Rubber Thread Pond White Brook Wilton Brook	MA34-18_2002 MA34048_2002 MA34057_2002 MA34105_2002 MA34-14_2002 MA34-15_2002	X X	-Nutrients -Organic enrichment/Low DO -Noxious aquatic plants -Turbidity -Noxious aquatic plants
6186	1.62	Unknown	Bassett Brook Hannum Brook Manhan River	MA34-11_2002		
6188	0.16	Unknown	Lampson Brook Weston Brook	MA34-06_2002 MA34-23_2002	X X	-Unionized Ammonia -Chlorine -Nutrients -Organic enrichment/Low DO -Unionized Ammonia -Chlorine -Nutrients -Organic enrichment/Low DO -Pathogens
6199	0.13	Unknown	Aldrich Lake Bachelor Brook Forge Pond Porter Swamp Weston Brook	MA34002_2002 MA34106_2002 MA34-07_2002 MA34024_2002 MA34-23_2002	X X X	-Noxious aquatic plants [4/12/2002-CN112.0] -Noxious aquatic plants [4/12/2002-CN112.0] -Nutrients -Noxious aquatic plants -(Exotic species*) -Unionized Ammonia -Chlorine -Nutrients -Organic enrichment/Low DO -Pathogens
6202	0.86	Unknown	Bachelor Brook Elmer Brook Pitchawam Swamp	MA34-07_2002		
6206	0.33	Unknown	Muddy Brook			

Table A8. Connecticut Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
6207	2.36	Unknown	Lower Pond	MA34049_2002	X	-Noxious aquatic plants -(Exotic species*)
			Pitchawam Swamp			
			Slabbery Pond			
			Snows Pond			
			Stony Brook	MA34-19_2002		
			Upper Pond	MA34095_2002		-(Exotic species*)
6210	0.36	Unknown	Stony Brook	MA34-19_2002		
6211	1.12	Unknown	Leaping Well Brook			
			Leaping Well Reservoir	MA34040_2002	X	-Noxious aquatic plants
			Stony Brook	MA34-19_2002		
6212	18.04	Unknown	Bachelor Brook	MA34-07_2002		
			Conn River Brook			
			Connecticut River	MA34-04_2002	X	-Priority organics -Pathogens
				MA34-05_2002	X	-Priority organics -Pathogens -Suspended solids
			Cow Bridge Brook			
			Danks Pond	MA34019_2002		
			Dry Brook			
			Fort River	MA34-27_2002		
			Great Pond			
			Greene Swamp			
			Hulberts Pond	MA34036_2002		-(Flow alteration*)
			Lake Bray	MA34013_2002		-(Exotic species*)
			Lake Warner	MA34098_2002		-Nutrients [4/12/2002-CN112.0] -Organic enrichment/Low DO [4/12/2002-CN112.0] -Noxious aquatic plants [4/12/2002-CN112.0] -Turbidity [4/12/2002-CN112.0] -(Exotic species*)
			Log Pond Cove	MA34124_2002	X	-Priority organics -(Exotic species*)
			Manhan River	MA34-11_2002		
			Mill River	MA34-24_2002		
				MA34-28_2002		
			Mill River Diversion	MA34-32_2002		
			Mohawk Brook			
			Neds Ditch			
			Oxbow	MA34066_2002	X	-Turbidity
			Rocky Hill Pond			
			Russell Cove			
			Serendipity Stream			
			Stony Brook	MA34-19_2002		
			Sugarloaf Brook			
			Superstition Stream			
			Unnamed Tributary	MA34-31_2002		
			White Brook			
6214	0.21	Unknown	Superstition Stream			
			Whiting Street Reservoir	MA34101_2002		-(Exotic species*)
6217	5.45	Unknown	Buttery Brook			
			Taylor Pond			
6218	4.56	Unknown	Clear Pond			
			Tannery Brook			
6219	3.68	Unknown	Goldine Brook			
			Schoolhouse Brook			

Table A8. Connecticut Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
6220	0.19	Unknown	Piper Brook			
6223	61.05	Unknown	1St Level Canal 2Nd Level Canal Connecticut River	MA34-05_2002	X	-Priority organics -Pathogens -Suspended solids
			Mountain Lake	MA34055_2002	X	-Noxious aquatic plants -Turbidity
			Slabbery Pond Upper Van Horn Park Pond	MA34128_2002	X	-Nutrients -Noxious aquatic plants -Turbidity
			Van Horn Reservoir			
6228	0.47	Unknown	Cedar Swamp Nine Mile Pond	MA34127_2002		
6234	0.63	Unknown	North Branch Mill River			
6237	0.01	Unknown	Loon Pond	MA34045_2002	X	-Nutrients [4/12/2002-CN112.0] -Noxious aquatic plants [4/12/2002-CN112.0]
			North Branch Mill River			
6246	1.16	Unknown	Dan Baker Cove Island Pond Lake Lookout	MA34044_2002	X	-Noxious aquatic plants -Turbidity
			Mill River Noonan Cove	MA34-29_2002 MA34058_2002	X	-Noxious aquatic plants -Turbidity
			Venture Pond	MA34096_2002	X	-Nutrients -Organic enrichment/Low DO -Noxious aquatic plants -Turbidity
			Watershops Pond	MA34099_2002	X	-Noxious aquatic plants -Turbidity
6252	17.97	Unknown	Connecticut River	MA34-05_2002	X	-Priority organics -Pathogens -Suspended solids
			Cooley Brook Mill River Wheel Meadow Brook	MA34-20_2002 MA34-29_2002		
6255	12.86	Unknown	Silver Lake Three Mile Brook	MA34084_2002		
6260	2.57	Unknown	Longmeadow Brook	MA34-21_2002		
6261	1.51	Unknown	Raspberry Brook	MA34-22_2002		
6267	0.12	Unknown	Philo Brook Taylor Pond			
6280	0.62	Unknown	Connecticut River	MA34-05_2002	X	-Priority organics -Pathogens -Suspended solids
			Longmeadow Brook Raspberry Brook	MA34-21_2002 MA34-22_2002		
6281	0.00	Unknown	Fourmile Brook Worthington Brook			

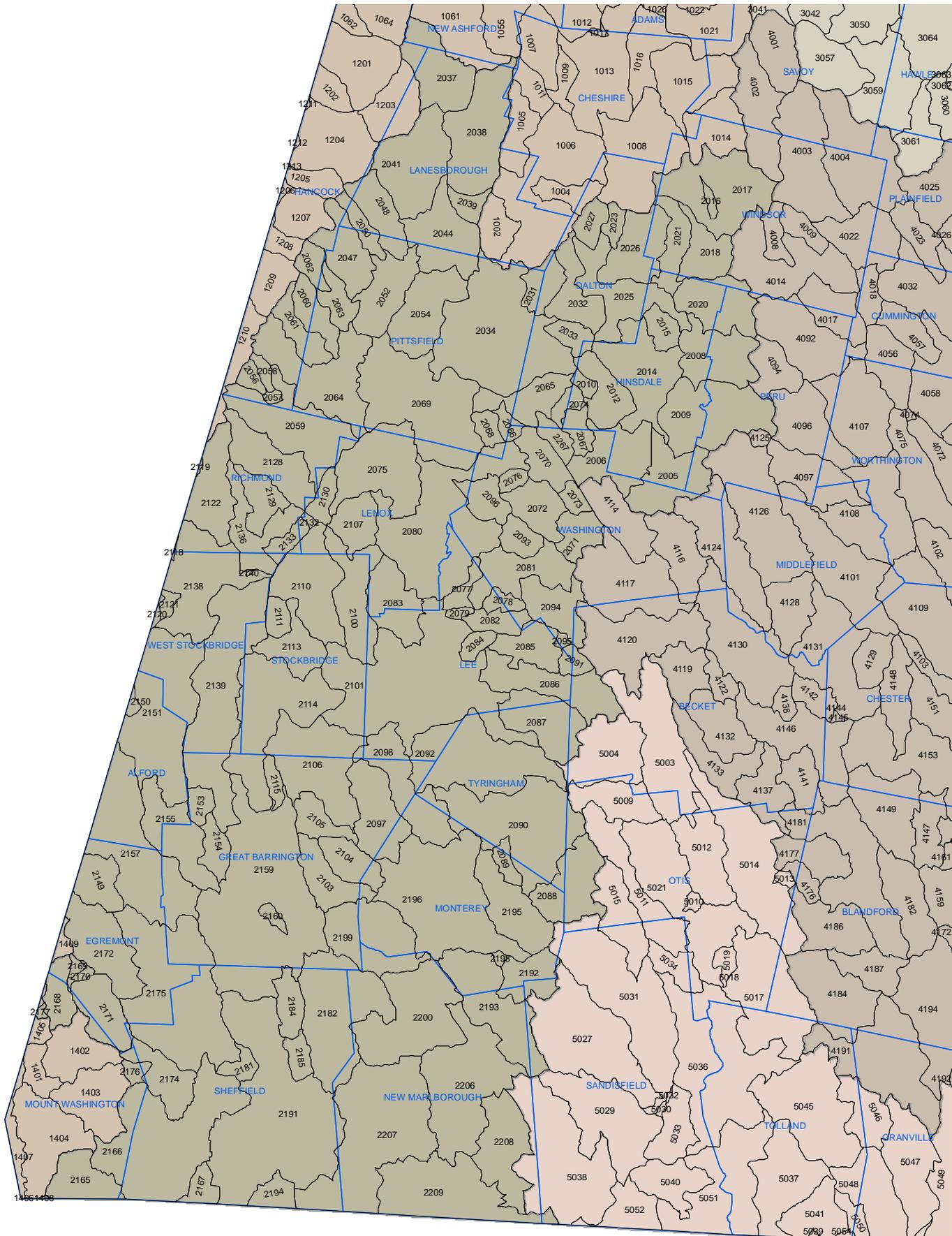


Appendix A
Sub-Basin
Identification Maps:
FRENCH



Table A9. French Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
10117	1.38	Unknown	Burncoat Brook Burncoat Pond Cedar Meadow Pond	MA42-07_2002 MA42007_2002 MA42009_2002		
10123	0.86	Unknown	Ballard Hill Pond Bartons Brook Bouchard Pond Burncoat Brook Dutton Pond Greenville Pond Greenville Pond West Town Meadow Brook	MA42069_2002 MA42-08_2002 MA42003_2002 MA42-07_2002 MA42015_2002 MA42023_2002 MA42022_2002 MA42-01_2002 MA42-02_2002	X X	-Nutrients [7/12/2002-CN110.0] -Noxious aquatic plants [7/12/2002-CN110.0] -Turbidity [7/12/2002-CN110.0]
10124	0.16	Unknown	Henshaw Pond	MA42025_2002		
10125	0.01	Unknown	French River Great Cedar Swamp Greenville Pond Grindstone Brook Rochdale Pond	MA42-03_2002 MA42023_2002 MA42048_2002	X X X	-Metals -Turbidity [7/12/2002-CN110.0] -Nutrients [7/12/2002-CN110.0] -Organic enrichment/Low DO [7/12/2002-CN110.0] -Noxious aquatic plants [7/12/2002-CN110.0]
10126	0.26	Unknown	French River Texas Pond	MA42-03_2002 MA42058_2002	X X	-Metals -Metals -Noxious aquatic plants [7/12/2002-CN110.0]
10128	2.49	Unknown	French River Thayers Pond	MA42-03_2002 MA42-04_2002 MA42059_2002	X X	-Metals -Metals -Nutrients -Turbidity
10131	8.27	Unknown	Carbuncle Pond Cedar Swamp Chimney Pond French River Stumpy Pond Thayers Pond Unnamed Tributary Wellington Brook	MA42008_2002 MA42-04_2002 MA42059_2002 MA42-12_2002 MA42-11_2002	X	-Metals -Nutrients -Turbidity
10133	0.01	Unknown	Hammond Pond Hultered Pond Jones Pond Little Nugget Lake Little River Pikes Pond Snow Pond Tucker Pond Wee Laddie Pond	MA42072_2002 MA42030_2002 MA42032_2002 MA42-09_2002 MA42044_2002 MA42054_2002 MA42065_2002	X X X	-Noxious aquatic plants [7/12/2002-CN110.0] -Metals -Turbidity [7/12/2002-CN110.0]
10137	0.08	Unknown	Dodge Pond Granite Reservoir Hultered Pond Shepherd Pond South Charlton Reservoir	MA42019_2002 MA42051_2002	X	-Noxious aquatic plants [7/12/2002-CN110.0]

Table A9. French Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
10151	4.23	Unknown	Eames Pond Lowes Pond Mckinstry Pond	MA42034_2002 MA42035_2002	X X	-Noxious aquatic plants [7/12/2002-CN110.0] -Noxious aquatic plants [7/12/2002-CN110.0]
10152	2.16	Unknown	Lowes Brook			
10159	1.54	Unknown	Club Pond Webster Lake	MA42064_2002		
10160	7.23	Unknown	Bates Cove Cedar Swamp Lake Chaubunagungamaug Middle Pond Mill Brook Narrows North Pond Pout Pond Reid Smith Cove South Pond Sucker Brook Cove Webster Lake Winter Cove	MA42-10_2002 MA42064_2002		
10161	0.32	Unknown	Mill Brook	MA42-10_2002		
10166	7.17	Unknown	French River Mill Brook	MA42-04_2002 MA42-05_2002 MA42-10_2002	X	-Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Taste, odor and color -(Objectionable deposits*)
10168	0.32	Unknown	French River Hayden Pond Larner Pond Low Pond Merino Pond Mosquito Pond New Pond Peter Pond Pierpoint Meadow Pond Wallis Pond	MA42-05_2002 MA42024_2002 MA42068_2002 MA42033_2002 MA42036_2002 MA42060_2002 MA42037_2002 MA42042_2002 MA42043_2002 MA42062_2002	X X X X X	-Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Taste, odor and color -(Objectionable deposits*) -Noxious aquatic plants [7/12/2002-CN110.0] -Noxious aquatic plants [7/12/2002-CN110.0] -Nutrients [7/12/2002-CN110.0] -Organic enrichment/Low DO [7/12/2002-CN110.0] -Organic enrichment/Low DO [7/12/2002-CN110.0] -Noxious aquatic plants [7/12/2002-CN110.0]
10169	2.35	Unknown	Conant Pond French River Packard Pond Potash Brook	MA42-05_2002 MA42-06_2002 MA42040_2002	X X	-Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Taste, odor and color -(Objectionable deposits*) -Nutrients -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Taste, odor and color -Turbidity -(Objectionable deposits*)



Appendix A
Sub-Basin
Identification Maps:
HOUSATONIC

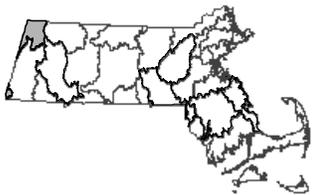


Table A10. Housatonic Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
2014	0.67	Unknown	East Branch Housatonic River Frisell Brook	MA21-01_2002	X	-Priority organics
2025	0.77	Unknown	Anthony Brook Center Pond Cleveland Brook East Branch Housatonic River Egypt Reservoir Wahconah Falls Brook	MA21-10_2002 MA21016_2002 MA21-08_2002 MA21-01_2002 MA21-11_2002	X X X	-Priority organics -Priority organics
2026	0.64	Unknown	Little Egypt Reservoir Wahconah Falls Brook Weston Brook Windsor Reservoir	MA21-11_2002		
2031	0.77	Unknown	East Branch Housatonic River	MA21-02_2002	X	-Cause Unknown -Unknown toxicity -Priority organics -Pathogens
2032	1.93	Unknown	Center Pond East Branch Housatonic River Walker Brook	MA21016_2002 MA21-01_2002 MA21-02_2002	X X X	-Priority organics -Priority organics -Cause Unknown -Unknown toxicity -Priority organics -Pathogens
2034	5.59	Unknown	Barton Brook Brattle Brook East Branch Housatonic River Goodrich Pond Silver Lake Unkamet Brook	MA21-02_2002 MA21042_2002	X	-Cause Unknown -Unknown toxicity -Priority organics -Pathogens
2039	0.76	Unknown	Town Brook			
2044	1.13	Unknown	Pontoosuc Lake Town Brook	MA21083_2002	X	-Metals -(Exotic species*)
2054	0.10	Unknown	Pecks Pond Pontoosuc Lake West Branch Housatonic River	MA21083_2002 MA21-18_2002	X X	-Metals -(Exotic species*) -Priority organics -Siltation -(Other habitat alterations*) -Pathogens
2064	1.28	Unknown	Cranberry Pond Jacoby Brook Mud Pond Shaker Brook Smith Brook Southwest Branch Housatonic River Twin Pond	MA21-17_2002	X	-Cause Unknown -Siltation -(Other habitat alterations*)

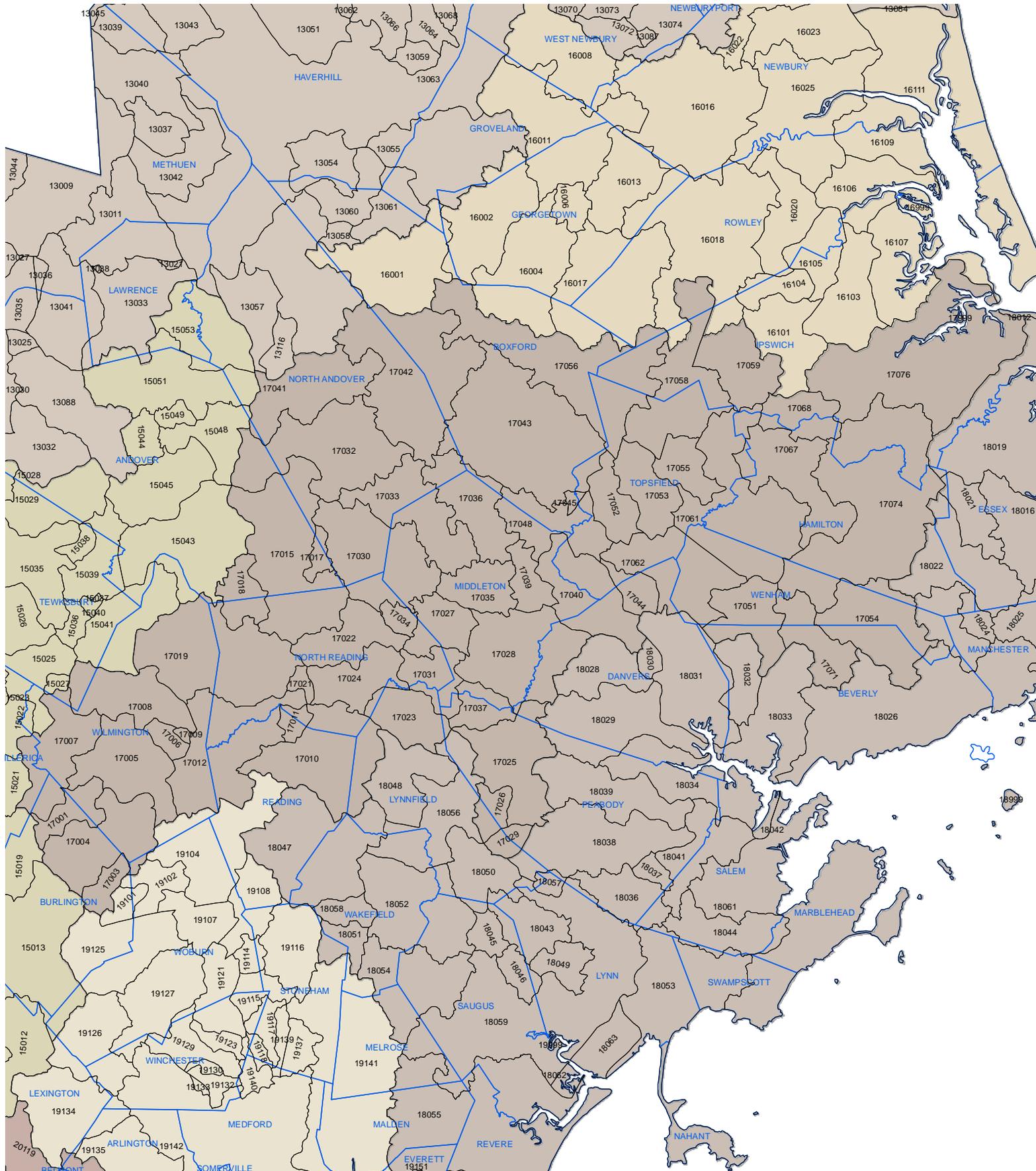
Table A10. Housatonic Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment	
2069	2.70	Unknown	East Branch Housatonic River	MA21-02_2002	X	-Cause Unknown -Unknown toxicity -Priority organics -Pathogens	
			Housatonic River	MA21-04_2002	X	-Priority organics -Pathogens -Turbidity	
			Maloy Brook Morewood Lake Sackett Brook				
			Southwest Branch Housatonic River	MA21-17_2002	X	-Cause Unknown -Siltation -(Other habitat alterations*)	
			West Branch Housatonic River	MA21-18_2002	X	-Priority organics -Siltation -(Other habitat alterations*) -Pathogens	
2075	1.34	Unknown	Yokun Brook				



Appendix A
Sub-Basin
Identification Maps:
HUDSON

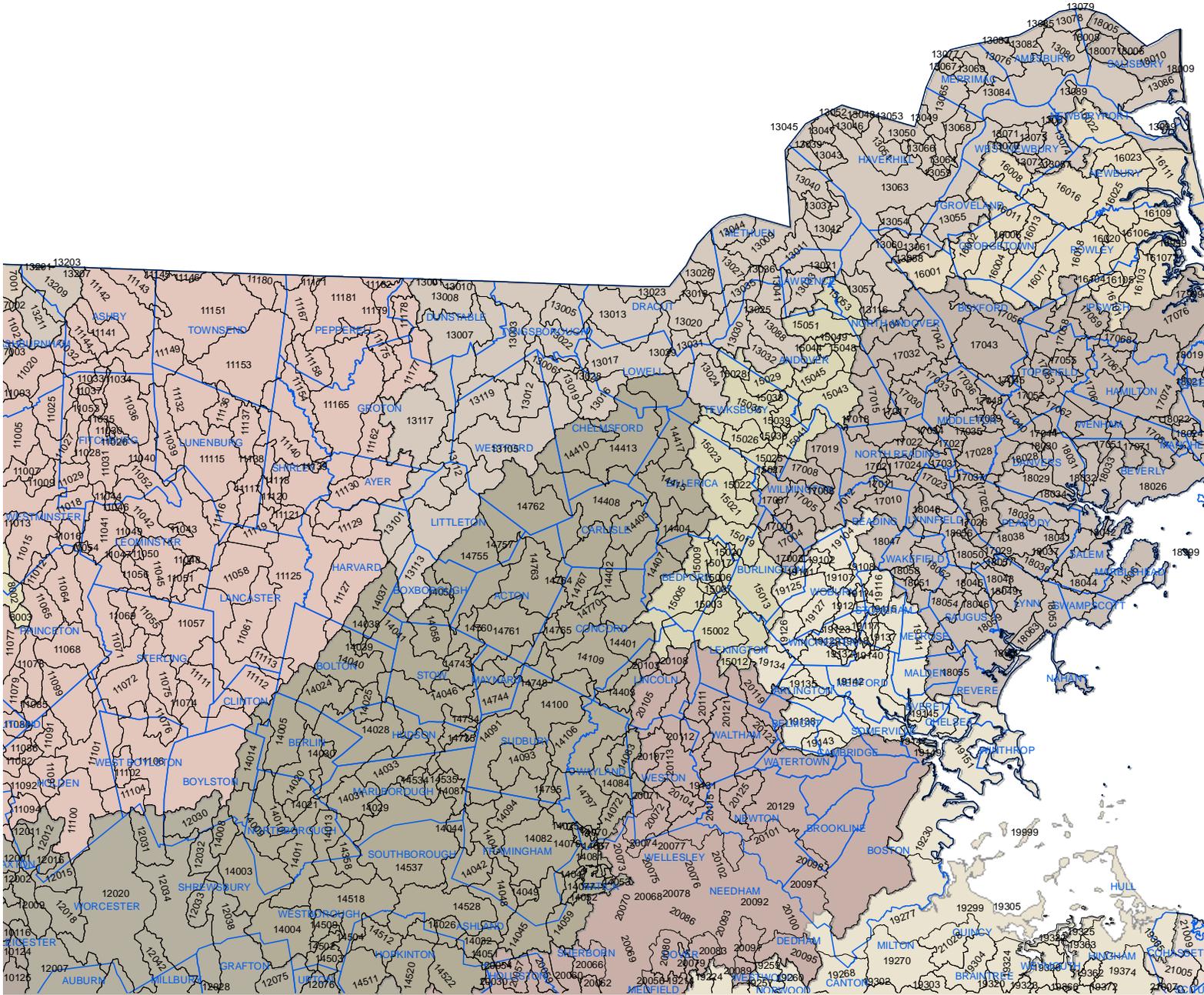
Table A11. Hudson Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
1004	0.00	Unknown	Gore Brook Gore Pond			
1006	2.38	Unknown	Berkshire Pond Cheshire Reservoir	MA11001_2002 MA11002_2002	X	-Nutrients -Noxious aquatic plants -Turbidity -(Exotic species*)
				MA11018_2002	X	-Noxious aquatic plants -Turbidity -(Exotic species*)
			Collins Brook Hoosic River	MA11019_2002 MA11-03_2002	X	-Cause Unknown -(Other habitat alterations*) -Pathogens



Appendix A
Sub-Basin
Identification Maps:
IPSWICH

Table A12. Ipswich Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
17004	1.62	0	Maple Meadow Brook Mill Pond Sawmill Brook	MA92-04_2002 MA92041_2002	X	-Metals
17005	2.06	6	Ipswich River Maple Meadow Brook	MA92-04_2002		
17007	0.46	4	Lubber Pond East Lubber Pond West Lubbers Brook Mud Pond	MA92035_2002 MA92036_2002 MA92-05_2002		
17008	2.48	14	Lubbers Brook Mud Pond Silver Lake	MA92-05_2002 MA92059_2002		
17010	0.87	3	Bear Meadow Brook Cedar Swamp	MA92-07_2002		
17012	8.45	36	Bear Meadow Brook Ipswich River	MA92-07_2002 MA92-06_2002	X	-Nutrients -(Flow alteration*)
17015	1.24	17	Bear Pond Brackett Pond Bradford Pond Collins Pond Field Pond Frye Pond Skug River	MA92004_2002 MA92005_2002 MA92010_2002 MA92019_2002 MA92023_2002	X X X	-Turbidity -Noxious aquatic plants -Turbidity -Noxious aquatic plants
17018	4.26	30	Martins Pond	MA92038_2002	X	-Metals -Noxious aquatic plants -Turbidity -(Exotic species*)
17019	11.50	70	Martins Brook Martins Pond	MA92-08_2002 MA92038_2002	X X	-Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Metals -Noxious aquatic plants -Turbidity -(Exotic species*)
17024	0.01	1	Ipswich River Unnamed Tributary Wills Brook	MA92-06_2002 MA92-09_2002 MA92-10_2002	X X	-Nutrients -(Flow alteration*) -Organic enrichment/Low DO -Pathogens
17025	2.54	10	Crystal Pond Devils Dishfull Pond Elginwood Pond Norris Brook Pierces Pond	MA92013_2002 MA92015_2002 MA92017_2002 MA92-11_2002 MA92048_2002	X X X	-Noxious aquatic plants -Noxious aquatic plants -Turbidity -Organic enrichment/Low DO -Suspended solids -Turbidity
17028	4.32	17	Ipswich River Norris Brook Unnamed Tributary	MA92-06_2002 MA92-11_2002 MA92-12_2002	X X X	-Nutrients -(Flow alteration*) -Organic enrichment/Low DO -Suspended solids -Turbidity -Pathogens
17029	1.72	3	Suntaug Lake	MA92065_2002		
17032	3.55	24	Boston Brook Farnum Street Pond	MA92-13_2002 MA92018_2002		

Table A12. Ipswich Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
17040	5.21	43	Nichols Brook Orne Swamp	MA92-25_2002		
17041	2.17	8	Mosquito Brook			
17043	4.62	79	Crooked Pond Fish Brook Howes Pond Kimballs Pond Towne Pond	MA92-14_2002 MA92026_2002 MA92068_2002		
17051	2.18	3	Cedar Pond Wenham Lake	MA92073_2002		
17053	0.95	4	Ipswich River	MA92-06_2002	X	-Nutrients -(Flow alteration*)
17055	0.58	1	Hassocky Meadow Mile Brook Pintail Pond Rockery Pond	MA92-16_2002		
17056	3.95	53	Fourmile Pond Hood Pond Lowe Pond Lower Four Mile Pond Pye Brook Spofford Pond Stevens Pond	MA92022_2002 MA92025_2002 MA92034_2002 MA92032_2002 MA92060_2002 MA92062_2002	X X	-Metals -Metals -(Exotic species*)
17058	2.28	2	Howlett Brook Mile Brook	MA92-17_2002 MA92-16_2002	X	-Pathogens
17061	0.00	1	Bunker Meadows Gravelly Brook Hassocky Meadow Howlett Brook Idlewild Brook Ipswich River Mile Brook Muddy Pond Pleasant Pond Salem Beverly Waterway Canal Wenham Swamp	MA92-18_2002 MA92-17_2002 MA92-24_2002 MA92-06_2002 MA92-15_2002 MA92-16_2002 MA92049_2002	X X X	-Pathogens -Nutrients -(Flow alteration*) -Organic enrichment/Low DO -(Flow alteration*)
17071	2.37	16	Beaver Pond Miles River Norwood Pond	MA92002_2002 MA92-03_2002	X	-Organic enrichment/Low DO -Pathogens
17074	1.50	3	Cutler Pond Long Causeway Brook Miles River	MA92-20_2002 MA92-03_2002	X	-Organic enrichment/Low DO -Pathogens
17076	1.72	4	Ipswich River Kimball Brook Labor In Vain Creek Miles River Ranfoul Pond Unnamed Tributary	MA92-02_2002 MA92-15_2002 MA92-21_2002 MA92-22_2002 MA92-03_2002 MA92-23_2002	X X X X X	-Pathogens -Organic enrichment/Low DO -(Flow alteration*) -Organic enrichment/Low DO -Pathogens -Organic enrichment/Low DO -Pathogens -Organic enrichment/Low DO -Pathogens
TOTAL:		452				



Appendix A
Sub-Basin
Identification Maps:
MERRIMACK

Table A13. Merrimack Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
13006	5.31	2	Deep Brook	MA84A-21_2002	X	-Unknown toxicity -Siltation -Organic enrichment/Low DO -Pathogens
13009	14.15	69	Mystic Pond Peat Meadow Spicket River	MA84A-10_2002	X	-Cause Unknown -Metals -Nutrients -(Other habitat alterations*) -Pathogens -(Objectionable deposits*)
13011	2.69	6	Searles Pond Spicket River	MA84A-10_2002	X	-Cause Unknown -Metals -Nutrients -(Other habitat alterations*) -Pathogens -(Objectionable deposits*)
13013	1.02	Unknown	Beaver Brook	MA84A-11_2002	X	-Cause Unknown -(Other habitat alterations*) -Pathogens -Oil and grease -Turbidity -(Objectionable deposits*)
			Double Brook Long Pond	MA84032_2002	X	-Metals -Noxious aquatic plants
			Peppermint Brook			
13016	6.38	5	Black Brook	MA84A-17_2002	X	-Unknown toxicity -Siltation -Pathogens -Turbidity
13017	9.49	36	Black Brook	MA84A-17_2002	X	-Unknown toxicity -Siltation -Pathogens -Turbidity
			Claypit Brook Concord River Eastern Canal Hamilton Canal Merrimack River	MA84A-01_2002	X	-Metals -Pathogens
				MA84A-02_2002	X	-Metals -Nutrients -(Flow alteration*) -Pathogens
			Northern Canal Pawtucket Canal Spruce Swamp Western Canal			
13018	0.09	0	Trout Brook	MA84A-13_2002		

Table A13. Merrimack Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment	
13019	4.29	5	Newfield Pond	MA84046_2002	X	-Metals -Organic enrichment/Low DO -Noxious aquatic plants -(Exotic species*)	
			Stony Brook	MA84B-04_2002	X	-Cause Unknown -Nutrients -pH -Organic enrichment/Low DO -Pathogens	
13020	0.90	9	Richardson Brook	MA84A-12_2002			
			Trout Brook	MA84A-13_2002			
13022	7.37	31	Deep Brook	MA84A-21_2002	X	-Unknown toxicity -Siltation -Organic enrichment/Low DO -Pathogens	
			Lawrence Brook	MA84A-20_2002			
			Limit Brook				
			Locust Pond	MA84031_2002	X	-Metals	
			Merrimack River	MA84A-01_2002	X	-Metals -Pathogens	
			Uptons Pond	MA84075_2002			
13024	7.68	91	Trull Brook	MA84A-14_2002			
13027	1.41	3	Bartlett Brook				
			Cedar Pond				
			Peters Pond				
13028	0.32	0	Merrimack River	MA84A-01_2002	X	-Metals -Pathogens	
			Stony Brook	MA84B-04_2002	X	-Cause Unknown -Nutrients -pH -Organic enrichment/Low DO -Pathogens	
13030	1.18	3	Merrimack River	MA84A-03_2002	X	-Priority organics -Metals -Nutrients -Pathogens	
13031	2.60	15	Merrimack River	MA84A-02_2002	X	-Metals -Nutrients -(Flow alteration*) -Pathogens	
				MA84A-03_2002	X	-Priority organics -Metals -Nutrients -Pathogens	
			Richardson Brook	MA84A-12_2002			
			Trull Brook	MA84A-14_2002			
13032	3.96	33	Haggets Pond	MA84022_2002	X	-Metals	

Table A13. Merrimack Basin

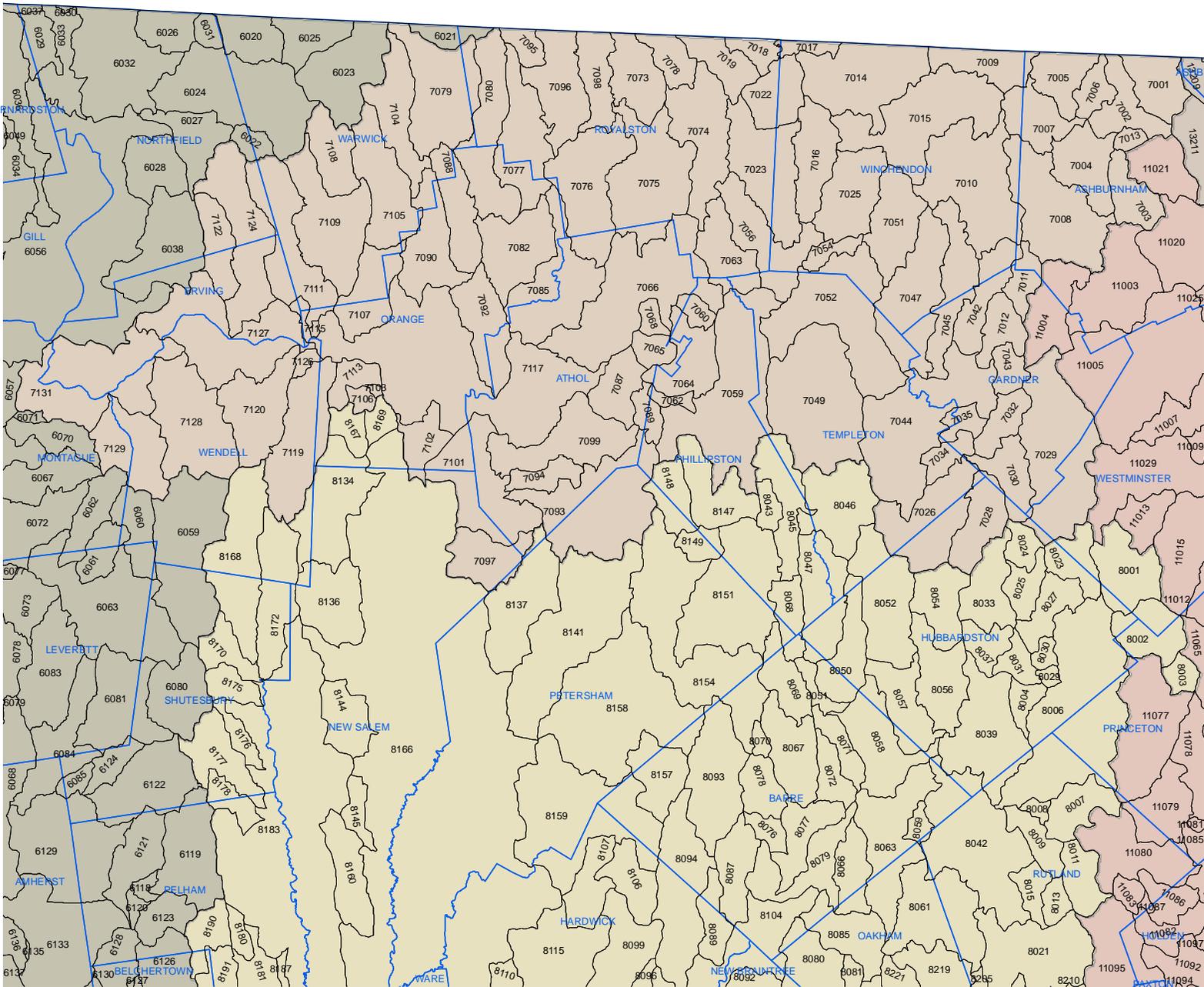
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
13033	0.84	2	Merrimack River	MA84A-03_2002	X	-Priority organics -Metals -Nutrients -Pathogens
				MA84A-04_2002	X	-Priority organics -Nutrients -Pathogens
			Spicket River	MA84A-10_2002	X	-Cause Unknown -Metals -Nutrients -(Other habitat alterations*) -Pathogens -(Objectionable deposits*)
13035	4.50	15	Griffin Brook Merrimack River	MA84A-03_2002	X	-Priority organics -Metals -Nutrients -Pathogens
			Mill Pond			
13036	2.30	9	Merrimack River	MA84A-03_2002	X	-Priority organics -Metals -Nutrients -Pathogens
13041	6.21	39	Merrimack River	MA84A-03_2002	X	-Priority organics -Metals -Nutrients -Pathogens
13042	7.43	32	Bare Meadow Brook	MA84A-18_2002	X	-Siltation -Organic enrichment/Low DO -Pathogens -Turbidity
			Hills Pond			
13050	7.25	85	Frye Pond Snows Brook			
13051	2.74	42	Little River	MA84A-09_2002	X	-(Other habitat alterations*) -Pathogens
13057	1.10	6	Stevens Pond Sutton Pond	MA84064_2002	X	-Metals
13063	0.69	6	Lake Cochichewick	MA84008_2002	X	-Metals
13065	1.84	7	East Meadow River Neal Pond			
13066	0.05	0	Kenoza Lake	MA84028_2002	X	-Metals
13068	0.20	6	Millvale Reservoir	MA84041_2002	X	-Metals
13069	0.03	0	Cobbler Brook	MA84A-22_2002	X	-Cause Unknown -Unknown toxicity
13071	0.30	2	Mill Pond	MA84039_2002		
13076	0.56	2	Black River Lake Attitash Powwow River	MA84002_2002 MA84A-28_2002	X X	-Metals -Pathogens -Suspended solids -Noxious aquatic plants -Turbidity
			Sargent Mill Pond Tuxbury Pond			

Table A13. Merrimack Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment		
13080	7.23	132	Back River	MA84A-16_2002	X	-Siltation -Pathogens -Turbidity		
			Lake Gardner					
			Pow Wow River					
			Powwow River	MA84A-08_2002	X	-Pathogens		
				MA84A-25_2002	X	-Pathogens -Suspended solids -Noxious aquatic plants -Turbidity		
13084	30.15	188	Back River					
			Bailey Pond	MA84003_2002				
			Boggy Meadows					
			Cobbler Brook	MA84A-22_2002	X	-Cause Unknown -Unknown toxicity		
			Goodwin Creek					
			Indian River					
			Merrimack River	MA84A-05_2002	X	-Priority organics -Unionized Ammonia -Pathogens		
				MA84A-06_2002	X	-Priority organics -Pathogens		
				MA84A-26_2002	X	-Pathogens		
			Plum Island River	MA84A-27_2002	X	-Pathogens		
			Plumbush Creek					
Powwow River	MA84A-08_2002	X	-Pathogens					
Presbus Creek								
Town Creek								
13086	0.75	0	Allen Creek					
			Black Rock Creek					
			Merrimack River	MA84A-06_2002	X	-Priority organics -Pathogens		
			Middle Creek					
13088	11.11	86	Fish Brook					
			Haggets Pond	MA84022_2002	X	-Metals		
13090	36.52	337	Bare Meadow Brook	MA84A-18_2002	X	-Siltation -Organic enrichment/Low DO -Pathogens -Turbidity		
			Creek Brook					
			Lake Saltonstall	MA84059_2002	X	-Metals		
			Little River	MA84A-09_2002	X	-(Other habitat alterations*) -Pathogens		
			Merrimack River	MA84A-04_2002	X	-Priority organics -Nutrients -Pathogens		
				MA84A-05_2002	X	-Priority organics -Unionized Ammonia -Pathogens		
						Sutton Pond		
13101	1.22	Unknown	Bennetts Brook					
			Black Pond					
			Forge Pond	MA84015_2002				
			Gibson Brook					
			New Estate Swamp					
			Spectacle Pond	MA84089_2002	X	-Organic enrichment/Low DO -Noxious aquatic plants -(Exotic species*)		

Table A13. Merrimack Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
13105	5.01	Unknown	Bootwell Brook Cold Spring Brook Grass Pond Reed Brook Stony Brook	MA84B-03_2002	X	-Cause Unknown -pH -Organic enrichment/Low DO -Pathogens -Turbidity
				MA84B-04_2002	X	-Cause Unknown -Nutrients -pH -Organic enrichment/Low DO -Pathogens
			Tadmuck Brook			
13112	0.80	Unknown	Forge Pond Springy Pond Stony Brook	MA84015_2002		
				MA84B-03_2002	X	-Cause Unknown -pH -Organic enrichment/Low DO -Pathogens -Turbidity
13113	11.03	Unknown	Beaver Brook	MA84B-02_2002	X	-Nutrients -pH -Organic enrichment/Low DO -Pathogens -Suspended solids
				MA84B-05_2002		
			Black Pond Forge Pond Mill Pond	MA84015_2002		
				MA84038_2002	X	-Noxious aquatic plants
				MA84081_2002	X	-Noxious aquatic plants
			Muddy Brook Unnamed Tributary	MA84B-01_2002	X	-Nutrients -pH -Organic enrichment/Low DO -Pathogens -Suspended solids
			Wolf Swamp			
13117	0.40	Unknown	Bradaocook Pond Burnt Meadow Pond Burnt Meadow Swamp Duck Pond Knops Pond/Lost Lake Martins Pond Brook	MA84084_2002		
				MA84A-19_2002	X	-Siltation -Organic enrichment/Low DO -Turbidity
			Springy Pond Whitney Pond			
TOTAL KNOWN:		1304				



Appendix A
Sub-Basin
Identification Maps:
MILLERS

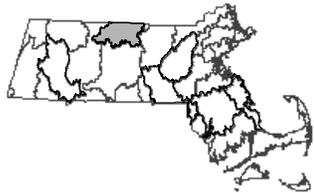


Table A14. Millers Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
7029	7.47	Unknown	Dunn Pond	MA35021_2002		
			Foster Brook			
			Greenwood Pond	MA35025_2002		
			Mahoney Brook			
			Minott Pond	MA35046_2002		
			Minott Pond South	MA35045_2002		
			Quag Pond			
			Upper Reservoir	MA35091_2002	X	-Metals
Wrights Reservoir	MA35104_2002					
7030	0.01	Unknown	Baker Brook			
			Bents Pond	MA35007_2002	X	-Noxious aquatic plants -Turbidity
			Otter River	MA35-06_2002		
7034	0.29	Unknown	Ramsdall Pond	MA35062_2002		
			Otter River	MA35-06_2002		
7035	0.96	Unknown	Snake Pond			
			Kendall Pond	MA35034_2002		
7044	2.63	Unknown	Otter River	MA35-06_2002		
			Otter River	MA35-07_2002	X	-Nutrients -Organic enrichment/Low DO -(Other habitat alterations*)
			Parker Pond	MA35056_2002		
7045	0.36	Unknown	Partridgeville Pond	MA35057_2002		
			Perley Brook			
			Ridgley Pond			
			Wilder Brook			
			Bailey Brook			
7047	1.42	Unknown	Hilchey Pond	MA35029_2002	X	-Turbidity
			Mellen Pond			
7049	0.04	Unknown	Otter River	MA35-07_2002	X	-Nutrients -Organic enrichment/Low DO -(Other habitat alterations*)
				MA35-08_2002	X	-Priority organics -Metals -Nutrients -Organic enrichment/Low DO -Salinity/TDS/chlorides -(Other habitat alterations*) -Pathogens
			Bourn-Hadley Pond	MA35008_2002		
			Brazell Pond	MA35010_2002		
			Crow Hill Brook			
			Day Millpond			
Trout Brook						

Table A14. Millers Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
7052	1.90	Unknown	Beaman Brook Beaman Pond Depot Pond Hansel Pond Mud Pond Norcross Hill Brook Otter River	MA35018_2002 MA35-08_2002	X	-Priority organics -Metals -Nutrients -Organic enrichment/Low DO -Salinity/TDS/chlorides -(Other habitat alterations*) -Pathogens
			Stoddard Pond	MA35083_2002		

Table A15. Narraganset Bay Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
26013	1.08	Unknown	Carpenter Brook Folleys Brook Palmer River	MA53-04_2002	X	-Nutrients -(Flow alteration*) -Pathogens
			Perryville Pond Rumneymarsh Brook Sabin Pond West Branch Wolf Plain Brook			
26014	0.06	Unknown	Clear Run Brook Palmer River	MA53-04_2002	X	-Nutrients -(Flow alteration*) -Pathogens
			Shad Factory Pond	MA53-05_2002	X	-Pathogens
26016	0.00	Unknown	Rocky Run			
26018	1.31	Unknown	Oak Swamp Oak Swamp Brook Rocky Run			
26019	1.40	Unknown	Palmer River	MA53-03_2002	X	-Pathogens
			Shad Factory Pond Tory Creek	MA53-05_2002	X	-Pathogens
26020	0.66	Unknown	Runnins River	MA53-01_2002	X	-Cause Unknown -Metals -Nutrients -Organic enrichment/Low DO -Pathogens -Oil and grease -(Objectionable deposits*)
26021	0.82	Unknown	Old Grist Mill Pond Runnins River	MA53-01_2002	X	-Cause Unknown -Metals -Nutrients -Organic enrichment/Low DO -Pathogens -Oil and grease -(Objectionable deposits*)
26022	8.81	Unknown	Burrs Pond Runnins River	MA53001_2002	X	-Metals
				MA53-01_2002	X	-Cause Unknown -Metals -Nutrients -Organic enrichment/Low DO -Pathogens -Oil and grease -(Objectionable deposits*)

Table A15. Narraganset Bay Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
26023	1.63	Unknown	Palmer River	MA53-03_2002	X	-Pathogens
			Runnins River	MA53-01_2002	X	-Cause Unknown -Metals -Nutrients -Organic enrichment/Low DO -Pathogens -Oil and grease -(Objectionable deposits*)
			Warren River Pond	MA53-06_2002	X	-Pathogens
26187	9.72	Unknown	King Philip Spring	MA61004_2002	X	-Metals
			North Watuppa Lake			
			North Watuppa Pond			
			Pond Swamp			
			Queen Gutter Brook			
The Narrows						
26189	4.50	Unknown	South Watuppa Pond	MA61006_2002		
			Sucker Brook			
26192	2.82	Unknown	Cook Pond	MA61001_2002	X	-Cause Unknown -Unknown toxicity -Nutrients -Organic enrichment/Low DO -Thermal modifications -Pathogens
			Mount Hope Bay	MA61-06_2002		
			Quequechan River	MA61-05_2002		
			Taunton River	MA62-04_2002		
26193	11.97	Unknown	Quequechan River	MA61-05_2002		
			South Watuppa Pond	MA61006_2002		
26194	4.44	Unknown	South Watuppa Pond	MA61006_2002		
26507	6.58	Unknown	Lee River	MA61-01_2002	X	-Nutrients -Organic enrichment/Low DO -Pathogens
				MA61-02_2002	X	-Pathogens -Taste, odor and color -Noxious aquatic plants -(Objectionable deposits*)
26509	0.34	Unknown	Cedar Cove	MA61-04_2002	X	-Nutrients -Organic enrichment/Low DO -Pathogens
			Cole River			
			Lee River			
			Mount Hope Bay	MA61-07_2002	X	-Cause Unknown -Unknown toxicity -Nutrients -Organic enrichment/Low DO -Thermal modifications -Pathogens

Table A15. Narraganset Bay Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
26511	8.42	Unknown	Cole River	MA61-03_2002 MA61-04_2002	X	-Nutrients -Organic enrichment/Low DO -Pathogens
			Milford Pond			
26513	2.04	Unknown	Cole River	MA61-04_2002	X	-Nutrients -Organic enrichment/Low DO -Pathogens
			Mount Hope Bay	MA61-07_2002	X	-Cause Unknown -Unknown toxicity -Nutrients -Organic enrichment/Low DO -Thermal modifications -Pathogens
26514	0.58	Unknown	Kickamuit River Warren Reservoir	MA61-08_2002	X	-Pathogens
26515	0.40	Unknown	Birch Swamp Heath Brook Kickamuit River	MA61-08_2002	X	-Pathogens

Table A16. Nashua Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
11005	3.11	Unknown	Crocker Pond Muddy Pond Whitman River Whitmanville Reservoir	MA81025_2002 MA81-11_2002 MA81109_2002		
11018	8.31	Unknown	Flag Brook North Nashua River Rice Meadow Pond Sawmill Pond Wymans Brook	MA81-10_2002 MA81118_2002		
11029	6.11	Unknown	Burnt Millpond Cedar Swamp Flag Brook North Nashua River Partridge Pond Phillips Brook Round Meadow Pond Snows Millpond Tophet Swamp Whitman River	MA81-10_2002 MA81-01_2002 MA81098_2002 MA81-12_2002 MA81114_2002 MA81127_2002 MA81-11_2002	X X	-Cause Unknown -(Other habitat alterations*) -Pathogens -Noxious aquatic plants -Turbidity
11031	0.38	Unknown	Nichols Pond North Nashua River Overlook Reservoir Sand Brook Sheldon Pond	MA81-01_2002 MA81-02_2002	X X	-Cause Unknown -(Other habitat alterations*) -Pathogens -Cause Unknown -Unknown toxicity -Pathogens -Taste, odor and color -(Objectionable deposits*)
11036	1.18	Unknown	Falulah Brook Greenes Pond Putnam Pond Saima Pond			
11039	0.92	Unknown	Paige Pond Pearl Hill Brook			
11040	0.60	Unknown	Baker Brook			
11041	0.46	Unknown	Notown Reservoir	MA81092_2002		
11042	3.02	Unknown	Distributing Reservoir Goodfellow Brook Mirror Lake Monoosnuc Brook Pierce Pond Rockwell Pond	MA81084_2002 MA81-13_2002 MA81101_2002 MA81112_2002		
11044	1.24	Unknown	Notown Reservoir	MA81092_2002		
11045	0.81	Unknown	Barrett Pond Fall Brook Fall Brook Reservoir Lake Samoset Morse Reservoir	MA81162_2002 MA81-14_2002 MA81038_2002 MA81116_2002		
11046	0.25	Unknown	Monoosnuc Brook	MA81-13_2002		

Table A16. Nashua Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
11048	0.00	Unknown	Fall Brook	MA81-14_2002		
11051	1.39	Unknown	Fall Brook	MA81-14_2002		
11052	17.36	Unknown	Baker Brook			
			Fall Brook	MA81-14_2002		
			Monoosnuc Brook	MA81-13_2002		
			North Nashua River	MA81-02_2002	X	-Cause Unknown -Unknown toxicity -Pathogens -Taste, odor and color -(Objectionable deposits*)
				MA81-03_2002	X	-Cause Unknown -Unknown toxicity -Pathogens -Taste, odor and color
				MA81-04_2002	X	-Turbidity -Cause Unknown -Pathogens -Taste, odor and color
			White Pond	MA81155_2002		-Turbidity
11057	0.49	Unknown	Bartlett Pond Pratts Pond Wekepeke Brook			
11058	1.47	Unknown	Little Spectacle Pond Mcgovern Brook Nashua River North Nashua River	MA81-04_2002	X	-Cause Unknown -Pathogens -Taste, odor and color -Turbidity
			Oak Hill Pond Spectacle Brook Spectacle Pond	MA81132_2002		
11072	2.92	Unknown	Houghton Brook Scanlon Brook Stillwater River	MA81-31_2002		
11075	0.58	Unknown	Connelly Brook Tannery Brook The Quag West Waushacum Pond	MA81170_2002 MA81153_2002		
11092	0.43	Unknown	Asnebumskit Brook Eagle Lake Kendall Reservoir Pine Hill Reservoir Stump Pond	MA81034_2002 MA81062_2002 MA81102_2002 MA81171_2002		
11095	0.25	Unknown	Asnebumskit Pond Bumbo Brook Pine Hill Reservoir Streeter Pond Worcester Brook	MA81002_2002 MA81102_2002 MA81136_2002		
11097	0.87	Unknown	Asnebumskit Brook Warren Tannery Brook			
11100	3.18	Unknown	Bryant Pond Chaffin Pond Chaffins Brook Dawson Pond Poor Farm Brook Unionville Pond Unnamed Tributary	MA81017_2002 MA81-33_2002 MA81028_2002 MA81143_2002 MA81-35_2002	X X	-Cause Unknown -Cause Unknown -Organic enrichment/Low DO

Table A16. Nashua Basin

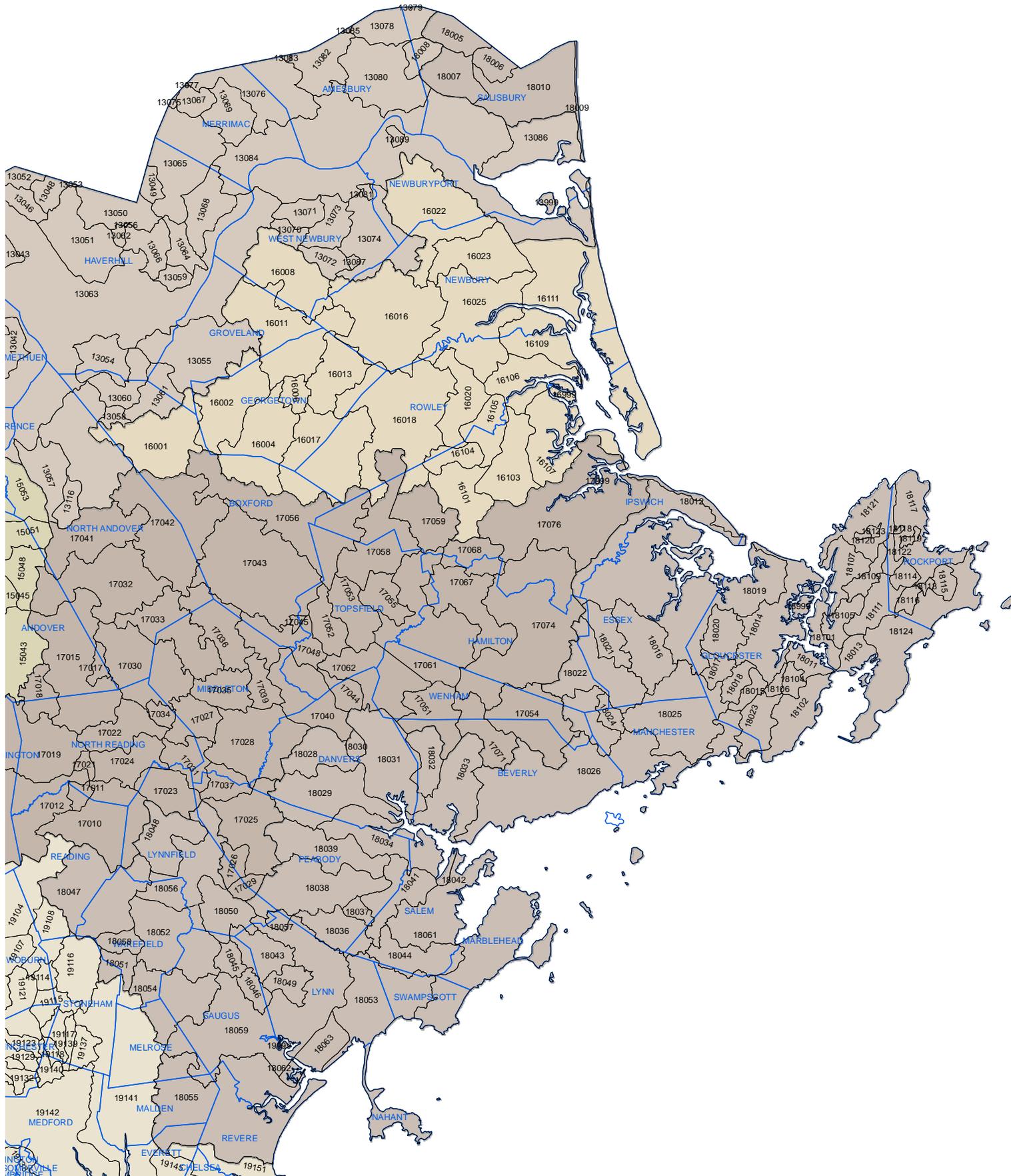
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
11104	5.14	Unknown	Gates Brook	MA81-24_2002	X	-Cause Unknown -Pathogens
			Scarletts Brook	MA81-25_2002	X	-Pathogens
11106	4.53	Unknown	Carrolls Pond			
			Carville Basin			
			French Brook			
			Gates Brook	MA81-24_2002	X	-Cause Unknown -Pathogens
			Gates Cove			
			Hastings Cove			
			Lily Pond			
			Malagasco Brook	MA81-29_2002	X	-Cause Unknown -Organic enrichment/Low DO -Pathogens
			Malden Brook	MA81-27_2002		
			Muddy Brook	MA81-28_2002	X	-Cause Unknown
			Pine Swamp			
			Prescott Cove			
			Quinapoxet River	MA81-32_2002		
			Scotland Swamp			
			South Bay			
			Stillwater Basin			
			Stillwater River	MA81-31_2002		
			Boylston Brook	MA81-34_2002	X	-Cause Unknown
			Wachusett Reservoir	MA81147_2002	X	-Metals
11111	0.03	Unknown	Coachlace Pond	MA81019_2002		
			Fitch Pond			
			Mossy Pond			
			South Meadow Brook			
			South Meadow Pond	MA81129_2002 MA81165_2002		
11112	0.65	Unknown	Goodridge Brook	MA81065_2002		
			Lancaster Millpond	MA81-08_2002	X	-Cause Unknown -Unknown toxicity -Pathogens
			Nashua River	MA81-09_2002	X	-Cause Unknown -Nutrients -Pathogens -(Objectionable deposits*)
			Wachusett Reservoir	MA81147_2002	X	-Metals
11115	2.25	Unknown	Catacoonamug Brook			
			Dead Pond			
			Lake Whalom	MA81154_2002		
			Massapoag Pond	MA81080_2002		
			Turkey Hill Pond			
			White Rabbit Swamp			
11116	0.24	Unknown	Easter Brook			
			Lake Shirley	MA81122_2002	X	-Noxious aquatic plants -Turbidity -(Exotic species*)

Table A16. Nashua Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment	
11125	0.84	Unknown	Catacoonamug Brook	MA81-16_2002			
			Cranberry Pond				
			Nashua River	MA81-05_2002	X	-Cause Unknown -Unknown toxicity -Metals -Nutrients -Pathogens -Taste, odor and color -Turbidity	
				MA81-09_2002	X	-Cause Unknown -Nutrients -Pathogens -(Objectionable deposits*)	
			North Nashua River	MA81-04_2002	X	-Cause Unknown -Pathogens -Taste, odor and color -Turbidity	
			Slate Rock Pond				
			Still River	MA81-15_2002			
11129	0.01	Unknown	Bowers Brook				
			Cold Spring Brook				
			Little Mirror Lake				
			Mirror Lake	MA81085_2002	X	-Metals	
			Robbins Pond				
11130	1.69	Unknown	Balch Pond				
			Flannagan Pond	MA81044_2002			
			Grove Pond	MA81053_2002	X	-Metals -Noxious aquatic plants -(Exotic species*)	
			Long Pond	MA81073_2002			
			Nonacoicus Brook	MA81-17_2002			
			Plow Shop Pond	MA81103_2002	X	-Metals -Noxious aquatic plants -(Exotic species*)	
			Robbins Pond	MA81111_2002			
			Sandy Pond	MA81117_2002			
			Willow Brook				
11132	0.00	Unknown	Hickory Hills Lake	MA81031_2002	X	-Metals	
			Mulpus Brook	MA81-22_2002			
11137	1.30	Unknown	Flurcum Swamp				
			Lane Pond				
			Mulpus Brook	MA81-22_2002			
			Perrins Pond				
			White Rabbit Swamp				
11139	0.79	Unknown	Mulpus Brook	MA81-22_2002			
11140	0.06	Unknown	Mulpus Brook	MA81-22_2002			
			Perrins Pond				
11151	2.72	Unknown	Ash Swamp				
			Bayberry Hill Brook				
			Dead Swamp				
			Pearl Hill Brook				
			Squannacook River	MA81-18_2002			
			Walker Brook				
			Walker Pond				
Wolf Swamp							
11153	2.20	Unknown	Bixby Brook				
			Bixby Reservoir	MA81010_2002			
			Graves Pond				
			Harbor Pond	MA81054_2002			
			Squannacook River	MA81-18_2002			
			Trout Brook				
			Witch Brook				

Table A16. Nashua Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
11154	0.35	Unknown	Flat Pond Nashua River	MA81-05_2002	X	-Cause Unknown -Unknown toxicity -Metals -Nutrients -Pathogens -Taste, odor and color -Turbidity
				MA81-06_2002	X	-Cause Unknown -Metals -Nutrients -Organic enrichment/Low DO -Noxious aquatic plants -Turbidity
			Pumpkin Brook Squannacook River	MA81-18_2002 MA81-19_2002	X	-Cause Unknown
			Trap Swamp Brook			
11158	0.10	Unknown	Bancroft Brook Robinson Brook			
11162	0.21	Unknown	Cady Pond Groton School Pond James Brook	MA81-20_2002		
11165	2.76	Unknown	Dead River James Brook	MA81-20_2002		
				MA81-22_2002		
			Mulpus Brook Nashua River	MA81-05_2002	X	-Cause Unknown -Unknown toxicity -Metals -Nutrients -Pathogens -Taste, odor and color -Turbidity
				MA81-06_2002	X	-Cause Unknown -Metals -Nutrients -Organic enrichment/Low DO -Noxious aquatic plants -Turbidity
				MA81-07_2002	X	-Cause Unknown -Nutrients -Pathogens -Turbidity
			Nod Brook Nonacoicus Brook Pepperell Pond	MA81-17_2002 MA81167_2002	X	-Metals -Nutrients -Noxious aquatic plants -Turbidity -(Exotic species*)
				Spruce Swamp Walker Brook Wrangling Brook		



Appendix A
Sub-Basin
Identification Maps:
NORTH COASTAL

Table A17. North Coastal Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
18007	6.67	107	Meader Brook Smallpox Brook			
18010	4.15	35	Blackwater River Great Meadows Little River			
18011	1.60	0	Annisquam River Fernwood Lake Lower Banjo Pond Upper Banjo Pond	MA93-12_2002 MA93022_2002 MA93080_2002	X X	-Pathogens -Noxious aquatic plants -Turbidity
18013	0.21	0	Gloucester Harbor	MA93-18_2002	X	-Pathogens
18014	3.29	14	Annisquam River Sleepy Hollow Pond	MA93-12_2002	X	-Pathogens
18016	0.15	0	Alewife Brook Essex River	MA93-11_2002	X	-Pathogens
18019	0.65	2	Castle Neck River Ebben Creek Essex Bay Essex River Farm Creek Lufkin Creek Sleepy Hollow Pond Soginese Creek	MA93-16_2002 MA93-11_2002	X X	-Pathogens -Pathogens
18023	1.16	0	Clark Pond Lily Pond West Pond			
18025	3.30	17	Bayberry Swamp Beaverdam Swamp Cat Brook Cedar Swamp Dexter Pond Millets Swamp Sawmill Brook	MA93-29_2002	X	-pH -Siltation -Pathogens
18026	0.14	2	Coy Pond Gravelly Pond Round Pond	MA93016_2002 MA93028_2002 MA93063_2002	X	-Noxious aquatic plants -Turbidity
18027	8.93	44	Beverly Harbor Cat Brook Chubb Creek Curtis Brook Lily Pond Mackerel River Manchester Harbor Plum Brook Salem Sound	MA93-20_2002 MA93-29_2002 MA93-19_2002 MA93-25_2002	X X X X	-Pathogens -pH -Siltation -Pathogens -Pathogens
18028	9.86	41	Beaver Brook	MA93-37_2002	X	-Organic enrichment/Low DO -Pathogens

Table A17. North Coastal Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
18029	14.09	38	Beaver Brook	MA93-37_2002	X	-Organic enrichment/Low DO -Pathogens
			Crane Brook	MA93-02_2002	X	-Unionized Ammonia -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Suspended solids -Turbidity
			Crane River	MA93-38_2002	X	-Pathogens -Turbidity
			Mill Pond Porter River	MA93-41_2002 MA93-04_2002	X X	-Pathogens -Siltation -Pathogens -Noxious aquatic plants -Turbidity
18031	4.50	3	Frost Fish Brook	MA93-36_2002	X	-Pathogens
			Porter River	MA93-04_2002	X	-Siltation -Pathogens -Noxious aquatic plants -Turbidity
18032	1.40	7	Bass River	MA93-07_2002		
18033	5.38	22	Bass River	MA93-07_2002		-Pathogens
			Beverly Harbor	MA93-08_2002	X	
			Danvers River	MA93-20_2002	X	-Pathogens
			Shoe Pond	MA93068_2002	X	-Pathogens -Turbidity
18034	8.90	19	Danvers River	MA93-09_2002	X	-Pathogens
			North River	MA93-42_2002	X	-Unionized Ammonia -Organic enrichment/Low DO -Pathogens
			Waters River	MA93-01_2002	X	-(Other habitat alterations*) -Pathogens
18038	19.90	101	Cedar Pond	MA93013_2002		
			Craig Pond			
			Goldthwait Brook	MA93-05_2002	X	-Cause Unknown -Unknown toxicity -Unionized Ammonia -Nutrients -Organic enrichment/Low DO -(Flow alteration*) -(Other habitat alterations*) -Pathogens -Noxious aquatic plants
			Little Elder Pond			
			Pierces Pond			
18039	10.70	46	Proctor Brook	MA93-39_2002	X	-Cause Unknown -Nutrients -Siltation -(Other habitat alterations*) -Pathogens

Table A17. North Coastal Basin

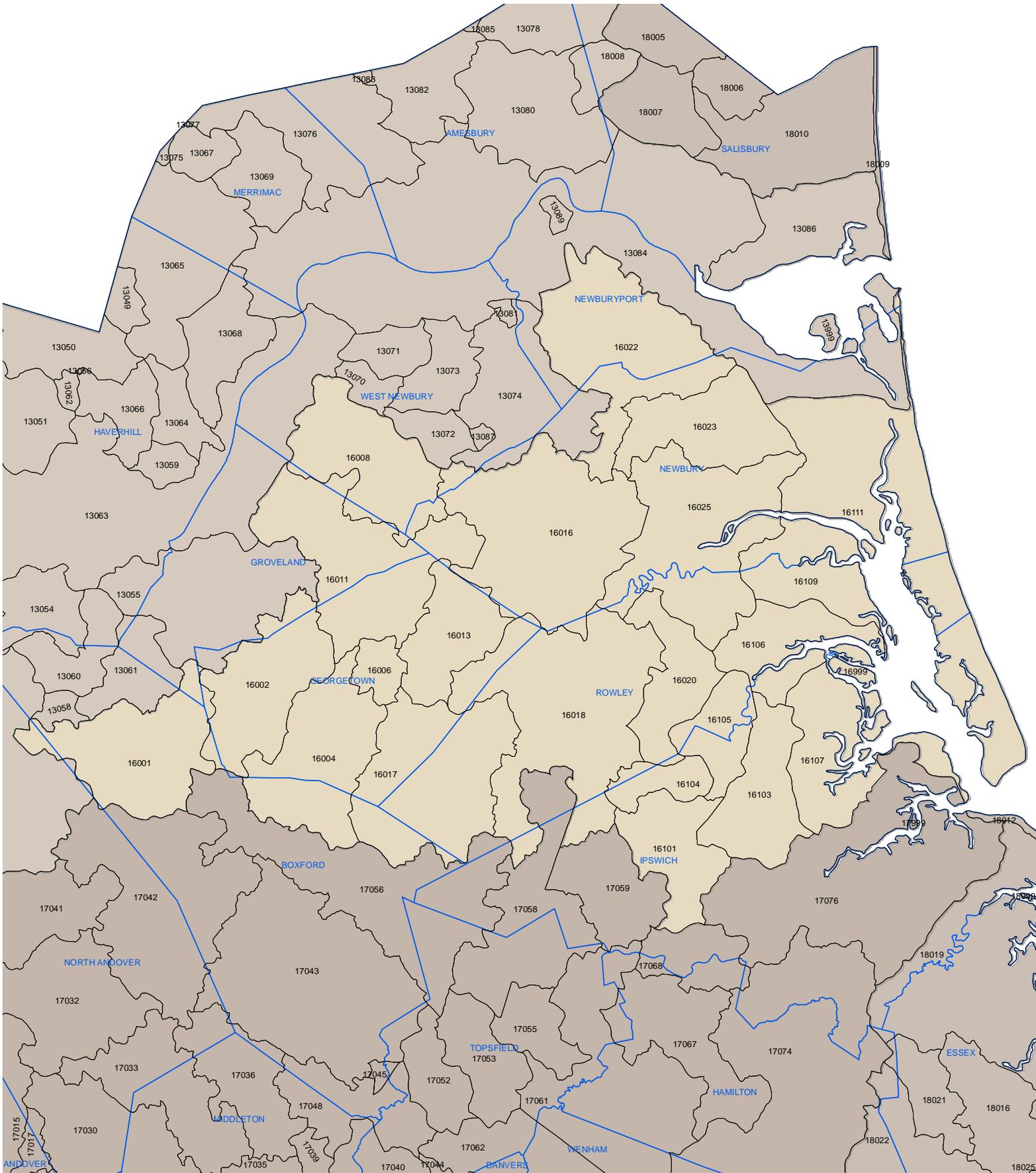
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment			
18041	0.25	1	Meadow Pond	MA93-42_2002	X	-Unionized Ammonia -Organic enrichment/Low DO -Pathogens			
			North River						
			Proctor Brook				MA93-39_2002	X	-Cause Unknown -Nutrients -Siltation -(Other habitat alterations*) -Pathogens
			Strongwater Brook				MA93-40_2002	X	-Pathogens
18042	0.09	1	Danvers River	MA93-09_2002	X	-Pathogens			
			North River	MA93-42_2002	X	-Unionized Ammonia -Organic enrichment/Low DO -Pathogens			
18043	0.20	4	Walden Pond	MA93084_2002					
18044	2.75	5	Forest River	MA93-10_2002	X	-Organic enrichment/Low DO -(Flow alteration*) -(Other habitat alterations*) -Pathogens			
			Salem Harbor Thompsons Meadow				MA93-21_2002	X	-Pathogens
18045	2.87	4	Hawkes Brook	MA93-32_2002	X	-Pathogens			
				MA93-33_2002	X	-Pathogens			
			Hawkes Pond	MA93032_2002	X	-Turbidity			
			Walden Pond	MA93084_2002					
18047	13.65	78	Lake Quannapowitt	MA93060_2002	X	-Noxious aquatic plants -Turbidity -(Exotic species*)			
			Saugus River	MA93-34_2002	X	-Nutrients -(Flow alteration*) -(Other habitat alterations*) -Pathogens -Noxious aquatic plants -Turbidity			
18050	7.21	26	Hawkes Brook	MA93-32_2002	X	-Pathogens			
			Hawkes Pond	MA93032_2002	X	-Turbidity			
18051	0.01	0	Crystal Lake	MA93018_2002					
18052	1.23	9	Hawkes Brook	MA93-33_2002	X	-Pathogens			
			Lower Pond	MA93044_2002					
			Mill River	MA93-31_2002			X	-Organic enrichment/Low DO -Pathogens -Suspended solids -Turbidity	
			Saugus River	MA93-34_2002			X	-Nutrients -(Flow alteration*) -(Other habitat alterations*) -Pathogens -Noxious aquatic plants -Turbidity	
				MA93-35_2002			X	-Organic enrichment/Low DO -(Flow alteration*) -(Other habitat alterations*) -Pathogens	
			Upper Pond	MA93083_2002					

Table A17. North Coastal Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
18053	2.23	8	Bear Pond Dorothy Cove Floating Bridge Pond	MA93024_2002	X	-Nutrients -Noxious aquatic plants -Turbidity
			Foster Pond Frog Pond Goldfish Pond Lynn Harbor Nahant Bay Reed Cove	MA93-23_2002 MA93-24_2002	X X	-Pathogens -Pathogens
18054	1.21	7	Crystal Pond Brook Griswold Pond Nihan Pond Spring Pond	MA93029_2002 MA93072_2002		
18055	20.65	81	Lynn Harbor Pines River Rumney Marsh Saugus River	MA93-23_2002 MA93-15_2002 MA93-14_2002	X X X	-Pathogens -Pathogens -Thermal modifications -(Flow alteration*) -Pathogens -Oil and grease
			Swains Pond Towners Pond			
18056	3.20	13	Pillings Pond Reedy Meadow Saugus River	MA93056_2002 MA93-34_2002	X X	-Noxious aquatic plants -Turbidity -Nutrients -(Flow alteration*) -(Other habitat alterations*) -Pathogens -Noxious aquatic plants -Turbidity
18057	0.75	3	Nells Pond			
18059	13.50	62	Breeds Pond Cedar Brook Fiske Brook Flax Pond	MA93006_2002 MA93023_2002	X	-Noxious aquatic plants -Turbidity -(Exotic species*)
			Lily Mere Nells Pond Nihan Pond Penny Brook Prankers Pond Saugus River	MA93-14_2002 MA93-35_2002	X X	-Thermal modifications -(Flow alteration*) -Pathogens -Oil and grease -Organic enrichment/Low DO -(Flow alteration*) -(Other habitat alterations*) -Pathogens
			Shute Brook Sluice Pond Stevens Pond	MA93071_2002		

Table A17. North Coastal Basin

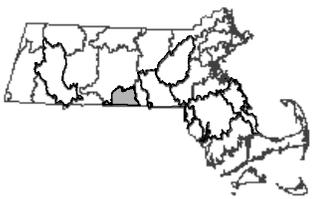
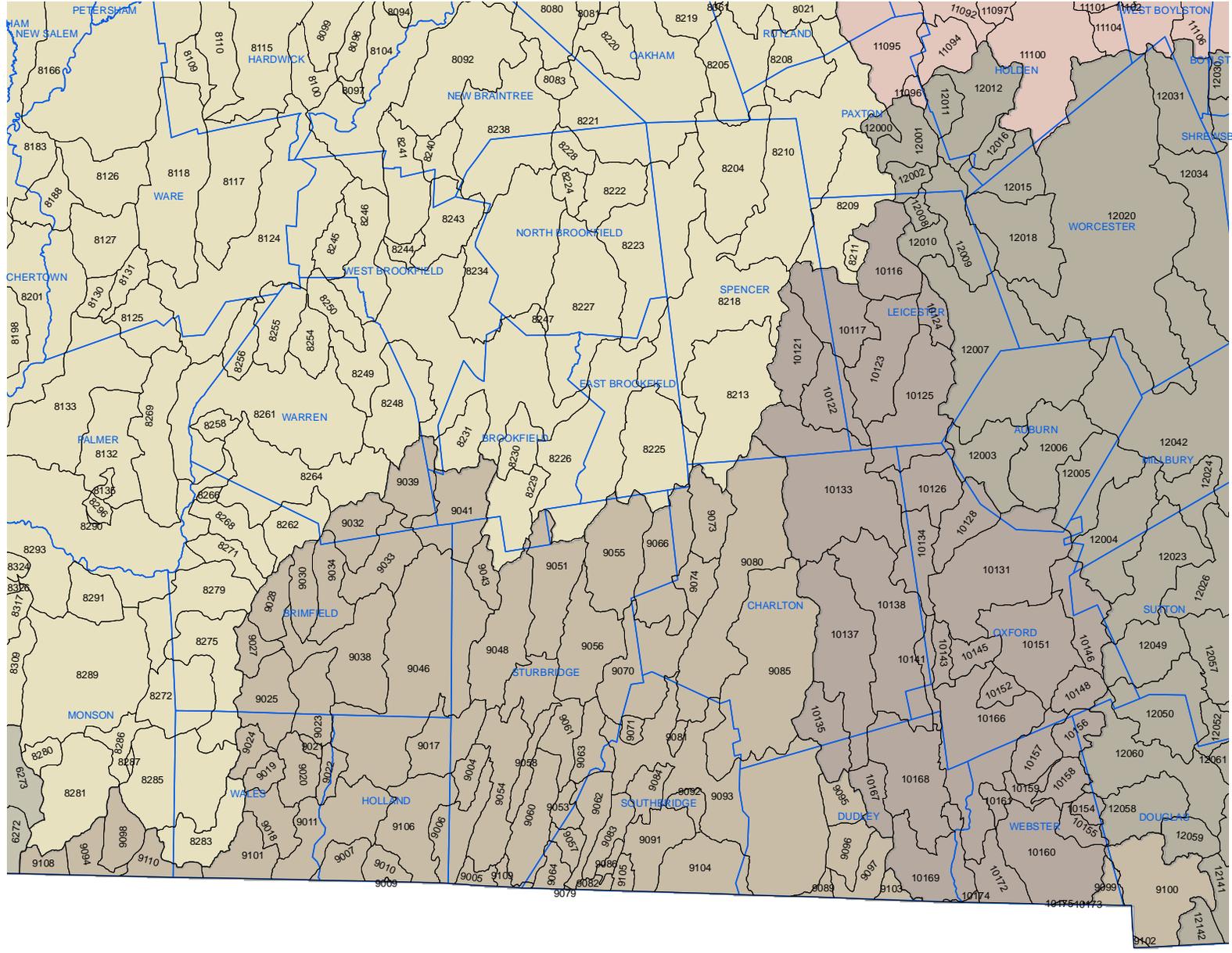
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
18061	1.85	2	Beverly Harbor Black Joe Pond Flag Pond	MA93-20_2002	X	-Pathogens
			Marblehead Harbor Nahant Bay Oliver Pond Palmer Pond Reds Pond	MA93-22_2002 MA93-24_2002	X X	-Pathogens -Pathogens
			Salem Harbor Salem Sound Ware Pond	MA93-21_2002 MA93-25_2002	X X	-Pathogens -Pathogens
18062	0.73	5	Saugus River	MA93-14_2002	X	-Thermal modifications -(Flow alteration*) -Pathogens -Oil and grease
18063	0.32	0	Lynn Harbor Saugus River	MA93-23_2002 MA93-14_2002	X X	-Pathogens -Thermal modifications -(Flow alteration*) -Pathogens -Oil and grease
18101	1.63	7	Annisquam River Mill River	MA93-12_2002 MA93-28_2002	X X	-Pathogens -Pathogens
18102	2.14	2	Buswell Pond Gloucester Harbor West Pond	MA93009_2002 MA93-18_2002 MA93089_2002	X X	-Pathogens -Nutrients -Noxious aquatic plants
18105	1.01	3	Goose Cove Reservoir Mill Pond Strangman Pond Unnamed Tributary	MA93093_2002 MA93050_2002 MA93076_2002 MA93-27_2002	X	-Noxious aquatic plants -Turbidity
18106	0.09	0	Fernwood Lake Wallace Pond	MA93022_2002 MA93085_2002		
18107	0.01	0	Annisquam River Duck Pond Goose Cove Reservoir Langsford Pond Mill River	MA93-12_2002 MA93093_2002 MA93-28_2002	X X	-Pathogens -Pathogens
18111	1.54	2	Alewife Brook Babson Reservoir Strangman Pond Unnamed Tributary	MA93-26_2002 MA93001_2002 MA93-27_2002		
18114	0.51	0	Loop Pond			
18116	0.15	0	Cape Pond	MA93011_2002	X	-Turbidity
18117	0.17	0	Oregon Pond Quarry Reservoir Rockport Harbor	MA93053_2002 MA93-17_2002	X	-Pathogens
18119	0.01	0	Quarry Reservoir	MA93053_2002		
18121	0.03	0	Annisquam River Beaver Swamp Lily Pond Orchard Swamp	MA93-12_2002	X	-Pathogens
18124	1.36	4	Camborne Pond Days Pond Gloucester Harbor Loblolly Cove Niles Pond	MA93092_2002 MA93-18_2002 MA93052_2002	X	-Pathogens
TOTAL:		825				



Appendix A
Sub-Basin
Identification Maps:
PARKER



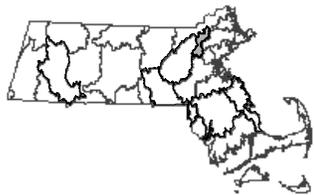
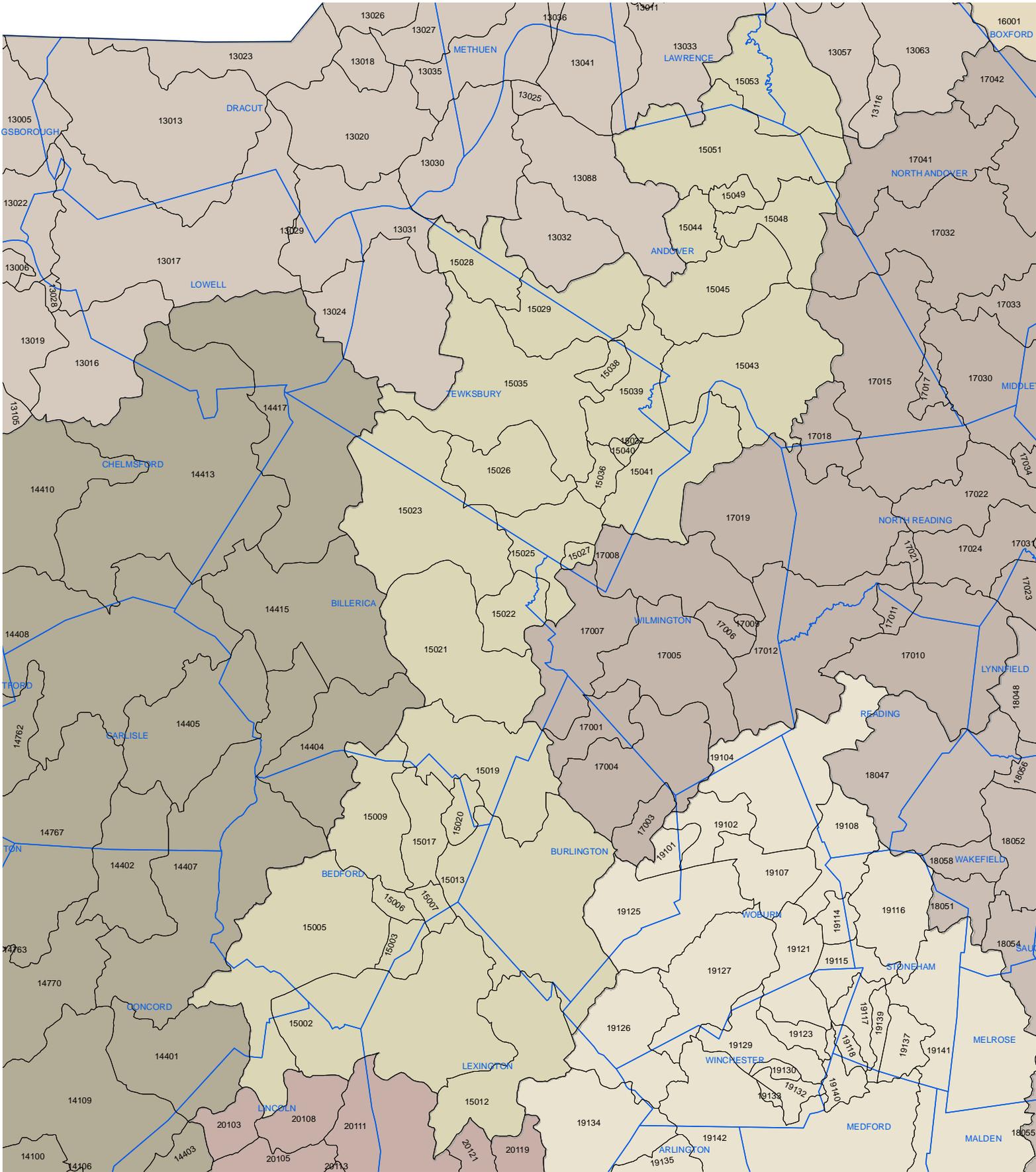
Table A18. Parker Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
16008	0.07	0	Ash Swamp Beaver Brook Little Crane Pond	MA91007_2002		
16011	0.85	0	Beaver Brook Crane Pond Parker River	MA91004_2002 MA91-01_2002	X	-Metals -(Flow alteration*)
16013	0.58	10	Jackman Brook Parker River Wheeler Brook	MA91-07_2002 MA91-01_2002	X	-Metals -(Flow alteration*)
16016	0.66	1	Cart Creek Parker River	MA91-01_2002 MA91-02_2002	X X	-Metals -(Flow alteration*) -Pathogens
16017	0.44	4	Lower Mill Pond Mill River Muddy Brook Upper Mill Pond	MA91008_2002 MA91-08_2002 MA91015_2002	X X	-Noxious aquatic plants -(Exotic species*) -Cause Unknown
16018	0.76	1	Bachelor Brook Great Swamp Brook Hawk Meadow Lower Mill Pond Mill River Upper Millpond Wilson Pond	MA91-08_2002 MA91017_2002	X	-Cause Unknown
16020	0.73	1	Central Street Pond Ox Pasture Brook	MA91003_2002 MA91-10_2002		
16022	7.07	50	Little River State Street Pond	MA91-11_2002 MA91014_2002	X	-Pathogens
16023	0.10	2	Little River Quills Pond	MA91-11_2002 MA91011_2002	X	-Pathogens
16103	0.27	0	Egypt River Muddy Run Rowley River	MA91-14_2002 MA91-05_2002	X X	-Pathogens -Pathogens
16105	0.59	3	Bull Brook Bull Brook Reservoir Egypt River Rowley River	MA91002_2002 MA91-13_2002 MA91-14_2002 MA91-05_2002	 X X	 -Pathogens -Pathogens
16106	0.77	0	Club Head Creek Rowley River Sand Creek West Creek	MA91-05_2002	X	-Pathogens
TOTAL:		72				



Appendix A
Sub-Basin
Identification Maps:
QUINEBAUG

Table A19. Quinebaug Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
9048	1.01	Unknown	Quinebaug River	MA41-01_2002	X	-Metals -Pathogens
9051	0.37	Unknown	Cedar Pond New Boston Road Pond	MA41008_2002 MA41035_2002		
9056	0.91	Unknown	Hobbs Brook Pistol Pond Walker Pond	MA41057_2002 MA41052_2002	X	-Noxious aquatic plants
9061	2.76	Unknown	Quinebaug River	MA41-01_2002 MA41-02_2002	X	-Metals -Pathogens
9063	0.48	Unknown	Quinebaug River	MA41-02_2002		
9071	0.12	Unknown	Quinebaug River	MA41-02_2002		
9080	1.37	Unknown	Cady Brook	MA41-05_2002	X	-(Flow alteration*) -Pathogens
				MA41-06_2002	X	-Nutrients -Organic enrichment/Low DO -(Flow alteration*) -Taste, odor and color
			Glen Echo Lake Lambs Pond Prindle Lake Railroad Pond	MA41017_2002 MA41043_2002 MA41058_2002	X	-Organic enrichment/Low DO
9081	0.09	Unknown	Cady Brook	MA41-06_2002	X	-Nutrients -Organic enrichment/Low DO -(Flow alteration*) -Taste, odor and color
			Carpenter Pond			
9085	0.51	Unknown	Dresser Hill Pond Mcintyre Pond Wabash Pond	MA42014_2002 MA41031_2002	X	-Turbidity [7/12/2002-CN110.0]
9089	0.24	Unknown	Quinebaug River	MA41-04_2002	X	-Pathogens
9093	3.48	Unknown	Blood Pond Cady Brook	MA41-06_2002	X	-Nutrients -Organic enrichment/Low DO -(Flow alteration*) -Taste, odor and color
			Carpenter Pond Quinebaug River	MA41-02_2002 MA41-03_2002	X	-Nutrients -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Taste, odor and color -(Objectionable deposits*)
				MA41-04_2002	X	-Pathogens
				MA41-09_2002	X	-Organic enrichment/Low DO -(Other habitat alterations*) -Turbidity -(Objectionable deposits*)
			Sylvestri Pond	MA41049_2002		
9097	0.67	Unknown	Conant Pond Wielock Pond	MA41056_2002	X	-Turbidity



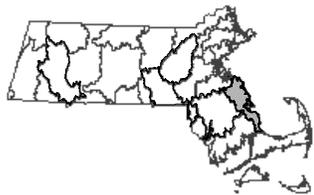
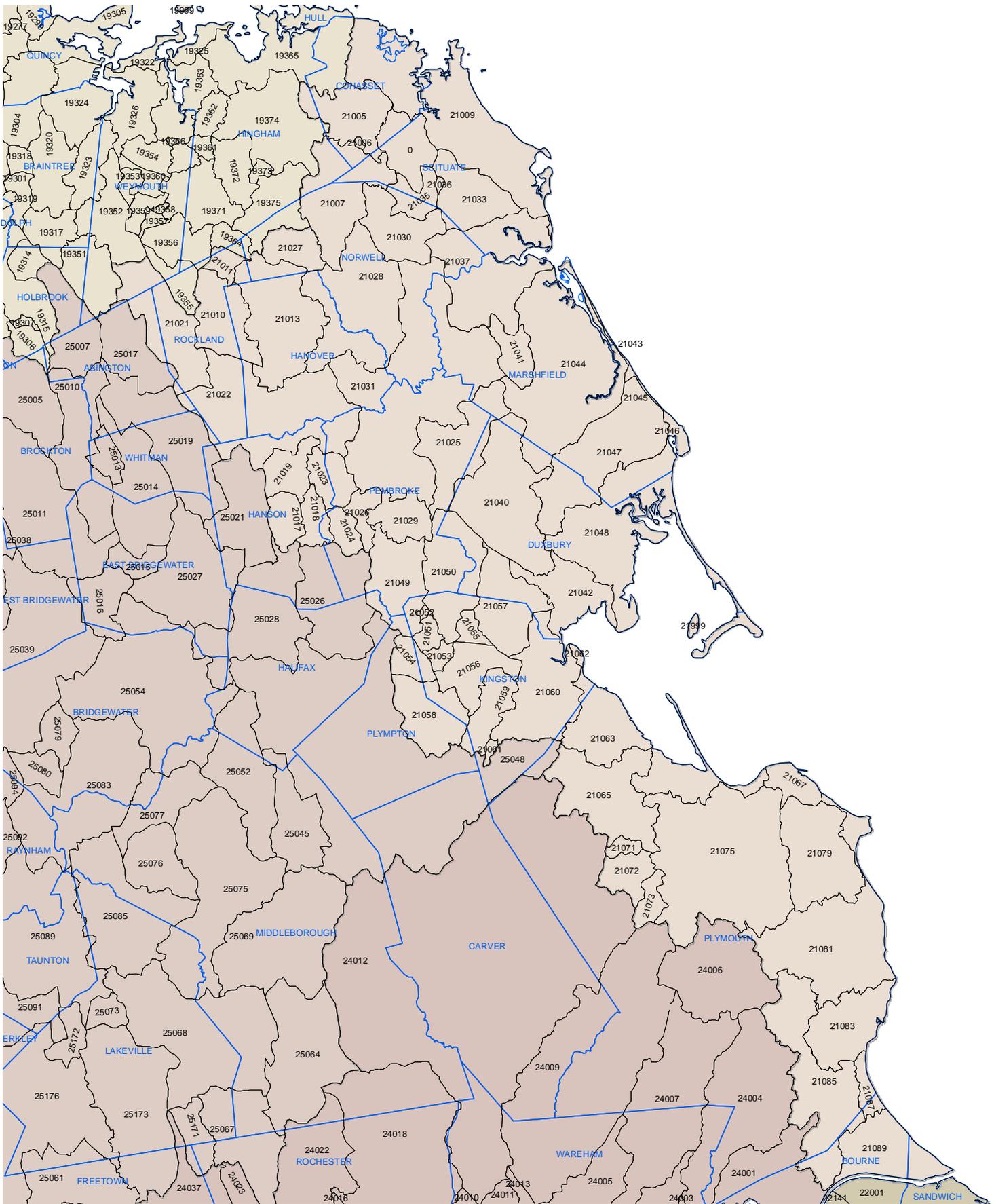
Appendix A
Sub-Basin
Identification Maps:
SHAWSHEEN

Table A20. Shawsheen Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
15002	13.56	52	Kiln Brook	MA83-10_2002	X	-Pathogens [9/12/2002-CN122.0]
			Shawsheen River	MA83-08_2002	X	-Other habitat alterations -Pathogens [9/12/2002-CN122.0]
			Trophet Swamp			
15003	0.86	2	Shawsheen River	MA83-01_2002	X	-Unknown toxicity -Organic enrichment/Low DO -Pathogens [9/12/2002-CN122.0]
				MA83-08_2002	X	-Other habitat alterations -Pathogens [9/12/2002-CN122.0]
15005	1.57	11	Elm Brook	MA83-05_2002	X	-Pathogens [9/12/2002-CN122.0] -Turbidity
			White Cedar Swamp			
15006	0.03	0	Elm Brook	MA83-05_2002	X	-Pathogens [9/12/2002-CN122.0] -Turbidity
			Shawsheen River	MA83-01_2002	X	-Unknown toxicity -Organic enrichment/Low DO -Pathogens [9/12/2002-CN122.0]
15009	1.20	0	Fawn Lake	MA83004_2002		
			Shawsheen River	MA83-01_2002	X	-Unknown toxicity -Organic enrichment/Low DO -Pathogens [9/12/2002-CN122.0]
15012	1.29	2	Spring Brook	MA83-14_2002	X	-Pathogens [9/12/2002-CN122.0]
			Butterfield Pond	MA83003_2002	X	-Noxious aquatic plants -Turbidity
15013	16.01	51	Vine Brook	MA83-06_2002	X	-Pathogens [9/12/2002-CN122.0]
			Butterfield Pond			
15017	4.23	0	Long Meadow Brook	MA83-11_2002	X	-Pathogens [9/12/2002-CN122.0]
			Sandy Brook	MA83-13_2002	X	-Pathogens [9/12/2002-CN122.0]
			Vine Brook	MA83-06_2002	X	-Pathogens [9/12/2002-CN122.0]
15019	1.87	6	Shawsheen River	MA83-01_2002	X	-Unknown toxicity -Organic enrichment/Low DO -Pathogens [9/12/2002-CN122.0]
				MA83-02_2002	X	-Unknown toxicity -Metals -Organic enrichment/Low DO -Pathogens [9/12/2002-CN122.0]
			Spring Brook	MA83-14_2002	X	-Pathogens [9/12/2002-CN122.0]
			Vine Brook	MA83-06_2002	X	-Pathogens [9/12/2002-CN122.0]
15021	2.31	12	Shawsheen River	MA83-02_2002	X	-Unknown toxicity -Metals -Organic enrichment/Low DO -Pathogens [9/12/2002-CN122.0]
			Jones Brook			
15022	0.00	0	Webb Brook			
			Shawsheen River	MA83-02_2002	X	-Unknown toxicity -Metals -Organic enrichment/Low DO -Pathogens [9/12/2002-CN122.0]

Table A20. Shawsheen Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
15023	0.06	0	Content Brook	MA83-09_2002	X	-Pathogens [9/12/2002-CN122.0]
			Long Pond	MA83010_2002	X	-Nutrients -Noxious aquatic plants
			Pond Street Pond Richardson Pond	MA83021_2002 MA83020_2002		
15025	0.82	5	Content Brook	MA83-09_2002	X	-Pathogens [9/12/2002-CN122.0]
			Shawsheen River	MA83-02_2002	X	-Unknown toxicity -Metals -Organic enrichment/Low DO -Pathogens [9/12/2002-CN122.0]
15026	1.51	6	Heath Brook			
15028	4.15	23	Ames Pond	MA83001_2002	X	-Metals
			Meadow Brook	MA83-12_2002	X	-Pathogens [9/12/2002-CN122.0]
15029	3.20	13	Meadow Brook	MA83-12_2002	X	-Pathogens [9/12/2002-CN122.0]
			Pinnacle Brook Unnamed Tributary	MA83-15_2002	X	-Pathogens [9/12/2002-CN122.0]
15035	1.65	5	Great Swamp			
			Meadow Brook	MA83-12_2002	X	-Pathogens [9/12/2002-CN122.0]
			Round Pond Strong Water Brook	MA83018_2002 MA83-07_2002	X	-Pathogens [9/12/2002-CN122.0]
15039	4.51	20	Shawsheen River	MA83-02_2002	X	-Unknown toxicity -Metals -Organic enrichment/Low DO -Pathogens [9/12/2002-CN122.0]
			Unnamed Tributary	MA83-15_2002	X	-Pathogens [9/12/2002-CN122.0]
15043	2.88	11	Fosters Pond	MA83005_2002	X	-Metals -(Exotic species*)
			Lowell Junction Pond	MA83011_2002	X	-Metals -Noxious aquatic plants -(Exotic species*)
			Shawsheen River	MA83-02_2002	X	-Unknown toxicity -Metals -Organic enrichment/Low DO -Pathogens [9/12/2002-CN122.0]
			Unnamed Tributary	MA83-16_2002	X	-Pathogens [9/12/2002-CN122.0]
15048	1.47	8	Rabbit Pond	MA83015_2002	X	-Turbidity
			Rogers Brook	MA83-04_2002	X	-Pathogens [9/12/2002-CN122.0] -Turbidity
			Shawsheen River	MA83-02_2002	X	-Unknown toxicity -Metals -Organic enrichment/Low DO -Pathogens [9/12/2002-CN122.0]
				MA83-03_2002	X	-Unknown toxicity -Pathogens [9/12/2002-CN122.0]
15049	0.02	0	Rogers Brook	MA83-04_2002	X	-Pathogens [9/12/2002-CN122.0] -Turbidity
			Shawsheen River	MA83-03_2002	X	-Unknown toxicity -Pathogens [9/12/2002-CN122.0]
15051	12.18	45	Gravel Pit Pond	MA83007_2002		
			Hussey Brook Hussey Brook Pond	MA83008_2002 MA83009_2002	X	-Noxious aquatic plants
			Hussey Pond	MA83009_2002	X	-Unknown toxicity
			Shawsheen River	MA83-03_2002	X	-Pathogens [9/12/2002-CN122.0]
15053	10.28	86	Shawsheen River	MA83-03_2002	X	-Unknown toxicity -Pathogens [9/12/2002-CN122.0]
TOTAL:		358				



Appendix A
Sub-Basin
Identification Maps:
SOUTH COASTAL

Table A21. South Coastal Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
21005	1.02	Unknown	Aaron River Bound Brook Herring Brook Lily Pond	MA94-18_2002		
21010	0.57	Unknown	Ben Mann Brook Cushing Brook Drinkwater River	MA94-21_2002	X	-Metals
21013	4.95	Unknown	Drinkwater River Hackett Pond Hell Swamp Longwater Brook Peg Swamp Pine Island Swamp Shinglemill Brook Shinglemill Pond	MA94-21_2002	X	-Metals
21021	2.27	1	French Stream Studleys Pond	MA94-03_2002 MA94151_2002	X	-Unknown toxicity -Nutrients -Organic enrichment/Low DO -Pathogens
21022	1.84	Unknown	Beech Hill Swamp Drinkwater River Factory Pond Forge Pond French Stream Indian Head River Torrey Branch Trout Pond Wampum Swamp	MA94-21_2002 MA94175_2002 MA94037_2002 MA94-03_2002 MA94-04_2002 MA94-22_2002	X X X X X	-Metals -Metals -Noxious aquatic plants -Turbidity -(Exotic species*) -Unknown toxicity -Nutrients -Organic enrichment/Low DO -Pathogens -Metals -Nutrients -Organic enrichment/Low DO
21025	2.45	Unknown	Arnold School Pond Keene Pond Mc Farland Brook Pudding Brook Randall Pond Reservoir	MA94004_2002 MA94127_2002		
21027	1.28	Unknown	Hatch Pond Jacobs Pond	MA94077_2002		
21028	6.30	36	Hoop Pole Swamp Mill Pond Mollys Brook Old Pond Meadows Peterson Pond Third Herring Brook Wildcat Brook Wildcat Creek			

Table A21. South Coastal Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
21031	6.88	Unknown	Copeland Tannery Brook Hatch Pond Herring Brook Howard Pond Indian Head River Little Pudding Brook Magoun Pond Mine Brook Mounce Pond No Bottom Pond North River Oakman Pond Robinson Creek Second Herring Brook Swamp Brook	MA94-22_2002 MA94-05_2002	X	-Pathogens
21033	2.43	Unknown	First Herring Brook Old Oaken Bucket Pond Satsuit Meadow Tack Factory Pond	MA94113_2002 MA94152_2002	X	-Noxious aquatic plants -Turbidity
21037	2.68	Unknown	Bares Brook Branch Creek Cove Brook Hanna Eames Brook Herring River Lewis Pond Macomers Creek North River North River Marsh Old Oaken Bucket Pond Stony Brook Torrey Pond Wales Pond	MA94-07_2002 MA94-05_2002 MA94-06_2002 MA94113_2002	X X X X	-Pathogens -Pathogens -Pathogens -Noxious aquatic plants -Turbidity
21038	1.93	Unknown	Bound Brook The Gulf	MA94-18_2002 MA94-19_2002		
21040	6.10	Unknown	Keene Pond Lorings Bogs Pond Lovings Bogs Philips Brook Pine Lake Round Pond South River South River Pond South River Reservoir	MA94079_2002 MA94089_2002 MA94120_2002 MA94131_2002 MA94-08_2002 MA94148_2002		
21041	1.79	Unknown	Furnace Brook			
21042	2.78	Unknown	Duxbury Bay Island Creek Pond Mill Pond Round Pond	MA94-15_2002 MA94073_2002 MA94101_2002	X	-Pathogens

Table A21. South Coastal Basin

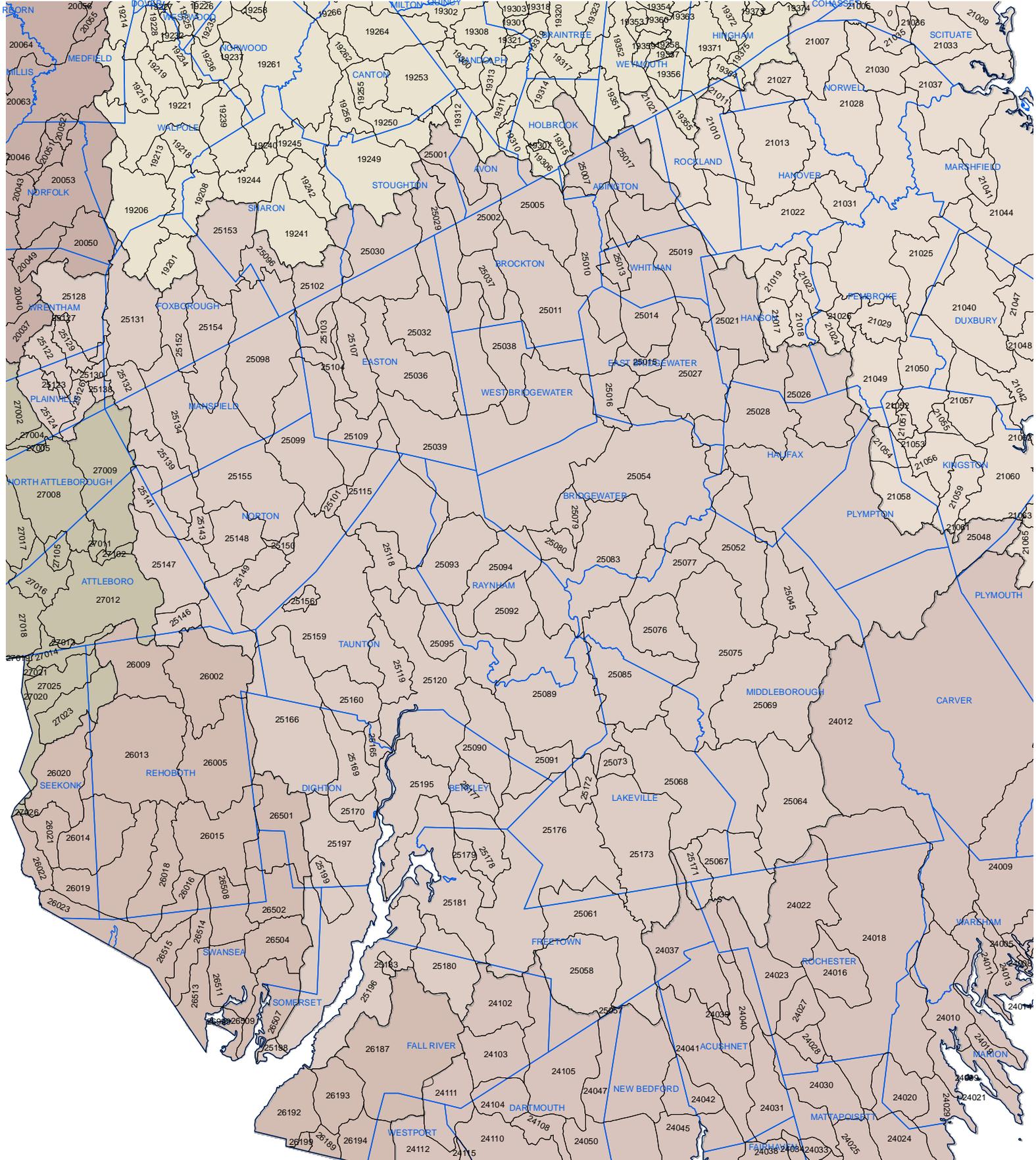
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
21044	3.35	Unknown	Branch Creek			
			Broad Creek			
			Chandlers Pond			
			Furnace Brook			
			Furnace Pond			
			Lewis Pond			
			Littles Creek			
			North River	MA94-06_2002	X	-Pathogens
			Parsons Pond			
South River	MA94-08_2002					
			MA94-09_2002	X	-Pathogens	
			Wales Pond			
21047	2.66	Unknown	Bass Creek			
			Black Mountain Pond	MA94009_2002		
			Green Harbor Marsh			
			Green Harbor River	MA94-10_2002		
			Wharf Creek			
			Winslow Cemetary Pond	MA94172_2002		
			Wright Pond	MA94174_2002		
Wright Reservoir						
21048	2.05	Unknown	Allens Pond			
			Cut River			
			Duck Hill River			
			Duxbury Bay	MA94-15_2002	X	-Pathogens
			Duxbury Marsh			
			Governor Winslow House Pond	MA94047_2002		
			Green Harbor	MA94-11_2002	X	-Pathogens
			North Hill Marsh			
			North Hill Marsh Pond	MA94109_2002		
Pine Point River						
Plymouth Bay	MA94-17_2002	X	-Pathogens			
21050	0.57	Unknown	Lower Chandler Pond	MA94091_2002		
			Pembroke Street South Pond	MA94117_2002		
			Pine Brook			
			Reeds Millpond	MA94126_2002		
			Upper Chandler Pond	MA94165_2002		
			West Chandler Pond	MA94170_2002		
21056	0.01	Unknown	Crossman Pond	MA94032_2002	X	-Noxious aquatic plants
			Fountainhead Brook			
			Jones River	MA94-12_2002		
				MA94-13_2002		
			MA94-14_2002	X	-Pathogens	
21057	6.18	Unknown	Bassett Brook			
			Blackwater Pond			
			Bracketts Pond			
			Dead Swamp			
			Halls Brook			
			Lower Chandler Pond			
			Pine Street Pond	MA94121_2002		
21059	0.51	Unknown	Crossman Pond			
			Furnace Brook			
			Granny Pond			
			Indian Pond	MA94072_2002		
			Russell Pond	MA94133_2002		
			Soules Pond			

Table A21. South Coastal Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
21060	10.58	Unknown	Foundry Pond	MA94038_2002	X	-Turbidity
			Goose Pond			
			Great Mink Hole			
			Jones River	MA94-14_2002	X	-Pathogens
			Little Mink Hole			
			Little Smelt Pond			
			Lucas Pond			
			Pratt Pond			
			Rocky Pond			
			Smelt Brook			
			Smelt Pond	MA94184_2002		
			Wolf Pond			
			21063	12.65	Unknown	Arms House Pond
Duxbury Bay	MA94-15_2002	X				-Pathogens
Eel River	MA94-23_2002					
Foundry Pond						
Hedges Pond						
Leach Pond						
Little Smelt Pond						
No Bottom Pond						
Plymouth Bay	MA94-17_2002	X				-Pathogens
Plymouth Harbor	MA94-16_2002	X				-Pathogens
Spooner Pond						
Stone Pond						
21065	2.35	Unknown	Arms House Pond			
			Billington Sea	MA94007_2002	X	-Noxious aquatic plants -Turbidity
			Briggs Reservoir	MA94020_2002		
			Cooks Pond	MA94027_2002		
			Goose Pond			
			Harlow Pond			
			Little Muddy Pond			
			Little Pond	MA94182_2002		
			Lout Pond	MA94090_2002		
			No Bottom Pond			
			North Triangle Pond	MA94110_2002		
			South Triangle Pond	MA94149_2002		
			Town Brook			
			Trask Pond			
Triangle Pond						
21075	3.51	Unknown	Crooked Pond			
			Eel River	MA94-23_2002		
			Forge Pond	MA94036_2002		
			Gunners Exchange Pond	MA94055_2002		
			Hallfield Pond			
			Hooper Pond			
			Howland Pond			
			Hoyts Pond	MA94070_2002		
			Island Pond	MA94076_2002		
			Negro Pond			
			Russell Millpond	MA94132_2002	X	-Noxious aquatic plants
			South Triangle Pond			
			Turtle Pond			

Table A21. South Coastal Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
21079	2.81	Unknown	Bartlett Pond	MA94005_2002		
			Beaver Dam Brook			
			Beaver Dam Pond	MA94006_2002		
			Fresh Pond	MA94040_2002		
			Long Island Pond	MA94088_2002		
			Rabbit Pond			
21081	3.00	Unknown	Warner Pond			
			Black Pond			
			Briggs Reservoir	MA94019_2002		
			Clam Pudding Pond			
			Cotton Pond			
			Dugway Pond			
			Ellis Bog			
			Hathaway Pond			
			Indian Brook			
			Island Pond	MA94075_2002		
			Lilly Pond			
			Morey Hole	MA94102_2002		
			Rocky Pond			
			Savery Grassy Pond			
			Scokes Pond			
Shallow Pond	MA94140_2002					
Ship Pond	MA94142_2002					
Tays Bog						
21083	1.80	Unknown	Black Jimmy Pond	MA94008_2002		
			Black Pond			
			Center Hill Pond			
			Hedges Bog			
			Hedges Pond	MA94065_2002		
			Salt Pond			
			Savery Pond	MA94136_2002		
21085	6.13	Unknown	Black Pond			
			Bloody Pond	MA94015_2002		
			Elbow Pond	MA94035_2002		
			Foundry Pond			
			Grassy Pond			
			Great Herring Pond	MA94050_2002	X	-Metals
			Hathaway Pond			
			Island Pond	MA94074_2002		
			Little Herring Pond	MA94082_2002		
Pickarel Pond						
Triangle Pond	MA94160_2002					
21089	6.70	Unknown	Black Pond			
			Cape Cod Canal	MA95-14_2002	X	-Pathogens
			Foundry Pond			
			Long Swamp			
TOTAL KNOWN:		37				



Appendix A
Sub-Basin
Identification Maps:
TAUNTON



Table A22. Taunton Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
25001	3.88	Unknown	Brockton Reservoir Waldo Lake	MA62023_2002 MA62201_2002		
25002	10.63	Unknown	Cross Pond Ellis Brett Pond Lovett Brook Lower Porter Pond Thirtyacre Pond Upper Porter Pond Waldo Lake	MA62052_2002 MA62111_2002 MA62190_2002 MA62200_2002 MA62201_2002		
25005	4.82	Unknown	Cary Brook Searles Brook Trout Brook Upper Porter Pond	MA62-07_2002	X	-Siltation -Organic enrichment/Low DO -Pathogens
25007	0.25	2	Beaver Brook Cleveland Pond Cushing Pond	MA62042_2002 MA62056_2002		
25010	1.55	Unknown	Beaver Brook Cleveland Pond Hunts Pond Jones Pond	MA62-09_2002 MA62042_2002		
25011	1.51	Unknown	Beaver Brook Cross Pond Edson Brook Ellis Brett Pond Jones Pond Lower Porter Pond Matfield River Salisbury Brook Salisbury Plain River Thirtyacre Pond Trout Brook Upper Porter Pond	MA62-09_2002 MA62052_2002 MA62-32_2002 MA62-08_2002 MA62-05_2002 MA62-06_2002 MA62-07_2002	X X X X X	-Pathogens -Siltation -Pathogens -Siltation -(Other habitat alterations*) -Pathogens -Suspended solids -Cause Unknown -Pathogens -Siltation -Organic enrichment/Low DO -Pathogens
25014	4.78	Unknown	Hunts Pond Meadow Brook			
25015	0.58	Unknown	Forge Pond			
25016	1.76	Unknown	Matfield River	MA62-32_2002	X	-Pathogens
25017	2.82	Unknown	Island Grove Pond Shumatuscacant River	MA62094_2002 MA62-33_2002	X	-Noxious aquatic plants -Turbidity -(Exotic species*)
25019	2.00	Unknown	Bear Meadow Hobart Pond Poor Meadow Brook Shumatuscacant River	MA62090_2002 MA62-33_2002	X	-Turbidity -(Exotic species*)

Table A22. Taunton Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
25027	0.01	Unknown	Black Brook Poor Meadow Brook Satucket River	MA62-34_2002 MA62-10_2002		
25029	2.47	Unknown	Dorchester Brook French Pond Gibney Pond Monte Pond			
25030	1.96	Unknown	Ames Long Pond Dry Pond Farrington Pond Flyaway Pond Longwater Pond Picker Pond Queset Brook Shovelshop Pond Whitman Brook	MA62001_2002 MA73040_2002 MA62109_2002 MA62-21_2002 MA62172_2002	X	-Noxious aquatic plants -Turbidity -(Exotic species*)
25032	16.42	Unknown	Ames Pond Coweset Brook Dean Pond Hockomock River Longwater Pond Morse Pond Queset Brook	MA62-22_2002 MA62-35_2002 MA62-21_2002		
25036	1.56	Unknown	Black Brook Little Cedar Swamp	MA62106_2002		
25037	2.37	Unknown	West Meadow Brook			
25039	5.50	Unknown	Black Brook Hockomock River Hockomock Swamp Howard Brook Lake Nippenicket Nunkets Pond Town River Willow Brook	MA62-35_2002 MA62131_2002 MA62-11_2002 MA62-12_2002		
25045	0.56	Unknown	Raven Brook			
25048	0.48	Unknown	Annasnapett Brook Bonney Pond Cedar Swamp Colchester Brook Cooper Pond Doten Brook Fuller Street Pond Granny Pond Johns Pond Little Cedar Swamp Lyon Pond Muddy Pond Muddy Pond Brook North Center Street Pond Palmer Mill Brook Peterson Swamp Ricketts Pond Savery Pond Trickle Pond Turkey Swamp Whetstone Brook Winnetuxet River	MA62046_2002 MA95058_2002 MA62096_2002 MA62125_2002 MA94104_2002 MA62132_2002 MA62167_2002		

Table A22. Taunton Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
25054	1.68	Unknown	Beaver Brook Blood Pond Carver Pond Matfield River Satucket River South Brook Spring Brook Taunton River Town River Winnetuxet River	MA62033_2002 MA62-32_2002 MA62-10_2002 MA62-01_2002 MA62-12_2002 MA62-13_2002 MA62-24_2002	X	-Pathogens
25061	4.06	Unknown	Bolton Cedar Swamp East Freetown Pond Fall Brook Sassaquin Pond	MA62063_2002 MA95129_2002		
25064	2.72	Unknown	Black Brook Millers Neck Brook			
25068	2.01	Unknown	Assawompset Pond Bates Brook Cranberry Pond Loon Pond Nemasket River Owl Swamp Pocksha Pond Sampsons Cove Tamett Brook The Reservoir	MA62003_2002 MA62-25_2002 MA62145_2002 MA62189_2002		
25069	2.08	Unknown	Fall Brook Shaving Brook Shorts Brook Stony Brook Tispaquin Pond Woods Brook Woods Pond	MA62220_2002	X	-Turbidity -(Exotic species*)
25075	6.73	Unknown	Beaver Dam Brook Beaverdam Swamp Fall Brook Meetinghouse Swamp Nemasket River	MA62-25_2002 MA62-26_2002		
25076	2.03	Unknown	Joses Meadow Purchade Brook			
25083	1.48	Unknown	Bassett Brook Ice Pond Otis Pratt Brook Sawmill Brook Taunton River	MA62-36_2002 MA62-01_2002		
25085	7.98	Unknown	Clear Pond Dunham Pond Nevertouch Pond Pogouy Brook Poquoy Pond Puddingshear Brook Thatchers Pond The Reservoir	MA62147_2002		

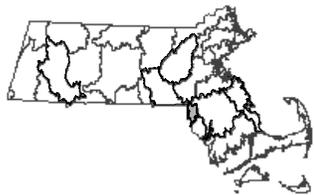
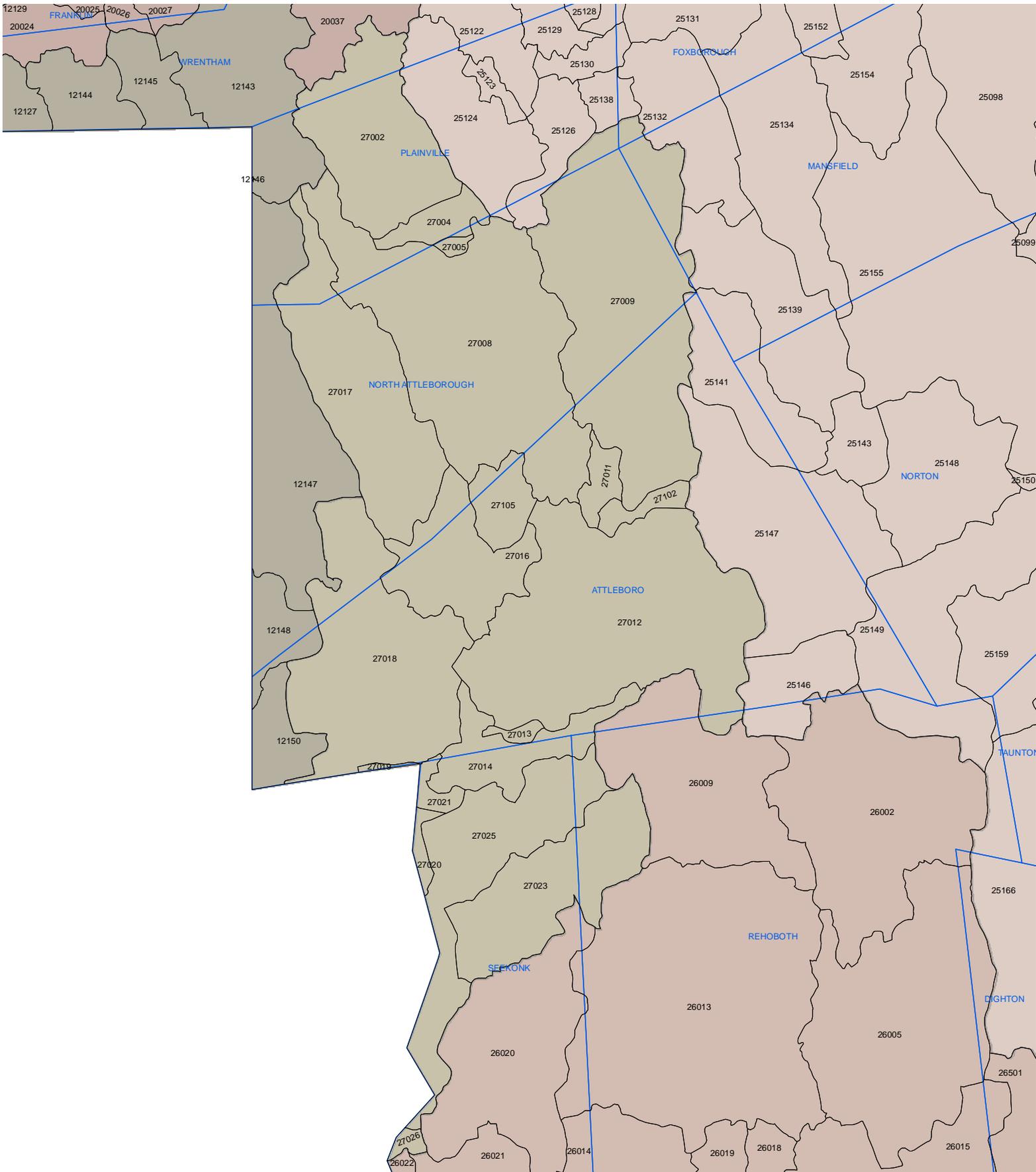
Table A22. Taunton Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
25089	0.57	Unknown	Big Bearhole Pond	MA62011_2002	X	-Organic enrichment/Low DO -Noxious aquatic plants -(Exotic species*)
			Cain Pond	MA62030_2002	X	-Organic enrichment/Low DO -Turbidity
			Deep Pond			
			Furnace Brook			
			Furnace Pond			
			Kings Pond			
			Lake Rico	MA62148_2002		
			Little Bearhole Pond			
			Middle Pond	MA62115_2002		
			Richmond Pond	MA62159_2002		
			Taunton River	MA62-01_2002		
			Thatchers Pond			
			Thompson Brook			
25090	13.26	Unknown	Barstows Pond			
			Cotley River			
25091	5.91	Unknown	Cotley River			
25092	1.94	Unknown	Dam Lot Brook			
			Johnson Pond			
25093	3.54	Unknown	Dead Swamp			
			Pine Swamp			
			Pine Swamp Brook			
			Prospect Hill Pond	MA62149_2002		
25094	3.79	Unknown	Forge River	MA62-37_2002		
			Gushee Pond	MA62084_2002		
			Hewitt Pond	MA62088_2002		
			Johnson Pond	MA62097_2002		
			Kings Pond	MA62101_2002		
			Titicut Swamp			
			Tracy Pond			
25095	5.25	Unknown	Cotley River			
			Forge River	MA62-37_2002		
			Taunton River	MA62-01_2002		
				MA62-02_2002	X	-Pathogens
25099	7.34	Unknown	Canoe River	MA62-27_2002		
25115	2.10	Unknown	Black Pond			
			Canoe River	MA62-27_2002		
			Hockomock Swamp			
			Lake Sabbatia	MA62166_2002		
			Mulberry Meadow Brook	MA62-31_2002		
			Snake River	MA62-28_2002		
			Winnecunnet Pond	MA62213_2002		
25118	0.02	Unknown	Lake Sabbatia	MA62166_2002		
			Mill River	MA62-29_2002		
			Watson Pond	MA62205_2002	X	-Nutrients -Organic enrichment/Low DO -Noxious aquatic plants -Turbidity -(Exotic species*)
			Whittenton Impoundment	MA62228_2002		
25119	0.01	Unknown	Cobb Brook			
			Crapo Bog			
25120	1.24	Unknown	Mill River	MA62-29_2002		
			Taunton River	MA62-02_2002	X	-Pathogens
25122	0.32	Unknown	Hawthorne Brook			
			Trout Pond			
25124	1.05	Unknown	Turnpike Lake	MA62198_2002		

Table A22. Taunton Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
25128	2.57	Unknown	Cracker Pond Crocker Pond Meadow Brook Rabbly Hill Pond Route One Pond, West Thurston Street Pond	MA62051_2002 MA62165_2002 MA62192_2002		
25131	2.44	Unknown	Carpenter Pond Cocasset Brook Cocasset Lake Furnace Lake Governor Meadow Sunset Lake Wading River	MA62032_2002 MA62043_2002 MA62076_2002 MA62184_2002	X	-Turbidity
25132	2.80	Unknown	Blakes Pond Robinson Pond Wading River Witch Pond Swamp	MA62221_2002 MA62163_2002 MA62-17_2002	X	-Cause Unknown -Organic enrichment/Low DO -Pathogens
25134	4.19	Unknown	Hodges Brook			
25139	0.01	Unknown	Sweets Pond Wading River	MA62185_2002 MA62-17_2002	X	-Cause Unknown -Organic enrichment/Low DO -Pathogens
25141	0.34	Unknown	Wading River	MA62-17_2002	X	-Cause Unknown -Organic enrichment/Low DO -Pathogens
25143	0.41	Unknown	Wading River	MA62-17_2002	X	-Cause Unknown -Organic enrichment/Low DO -Pathogens
25147	1.42	Unknown	Chartley Brook Chartley Pond Coopers Pond	MA62038_2002		
25148	1.22	Unknown	Barrowsville Pond Wading River	MA62007_2002 MA62-17_2002	X	-Cause Unknown -Organic enrichment/Low DO -Pathogens
25150	0.04	Unknown	Wading River	MA62-17_2002	X	-Cause Unknown -Organic enrichment/Low DO -Pathogens
25152	10.58	Unknown	Hersey Pond Robinson Brook	MA62-14_2002		
25153	4.61	Unknown	Billings Brook Gavins Pond Mcavoy Pond Rumford River Vandys Pond Wolomolopoag Pond	MA62077_2002 MA62112_2002 MA62-15_2002 MA62216_2002	X	-Pesticides -Organic enrichment/Low DO -Pathogens
25154	6.89	Unknown	Cabot Pond Fulton Pond Glue Factory Pond Hodges Pond Robinson Brook Rumford River	MA62029_2002 MA62075_2002 MA62091_2002 MA62-14_2002 MA62-15_2002	X X X X	-Pesticides -Pesticides -Pesticides -Pesticides -Organic enrichment/Low DO -Pathogens

Table A22. Taunton Basin						
Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
25155	9.64	Unknown	Norton Reservoir	MA62134_2002	X	-Pesticides -Nutrients -Noxious aquatic plants -Turbidity -(Exotic species*)
			Rumford River	MA62-15_2002	X	-Pesticides -Organic enrichment/Low DO -Pathogens
			Threemile River	MA62-16_2002	X	-Pathogens
			Wading River	MA62-17_2002	X	-Cause Unknown -Organic enrichment/Low DO -Pathogens
25159	3.73	Unknown	Fall Brook			
			Meadow Brook			
			Meadow Brook Pond	MA62113_2002		
			Oakland Pond	MA62136_2002		
			Threemile River	MA62-16_2002	X	-Pathogens
25160	0.13	Unknown	Three Mile River Impoundment	MA62231_2002		
25165	0.53	Unknown	Threemile River	MA62-16_2002	X	-Pathogens
			Taunton River	MA62-02_2002	X	-Pathogens
25166	0.40	Unknown	Threemile River	MA62-16_2002	X	-Pathogens
			Maple Swamp			
25170	0.68	Unknown	Segreganset River	MA62-18_2002		
			Segreganset River Ponds	MA62169_2002	X	-Noxious aquatic plants -Turbidity
25173	2.40	Unknown	Cedar Swamp			
			Segreganset River	MA62-18_2002		
			Fall Brook			
			Hathaway Brook			
25176	3.19	Unknown	Long Pond	MA62108_2002		
			Mill Pond			
			Mullein Hill Chapel Pond	MA62127_2002		
25177	3.83	Unknown	Cedar Swamp			
			Holloway Brook			
25178	0.20	Unknown	Quaker Brook			
			Assonet River	MA62-19_2002		
25180	0.05	Unknown	Forge Pond	MA62072_2002		
			Quaker Brook			
25181	2.01	Unknown	Mill Brook			
			Rattlesnake Brook			
			Assonet River	MA62-19_2002		
			Assonet River	MA62-20_2002	X	-Pathogens
25196	14.74	Unknown	Shepherds Cove			
			Taunton River	MA62-03_2002	X	-Organic enrichment/Low DO -Pathogens
			Terry Brook			
25196	14.74	Unknown	Mount Hope Bay	MA61-06_2002	X	-Cause Unknown -Unknown toxicity -Nutrients -Organic enrichment/Low DO -Thermal modifications -Pathogens
			Quequechan River	MA61-05_2002		
			Steep Brook			
			Taunton River	MA62-03_2002	X	-Organic enrichment/Low DO -Pathogens
				MA62-04_2002	X	-Organic enrichment/Low DO -Pathogens

Table A22. Taunton Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
25197	8.32	Unknown	Broad Cove	MA62022_2002		
			Buffington Brook			
			Labor In Vain Brook			
			Mount Hope Bay	MA61-06_2002	X	-Cause Unknown -Unknown toxicity -Nutrients -Organic enrichment/Low DO -Thermal modifications -Pathogens
			Muddy Cove Brook	MA62-23_2002		
			Muddy Cove Brook Pond	MA62124_2002	X	-Noxious aquatic plants -Turbidity
			Segreganset River	MA62-18_2002		
			Somerset Reservoir	MA62174_2002	X	-Metals
			Taunton River	MA62-02_2002	X	-Pathogens
				MA62-03_2002	X	-Organic enrichment/Low DO -Pathogens
	MA62-04_2002	X	-Organic enrichment/Low DO -Pathogens			
25198	1.35	Unknown	Mount Hope Bay	MA61-06_2002	X	-Cause Unknown -Unknown toxicity -Nutrients -Organic enrichment/Low DO -Thermal modifications -Pathogens
TOTAL KNOWN:		2				



Appendix A
Sub-Basin
Identification Maps:
TEN MILE



Table A23. Ten Mile Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
27004	0.58	Unknown	Plainville Pond	MA52-02_2002	X	-Cause Unknown -Metals -Nutrients -Siltation -(Other habitat alterations*) -Pathogens -Noxious aquatic plants -Turbidity
			Ten Mile River			
			Wetherells Pond			
			Whiting Pond	MA52042_2002		
27005	0.49	Unknown	Ten Mile River	MA52-02_2002	X	-Cause Unknown -Metals -Nutrients -Siltation -(Other habitat alterations*) -Pathogens -Noxious aquatic plants -Turbidity
			Whiting Pond			
27008	8.33	Unknown	Falls Pond	MA52013_2002	X	-Nutrients -Noxious aquatic plants -Turbidity
				MA52014_2002		
			Farmers Pond	MA52015_2002	X	-Nutrients -Noxious aquatic plants
			Manchester Pond Reservoir	MA52026_2002		
			Mechanics Pond	MA52027_2002	X	-Nutrients -Pathogens -Noxious aquatic plants
			Peck Pond			
			Scotts Brook	MA52-09_2002	X	-(Flow alteration*)
Ten Mile River	MA52-02_2002	X	-Cause Unknown -Metals -Nutrients -Siltation -(Other habitat alterations*) -Pathogens -Noxious aquatic plants -Turbidity			
				MA52-03_2002	X	-Cause Unknown -Unknown toxicity -Metals -Nutrients -Organic enrichment/Low DO -Pathogens -Noxious aquatic plants
			Whiting Pond	MA52042_2002		

Table A23. Ten Mile Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment			
27009	10.39	Unknown	Black Pond						
			Bungay River	MA52-06_2002					
			Greenwood Lake	MA52017_2002					
			Mechanics Pond	MA52027_2002	X	-Nutrients -Pathogens -Noxious aquatic plants			
			Plain Street Pond	MA52032_2002	X	-Noxious aquatic plants -(Exotic species*)			
			Witch Pond						
			Witch Pond Swamp						
27012	0.43	Unknown	Dodgeville Pond	MA52011_2002	X	-Nutrients -Pathogens -Noxious aquatic plants -Turbidity			
			Hebronville Pond	MA52020_2002	X	-Noxious aquatic plants			
			Mechanics Pond	MA52027_2002	X	-Nutrients -Pathogens -Noxious aquatic plants			
			Speedway Brook	MA52-05_2002	X	-Cause Unknown -Metals -Nutrients -Siltation -Organic enrichment/Low DO -(Other habitat alterations*) -Pathogens -Turbidity			
			Ten Mile River	MA52-03_2002	X	-Cause Unknown -Unknown toxicity -Metals -Nutrients -Organic enrichment/Low DO -Pathogens -Noxious aquatic plants			
						Thacher Brook			
						Ten Mile River	MA52-03_2002	X	-Cause Unknown -Unknown toxicity -Metals -Nutrients -Organic enrichment/Low DO -Pathogens -Noxious aquatic plants
27013	0.02	Unknown	Ten Mile River	MA52-03_2002	X	-Cause Unknown -Unknown toxicity -Metals -Nutrients -Organic enrichment/Low DO -Pathogens -Noxious aquatic plants			
27014	0.00	Unknown	Ten Mile River	MA52-03_2002	X	-Cause Unknown -Unknown toxicity -Metals -Nutrients -Organic enrichment/Low DO -Pathogens -Noxious aquatic plants			
27016	6.49	Unknown	Fourmile Brook	MA52-10_2002					
			Luther Reservoir	MA52025_2002	X	-Turbidity			
			Orrs Pond	MA52029_2002					
			Sevenmile River	MA52-07_2002	X	-Organic enrichment/Low DO -(Flow alteration*) -Pathogens			
			Todds Pond						

Table A23. Ten Mile Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
27017	7.01	Unknown	Hoppin Hill Reservoir	MA52021_2002		
			Scotts Brook	MA52-09_2002	X	-(Flow alteration*)
			Sevenmile River	MA52-07_2002	X	-Organic enrichment/Low DO -(Flow alteration*) -Pathogens
27018	13.97	Unknown	Lake Como	MA52010_2002	X	-Noxious aquatic plants -Turbidity -(Exotic species*)
			Orrs Pond	MA52029_2002		
			Sevenmile River	MA52-07_2002	X	-Organic enrichment/Low DO -(Flow alteration*) -Pathogens
			Sweedens Swamp	MA52-08_2002	X	-Pathogens
27105	2.17	Unknown	Fourmile Brook	MA52-10_2002		
			Manchester Pond			
			Manchester Pond Reservoir	MA52026_2002		

Table A24. Westfield Basin

Sub-basin ID	Mass Highway Road Miles in Urbanized Area	Number of Known Outfalls	Receiving Waterbody	Water Body Segment ID Code	Impaired - Category 4a or 5	Impairment
4173	0.92	Unknown	Pond Brook Potash Brook Russell Pond Westfield River	MA32-22_2002 MA32061_2002 MA32-05_2002		
4211	0.01	Unknown	Ashley Brook Jacks Brook Little River	MA32-08_2002		
4212	0.10	Unknown	Little River	MA32-08_2002		
4215	1.25	Unknown	Arm Brook			
4216	0.72	Unknown	Arm Brook			
4219	0.16	Unknown	Barry Brook Buck Pond Fuller Reservation Pond Horse Pond Pond Brook Powdermill Brook Sandy Brook Snake Pond	MA32012_2002 MA32043_2002 MA32-24_2002 MA32-09_2002	X	-Siltation -Pathogens -Suspended solids -Turbidity
4223	0.02	Unknown	Congamond Lakes Goose Pond Great Brook	MA32021_2002 MA32022_2002 MA32023_2002 MA32-25_2002		
4229	0.76	Unknown	Great Brook	MA32-25_2002		
4230	0.06	Unknown	Great Brook	MA32-25_2002		
4243	0.00	Unknown	Kellog Brook Slab Brook			
4246	0.01	Unknown	Great Brook	MA32-25_2002		
4248	6.03	Unknown	Great Brook Little River Moose Meadow Brook Powdermill Brook Westfield River Westfield River Brook	MA32-25_2002 MA32-08_2002 MA32-23_2002 MA32-09_2002 MA32-05_2002 MA32-06_2002	X	-Siltation -Pathogens -Suspended solids -Turbidity
4256	2.93	Unknown	Block Brook Miller Brook Paucatuck Brook Trask Brook Westfield River White Brook	MA32-27_2002 MA32-29_2002 MA32-06_2002 MA32-07_2002 MA32-28_2002		
4258	4.67	Unknown	Westfield Brook Westfield River	MA32-07_2002		

Appendix B

Endangered Species Review for Short Nose Sturgeon



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930-2298

MAR 19 2007

John Blundo
Massachusetts Highway Department
10 Park Plaza
Boston, Massachusetts 02116-3969

Attn: Henry Barbaro

Dear Mr. Blundo,

This is in response to your letter dated February 12, 2007 regarding an application by the Massachusetts Highway Department (MassHighway) for coverage under the National Pollutant Discharge Elimination System General Permit for Discharges from Small Municipal Separate Storm Water Systems (MS4 permit) administered by the US Environmental Protection Agency (EPA). EPA has granted MassHighway partial authorization to discharge storm water under this permit with the exception of the Merrimack and Connecticut River mega-basins. In order for MassHighway to obtain coverage for the remaining roadways (i.e., those in the Merrimack and Connecticut River watersheds), MassHighway must demonstrate to EPA that storm water runoff from these roads will have no effect on threatened and/or endangered species listed by NOAA's National Marine Fisheries Service (NMFS).

As you know, populations of shortnose sturgeon (*Acipenser brevirostrum*) occur in the Connecticut River from the Turners Falls Dam to the mouth of the River in Connecticut and in the Merrimack River from the mouth of the River to the Lawrence Dam. Several MassHighway roads exist in the Merrimack and Connecticut River watersheds and storm water runoff from these roads has the potential to enter either of these rivers.

MassHighway has used the Impervious Cover Model to demonstrate that storm water runoff from MassHighway roads in the Merrimack and Connecticut River watersheds constitute less than one percent of the total discharge volume of these rivers and less than one percent of the possible total contaminant loading. This model assumes that all pavement runoff is captured and discharged directly into the Rivers, while in reality most runoff is filtered through the ground and a minimal amount of runoff is likely directly discharged to either River. As such, MassHighway has determined that storm water runoff from these roads has no effect on the water quality of the mainstem Merrimack and/or Connecticut Rivers. Additionally, MassHighway has an extensive storm water management program and employs many Best Management Practices to reduce the pollutant load of any storm water runoff from MassHighway roads.



The information provided by MassHighway supports the conclusion that storm water runoff from MassHighway roads within the Merrimack and Connecticut River watersheds will not affect water quality in either river in a way that will cause effects to shortnose sturgeon. As such, the inclusion of these roadways in EPA's MS4 permit will not affect any species listed by NMFS. Should project plans change or new information become available that changes the basis for this determination, further coordination with NMFS should be pursued. Should you have any questions about these comments, please contact Julie Crocker at (978) 281-9300 ext. 6530 or by e-mail (Julie.Crocker@noaa.gov).

Sincerely,



Mary A. Colligan
Assistant Regional Administrator
for Protected Resources

Cc: Boelke, F/NER4

February 12, 2007

Mary A. Colligan
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Regional Office
One Blackburn Drive
Gloucester, MA 01930-2298

Subject: MassHighway NPDES Permit – Discharges to Shortnose Sturgeon Habitat

Dear Ms. Colligan:

The Massachusetts Highway Department (MassHighway) has received your letter dated August 21, 2006, requesting additional information to help determine whether discharges from MassHighway outfalls have the potential to adversely affect shortnose sturgeon within the Connecticut and Merrimack Rivers. In response to your request, we have prepared an estimate of the average annual runoff and pollutant load from MassHighway roads in the Connecticut and Merrimack River basins.

Using a state-of-the-art model (the Impervious Cover Model), MassHighway has determined that the portion of MassHighway highways in both the Connecticut and Merrimack megabasin watersheds constitute less than one percent of the total discharge volume, as well as contaminant loading; even if it is assumed that all the pavement runoff is captured and discharged directly into the Rivers. We feel that this model, and the programs included in the attached Notice of Intent, illustrates that the shortnose sturgeon habitat is not being adversely impacted by MassHighway roads. We are attaching a copy of the current Notice of Intent (submitted to EPA and DEP) to provide you with more detail on the existing and proposed programs that are being implemented under the NPDES program

MassHighway currently has partial authorization to discharge storm water under the NPDES General Permit for MS4s (outside of the Merrimack and Connecticut mega-basins). However, MassHighway will not be issued full authorization from EPA until the National Marine Fisheries Service finds that MassHighway's storm water discharges do not adversely affect the shortnose sturgeon. Therefore, we appreciate your timely response to this submittal.

If you have any concerns or comments regarding this letter, please feel free to contact Henry Barbaro at (617) 973-7419.

Sincerely,

John, Blundo, P.E.
Chief Engineer

Enclosure: Attachment A – Analysis of MassHighway Storm Water Discharges
Attachment B - NPDES Notice of Intent (12/13/06)

Attachment A. Analysis of MassHighway Storm Water Discharges within the Connecticut and Merrimack River Watersheds

Attachment A. Analysis of MassHighway Storm Water Discharges within the Connecticut and Merrimack River Watersheds

MassHighway used the Impervious Cover Model (ICM) to perform a rough estimate of the average annual storm water volume and pollutant loading based on impervious cover associated with MassHighway roads and the land uses in the watershed.

1.0 Impervious Cover Model Overview

The Center of Watershed Protection's Impervious Cover Model (Schueler, 2003) provides a simple method for estimating storm water runoff volumes and pollutant loads based on impervious cover in the watershed. The method uses the five following steps:

Watershed Delineation including delineation of each sub-watershed in an area of interest and development of a GIS data-layer.

Impervious Cover Mapping including development of land cover and/or impervious cover GIS data-layers.

Impervious Cover Determination for overall watershed impervious cover magnitude and percentage of watershed area.

Estimation of Annual Storm Water Runoff Volume based on watershed impervious cover.

Estimation of Average Annual Pollutant Loads using annual runoff volume and event mean pollutant concentration for selected pollutants.

The equations used to estimate annual storm water runoff and pollutant load are shown in Figure 1.

Attachment A. Analysis of MassHighway Storm Water Discharges within the Connecticut and Merrimack River Watersheds (continued)

Figure 1: “Simple Method”

Step 1 – Calculate Runoff Volume Coefficient

$R_v = \text{Runoff Volume Coefficient} = 0.05 + 0.9I_a$, where

I_a = Impervious fraction (from GIS analysis)

Step 2 – Calculate Annual Runoff Volume

$R = \text{Annual runoff (acre*ft)} = P * P_j * R_v * A$, where

P = Annual rainfall (ft)

P_j = Fraction of rainfall events producing runoff = 0.9

A = Watershed area (acres)

Step 3 – Calculate Annual Pollutant Load

$L = \text{Annual pollutant load (lbs)} = R * C * U * A$, where

C = Pollutant concentration in stormwater, EMC (mg/l) from literature

U = Unit conversion factor = 0.226

A = Area (acres).

2.0 Impervious Cover

To calculate watershed impervious cover, the Massachusetts portion of the Merrimack and Connecticut River megabasins were digitally intersected with the Massachusetts land cover layer, and the area of each land use category calculated. Watershed impervious percentage was then calculated based on the assumed impervious percentages for each land use as shown in Table 1. The assumed percentage of impervious cover for each land use was derived using recommended percentages from TR-55, Urban Hydrology for Small Watersheds (USDA, 1986).

Attachment A. Analysis of MassHighway Storm Water Discharges within the Connecticut and Merrimack River Watersheds (continued)

Table 1: Estimated Percent Impervious Cover by Land Cover

Land Use	Estimated Percent Impervious Cover
Commercial-Industrial-Transportation	79%
Dense Residential Developed	65%
High Intensity Residential	65%
Highways/Runways	75%
Low Intensity Residential	25%
Sparse Residential Developed	20%
Urban/Industrial	72%
Other	0%

The MassHighway road area within each watershed was calculated using the surface width (travel lane) and shoulder width (left and right) values provided in the MassHighway road shapefiles available on MassGIS assuming 100% of this area is impervious cover, as shown in Table 2.

Table 2: Impervious Cover by Mega-Basin

Watershed	Watershed Area (acres)	Impervious Cover (acres)	Impervious Percentage (%)
MA Portion of Merrimack River Mega-Basin	766,800	86,700	11
MH Roads in Merrimack Mega-Basin	970	970	100
MA Portion of Connecticut River*	1,741,200	65,000	4
MH Roads In Connecticut Watershed*	650	650	100

3.0 Storm Water Volume Analysis

In assessing the potential impact of stormwater runoff from MassHighway roads to these rivers, the average annual storm water contribution from MassHighway roads in the Merrimack and Connecticut River megabasins was estimated using the Simple Method described above. Land use values within each of the watersheds within Massachusetts were obtained from MassGIS data. Table 3 summarizes this analysis.

Attachment A. Analysis of MassHighway Storm Water Discharges within the Connecticut and Merrimack River Watersheds (continued)

Table 3: Estimated Average Annual Storm Water Volume

		Area (sq. mi.)	Area (acres)	Avg. Annual Precip. (inches)	Avg. Annual SW Runoff (inches)	Avg. Annual SW Volume (acre-ft)	SW Volume from MH Roads (%)
Merrimack River	MassHighway Roads	1.5	969	45.8	39.2	3,200	--
	MA Portion of Watershed	1,198	766,800	45.8	6.3	403,000	0.8%
	Overall Watershed	5,010	3,206,400				
Connecticut River	MassHighway Roads	1.0	654	45.5	38.9	2,200	--
	MA Portion of Watershed	2,721	1,741,200	45.5	3.4	494,000	0.4%
	Overall Watershed	11,000	7,040,000				

- Merrimack River watershed areas were obtained from Merrimack River Watershed Council web site (www.merrimack.org)
- Connecticut River watershed areas were obtained from Connecticut River Watershed Council web site (www.ctriver.org)
- MassHighway road areas were obtained from MassHighway GIS shapefiles and include all MassHighway roads within the watershed regardless of whether they are within urbanized area zones. Each area was calculated from the surface width plus the shoulder widths to determine an overall impervious width, multiplied by the length.
- Average annual precipitation was obtained from WorldClimate.com. Lawrence station was used for Merrimack River and Springfield station for the Connecticut River. Average annual runoff values were obtained from Water Atlas of the United States published by Water Information Center in 1973.
- MA portion of watershed includes only the portion of the watershed within Massachusetts.
- Connecticut mega-basin includes Connecticut, Chicopee, Westfield and Millers rivers.
- Merrimack mega-basin includes Merrimack, Nashua, Concord and Shawsheen rivers.

Although this analysis is a rough estimate, it indicates the order of magnitude of MassHighway’s storm water runoff volume relative to the total runoff experienced from each watershed. The analysis only includes storm water runoff and does not account for groundwater base flow or point source discharges within the river which provides further dilution of the storm water from MassHighway roads. The analysis indicates that the estimated storm water runoff from MassHighway roads is a very small fraction of the storm water volume received by the rivers each year.

4.0 Pollutant Load Analysis

The average annual pollutant loading from MassHighway roads versus the loading from the other land uses in each of the watersheds was estimated using the Simple Method. The method uses EMC to determine the pollutant loading per acre of watershed.

Attachment A. Analysis of MassHighway Storm Water Discharges within the Connecticut and Merrimack River Watersheds (continued)

4.1 Event Mean Concentrations (EMC)

EMCs represent the average concentration of the pollutant during an entire stormwater runoff event. EMCs are empirically derived from large stormwater data sets compiled by the Nationwide Urban Runoff Program, the US. Geological Survey, and the EPA NDPS Phase I stormwater program (Schueler, 2003). EMC estimates were selected because they are based on field data collected from thousands of storm events. However, these estimates are based on nationwide data, so they do not account for regional variation in soil types, climate, and other factors. Thus, EMCs applied to Massachusetts watersheds should be considered to be screening-level estimates. EMC values are provided in the Impacts of Impervious Cover document (Schueler, 2003) for a variety of constituents including:

- TSS
- Total P
- Soluble P
- Total N
- TKN
- Chromium
- Nitrite & Nitrate
- Copper
- Lead
- Zinc
- Cadmium

4.2 Assumptions and Limitations

Watershed impervious cover/EMC can be employed to estimate annual pollutant loading. This method includes the following limitations and limiting assumptions:

- This method does not account for point source pollutant loadings.
- EMCs will provide reasonable accuracy over long time periods (i.e., annual loads), but since concentrations vary significantly from storm to storm, this method should not be used for calculating loads for individual storm events. The event mean concentrations are based on countrywide data and do not account for regional variation in soil types, climate and other factors.
- This method does not account for in-stream water quality processes.
- This method does not account for existing water quality BMPs or natural treatment prior to reaching the river. This is especially prevalent in the MassHighway road pollutant loadings since the model estimates the pollutant loading as if the impervious acreage is directly discharged to the river.

Attachment A. Analysis of MassHighway Storm Water Discharges within the Connecticut and Merrimack River Watersheds (continued)

4.3 Watershed Specific Pollutant Load Summary

Table 4 shows the estimated annual loads calculated using the Simple Method for the Merrimack River megabasin within Massachusetts versus the annual load from MassHighway roads. The Merrimack mega-basin includes the sub-watersheds for the Merrimack, Nashua, Concord and Shawsheen rivers.

Table 4: Estimated Annual Loads – Merrimack River Mega-Basin

Constituent	Event Mean Concentrations	Estimated Annual Load		
		MA Portion of Watershed	MH Roads	MH Contribution vs. MA watershed (%)
Sediments				
TSS (lbs)	78.4	84,962,300	672,400	0.8
Nutrients				
Total P (lbs)	0.32	346,800	2,750	0.8
Soluble P (lbs)	0.13	140,900	1,120	0.8
Total N (lbs)	2.39	2,590,000	20,500	0.8
TKN (lbs)	1.73	1,874,800	14,850	0.8
Nitrite & Nitrate (lbs)	0.66	715,200	5,650	0.8
Metals				
Copper (lbs)	0.0134	14,500	115	0.8
Lead (lbs)	0.0675	73,150	580	0.8
Zinc (lbs)	0.162	175,600	1,390	0.8
Cadmium (lbs)	0.0007	760	6	0.8
Chromium (lbs)	0.004	4,340	34	0.8

Table 5 shows the estimated annual loads calculated using the Simple Method for the Connecticut River megabasin within Massachusetts, based on the relevant pollutants for this type of impairment. The Connecticut River mega-basin includes the sub-watersheds for the Connecticut, Chicopee, Westfield, and Millers rivers.

Attachment A. Analysis of MassHighway Storm Water Discharges within the Connecticut and Merrimack River Watersheds (continued)

Table 5: Estimated Annual Loads – Connecticut River in MA

Constituent	Event Mean Concentrations	Estimated Annual Load		
		MA Portion of Watershed	MH Roads	MH Contribution vs. MA watershed (%)
Sediments				
TSS (lbs)	78.4	105,620,300	450,700	0.4
Nutrients				
Total P (lbs)	0.32	431,100	1,840	0.4
Soluble P (lbs)	0.13	175,100	750	0.4
Total N (lbs)	2.39	3,219,800	13,740	0.4
TKN (lbs)	1.73	2,330,700	9,950	0.4
Nitrite & Nitrate (lbs)	0.66	889,200	3,800	0.4
Metals				
Copper (lbs)	0.0134	18,000	80	0.4
Lead (lbs)	0.0675	91,000	390	0.4
Zinc (lbs)	0.162	218,200	930	0.4
Cadmium (lbs)	0.0007	950	4	0.4
Chromium (lbs)	0.004	5,400	23	0.4

4.4 Unaccounted for Treatment Factors

This analysis does not account for the many water quality treatment BMPs that mitigate the pollutant loading from MassHighway roads or the fact that a significant portion of the MassHighway roads do not directly discharge to receiving waters. A significant percentage of the storm water conveyance system along the linear roads is comprised of country drainage (i.e. overland flow and swales). Runoff from these roads typically infiltrates into the ground as it travels long distances in vegetated swales or over vegetated buffers. Only a small fraction of this runoff from these roads (e.g., I-91 within the Connecticut River Basin) ever reaches a receiving tributary.

Furthermore, MassHighway’s Notice of Intent (NOI), submitted as part of applying for coverage under the NPDES Phase II MS4 General Permit, includes many programs which will provide treatment or source controls for the roads discharging to the Connecticut and Merrimack Rivers.



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930-2298

Henry L. Barbaro
Wetlands and Water Resources
Massachusetts Highway Department
10 Park Plaza, Room 4260
Boston, Massachusetts 02116

AUG 21 2006

Dear Mr. Barbaro,

This is in response to your letter dated August 16, 2006 regarding an application by MassHighway for coverage under the National Pollutant Discharge Elimination System (NPDES) permit program for urbanized area road drainage system outfalls. In order to be eligible for coverage under this permit, MassHighway must demonstrate to the US Environmental Protection Agency that the discharges are not adversely affecting any species listed as threatened or endangered under the jurisdiction of NOAA's National Marine Fisheries Service.

Included with your letter were maps detailing the location of roads within urbanized areas in the Connecticut River and Merrimack River watersheds. Populations of the endangered shortnose sturgeon (*Acipenser brevirostrum*) occur in the mainstem of both rivers. Your letter requested that NMFS review the maps and indicate which outfalls may be adversely impacting shortnose sturgeon in these rivers. In order to determine whether discharges from any of these outfalls have the potential to adversely affect this species NMFS will need the following information:

- exact location of the discharge and distance from the mainstem river;
- volume of water discharged from the outfall;
- components of the discharge, including known concentrations of any pollutants; and,
- any mitigation measures in place at the outfall.

Without this information it is difficult to determine if any given outfall has the potential to adversely affect shortnose sturgeon in the Connecticut or Merrimack River. Should you have any questions regarding this correspondence, please contact Julie Crocker of my staff at (978)281-9300 x6530 or by e-mail (Julie.Crocker@noaa.gov).

Sincerely,

Mary A. Colligan
Assistant Regional Administrator
for Protected Resources

File Code: Sec 7 EPA R1 Masshighway MS4 coverage
PCTS: T/NER/2006/04049





Mitt Romney
Governor

Kerry Healey
Lt. Governor

John Cogliano
Secretary

Luisa Paiewonsky
Commissioner



MASSACHUSETTS
EXECUTIVE OFFICE
OF TRANSPORTATION

August 16, 2006

Julie Crocker
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Regional Office (NERO)
One Blackburn Drive
Gloucester, MA 01930-2298

Subject: MassHighway NPDES MS4 Permit Outfall Within Short Nose Sturgeon Habitat

Dear Ms. Crocker:

The National Pollutant Elimination System (NPDES) General Permit for Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) requires that permit applicant review the potential impact of drainage system outfalls on federal threatened and endangered species habitat. We are writing to request your review of MassHighway urbanized area roads within the Connecticut River watershed. The main stem of the Connecticut River and select tributaries have been identified as potential habitat for short-nose sturgeon according to Addendum A of the NPDES General Permit.

MassHighway has submitted an application for coverage under this MS4 permit to EPA and is awaiting authorization. In the Storm Water Management Plan (SWMP) prepared as part of the submittal, MassHighway stated that they would review urbanized area roads with National Marine Fisheries Service (NMFS) to determine if known storm water outfalls from their roadways are potentially having an adverse impact to short-nose sturgeon habitat. Outfalls are eligible for coverage under this permit if the discharges or discharge related activities are not likely to jeopardize the continued existence of any species that are listed as endangered or threatened under the Endangered Species Act (ESA) or result in the adverse modification or destruction of habitat that is designated as critical under the ESA.

MassHighway has begun to inventory stormwater outfalls along these roads but, due to the large number of urbanized area road miles owned by MassHighway, will not complete the statewide inventory until the end of the permit term (March 2008). Therefore, we have included with this memo a detailed map with MassHighway roads within areas classified as "urbanized" by the Census Bureau and the Connecticut River watershed and the Merrimack River watershed below the Lawrence Dam. We ask that you review the figures and let us know if there are any specific outfalls that are adversely impacting the short-nose sturgeon. If MassHighway can provide additional information for help in the review, please feel free to contact me at (617) 973-7419, or in writing to 10 Park Plaza, Room 4260, Boston, MA 02116.

Sincerely,

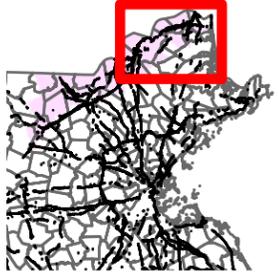
Henry L. Barbaro
Supervisor
Wetlands & Water Resources

Attachment: MassHighway Roads...Sturgeon Habitat (three figures)

MASS HIGHWAY ROADS IN
URBANIZED AREAS AND
IN SHORTNOSE STURGEON
HABITAT



LOCUS MAP



- Legend
- Town Boundary
 - MH Roads
 - Merrimac River
 - Watershed to Merrimac River
 - MH Roads in UA Intersecting the Watershed

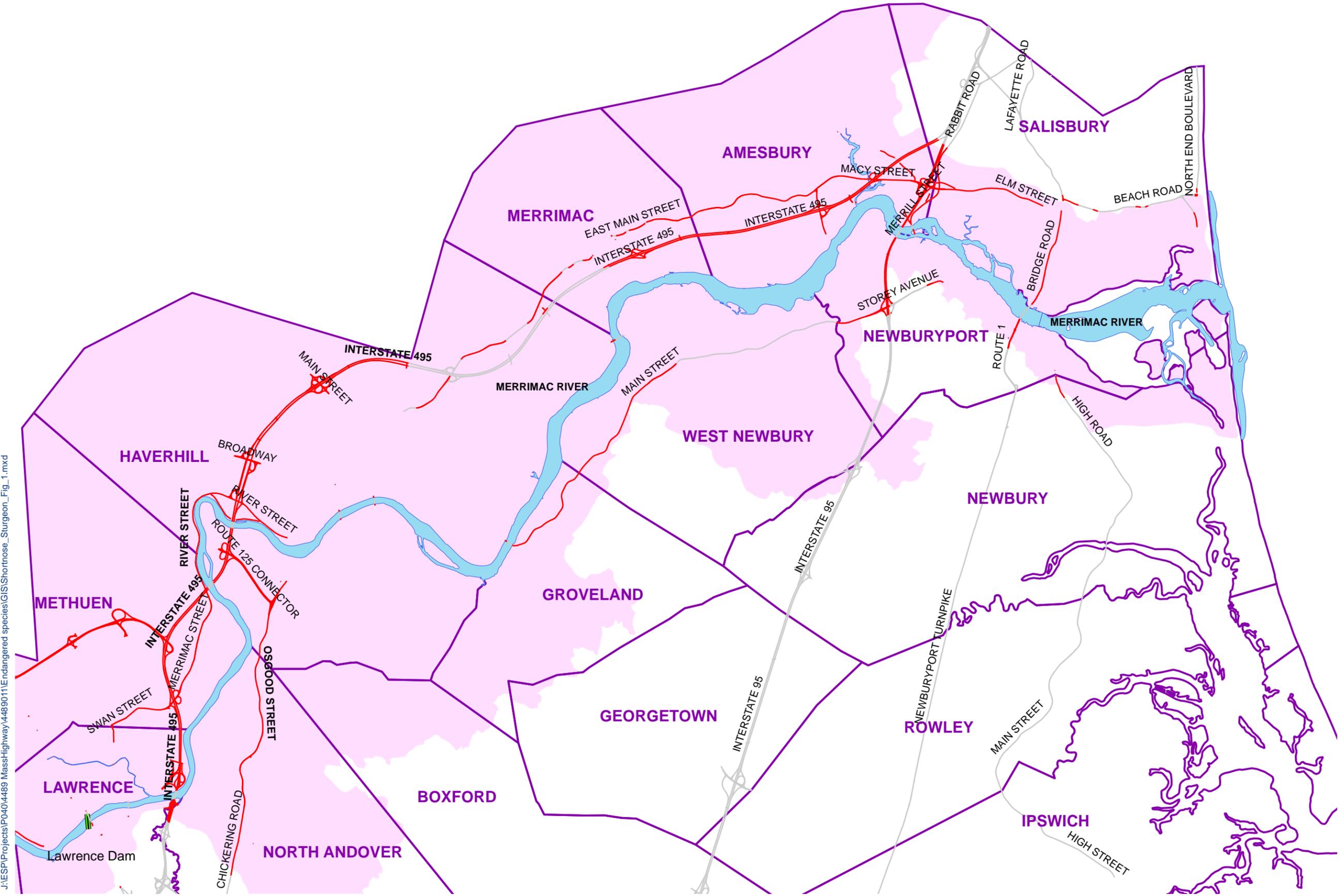
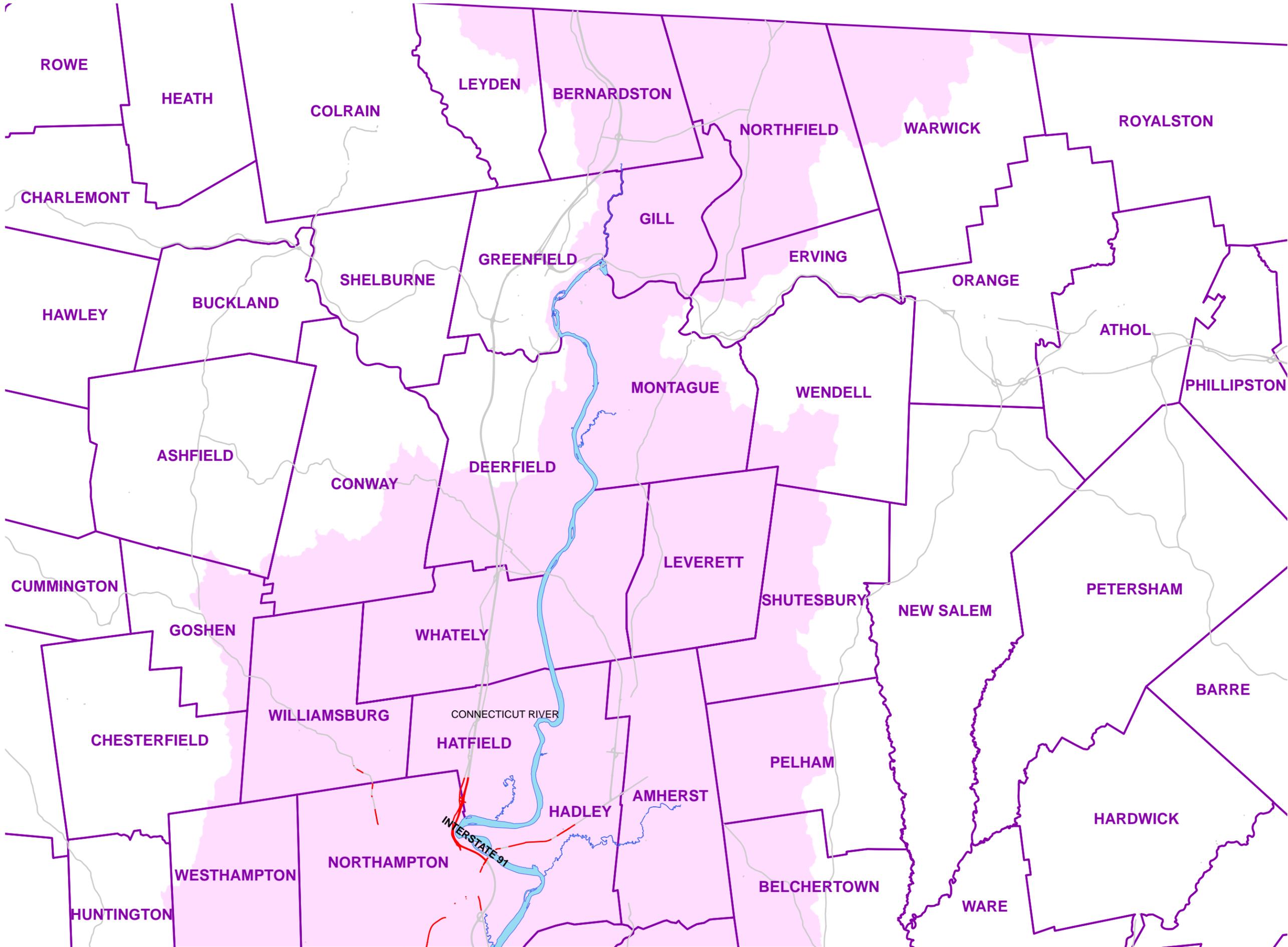


Figure 1

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MASS HIGHWAY ROADS IN URBANIZED AREAS AND IN SHORTNOSE STURGEON HABITAT

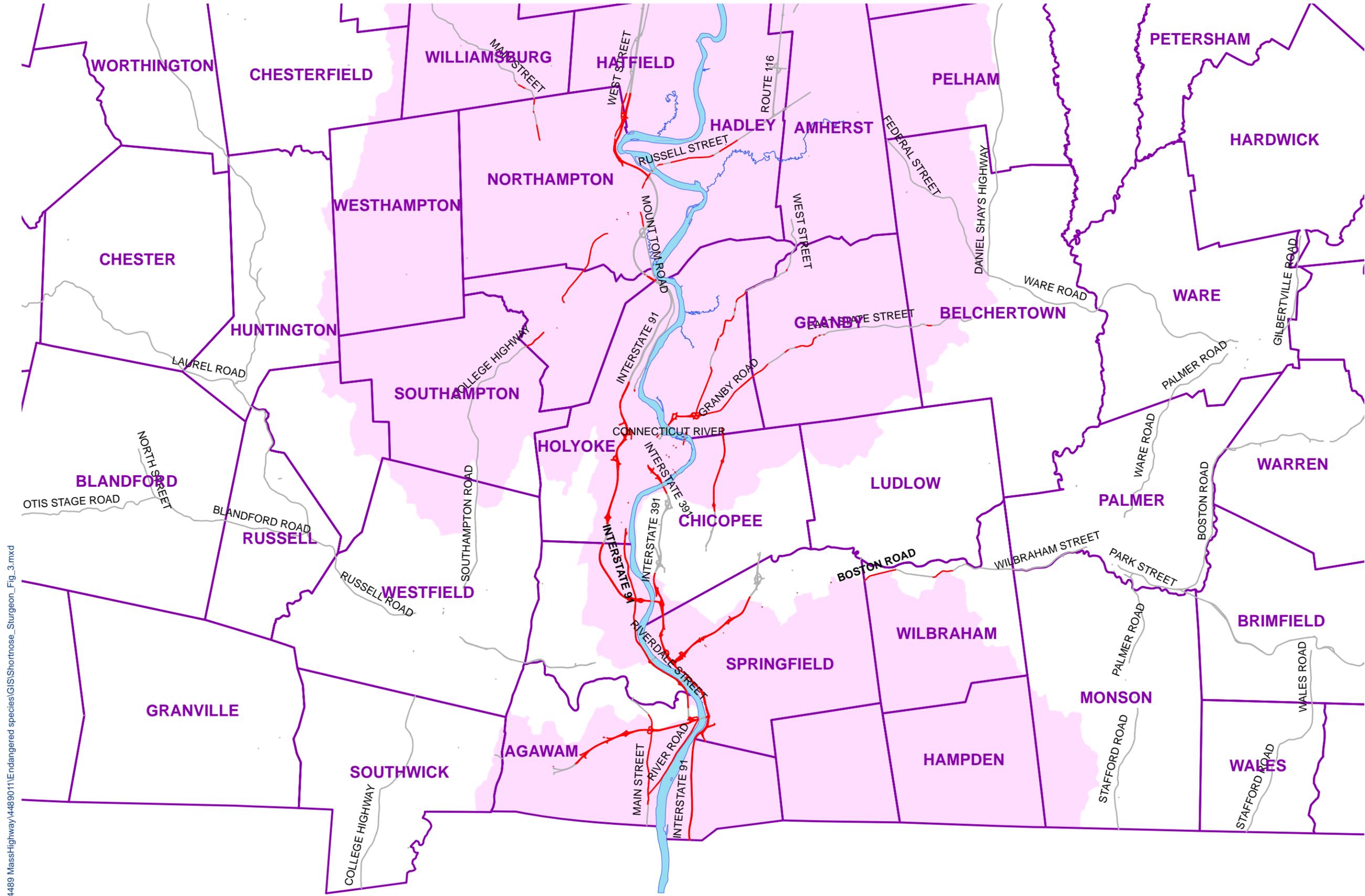


LOCUS MAP



- Legend
- MH Roads in UA Intersecting the Watershed
 - MH Roads
 - Town Boundary
 - Connecticut River
 - Watershed to Connecticut River

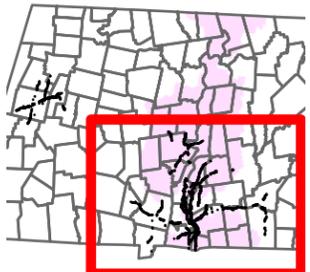
Figure 2



MASS HIGHWAY ROADS IN URBANIZED AREAS AND IN SHORTNOSE STURGEON HABITAT



LOCUS MAP



- Legend
- Town Boundary
 - MH Roads
 - Connecticut River
 - Watershed to Connecticut River
 - MH Roads in UA Intersecting the Watershed

Figure 3

Appendix C

Endangered Species Review for Dwarf Wedge Mussel



United States Department of the Interior



FISH AND WILDLIFE SERVICE
New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087

September 20, 2006

Henry Barbaro
Mass Highway
10 Park Plaza, Room 4260
Boston, MA 02116

Dear Mr. Barbaro:

This responds to your recent correspondence requesting information regarding adverse impacts to dwarf wedgemussels at stormwater outfalls along urbanized area roads owned by Mass Highway within the Connecticut River watershed area.

Based on information currently available to us, no dwarf wedgemussels are known to occur in close proximity to the urbanized roads referenced above. However, there is an historic record for dwarf wedgemussel in the Mill River Diversion, downstream of Easthampton Road. The reason for the lack of persistence of the dwarf wedgemussel at this site is unknown.

Thank you for your coordination. Please contact us at 603-223-2541 if we can be of further assistance.

Sincerely yours,

Michael J. Amaral
Endangered Species Specialist
New England Field Office



Mitt Romney
Governor

Kerry Healey
Lt. Governor

John Cogliano
Secretary

Luisa Paieworsky
Commissioner



August 16, 2006

Michael J. Amaral
Endangered Species Specialist
U.S. Fish and Wildlife Service
New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5087

Subject: MassHighway NPDES MS4 Permit Outfall Within Dwarf Wedge Mussel Habitat

Dear Mr. Amaral:

The National Pollutant Elimination System (NPDES) General Permit for Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) requires that permit applicant review the potential impact of drainage system outfalls on federal threatened and endangered species habitat. We are writing to request your review of MassHighway urbanized area roads within the Connecticut River watershed. The main stem of the Connecticut River and select tributaries have been identified as potential habitat for the dwarf wedge mussel according to Addendum A of the NPDES General Permit.

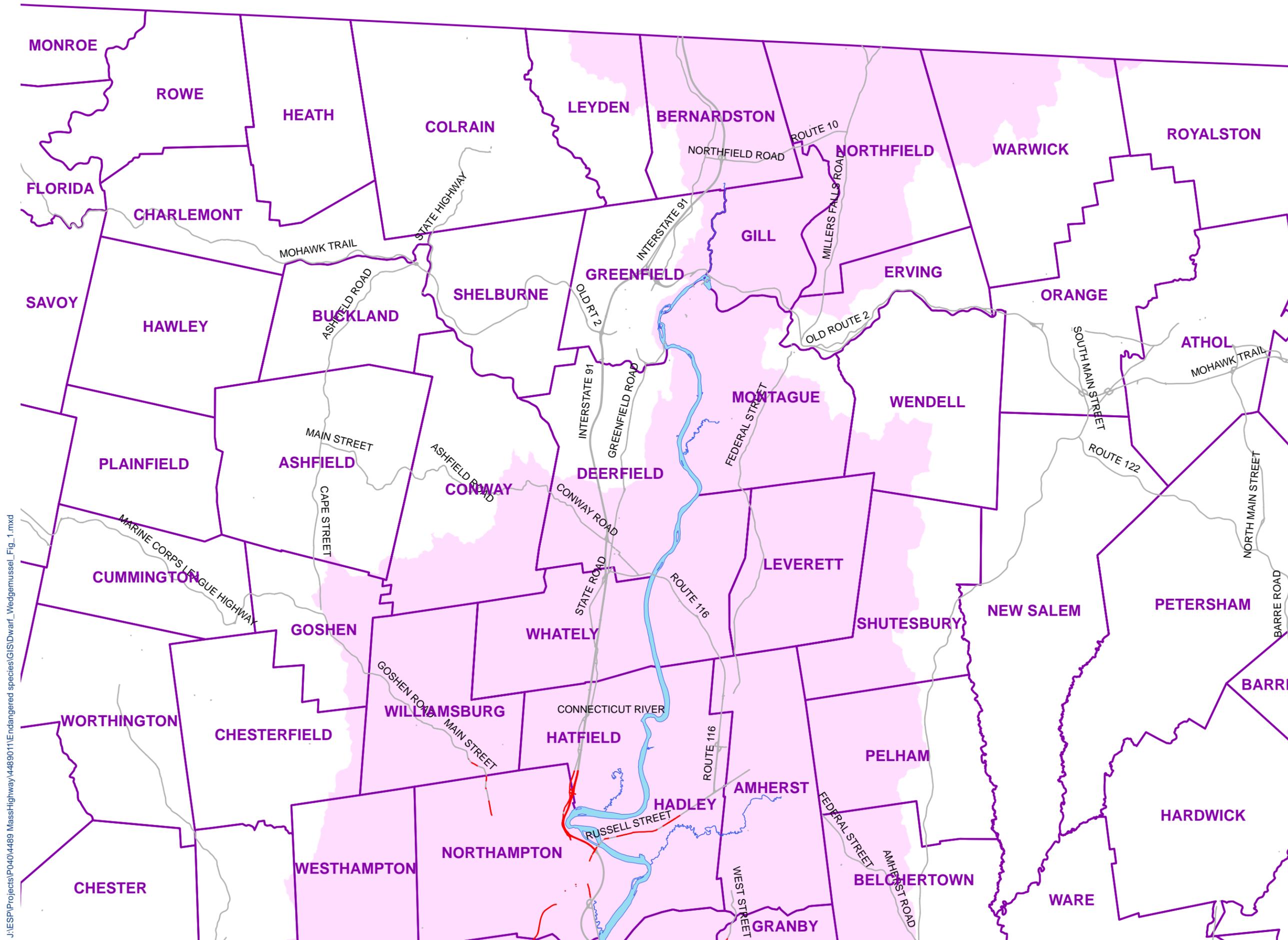
MassHighway has submitted an application for coverage under this MS4 permit to EPA and is awaiting authorization. In the Storm Water Management Plan (SWMP) prepared as part of the submittal, MassHighway stated that they would review urbanized area roads with United States Fish and Wildlife Service (USFWS) to determine if storm water outfalls from their roadways are potentially having an adverse impact to dwarf wedge mussel habitat. Outfalls are eligible for coverage under this permit if the discharges or discharge related activities are not likely to jeopardize the continued existence of any species that are listed as endangered or threatened under the Endangered Species Act (ESA) or result in the adverse modification or destruction of habitat that is designated as critical under the ESA.

MassHighway has begun to inventory stormwater outfalls along these roads but, due to the large number of urbanized area road miles owned by MassHighway, will not complete the statewide inventory until the end of the permit term (March 2008). Therefore, we have included with this memo a detailed map with MassHighway roads within areas classified as "urbanized" by the Census Bureau and the Connecticut River watershed. We ask that you review the figures and let us know if there are any specific outfalls that are adversely impacting the dwarf wedge mussel. If MassHighway can provide additional information for help in the review, please feel free to contact me at (617) 973-7419, or in writing to 10 Park Plaza, Room 4260, Boston, MA 02116.

Sincerely,

Henry L. Barbaro
Supervisor
Wetlands & Water Resources

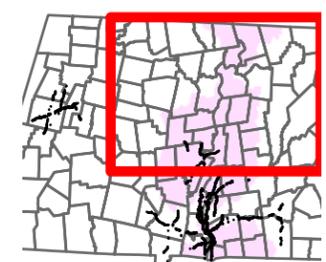
Attachments: MassHighway Roads...Mussel Habitat (two figures)



MASS HIGHWAY ROADS IN URBANIZED AREAS AND IN DWARF WEDGEMUSSEL HABITAT



LOCUS MAP



- Legend
- Town Boundary
 - MH Roads
 - Connecticut River
 - Watershed to Connecticut River
 - MH Roads in UA Intersecting the Watershed

Figure 1

J:\ESP\Projects\PO404489 MassHighway\4489011\Endangered species\GIS\Dwarf_Wedgemussel_Fig_1.mxd

Appendix D

Historic Properties Review with Massachusetts Historical Commission



Mitt Romney
Governor

Kerry Healey
Lt. Governor

John Cogliano
Secretary

Luisa Paiewonsky
Commissioner



August 16, 2006

Brona Simon
Deputy State Historic Preservation Officer
Massachusetts Historical Commission
220 Morrissey Boulevard
Boston, MA 02125-3314

RECEIVED

AUG 18 2006

MASS. HIST. COMM

Subject: MassHighway NPDES MS4 Permit Roads Near Historic Properties/ Districts

38693

Dear Ms. Simon:

The NPDES General Permit for Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) requires that permit applicants review the potential impact of drainage system outfalls on properties listed or eligible to be listed in the National Register of Historic Places.

MassHighway has submitted an application for coverage under this permit to EPA and is awaiting authorization. In the Storm Water Management Plan (SWMP) prepared as part of the submittal, MassHighway agreed to review urbanized area roads owned by MassHighway for any currently known adverse effects on historic properties caused by storm water discharges from MassHighway-owned roadways. Discharges, or implementation of a storm water management program, which adversely affects properties listed or eligible to be listed on the National Register of Historic Places would eliminate such discharges or programs for coverage under the MS4 General Permit.

MassHighway has begun to inventory existing storm water outfalls along these roads but, due to the large number of urbanized area road miles owned by MassHighway, will not complete the statewide inventory until the end of the permit term (March 2008). Therefore, we have included with this memo a CD which contains detailed maps, by town, of MassHighway roads within areas classified as "urbanized" by the Census Bureau, overlaid with the historic properties datalayer provided by MassGIS (Massachusetts Office of Geographic and Environmental Information). The detailed maps show all MassHighway roads in urbanized areas that are located within 500 feet of any historic property identified by MassGIS.

To the best recollection of MassHighway's senior Cultural Resources Unit staff (20+ years) storm water discharge from a MassHighway roadway has never been identified as having an adverse effect on a property listed, or eligible for listing, in the National Register. If you or your staff could review the enclosed CD and confirm MassHighway's opinion that there are, at present, no known storm water discharges from the shown MassHighway roadways causing adverse effects on historic properties, it would be greatly appreciated. If we can provide additional information for help in the review, please feel free to contact me at (617) 973-7419, or in writing to 10 Park Plaza, Room 4260, Boston, MA 02116.

Sincerely,

Henry L. Barbaro
Henry L. Barbaro
Supervisor
Wetlands & Water Resources

CONCURRENCE: *Brona Simon*
10/3/06
BRONA SIMON
DEPUTY STATE HISTORIC
PRESERVATION OFFICER
MASSACHUSETTS
HISTORICAL COMMISSION

XC: Greg Prendergast, MTD

Attachment: Historical Resources and MassHighway Roads (CD)

Appendix E

Maintenance Schedule – General and TMDL Watersheds and Maintenance Agreements for Roads within TMDL Approved Watersheds

MassHighway Maintenance Matrix

Drainage Asset	Area	Mow	Sweep	Activity Schedule			Other/Notes
				Inspect	Clean	Repair	
Roads	Facilities/ Material Storage Yards	Annually	ANI	Annually	--	ANI	
	Roads/ Weigh Stations/ Rest Areas	Annually	Annually	Annually	--	ANI	
PRETREATMENT BMPs							
Catchbasins	All*	--	--	Annually (after snow melt)	ANI	ANI	
Oil/ Water Separators	All*	--	--	Annually	ANI	ANI	Self-test alarm, if so equipped
Open Graded Friction Course	All*	--	Vacuum Sweep as Needed	Annually	Vacuum sweep as needed	ANI	Monitor for proper drainage
Sediment Forebays	All*	Twice annually	--	Annually	ANI	ANI	
Vegetated Filters Strip	All*	Annually	--	Annually	ANI	ANI	
Water Quality Inlet	All*	--	--	Annually	ANI	ANI	
TREATMENT BMPs							
Basins/Ponds							
Wet Pond/Wet Basin	All*	Side slopes annually	--	Annually	ANI	ANI	
Infiltration Basin	All*	Side slopes annually as needed	--	Annually	ANI	ANI	
Enhanced Wet Pond	All*	Side slopes annually as needed	--	Annually	ANI	ANI	
Constructed Storm Water Wetlands	All*	Side slopes annually as needed	--	Annually	ANI	ANI	
Gravel Wetland	All*	Side slopes annually as needed	--	Annually	ANI	ANI	
Bioretention Area	All*	As needed dependent on plantings	--	Annually	ANI	ANI	
Infiltration Trenches and Beds	All*	--	--	Annually	ANI	ANI	
Subsurface Recharge Systems	All*	--	--	Annually	ANI	ANI	
Channel/Swales							
Water Quality Swales, including:							
Dry Swales and Wet Swales	All*	Mow dry swales as needed	--	Annually (after snow melt)	ANI	ANI	Wet swales may/may not need to be mowed depending on type of vegetation.
Biofilter Swales (Grassed Channels)	All*	As needed	--	Annually	ANI	ANI	
Channel Systems/Drainage Channel	All*	As needed	--	Annually	ANI	ANI	
Filters							
Media Filter Drain	All*	Annually	--	Annually	ANI	ANI	Mow with retractable-arm mower to reduce compaction; Prevent formation of flow-restricting berms.

MassHighway Maintenance Matrix

Drainage Asset	Area	Mow	Sweep	Activity Schedule			Other/Notes
				Inspect	Clean	Repair	
Impoundments							
Impoundment Structures	All*	--	--	Annually	ANI	ANI	Inspect berms, dams, outlet and inlet structures and other appurtenances for structural integrity, hydraulic performance, surface stability as applicable
Other							
Infiltration Dry Wells and Galleys	All*	--	--	Annually	ANI	ANI	
Leaching Catch Basins	All*	--	--	Annually	ANI	ANI	
Porous Pavement	All*	--	Vacuum Sweep as Needed	Annually	Vacuum sweep as needed	ANI	Monitor for proper drainage
Compost Amended Vegetated Filter Strip	All*	Annually	--	Annually	ANI	ANI	Regrade and aerate as needed; Prevent formation of flow-restricting berms
Accessories							
Flow Splitters	All*	--	--	Annually	ANI	ANI	
Level Spreader	All*	--	--	Annually	ANI	ANI	
Outlet Sediment Traps	All*	--	--	Annually	ANI	--	
Check Dams	All*	--	--	Annually	ANI	ANI	
OTHER							
Holding Tanks - UST	Maintenance Facilities/ Material Storage Yards/Weigh Stations/ Rest Areas	--	--	Weekly	--	--	Gauge tank to determine if greater than 75% full.
Holding Tanks - AST	Maintenance Facilities/ Material Storage Yards/Weigh Stations/ Rest Areas	--	--	Monitor and set appropriate schedule	--	--	Gauge tank to determine if greater than 75% full.
Septic System	Maintenance Facilities/ Material Storage Yards/Weigh Stations/ Rest Areas	--	--	Annually	--	--	Record water meter readings and report to DHC.
NPDES Construction Site - Site Inspections	All*	--	--	Weekly	--	--	
NPDES Construction Site - Repair of erosion controls	All*	--	--	Weekly	ANI	--	
NPDES Construction Site - Cleaning of storm water structures	All*	--	--	Weekly	ANI	--	
District 3 Specific Maintenance Requirements							
Roads	Quinsigamond and Flint Pond Watershed	Annually	Annually	Annually	--	ANI	
	Leesville Pond in Kettle Brook Sub-basin; Mill Brook Tributary Basin; and Monoosnoc Basin	Annually	Annually	Annually	--	ANI	
	Salisbury Pond Watershed	Annually	Annually	Annually	--	ANI	

MassHighway Maintenance Matrix

Drainage Asset	Area	Mow	Sweep	Activity Schedule			Other/Notes
				Inspect	Clean	Repair	
Catch Basins	Roads within Quinsigamond and Flint Pond Sub-basin; Leesville Pond in Kettle Brook Sub-basin; Mill Brook Tributary Basin; and Monoosnoc Basin	--	--	6 months	ANI	ANI	
	Roads within Salisbury Pond Watershed	--	--	6 months	ANI	ANI	
Extended Detention Basins	Roads within Quinsigamond and Flint Pond Sub-basin; Leesville Pond in Kettle Brook Sub-basin; Mill Brook Tributary Basin; and Monoosnoc Basin	Annually	--	6 months	ANI	ANI	
	Roads within Salisbury Pond Watershed	Annually	--	6 months	ANI	ANI	
Water Quality Swales, including: Dry Swales, Bio-filter Swales (Grassed Channels), and Wet Swales	Roads within Quinsigamond and Flint Pond Sub-basin; Leesville Pond in Kettle Brook Sub-basin; Mill Brook Tributary Basin; and Monoosnoc Basin	--	--	6 months	ANI	ANI	
	Roads within Salisbury Pond Watershed	--	--	6 months	ANI	ANI	
Sediment Forebays	Roads within Quinsigamond and Flint Pond Sub-basin; Leesville Pond in Kettle Brook Sub-basin; Mill Brook Tributary Basin; and Monoosnoc Basin	--	--	6 months	ANI	ANI	
	Roads within Salisbury Pond Watershed	--	--	6 months	ANI	ANI	
ANI - As Needed per Inspection							
N/A - Not Applicable							

Appendix F

Catch Basin Cleaning Standard Operating Practice (SOP)

COMMONWEALTH OF MASSACHUSETTS MASSHIGHWAY DEPARTMENT STANDARD OPERATING PROCEDURES		S.O.P. NO. ENV-01-19-1-000 PAGE 1 OF 2
SUBJECT: Inspection and Maintenance of Stormwater Catch Basins at MassHighway Facilities		DISTRIBUTION A
EFFECTIVE APR 28 1999	ISSUED MAY -- 1999	APPROVED <i>Anthony J. Amorello</i>

PURPOSE

To minimize the discharge of sediments and other pollutants from stormwater catch basins (located on MassHighway Maintenance Facilities) to receiving waters through proper cleaning and maintenance of such basins. This policy does not include those stormwater catch basins or other drainage structures located within roadways or other right-of-ways belonging to MassHighway.

RESPONSIBILITY

It is the responsibility of the Facility Foreman to ensure facility operations do not result in excessive build up of sediment in catch basins.

District Maintenance Personnel (as designated by the District Highway Director (DHD) or the District Maintenance Engineer (DME)) are responsible for inspecting all stormwater catch basins located on the premises of each maintenance facility on an annual basis. District Maintenance Personnel are also responsible for all repairs to catch basins.

POLICY

All stormwater catch basins at each maintenance facility shall be inspected annually. The inspection shall include investigation of the presence of accumulated sediments as well as the structural integrity of the catch basins. Any catch basin that is found to contain sediment exceeding 50 percent of the capacity of the sump within the catch basin structure, shall be cleaned using a catch basin dredge (a.k.a. clam bucket) or vactor unit. Damaged catch basin structures shall be repaired promptly by District Maintenance Personnel. The inspections and subsequent cleanings should be performed immediately after the snow and ice season, and, whenever possible, before the spring rain season.

COMMONWEALTH OF MASSACHUSETTS MASSHIGHWAY DEPARTMENT STANDARD OPERATING PROCEDURES		S.O.P. NO. ENV-01-19-1-000 PAGE 2 OF 2
SUBJECT: Inspection and Maintenance of Stormwater Catch Basins at MassHighway Facilities		DISTRIBUTION A
EFFECTIVE APR 28 1999	ISSUED MAY -- 1999	APPROVED <i>Anthony Amorello</i>

Policy (cont'd)

To avoid a build up of silt at catch basins, facility personnel shall avoid rinsing any equipment, vehicles or stockpiling sand in the immediate vicinity of catch basins.

Appendix G

Catch Basin Cleaning Project Work Plan

Prepared for:
MassHighway Department
Massachusetts

MassHighway Catch Basin Accumulation Study

Plan of Study

ENSR Corporation
October 2006
Document No.: 04489-007-0301

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1.0 Introduction

This document presents MassHighway's Plan of Study, to track the accumulation of sediment in selected catch basins, to provide information for future use in developing catch basin cleaning protocols and schedules.

1.1 Study Background

MassHighway has developed a Storm Water Management Plan (SWMP) under the EPA NPDES Phase II Stormwater Program, General Permit for MS4s in Massachusetts. As one of the measurable goals under Management Measure 6F-1, MassHighway proposed a study of sediment accumulation in selected sample catch basins. This study is intended to gather information so MassHighway can make informed decisions regarding the frequency of catch basin cleaning to address the objectives of the EPA NPDES program, as well as Massachusetts Department of Environmental Protection's (MADEP's) concerns.

According to the SWMP, MassHighway will monitor the catch basins included in this study for three years, during which time the Department's study team will track accumulation of sediment in the basins and analyze the collected data.

1.2 Study Objective

The purpose of this study is to assess the rates of sediment accumulation in the selected representative catch basins, and determine whether there is a relationship between certain catch basin characteristics (e.g. reduced sanding area) and the rate of sediment accumulation. Once this study is completed, MassHighway anticipates using its results to make informed decisions regarding catch basin cleaning protocols and schedules.

1.3 Study Organization

The study team will be directed by MassHighway's Environmental Section. The data collection team will include MassHighway District 4 personnel and ENSR's technical staff members. MassHighway personnel will perform the catch basin inspections throughout the monitoring period (October 2006 – October 2009). ENSR's technical staff members will oversee the data collection methodology and analysis.

1.4 Study Schedule

The study will continue for three years, with the following schedule:

- | | |
|---|-----------------------------|
| • Finalize catch basins to be included in the study | August 2006 |
| • Train MassHighway inspection staff | October 2006 |
| • Clean catch basins and initiate data collection | October 2006 |
| • Monthly data collection and compilation | October 2006 - October 2009 |
| • Annual reports | April 2007 - 2010 |
| • Final report to MassHighway Environmental Section | June 2010 |

The monthly data collection effort will occur as follows:

- Second week of each month – Perform catch basin inspections.
- Third week of each month - Transfer inspection data from MassHighway to ENSR. MassHighway inspection staff will scan and email inspection report forms to ENSR within one week after completing each monthly inspection. The Data Collection Form is included in this report as Table 2.

- Fourth week of each month – ENSR will screen data and enter it into a database; if data collection problems are detected (e.g., missing information, questions regarding procedure by the inspection personnel, unusual conditions noted at particular catch basins), ENSR will advise MassHighway Environmental Section and District 4 personnel, so that necessary corrections can be made prior to the next monthly visit.
- Quarterly – Every three months, MassHighway District 4 will provide ENSR with a quarterly report summarizing information regarding roadway maintenance (including details on sweeping, de-icing and construction activities). ENSR will perform necessary calculations and enter data in to a database.

2.0 Study Area

2.1 Monitoring Categories

MassHighway determined that the catch basin study should include five different categories to reflect the different types of roads owned by MassHighway and the different salting/sanding practices. The goal of the study is to use the data to set appropriate cleaning schedules for each of the five categories and then set future cleaning schedules for roadways across the state based on the road categories. The five categories are listed below:

- High accumulation area
- High traffic/ reduced salt area
- High traffic/ standard winter deicing protocols
- Low traffic/ reduced salt area
- Low traffic/ standard winter deicing protocols.

The roads chosen for monitoring in each of these categories are summarized in Table 1 and depicted in Figures 1 through 6. Figure 1 provides a general overview of the study area; Figures 2 through 6 illustrate the specific locations of catch basins in each monitoring category. Catch basins selected for inclusion in the study are labeled, as are the roadways in the vicinity (for reference).

Table 1 Monitoring Categories Locations

Number	Category	Location of Roadway	Roadway Type*	# of Catch Basins
1	High Accumulation Area	Route 2, along Spy Pond	Freeway	10
2	High Traffic / Reduced Salt Area	Route 95 mainline, south of Route 2, along the Cambridge Reservoir	Freeway	20 (10 ramp, 10 mainline)
3	High Traffic / Standard Winter Deicing Protocols	Route 2 mainline at Routes 4 and 225	Freeway	20 (10 ramp, 10 mainline)
4	Low Traffic / Standard Winter Deicing Protocols	Route 20, Weston	Conventional Roadway	10
5	Low Traffic / Reduced Salt Areas	Route 2A, between Route 95 and Spring Street	Conventional Roadway	10

*Roadway Type, as defined in MassHighway's "Traffic Management Plan Manual":

Conventional Roadway – A street or highway other than a low-volume road, expressway, or freeway.

Expressway – A divided highway with partial control of access.

Freeway – A divided highway with full control of access.

Low-Volume Road – A facility lying outside of built-up areas of cities, towns, and communities, and it shall have a traffic volume of less than 400 AADT. It shall not be a freeway, expressway, interchange ramp, freeway service road, or a road on a designated state highway system.

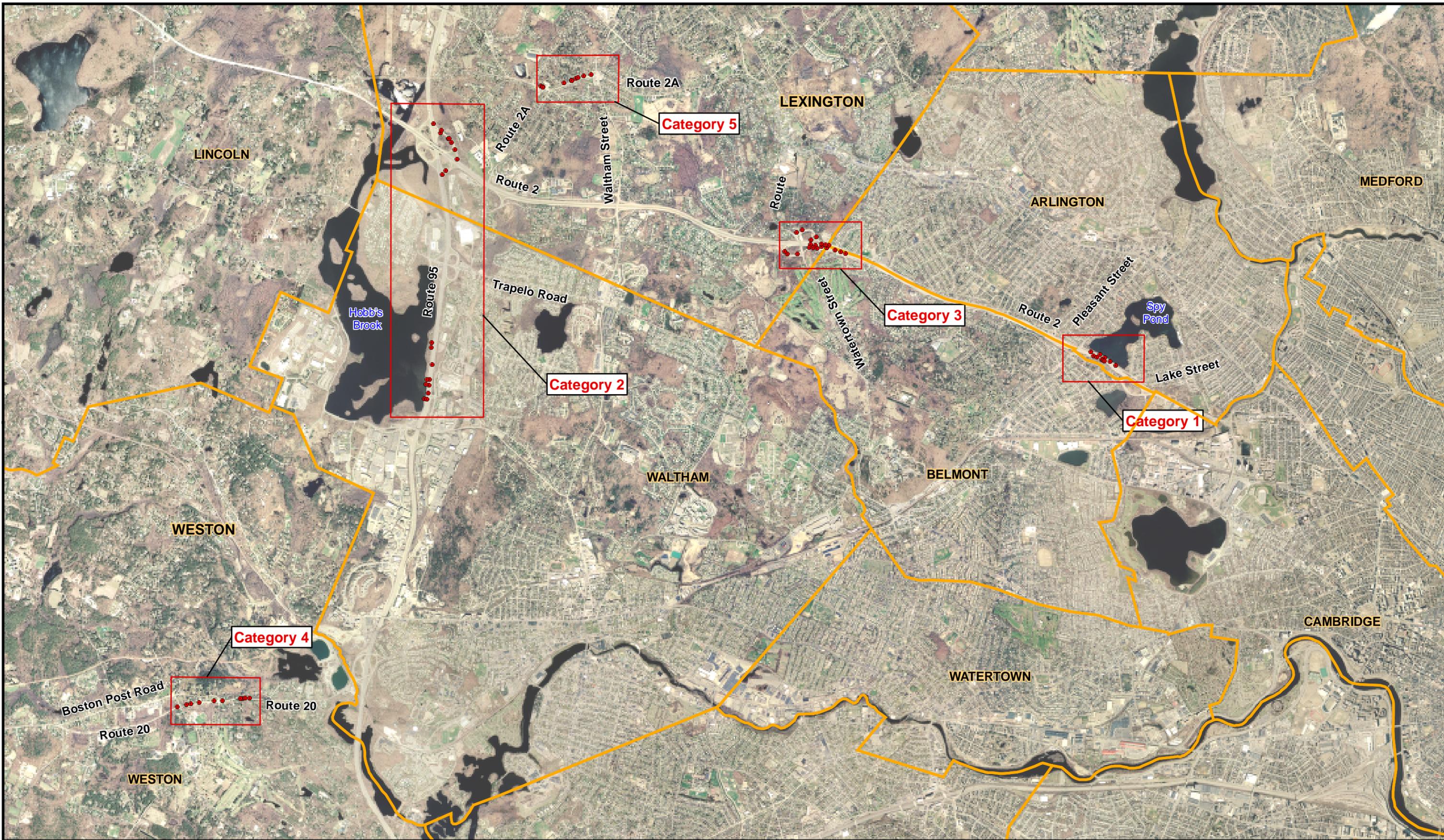


Figure 1
Overall Map Showing All Study Areas

MassHighway Catch Basin Accumulation Project
 Massachusetts Highway Department
 10 Park Plaza, Boston, MA 02116





Figure 2
 Category 1: High Accumulation Areas

MassHighway Catch Basin Accumulation Project
 Massachusetts Highway Department
 10 Park Plaza, Boston, MA 02116

July 2006

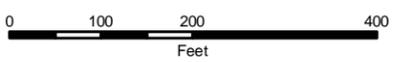




Figure 3a
 Category 2: High Traffic / Reduced Salt Areas

MassHighway Catch Basin Accumulation Project

Massachusetts Highway Department
 10 Park Plaza, Boston, MA 02116



January 2007





Figure 3b
 Category 2: High Traffic / Reduced Salt Areas

MassHighway Catch Basin Accumulation Project

Massachusetts Highway Department
 10 Park Plaza, Boston, MA 02116

January 2007



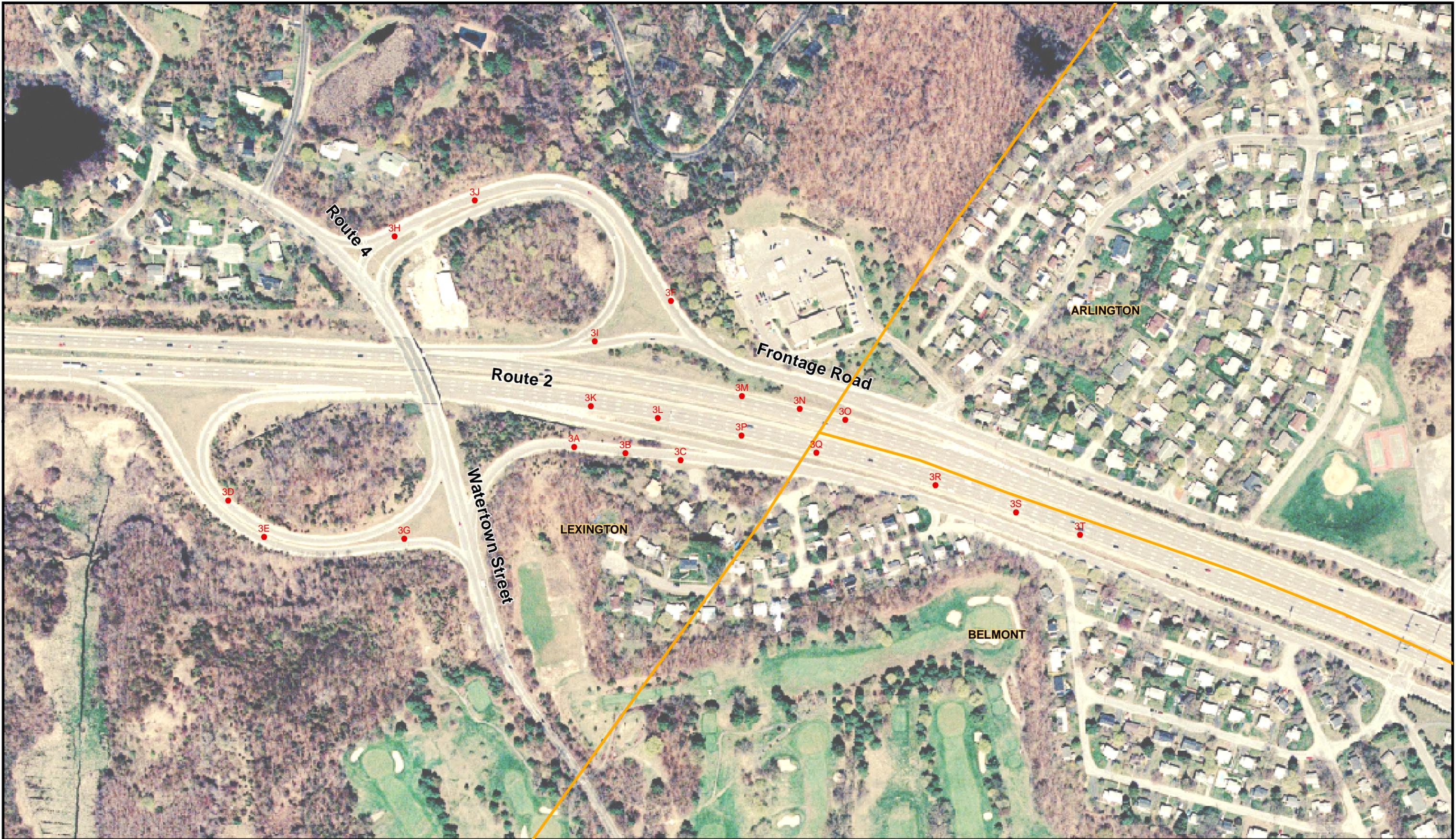


Figure 4
 Category 3: High Traffic / Standard Winter Deicing Protocols

MassHighway Catch Basin Accumulation Project
 Massachusetts Highway Department
 10 Park Plaza, Boston, MA 02116





Figure 5
 Category 4: Low Traffic / Standard Winter Deicing Protocols



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MassHighway Catch Basin Accumulation Project
 Massachusetts Highway Department
 10 Park Plaza, Boston, MA 02116

January 2007



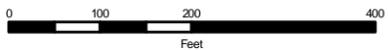


Figure 6
 Category 5: Low Traffic / Reduced Salt Areas

MassHighway Catch Basin Accumulation Project

Massachusetts Highway Department
 10 Park Plaza, Boston, MA 02116

January 2007



2.2 Selection of Catch Basins to be Monitored

ENSR performed a statistical analysis to determine the number of catch basins required to establish a valid mean within each catch basin cleaning category. The analysis determined that monitoring ten catch basins within each category would achieve eighty percent certainty that each measurement of sediment accumulated will be within twenty percent of the mean. The mean is the average amount of accumulated sediment in the catch basins.

Within two of the five categories (category 2 and 3), catch basins along both ramps and the mainline roadway have been selected so that a comparison can be made (e.g. along the same stretch of road, do catch basins located on ramps accumulate sediment faster or slower than catch basins on the mainline?). For these two criteria, twenty total catch basins will be monitored – ten on ramps and ten along the mainline.

The catch basins selected for this study are intended to represent a variety of locations so that generalizations can be made based on the analysis of collected data. The catch basins included in the monitoring will reflect different drainage conditions (characterized by grade, roadway use and condition, traffic volume, adjacent land use, topography, tree cover and typical sections). The catch basins selected will also be characterized by their location on the road (e.g., bottom of ramp, mid-point along grade, proximity to intersection), which will help determine how location might affect sediment accumulation rates.

3.0 Literature Search

ENSR has initiated a literature search to gather information regarding cleaning frequencies, sediment accumulations, and catch basin effectiveness. Information will be used to assist with data analysis throughout the course of the study; as the study progresses, further research will be done. The preliminary literature search included an internet source search, review of information provided by MassHighway, and review of other information identified during the course of the study in storm water related publications received by ENSR staff. Relevant findings will be considered during data analysis and included in the final study.

4.0 Data Collection

ENSR has prepared a data collection sheet for MassHighway’s data collection team to use in the field during monthly inspections (see Table 2, Monthly Data Collection Form). Once the monthly monitoring events are initiated, ENSR will create a database to track the data. Table 3, Catch Basin Required Information, describes the information that will be contained in this database. Within one week after each monitoring event, MassHighway will scan and email one data collection form per catch basin to ENSR so that the information can be transferred to the database. MassHighway will also provide ENSR with quarterly reports, indicating information regarding roadway sweeping, de-icing and construction for the section of roadway being monitored. MassHighway has access to data from which ice control material application rates can be calculated (e.g. amount of material applied per lane mile); raw data will be forwarded to ENSR, who will perform the necessary calculations.

Table 2 Monthly Data Collection Form

Catch Basin ID	
Inspection date	
Time of day	
Weather conditions	
Name of Inspector(s)	
Ramp or mainline Catch Basin?	
Roadway condition	good condition (surface, shoulder and curb) eroding shoulders frost heaves/potholes cracked pavement broken curbs other _____
Observations regarding general condition of catch basin and grate	
Is standing water present in catch basin?	yes / no
Depth to water from top of casing	
Depth to sediment from top of casing*	
Primary sediment type	water sand leaves muck / slurry debris organic material other _____
Depth to refusal from top of casing	
Thickness of sediment*	

* If more than one type of sediment is present, note the thickness of each layer

4.1 Initial Catch Basin Cleaning and Training

MassHighway District 4 staff and ENSR technical staff have field-verified each catch basin to make sure that they are appropriate and accessible. In October 2006, each catch basin will be cleaned (this cleaning will correspond with MassHighway’s regularly scheduled annual cleaning). The catch basins will be cleaned by clamshell truck, under the direction of District 4 personnel.

After the catch basins have been cleaned, a member of ENSR’s technical staff will train MassHighway’s data collection team on how to correctly measure the accumulated sediment thickness. Once a year, ENSR will accompany the data collection team for quality assurance purposes. If MassHighway personnel change over the course of the year, ENSR will accompany the new data collection team to train/orient them.

4.2 Initial Field Investigation

Over the course of the first three months of the study, a member of ENSR’s technical staff will visit each catch basin (accompanied by police detail) to obtain information required to populate the database that was created to track monthly data (see Table 3, Catch Basin Required Information). During this initial field investigation, each catch basin will be classified based on characteristics including location, type, condition and configuration (size and number of pipes in the catch basin, depth of sump). ENSR will estimate and plot the location of the ultimate discharge and the boundaries of the watershed to each catch basin on the attached figures during the initial field investigation. (ENSR will later include this information on the figures and estimate the surface area of each catch basin’s contributing watershed.) Specific data needs that can not be collected in the field will be obtained from appropriate MassHighway district.

Table 3 Catch Basin Required Information

Parameter	Information to Be Compiled From	Description of Required Information
Catch Basin ID	See Figures 2-6.	
Inspection Date	Monthly inspection	
Time of Day	Monthly inspection	
Weather Conditions	Monthly inspection	
Name of Inspector(s)	Monthly inspection	
Catch Basin Type	Determine during initial visit.	curb inlet, drop inlet, etc
Catch Basin Grate Size	Determine during initial visit.	
Ramp or Mainline?	See Figures 2-6.	
Sump Size	Field review or District IV plans.	
Pipe Diameter	Field review or District IV plans.	
Depth to Pipe Invert	Determine during initial visit.	
Depth to Bottom	Determine during initial visit.	depth to bottom of catch basin
Catch Basin Location	Determine during initial visit.	ramp, mainline, flat section of roadway, interchange clover leaf, intermediate point on grade, super-elevated section, etc.
Roadway Grade	Determine from USGS or obtain from District IV.	flat (1-3%), moderate (3-5%), steep (>5%)
Roadway Condition	Determine during initial visit – check monthly inspection sheets for changes.	eroding shoulders, frost heaves/potholes, cracked pavement, broken curbs, etc
Roadway Use (as Classified by MassHighway)	See Table 1	

Parameter	Information to Be Compiled From	Description of Required Information
Adjacent Land Use	Determine during initial visit.	rural, agricultural, urban/commercial/industrial
Is there dense tree cover along the roadway?	Monthly inspection	yes / no
Discharge Location	Locate during initial visit or use MassHighway plans. Add to GIS figures.	
Watershed Area	Determine during initial visit. Sketched in the field. Add to GIS figures and calculate area.	
Date of Last Cleaning	District IV will provide cleaning records/ schedule for areas being monitored in quarterly reports.	
Has construction been performed on the roadway since the last visit?	District IV will alert ENSR if construction is scheduled for any of the monitoring areas in quarterly reports.	
Has road been swept since last visit?	District IV will alert ENSR to sweeping activities in each of the monitoring areas in quarterly reports.	
Has road been de-iced since last visit?	District IV will alert ENSR to de-icing activities in each of the monitoring areas in quarterly reports; District IV will provide data from which ENSR can calculate material application rates.	
Observations Regarding General Condition of Catch Basin and Grate	Monthly inspection	
Is standing water present in the basin?	Monthly inspection	yes / no
Depth to Sediment	Monthly inspection	
Primary Sediment Type	Monthly inspection	none, sand, leaves, muck/slurry, debris, other
Sediment Thickness	Monthly inspection	depth to bottom - depth to sediment

4.3 Monthly Monitoring

Once MassHighway’s data collection team is trained, monthly monitoring will be initiated. During the second week of each month, MassHighway’s data collection team will perform monthly inspections. At each catch basin, the data collection team will measure the sediment thickness using the appropriate technique for sediment conditions, note the composition of the material, the presence of standing water (if there is any), inspection date, time of day, weather conditions, the condition of catch basin and grate (e.g. is the grate covered with rubbish) and the roadway condition. If a catch basin is frequently full of sediment upon inspection, the data collection team will inspect the discharge outlet to determine if the system is clogged. This condition should be reported to ENSR and the Environmental Section so that a remedy can be implemented.

5.0 Other Data Needs

During the three year monitoring period, ENSR will collect precipitation data for the study areas to be used in combination with physical observations in the data analysis. ENSR will update the database monthly with precipitation data obtained from the Mass.gov website's Office of Water Resources page. The Massachusetts Department of Conservation and Recreation's (DCR's) precipitation data is used to calculate a composite of precipitation conditions in six regions (one of which is the Northeast Region, which includes Study Areas 1 and 2) plus a statewide composite. Monthly reports in MS Excel format can be downloaded from the website; ENSR will download these reports and record the Northeast Region's monthly precipitation into the project database.

ENSR will also review MassHighway's quarterly reports to record information regarding roadway sweeping, de-icing and construction into the project database during the three-year monitoring period.

6.0 Catch Basin Cleaning During the Monitoring Period

The frequency of cleaning will depend on observations made throughout the course of this study. For example, most sources suggest that a catch basin should be cleaned once the depth of the deposits is between one-third to one-half the depth from the bottom of the basin to the invert of the lowest pipe in the basin. Using this criterion for cleaning, a calculation can be made in the field or after the data collection team returns from the field to determine when cleaning is necessary.

For the duration of this study, cleaning of the affected catch basins will be included in annual general cleaning work conducted by the District or subcontractors. MassHighway will arrange for additional cleaning as needed based on observations made throughout the course of the study. Cleaning will be conducted under the direction of District 4, according to MassHighway's specifications for cleaning drainage structures. The specifications state that cleaning drainage structures may be accomplished by "clam scoop" or by vacuum means; according to District 4, most catch basins are cleaned by the "clam scoop" method.

7.0 Data Management & Analysis

ENSR will analyze the data as follows:

- Once the monthly monitoring data is received by ENSR, it will be screened for inconsistencies and errors and entered into a database.
- After 6 months of data collection, ENSR will perform a qualitative analysis to determine if there appear to be any trends in sediment accumulation rate by catch basin category, and will report its findings to MassHighway Environmental Section.
- Based on this initial year of data collection, ENSR will develop a proposed analytical protocol for statistical analysis of the survey results, to assess how fixed parameters (e.g. tree cover, roadway grade, adjacent land use) affect sediment accumulation rates, and present this to the Environmental Section. ENSR will also offer recommendations for adjustment in data collection parameters or protocols, for the remainder of the 3-year study period.

8.0 Deliverables

- **Monthly Advisories (emails)** - Throughout the study, ENSR will provide MassHighway with monthly advisories, as warranted, to refine or correct data collection process or address specific problems as noted in the data collection protocol.
- **Six Month Qualitative Analysis (memo)** – ENSR will summarize any trends identified during the first six months of the study in a memo and will report statistical methods used to analyze the data.
- **Narrative for NPDES Permit Annual Reports** - As the study progresses, preliminary findings will be included in the NPDES permit annual reports that ENSR submits to MassHighway at the end of every April.
- **Year 1 Report** - Following consultation with MassHighway, ENSR will conduct a quantitative and qualitative analysis of the first year data, and prepare a report of findings (including recommendations for adjustment in data collection and/or analytical protocol) to the Department.
- **Year 2 Report** - Similarly, ENSR will prepare a report of findings after the second year data.
- **Final Report** - After the study has been completed, ENSR will prepare a report summarizing project findings and recommendations (third year data will be reflected in this report). The final report will include a summary of methodology, data and associated observations; a qualitative analysis of data and observations; a quantitative analysis of data; a detailed summary of the findings of this work; and a comparison of observations with cleaning frequency observations and standards that were encountered during the literature search.

Appendix H

Street Sweeping SOP

COMMONWEALTH OF MASSACHUSETTS MASSHIGHWAY DEPARTMENT STANDARD OPERATING PROCEDURES		S.O.P.NO. ENV-01-24-1-000	PAGE 1 OF 3
SUBJECT: The Handling and Storage of Street Sweepings at MassHighway Facilities		DISTRIBUTION A	
EFFECTIVE APR 28 1999	ISSUED MAY -- 1999	APPROVED <i>[Signature]</i> Amorello	

PURPOSE

To provide guidance on the handling and storage of street sweepings. Street sweepings are defined as sand and soil generated during the routine cleaning of roadways. Street sweepings may also contain leaves and other miscellaneous solid waste. Street sweepings do not include the material swept from the road surface that has resulted from hazardous materials spills or material cleaned from other roadway structures such as catchbasins or other drainage structures.

This policy does cover sweepings collected by MassHighway contractors. MassHighway contractors are fully responsible for the reuse and/or disposal of sweepings according to Department of Environmental Protection (DEP) policy. Under no circumstances are private contractors allowed to store sweepings on MassHighway property.

RESPONSIBILITY

It is responsibility of the District Maintenance Personnel (as designated by the District Highway Director (DHD) and District Maintenance Engineer (DME)) to ensure that sweepings are handled in compliance with this policy and other applicable state and federal regulations.

POLICY

This policy is based upon the DEP Policy # 94.092 " Reuses and Disposal of Street Sweepings." The DEP policy is attached and must be followed as part of this policy.

Storage of street sweepings can only be stockpiled in depots designated by the District Maintenance Engineer (DME). The DHC must provide input as to the location and management of the street sweepings stockpiles.

Street sweepings must be stored in a labeled accumulation area that ensures the prevention of dust, erosion, and off-site migration.

COMMONWEALTH OF MASSACHUSETTS MASSHIGHWAY DEPARTMENT STANDARD OPERATING PROCEDURES		S.O.P.NO. ENV-01-24-1-000	PAGE 2 OF 3
SUBJECT: The Handling and Storage of Street Sweepings at MassHighway Facilities		DISTRIBUTION A	
EFFECTIVE APR 28 1999	ISSUED MAY -- 1999	APPROVED <i>J. Amorello</i>	

The sweepings must not be stored within the 100-foot Buffer Zone of a Wetland, within a Wetland Resource Area or within the 200 foot Riverfront Area.

Sweepings collected from urbanized areas (such as the portion of Route 93 within Route 128) should be stockpiled separately from sweepings collected from other areas. Questions regarding what constitutes an urban area should be referred to the DEP Street Sweepings policy and /or the local DEP office.

Storage of street sweepings must be temporary. Storage of street sweepings for longer than one year requires approval by the regional DEP office. A request for longer term storage must be prepared by the DHC (and reviewed by the DHD/DME).

Street Sweeping Reuse and Disposal: on a regular basis the DME should request an inventory of sweepings amounts in each district. The inventory should be distributed to the District Department heads for disposal and/or reuse evaluation. As indicated in the DEP policy there are options for reuse that require no analytical testing or DEP oversight. Options for reuse (construction fill, compost additive, reapplication, etc.) will be evaluated on a case by case basis by the DME and DHC.

Any proposed reuse must be reviewed by the DHC and the respective department head (Maintenance, Construction, or their designee). If reuse is indicated by DHC, DEP review of the proposed reuse may be necessary.

Disposal of street sweepings as solid waste or as cover material is allowed at permitted solid waste landfills.

Street sweepings collected from urban areas must have analytical testing conducted before reuse.

COMMONWEALTH OF MASSACHUSETTS MASSHIGHWAY DEPARTMENT STANDARD OPERATING PROCEDURES		S.O.P.NO. ENV-01-24-1-000	PAGE 3 OF 3
SUBJECT: The Handling and Storage of Street Sweepings at MassHighway Facilities		DISTRIBUTION A	
EFFECTIVE APR 28 1999	ISSUED MAY - - 1999	APPROVED <i>Matthew J. Amorello</i>	

If testing is required for disposal or reuse, each stockpile of sweepings must be tested. The district is responsible for the analytical testing of any sweepings collected from the urban areas before reuse.

Preparation of the analytical requirements will be the responsibility of the DHC in consultation with the regional DEP office. Review of the analytical data will be the responsibility of the DHC and the DME.

REUSE AND DISPOSAL OF STREET SWEEPINGS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WASTE PREVENTION
FINAL POLICY # BWP-94.092

This Policy provides guidance on the Department of Environmental Protection's requirements, standards, and approvals for handling, reuse and disposal of street sweepings.

Date

By Signature on Original
Carl F. Dierker,
Assistant Commissioner,
Bureau of Waste Prevention

POLICY # BWP-94.092
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1 POLICY STATEMENT AND SCOPE

This Policy explains the Department of Environmental Protection's requirements for managing street sweepings. Street sweepings are solid waste subject to the Massachusetts solid waste regulations. The options for managing street sweepings are as follows.

1. Use the street sweepings in accordance with the pre-approved uses described in Section 4 of this policy.
2. Use the street sweepings for a beneficial use after obtaining prior approval from the Department under the provisions of the solid waste regulations, 310 CMR 19.060, Beneficial Use of Solid Wastes.
3. Dispose of street sweepings at a permitted solid waste landfill.

The provisions and requirements for managing street sweepings under these options are the subject of this policy.

2 APPLICABILITY

This policy applies to the reuse or disposal of street sweepings that are generated in the ordinary and customary maintenance of roadways.

The policy does not apply to catch basin cleanings or street sweepings mixed with catch basin cleanings or other wastes. The policy does not apply to the material generated as the result of the clean up of an oil or hazardous material spill.

Street sweepings are not exempt from the Hazardous Waste Regulations, 310 CMR 30.000, and must be handled as hazardous waste when they exhibit any of the characteristics of a hazardous waste. If there is no evidence of unusual contamination, the Department does not require street sweepings to be routinely tested, but, as is the case with any waste, the generator has the ultimate responsibility for determining whether the waste is a hazardous waste.

3 DEFINITIONS

Department or DEP means the Massachusetts Department of Environmental Protection.

Public Way means the strip of land over and under a publicly owned, paved road or highway and includes the publicly owned land adjacent to the road or highway.

Street Sweepings means materials consisting primarily of sand and soil generated during the routine cleaning of roadways but may also contain some leaves and other miscellaneous solid wastes collected

during street sweeping. Street sweepings does not mean the material generated during the clean up of a spill or material from other structures associated with a roadway such as catch basins.

Urban center roads means local roads in central commercial and retail business districts and industrial and manufacturing areas.

4 PRE-APPROVED USES, RESTRICTIONS AND CONDITIONS

This policy allows street sweepings to be used in several applications. No approval from the Department is required when the restrictions and conditions identified in this policy are adhered to. However, sweepings shall not be used unless prior approval is obtained from the owner of the location where the sweepings are to be used.

4.1 Use at Landfills

Street sweepings may be used for daily cover at lined or unlined permitted solid waste landfills and need no prior DEP approval if the sweepings satisfy the requirements for daily cover material specified at 310 CMR 19.130(15).

4.2 Use as Fill in Public Ways

Street sweepings shall be used for fill in public ways without prior approval from the Department only when the following restrictions and conditions are observed:

The sweepings have not been collected from Urban Center Roads (see definition);

The sweepings are used under the road surface or as fill along the side of the road within the public way;

The sweepings are not used in residential areas;

The sweepings are kept above the level of the groundwater;

The sweepings are not used in designated "No Salt Areas";

The sweepings are not used within the 100 foot buffer zone of a wetland or within wetland resource areas including bordering vegetative wetlands and riverfront areas;

The sweepings are not used within 500 feet of a ground or surface drinking water supply.

4.3 Use As an Additive to Restricted Use Compost

Street sweepings shall be used as an additive to compost without prior approval from the Department only when the following restrictions and conditions are observed:

The sweepings have not been collected from Urban Center Roads (see definition);

The compost is used only in public ways;

The compost is not used in residential areas;

The compost is kept above the level of the groundwater;

The compost is not used in designated "No Salt Areas";

The compost is not used within the 100 foot buffer zone of a wetland or within wetland resource areas including bordering vegetative wetlands and riverfront areas;

The compost is not used within 500 feet of a ground or surface drinking water supply.

5 OTHER USES

Any use not pre-approved in the preceding section requires prior Department approval under the Beneficial Use provisions of the Solid Waste Management Facility Regulations at 310 CMR 19.060. A "Beneficial Use Determination" or BUD can be made only after the submission of an application characterizing the waste and describing the proposed beneficial use.

6 DISPOSAL

While the beneficial use of street sweepings is strongly encouraged, the Department does not prohibit the disposal of street sweepings. Street sweepings may be disposed in either lined or unlined permitted solid waste landfills without prior approval from the Department.

7 HANDLING

7.1 Collection of Street Sweepings

Although DEP does not regulate the collection of street sweepings, collection practices should be compatible with intended uses. For example, sweepings from Urban Center Roads are not approved for the uses allowed for sweepings from other areas. Keeping sweepings from

Urban Center Roads separate from sweepings from other areas will make the full benefits of this policy available.

This policy does not cover sweepings known to be contaminated by spills, and such sweepings should be collected separately and kept segregated. Depending on the contamination and circumstances, the handling of contaminated sweepings may be governed by the Massachusetts Contingency Plan, 310 CMR 40, the Massachusetts Hazardous Waste Regulations, 310 CMR 30, the Massachusetts Site Assignment Regulations for Solid Waste Facilities, 310 CMR 16 or the Massachusetts Solid Waste Management Facility Regulations, 310 CMR 19.

7.2 Storage

Street sweepings shall be temporarily stored prior to use, only when the following conditions are satisfied:

Storage must be at the site where the sweepings are generated (in the public way) or at a location, such as a DPW yard, that is under the control of the governmental entity which is doing the sweeping or has contracted for the sweeping;

The sweepings shall be protected from wind and rain to the extent necessary to prevent dust, erosion and off-site migration;

The sweepings shall not be stored within the 100 foot buffer zone of a wetland or within wetland resource areas including bordering vegetative wetlands and riverfront areas;

The sweepings shall not be stored within 500 feet of a ground or surface drinking water supply;

Storage shall incorporate good management practice and result in no public nuisance;

Storage must be temporary. Street sweepings shall be used within one year of collection unless the DEP Regional Office in the region where the sweepings are stored grants a written extension. An extension may be granted when it is demonstrated that all storage conditions will continue to be satisfied and the stored sweepings will be put to a specific identified use prior to the expiration of the extension period.

7.3 Preparation Prior to Use

Solid waste, such as paper, auto parts and other trash, shall be removed from the sweepings prior to use. Leaves, twigs and other organic matter should also be removed when good engineering practice indicates this is necessary to produce a material that is suitable for the intended use.

8 BACKGROUND

The Department has consistently classified street sweepings as solid waste subject to Massachusetts General Law Chapter 111, Section 150A and the Massachusetts Solid Waste Regulations (Site Assignment Regulations for Solid Waste Facilities, 310 CMR 16.00 and Solid Waste Management Facility Regulations, 310 CMR 19.000). There has been confusion among some in the regulated community about this classification.

Prior to the development of this policy, the options for handling street sweepings were limited to:

1. Disposal at a permitted solid waste landfill,
2. Use as cover at a permitted solid waste landfill or
3. Use in accordance with a Beneficial Use Determination (BUD).
BUD decisions are made on a case-by-case basis and require the submittal of a formal application to the Department containing data showing the chemical composition of the street sweepings.

The simplest of these options was either to use the sweepings for landfill cover or to dispose of the sweepings at the local landfill.

As many local landfills close, these options become less available to many communities. However, transporting sweepings to a distant landfill involves increased transportation costs and possibly payment of tipping fees.

To clarify the requirements and to provide simpler and less expensive alternatives for handling street sweepings, the Department undertook the development of this policy. Because useful studies of the chemical composition of street sweepings could not be found in the literature, the Department solicited the help of municipalities and state agencies in conducting a study of the composition of street sweepings from various types of areas. The results showed that sweepings from all areas, except Urban Center Roads, were similar with the main constituents of concern being total petroleum hydrocarbons (TPH) and polynuclear aromatic hydrocarbons (PAHs). Very limited data from Urban Center Roads indicated that sweepings from these areas may be more contaminated than sweepings from other areas.

The test results indicate that sweepings may contain levels of contamination that are unsuitable for unrestricted use. However, except for sweepings from Urban Center Roads, the levels of contamination were consistent and low enough to allow the use of sweepings in restricted applications without requiring testing or pre-approval as long as certain conditions were met. Sweepings from urban areas were excluded from some pre-approved uses. This situation could change when more data are available from Urban Center Roads.

This policy makes it possible for municipalities, state agencies and other governmental entities to handle street sweepings in an environmentally sound manner with a minimum of paperwork and expense.

9 ADDITIONAL INFORMATION

For additional copies of this policy, permit application forms or other DEP documents (except regulations) call any DEP Regional Office and ask for the Service Center or call the DEP Infoline in Boston. The permit application number for a Beneficial Use Determination is BWP SW-13 (Major) and BWP SW-30 (Minor).

Many DEP documents, including this policy, are available via modem from the DEP electronic bulletin board system, (617)292-5546. Information about the DEP and some documents are also available from the DEP's internet site at <http://www.magnet.state.ma.us/dep>.

Copies of all Massachusetts regulations, including the solid waste regulations, may be purchased from the State House Bookstore, (617)727-2834. The solid waste regulations are:

310 CMR 16.000, Site Assignment Regulations for Solid Waste Facilities

310 CMR 19.000, Solid Waste Management Facility Regulations

Questions about the Provisions of the Policy

If you have technical questions about the policy, please call any DEP office and ask to speak with a staff member about the provisions of the policy.

DEP InfoLine: from area code 617 and outside MA: (617)338-2255
from area codes 413 and 508: (800)462-0444
e-mail: infoline@state.ma.us

DEP Western Regional Office
436 Dwight Street
Springfield, MA 01103
Main Number: (413)784-1100
Service Center: extension 214

DEP Southeast Regional Office
20 Riverside Drive
Lakeville, MA 02347
Main Number: (508)946-2700
Service Center: (508)946-2714

DEP Central Regional Office
627 Main Street
Worcester, MA 01605
Main Number: (508)792-7650
Service Center: (508)792-7683

DEP Boston Office
Division of Solid Waste
One Winter Street
Boston, MA 02108
(617)292-5960

DEP Northeast Regional Office
10 Commerce Way
Woburn, MA 01801
Main Number: (617)932-7600
Service Center: (617)932-7677

Appendix I

SWMP BMP which Address Impaired Waterbody Pollutant of Concern Matrix

BMPs versus Pollutant of Concern Matrix

BMP ID #	BMP	MEASURABLE GOALS	POLLUTANT OF CONCERN									
			Sediments	Nutrients	Oxygen-demanding substances	Pathogens	Road salts	Hydrocarbons	Heavy metals	Toxic Pollutants	Temperature	Taste, odor, and color
			Suspended Solids	Phosphorus	Noxious aquatic plants	Fecal coliform bacteria	Chlorides	Petroleum hydrocarbons	Copper	Oil and grease	Thermal modifications	
			Siltation	Unionized Ammonia	Biological oxygen demand	E. coli bacteria	Salinity	Oil and grease	Lead	Pesticides		
			Turbidity	Nitrogen	Chemical oxygen demand		TDS (Total dissolved solids)		Zinc	pH		
				Nitrate and Nitrite	Organic enrichment/Low DO				Cadmium	Priority organics		
					Priority organics							
					Total organic carbon							
Minimum Control #1: Public Education and Outreach												
1A	MTAP	Fund one pollution reduction training regarding storm water and/or snow and ice control for MassHighway and DPW staff annually. Document attendance in annual report.	X		X			X	X	X	X	
1B	Baystate Roads	Provide one pollution reduction training regarding snow and ice control for MassHighway employees and one for DPW snowplow drivers annually. Document attendance in annual report.	X		X			X	X	X	X	
1C	MassHighway Website	1) Add Environmental Division web page to MH web site.	X	X	X	X	X	X	X	X	X	X
1C	MassHighway Website	2) Add link for contacting Env. Section via email.	X	X	X	X	X	X	X	X	X	X
1C	MassHighway Website	3) Evaluate web page annually and revise as necessary.	X	X	X	X	X	X	X	X	X	X
1E	Educational Seminars for CIM members	Provide educational seminars for CIM members on CGP Permit coverage and environmental compliance.	X	X						X	X	
1F	Post Contact Names for Municipal Drainage Concerns on MassHighway Web Site	1) Include contact names and addresses in handout for municipal DPW staff who attend NPDES Phase II seminar. 2) Post DHD contact names on MH website and maintain link. 3) Research methods for sharing drainage outfall inventory with municipalities in a timely manner.	X	X	X	X	X	X	X	X	X	X
1G	River and Stream Signs	Install signs identifying rivers and streams crossed by MassHighway roads, until all named rivers and streams are signposted.								X		
1H	Anti-litter/ Dumping Messages on Variable Message Boards	Maintain anti-litter messages on permanent Variable Message Boards.	X			X			X	X	X	
1I	Anti-litter/ Dumping Literature at Rest Areas and Visitors Centers	1) Work with EOEEA Think Blue Campaign to identify appropriate brochures for use in visitor's centers. 2) Distribute literature to visitor centers and track number of brochures distributed annually.	X			X			X	X	X	
1J	New England DOT Coordination	Coordinate with New England DOTs to discuss on-going issues and programs being faced by the DOT's including wetland mitigation, storm water and erosion controls.	X	X	X	X	X	X	X	X	X	X
1K	Storm Water Coordinator	Fund a full-time storm water coordinator position each year.	X	X	X	X	X	X	X	X	X	X
Minimum Control #2: Public Participation and Involvement												
2A	Project Related Public Notification and Public Participation Requirements	1) Continue compliance with federal and state public notification and public participation requirements. 2) Post notice of all public hearings on MassHighway website.	X	X	X	X	X	X	X	X	X	X
2B	Adopt-a-Highway	Install signs supporting Adopt-a-Highway Program in active program areas.	X			X			X	X	X	
2C	511 Massachusetts	Maintain the existing 511 project.	X			X			X	X	X	
2D	MassHighway Web Site	1) Within thirty days of submission, post latest version of the Storm Water Management Plan on the website.	X	X	X	X	X	X	X	X	X	X
2D	MassHighway Web Site	2) Within thirty days of submission, post the annual report on the website	X	X	X	X	X	X	X	X	X	X
2E	AASHTO's Center for Environmental Excellence on "Strategies & Approaches to Complying with NPDES Phase II survey	Complete the Center for Environmental Excellence survey										

BMPs versus Pollutant of Concern Matrix

BMP ID #	BMP	MEASURABLE GOALS	POLLUTANT OF CONCERN									
			Sediments	Nutrients	Oxygen-demanding substances	Pathogens	Road salts	Hydrocarbons	Heavy metals	Toxic Pollutants	Temperature	Taste, odor, and color
			Suspended Solids	Phosphorus	Noxious aquatic plants	Fecal coliform bacteria	Chlorides	Petroleum hydrocarbons	Copper	Oil and grease	Thermal modifications	
			Siltation	Unionized Ammonia	Biological oxygen demand	E. coli bacteria	Salinity	Oil and grease	Lead	Pesticides		
			Turbidity	Nitrogen	Chemical oxygen demand		TDS (Total dissolved solids)		Zinc	pH		
	Nitrate and Nitrite	Organic enrichment/Low DO				Cadmium	Priority organics					
		Priority organics										
		Total organic carbon										
Minimum Control #3: Illicit Discharge Detection and Elimination												
3A	Rest Area Leases	1) Include drainage system requirements in all new rest area leases; 2) Summarize new rest area leases in annual report.	X	X	X	X	X	X	X	X	X	
3B-1	Drainage Inventory	1) Develop Drainage Inventory Specifications; 2) Include specification in all future construction and redevelopment projects which impact drainage.	X	X	X	X	X	X	X	X	X	
3B-2	Drainage Inventory	1) Complete a drainage outfall inventory of discharge from MassHighway roads in urbanized areas. 2) Summarize progress in annual report.	X	X	X	X	X	X	X	X	X	
3C-1	Illicit Connection Prohibition Policy	1) Issue Illicit Drainage Connection Policy; 2) Post policy on web site. 3) Enforce provisions through referral to AGs office. 4) Summarize actions taken in annual report.	X	X	X	X	X	X	X	X	X	
3C-2	Drainage Tie-In SOP	1) Issue revised Drainage Tie-In SOP; 2) Summarize drainage tie-in permit applications and permits issued in annual report.	X	X	X	X	X	X	X	X	X	
3D	Illicit Connection Review	1) Identify known potential illicit connections from District personnel, towns or public. 2) Field review discharges to priority receiving waters. 3) Develop and release RFR for development and implementation of IDDE program for prioritized watersheds. 4) Include IDDE methodology in District EMS compliance training annually. 5) Each year summarize IDDE activity in annual report.	X	X	X	X	X	X	X	X	X	
3E	Resident Engineer Illicit Connection Training	1) Provide training on illicit connection policy, illicit connection identification and protocol for reporting during annual Resident Engineer training seminars. 2) Summarize # of attendees in Year 4 annual report.	X	X	X	X	X	X	X	X	X	
3F	Maintenance Staff Illicit Connection Training	1) Provide training on illicit connection policy, illicit connection identification and protocol for reporting during annual environmental awareness training seminars for maintenance personnel. 2) Summarize # of attendees in Year 4 annual report.	X	X	X	X	X	X	X	X	X	
Minimum Control Measure #4: Construction Site Runoff Control												
4A	MassHighway Department Project Development & Design Guide	All drainage systems for MH roads will be designed in accordance with Ch. 8 of the MHD Design Guide.	X	X	X	X	X	X	X	X	X	
4B	MA DEP Stormwater Management Policy	Continue to meet criteria in Policy for projects subject to Wetlands Protection Act.	X	X	X	X	X	X	X	X	X	
4C	NPDES Construction General Permit	1) File NOIs for new projects that disturb more than one acre. 2) Summarize NOIs issued to MH in annual report.	X	X	X		X	X	X	X		
4D	Other state environmental regulations or policy	Continue compliance with other state environmental regulations and policies.	X	X	X	X	X	X	X	X	X	
4E	MassHighway Storm Water Handbook	1) Develop and issue MH SW Handbook (completed in May 2004). 2) Require that all new construction and redevelopment activities undertaken by MassHighway, or by others that are funded in whole or in part by MassHighway, comply with the Handbook.	X	X	X	X	X	X	X	X	X	
4F	Standard Specification for Highway and Bridges	Continue to include Subsection 7.02 "Prevention of Water Pollution" of the Standard Specification for Highway and Bridges in all MassHighway funded construction projects.	X	X	X		X	X	X			
4G	MassHighway Research Needs Program	Continue funding the program.										
4H	Pre-Construction Meeting Review of NPDES requirements	District Env. Staff will review NPDES requirement at pre-construction meetings for all projects.	X	X	X		X	X	X	X		
4I	Contract Bid Item and Special Provision for SWPPPs	A Special Provision/ Pay Item is included in all new construction contracts to cover the preparation of the SWPPP by the Contractor.	X	X	X		X	X	X	X		
4J	Field Guide on Erosion Prevention and Sediment Control	1) Finalize field guide. 2) Issue to Resident Engineers.	X	X	X							
4K	Storm Water Pollution Prevention Plan Guidance Manual	SWPPP Guidance for Contractors document completed and in use by Contractors on MassHighway projects.	X	X	X		X	X	X	X		
4L-1	Training	1) Conduct annual Erosion Prevention and Sediment Control Training for Construction Personnel. 2) Summarize # of attendees and topics covered in annual report.	X	X	X		X	X	X	X		
4L-2	Non-Traditional Erosion Control Specifications	1) Develop specifications for non-traditional erosion controls. 2) As new technologies/ techniques are developed, they will be tested and, if accepted, a spec will be developed.	X	X	X		X	X	X	X		

BMPs versus Pollutant of Concern Matrix

BMP ID #	BMP	MEASURABLE GOALS	POLLUTANT OF CONCERN									
			Sediments	Nutrients	Oxygen-demanding substances	Pathogens	Road salts	Hydrocarbons	Heavy metals	Toxic Pollutants	Temperature	Taste, odor, and color
			Suspended Solids	Phosphorus	Noxious aquatic plants	Fecal coliform bacteria	Chlorides	Petroleum hydrocarbons	Copper	Oil and grease	Thermal modifications	
			Siltation	Unionized Ammonia	Biological oxygen demand	E. coli bacteria	Salinity	Oil and grease	Lead	Pesticides		
			Turbidity	Nitrogen	Chemical oxygen demand		TDS (Total dissolved solids)		Zinc	pH		
	Nitrate and Nitrite	Organic enrichment/Low DO				Cadmium	Priority organics					
		Priority organics										
		Total organic carbon										
4M	Erosion and Sediment Control Field Tests	1) Perform field tests of at least one new E&S materials on MassHighway projects. 2) Create and distribute internal memo summarizing materials effectiveness and recommended use.	X	X	X		X	X	X	X		
4N	Construction Bulletins	Issue annual construction bulletin to each District regarding storm water issues.	X	X	X		X	X	X	X	X	
4O	Solicit Construction Activity Feedback from Public	1) Include contact info for all ongoing construction projects on MH web site. 2) Respond to concerns in a timely manner.	X	X	X		X	X	X	X		
4P	Construction Runoff Control Enforcement	1) If MH Site Engineer determines that a construction project is not complying with local, state or federal pollution control laws, biweekly payment will be withheld until the problem is rectified. 2) Summarize actions taken in annual report.	X	X	X		X	X	X	X		
4Q	Standard Practices Memo	MassHighway issued a memo dated June 16, 2006 regarding procedures to follow on discovery of any illicit discharges during construction.	X	X	X		X	X	X	X	X	
4R	Contractor Inspector Training	MH will modify NPDES SWPPP contract bid item to include half day training requirement.	X	X	X		X	X	X	X		
Minimum Control Measure #5: Post Construction Runoff Control												
5A-1	MassHighway Storm Water Handbook	1) Secure DEP ratification. 2) Require all new construction or redevelopment activities funded by MH to comply with Handbook.	X	X	X	X	X	X	X	X	X	
5A-2	Revise Ch.4 of SW Handbook	1) Complete revision of Ch.4. 2) Reissue Handbook to designers and internal staff.	X	X	X	X	X	X	X	X	X	
5A-3	Revise Ch.5 of SW Handbook	1) Complete revision of Ch.5 within 1 year of release of revised stormwater policy. 2) Reissue Handbook to designers and internal staff.	X	X	X	X	X	X	X	X	X	
5C	TARP	1) Continue to work with DEP to develop review protocol for innovative stormwater BMPs. 2) Summarize in annual report.	X	X	X	X	X	X	X	X	X	
5D	Southeast Expressway BMP Effectiveness Study	Conduct study of WQI and CB effectiveness at TSS removal from highway runoff (Completed 2002).	X									
5E	Highway Runoff Contaminant Model	Develop and calibrate model for a broad range of contaminants (e.g.nutrients, metals, hydrocarbons, and bacteria).	X	X		X	X	X				
5G	Right of Way Parcel Evaluation	1) Develop methodology for evaluating parcels which are candidates for disposal for their storm water management potential. 2) Implement methodology.	X	X	X	X	X	X	X	X	X	
5H-1	Post Construction Runoff Enforcement - Illicit Discharge Prohibition	1) Develop policy for addressing unauthorized connections to the MassHighway's drainage system. 2) Enforce the provisions through referrals to the Attorney General. 3) Summarize actions taken under this BMP in annual report.	X	X	X	X	X	X	X	X	X	
5H-2	Post Construction Runoff Enforcement - Drainage Tie In Policy	1) Develop permitting process for adjacent properties that would like to tie into the MassHighway drainage system. 2) Implement permitting program. 3) Summarize actions taken under this BMP in annual report.	X	X	X	X	X	X	X	X	X	
5H-3	Post Construction Runoff Enforcement - Off-Site Pollution to MassHighway Drainage System	Runoff not meeting the NPDES MS4 requirements which is reaching the MH MS4 and is not covered under 5H-1 or 5H-2 may be considered trespassing and referred to the AG's office by MassHighway counsel at the DHD's discretion.	X	X	X	X	X	X	X	X	X	
5I	Rest Area Leases	1) Include drainage system requirements in all new rest area leases; 2) Summarize new rest area leases in annual report.	X	X	X	X	X	X	X	X	X	
5J	Transportation Evaluation Criteria	Continue to include environmental considerations in the funding prioritization evaluation.	X	X	X	X	X	X	X	X	X	
5K	Federal Enhancement Funding	Continue to participate in quarterly meetings of enhancement committee.	X	X	X	X	X	X	X	X	X	
Minimum Control Measure #6: Pollution Prevention/Good Housekeeping												
6A-1	Source Control: 511 Massachusetts	Maintain the existing 511 project.	X			X		X	X	X		
6A-2	Source Control: Adopt a Highway	1) Continue to support Adopt-a-Highway program by installing signs where program is active. 2) Summarize number of road miles cleaned each year in annual report.	X			X		X	X	X		
6A-3	Source Control: Deicing Programs and Reduced Salt Areas	Continue to support deicing and reduced salt areas programs.	X		X		X	X	X	X		

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			Suspended Solids	Phosphorus	Noxious aquatic plants	Fecal coliform bacteria	Chlorides	Petroleum hydrocarbons	Copper	Oil and grease	Thermal modifications	
			Siltation	Unionized Ammonia	Biological oxygen demand	E. coli bacteria	Salinity	Oil and grease	Lead	Pesticides		
			Turbidity	Nitrogen	Chemical oxygen demand		TDS (Total dissolved solids)		Zinc	pH		
	Nitrate and Nitrite	Organic enrichment/Low DO				Cadmium	Priority organics					
		Priority organics										
		Total organic carbon										
6A-4	Source Control: HELP	Continue to provide 22 HELP vans and tow trucks to provide assistance to people with car trouble.						X	X	X		
6A-5	Source Control: Vegetation Management	1) Develop a generic Vegetation Management Plan (VMP) outlining methods of minimizing the discharge of pollutants related to the storage and application of pesticides, herbicides and fertilizers. 2) Prepare Yearly Operational Plan (YOP). 3) Post YOP on website. 4) Summarize actions taken in previous year in annual report.		X	X						X	
6A-6	Source Control: Ridesharing	Continue participation in ridesharing activities.						X	X	X		
6A-7	Source Control: Alternative Transportation	Continue to support alternative transportation through technical funding and assistance.						X	X	X		
6A-8	Source Control: Highway Safety	1) Incorporate safety measures into all new highway designs 2) Provide signage to warn of vehicle hazards including tipping hazards and steep grades. 3) Install VMS on selected roadways to improve driver awareness. 4) Include evolving safety technologies as part of future highway design projects as they are developed.						X	X	X		
6A-9	Source Control: Toxics Use Reduction	Maintain an active PPTF throughout the permit term. 2) Provide summary of actions taken on each pollution prevention initiatives in annual report.	X					X	X	X		
6B-1	Employee Training: MTAP and Baystate Roads Program Training	Continue to support MTAP and Baystate Roads program.	X		X			X	X	X		
6B-2	Employee Training: Environmental Awareness Training	1) Provide annual training to at least 300 maintenance facility personnel regarding good housekeeping -spill prevention. 2) Summarize attendance and topics covered in annual report.						X	X	X		
6B-3	Employee Training: Snow and Ice Program	1) Provide annual training to 200 of supervisors and drivers annually on the latest on snow and ice removal. 2) Summarize attendance and topics covered in annual report.	X		X			X	X	X		
6B-4	Employee Training: Equipment and Vehicle Safety Training	Ensure all equipment and vehicle operators have received training on the proper operation of the equipment and vehicles they operate. 2) Summarize training in annual report.						X	X	X		
6C-1	Maintenance Program	Continue maintenance activities for storm water system as indicated in Appendix E of the SWMP.	X	X	X	X		X	X	X	X	X
6C-2	Maintenance/ Material Storage Yards	1) Review maintenance and material storage yards and create a facility handbook for each that provides information on necessary steps to environmental compliance. Completed 199 5						X	X	X	X	
6C-2	Maintenance/ Material Storage Yards	2) Post EMS Manual on MassHighway website for public information.						X	X	X	X	
6C-2	Maintenance/ Material Storage Yards	3) Post generic Facility Handbook on website for public information.						X	X	X	X	
6C-3	Maintenance Record and Data Management Program	1) Develop work management system. 2) Populate program with infrastructure information from inventory (BMP 7R). 3) Implement system and begin to record maintenance activities in TMDL watersheds.	X	X				X	X	X	X	
6D	Waste Disposal	1) Street sweeping waste will be reused in appropriate slope stabilization and road work projects in compliance with MH SOP. 2) Material which can not be reused will be disposed of according to "Reuse and Disposal of Contaminated Soil at Massachusetts Landfills" DEP Policy #COMM-97-001.	X	X				X				
6E	Catch Basin Accumulation Project	Complete a study of debris accumulation in catch basins by November 2009. Include summary in annual report. Based on the results of the study, revise the existing cleaning schedule and SOP for catch basin cleaning by June 2010.	X	X	X			X				
6F	Snow and Ice Control GEIR – Policy Program Review	MassHighway will continue to at least biannually evaluate its snow and ice control policies and operational programs in order to make adjustments based on data and experience, and to respond to changing conditions.	X					X		X	X	
6G	Snow and Ice Control GEIR – Salt Remediation Program	Continue to provide the Salt Remediation Program with a funding level appropriate to quickly address salt related complaints.	X	X				X		X	X	
6H	Snow and Ice Control GEIR – Clean Well Initiative	Provide a continued level of funding that will allow MassHighway to complete up to 20 replacement wells per year.	X	X				X		X	X	
6I	Salt Management and Storage	Review Sheds: MassHighway will continue to prioritize the identification and selection of parcels being considered for new salt storage facilities, considering operational needs and the environmental setting.	X	X				X		X	X	

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			Siltation	Unionized Ammonia	Biological oxygen demand	E. coli bacteria	Salinity	Oil and grease	Lead	Pesticides		
			Turbidity	Nitrogen	Chemical oxygen demand		TDS (Total dissolved solids)		Zinc	pH		
				Nitrate and Nitrite	Organic enrichment/Low DO				Cadmium	Priority organics		
					Priority organics							
					Total organic carbon							
6I	Salt Management and Storage	Review Sand Piles: Review all facilities and implement measures identified.	X	X			X		X	X		
6I	Salt Management and Storage	Personnel: Hire a director of snow and ice operations.	X	X			X		X	X		
6J	Salt Storage BMPs/ Pollution Prevention	Continue to implement salt storage in compliance with DEP guidelines. Follow MH SOP for the Management of Sand and Deicing Chemicals at facilities. Continue to follow Facility Env. Handbook guidelines at maintenance facilities.	X	X			X		X	X		
6K	Equipment Improvements	Expand the use of anti-icing as a standard tool for snow and ice control.	X	X			X					
6L	Enhanced Weather Forecasting Information	Continue to provide sufficient funding to use weather forecasting contractor to provide up-to-date and local weather information during snow and ice season.	X	X			X					
6M	Road Weather Information System	Ensure that the RWIS system stations are maintain so as to remain fully functional.	X	X			X					
6N	Alternative Technologies	Maximize the use of premix and liquid calcium chloride as alternative deicers to reduce the quantity of granular sodium chloride. Monitor reduced salt zones during storms to ensure the proper timing of salt applications and to minimize the potential for overuse of deicing chemicals.					X					
6O	Research	Pursue research programs pertaining to storm water management. Currently, MassHighway has joined the Clear Roads program.	X	X	X	X	X	X	X	X	X	X
Additional Programs												
7A	Wetland Protection Act Compliance	1) All MassHighway projects will comply with the WPA and MESA. 2) When potential impacts are identified, MassHighway will work with the appropriate agencies to design the project to minimize the impacts.	X	X	X	X	X	X	X	X	X	X
7B	401 Water Quality Certification	MassHighway will continue to comply with MA 401 Water Quality Certification which includes review of the project by MA Natural Heritage program and US Fish and Wildlife if endangered species habitat is mapped in the project vicinity.	X	X	X	X	X	X	X	X	X	X
7C	CE Checklist	MassHighway projects which include federal funds must complete this checklist at 25% Design stage. The checklist includes determining if the site is in an area where there are federally listed endangered species or critical habitat and historic properties.										
7D	Environmental Site Data Form	MassHighway will develop this form to review potential impacts of a project to a variety of resource areas as part of compliance with the NPDES Construction and MS4 general permit. This form will include review of discharges for potential impact to state or federally listed endangered species or critical habitat, historic properties, impaired waterbodies and the other critical resource areas described in the general permit. The form will include instructions to the contractor/designer if impacts are identified.	X	X	X	X	X	X	X	X	X	X
7E	TMDL Recommendation Summary Table Update	Update table to include TMDL reports finalized within previous year and progress on implementation of any related measurable goals in annual report.	X	X	X	X	X	X	X	X	X	X
7F, 7G, 7H, 7I, 7J, 7K, 7L, 7M, 7N, 7P, 7Q	Impaired Waterbodies TMDL	MH will review projects which discharge to impaired waterbodies for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue.	X	X	X	X	X	X	X	X	X	X
7O	Salisbury Pond Nutrient TMDL	Sweep streets in this watershed at least once a year (usually in spring) and more often if necessary. All sumped drainage structures will be inspected and cleaned if necessary, twice a year and more often if necessary. MassHighway will inspect/ clean drainage outlet locations where sediment build-up is evident. MassHighway will inspect and repair damaged and/ or clogged drainage conveyances	X	X	X							
7P	Lake Quinsigamond and Flint Pond Nutrient TMDL	Continue to maintain level of staffing and funding to provide maintenance frequencies as outlined in 6-19-02 letter in App. E.	X	X	X							

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			Turbidity	Nitrogen	Chemical oxygen demand		TDS (Total dissolved solids)		Zinc	pH		
				Nitrate and Nitrite	Organic enrichment/Low DO				Cadmium	Priority organics		
		Priority organics										
		Total organic carbon										
7R	TMDL Watershed Drainage Inventory	Review 20% of MassHighway roads contributing to TMDL watersheds each year (as budget allows) and develop conceptual plan for BMPs if review indicates potential contribution to impairment.	X	X	X	X	X	X	X	X	X	
7S	Salt Remediation Program	Continue to provide the Salt Remediation Program with a funding level appropriate to quickly address salt related complaints.	X	X			X		X	X		
7T	Review of Specific Sites for Water Quality Exceedance in Response to Conservation Law Foundation (CLF) et al. Lawsuit	1. Analyze each of the three sites identified in the CLF lawsuit. Develop summary report with modeling methodology and summary of results. 2. For the sites which are determined to contribute to the exceedance of water quality at the stream crossing, construct BMPs to address MassHighway related exceedance by December 2010. 3. Submit a remedial plan to the courts by January 2010.							X			
8A	Cultural Resources Review	Reviews all projects for impacts to historic properties at the 25% Design stage.										

Appendix I

SWMP BMP which Address Impaired Waterbody Pollutant of Concern Matrix

BMPs versus Pollutant of Concern Matrix

BMP ID #	BMP	MEASURABLE GOALS	POLLUTANT OF CONCERN									
			Sediments	Nutrients	Oxygen-demanding substances	Pathogens	Road salts	Hydrocarbons	Heavy metals	Toxic Pollutants	Temperature	Taste, odor, and color
			Suspended Solids	Phosphorus	Noxious aquatic plants	Fecal coliform bacteria	Chlorides	Petroleum hydrocarbons	Copper	Oil and grease	Thermal modifications	
			Siltation	Unionized Ammonia	Biological oxygen demand	E. coli bacteria	Salinity	Oil and grease	Lead	Pesticides		
			Turbidity	Nitrogen	Chemical oxygen demand		TDS (Total dissolved solids)		Zinc	pH		
				Nitrate and Nitrite	Organic enrichment/Low DO				Cadmium	Priority organics		
					Priority organics							
					Total organic carbon							
Minimum Control #1: Public Education and Outreach												
1A	MTAP	Fund one pollution reduction training regarding storm water and/or snow and ice control for MassHighway and DPW staff annually. Document attendance in annual report.	X		X			X	X	X	X	
1B	Baystate Roads	Provide one pollution reduction training regarding snow and ice control for MassHighway employees and one for DPW snowplow drivers annually. Document attendance in annual report.	X		X			X	X	X	X	
1C	MassHighway Website	1) Add Environmental Division web page to MH web site.	X	X	X	X	X	X	X	X	X	X
1C	MassHighway Website	2) Add link for contacting Env. Section via email.	X	X	X	X	X	X	X	X	X	X
1C	MassHighway Website	3) Evaluate web page annually and revise as necessary.	X	X	X	X	X	X	X	X	X	X
1E	Educational Seminars for CIM members	Provide educational seminars for CIM members on CGP Permit coverage and environmental compliance.	X	X						X	X	
1F	Post Contact Names for Municipal Drainage Concerns on MassHighway Web Site	1) Include contact names and addresses in handout for municipal DPW staff who attend NPDES Phase II seminar. 2) Post DHD contact names on MH website and maintain link. 3) Research methods for sharing drainage outfall inventory with municipalities in a timely manner.	X	X	X	X	X	X	X	X	X	X
1G	River and Stream Signs	Install signs identifying rivers and streams crossed by MassHighway roads, until all named rivers and streams are signposted.								X		
1H	Anti-litter/ Dumping Messages on Variable Message Boards	Maintain anti-litter messages on permanent Variable Message Boards.	X			X			X	X	X	
1I	Anti-litter/ Dumping Literature at Rest Areas and Visitors Centers	1) Work with EOEEA Think Blue Campaign to identify appropriate brochures for use in visitor's centers. 2) Distribute literature to visitor centers and track number of brochures distributed annually.	X			X			X	X	X	
1J	New England DOT Coordination	Coordinate with New England DOTs to discuss on-going issues and programs being faced by the DOT's including wetland mitigation, storm water and erosion controls.	X	X	X	X	X	X	X	X	X	X
1K	Storm Water Coordinator	Fund a full-time storm water coordinator position each year.	X	X	X	X	X	X	X	X	X	X
Minimum Control #2: Public Participation and Involvement												
2A	Project Related Public Notification and Public Participation Requirements	1) Continue compliance with federal and state public notification and public participation requirements. 2) Post notice of all public hearings on MassHighway website.	X	X	X	X	X	X	X	X	X	X
2B	Adopt-a-Highway	Install signs supporting Adopt-a-Highway Program in active program areas.	X			X		X	X	X		
2C	511 Massachusetts	Maintain the existing 511 project.	X			X		X	X	X		
2D	MassHighway Web Site	1) Within thirty days of submission, post latest version of the Storm Water Management Plan on the website.	X	X	X	X	X	X	X	X	X	X
2D	MassHighway Web Site	2) Within thirty days of submission, post the annual report on the website	X	X	X	X	X	X	X	X	X	X
2E	AASHTO's Center for Environmental Excellence on "Strategies & Approaches to Complying with NPDES Phase II survey	Complete the Center for Environmental Excellence survey										

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	Nitrate and Nitrite	Organic enrichment/Low DO				Cadmium	Priority organics					
		Priority organics										
		Total organic carbon										
Minimum Control #3: Illicit Discharge Detection and Elimination												
3A	Rest Area Leases	1) Include drainage system requirements in all new rest area leases; 2) Summarize new rest area leases in annual report.	X	X	X	X	X	X	X	X	X	
3B-1	Drainage Inventory	1) Develop Drainage Inventory Specifications; 2) Include specification in all future construction and redevelopment projects which impact drainage.	X	X	X	X	X	X	X	X	X	
3B-2	Drainage Inventory	1) Complete a drainage outfall inventory of discharge from MassHighway roads in urbanized areas. 2) Summarize progress in annual report.	X	X	X	X	X	X	X	X	X	
3C-1	Illicit Connection Prohibition Policy	1) Issue Illicit Drainage Connection Policy; 2) Post policy on web site. 3) Enforce provisions through referral to AGs office. 4) Summarize actions taken in annual report.	X	X	X	X	X	X	X	X	X	
3C-2	Drainage Tie-In SOP	1) Issue revised Drainage Tie-In SOP; 2) Summarize drainage tie-in permit applications and permits issued in annual report.	X	X	X	X	X	X	X	X	X	
3D	Illicit Connection Review	1) Identify known potential illicit connections from District personnel, towns or public. 2) Field review discharges to priority receiving waters. 3) Develop and release RFR for development and implementation of IDDE program for prioritized watersheds. 4) Include IDDE methodology in District EMS compliance training annually. 5) Each year summarize IDDE activity in annual report.	X	X	X	X	X	X	X	X	X	
3E	Resident Engineer Illicit Connection Training	1) Provide training on illicit connection policy, illicit connection identification and protocol for reporting during annual Resident Engineer training seminars. 2) Summarize # of attendees in Year 4 annual report.	X	X	X	X	X	X	X	X	X	
3F	Maintenance Staff Illicit Connection Training	1) Provide training on illicit connection policy, illicit connection identification and protocol for reporting during annual environmental awareness training seminars for maintenance personnel. 2) Summarize # of attendees in Year 4 annual report.	X	X	X	X	X	X	X	X	X	
Minimum Control Measure #4: Construction Site Runoff Control												
4A	MassHighway Department Project Development & Design Guide	All drainage systems for MH roads will be designed in accordance with Ch. 8 of the MHD Design Guide.	X	X	X	X	X	X	X	X	X	
4B	MA DEP Stormwater Management Policy	Continue to meet criteria in Policy for projects subject to Wetlands Protection Act.	X	X	X	X	X	X	X	X	X	
4C	NPDES Construction General Permit	1) File NOIs for new projects that disturb more than one acre. 2) Summarize NOIs issued to MH in annual report.	X	X	X		X	X	X	X		
4D	Other state environmental regulations or policy	Continue compliance with other state environmental regulations and policies.	X	X	X	X	X	X	X	X	X	
4E	MassHighway Storm Water Handbook	1) Develop and issue MH SW Handbook (completed in May 2004). 2) Require that all new construction and redevelopment activities undertaken by MassHighway, or by others that are funded in whole or in part by MassHighway, comply with the Handbook.	X	X	X	X	X	X	X	X	X	
4F	Standard Specification for Highway and Bridges	Continue to include Subsection 7.02 "Prevention of Water Pollution" of the Standard Specification for Highway and Bridges in all MassHighway funded construction projects.	X	X	X		X	X	X			
4G	MassHighway Research Needs Program	Continue funding the program.										
4H	Pre-Construction Meeting Review of NPDES requirements	District Env. Staff will review NPDES requirement at pre-construction meetings for all projects.	X	X	X		X	X	X	X	X	
4I	Contract Bid Item and Special Provision for SWPPPs	A Special Provision/ Pay Item is included in all new construction contracts to cover the preparation of the SWPPP by the Contractor.	X	X	X		X	X	X	X	X	
4J	Field Guide on Erosion Prevention and Sediment Control	1) Finalize field guide. 2) Issue to Resident Engineers.	X	X	X							
4K	Storm Water Pollution Prevention Plan Guidance Manual	SWPPP Guidance for Contractors document completed and in use by Contractors on MassHighway projects.	X	X	X		X	X	X	X	X	
4L-1	Training	1) Conduct annual Erosion Prevention and Sediment Control Training for Construction Personnel. 2) Summarize # of attendees and topics covered in annual report.	X	X	X		X	X	X	X	X	
4L-2	Non-Traditional Erosion Control Specifications	1) Develop specifications for non-traditional erosion controls. 2) As new technologies/ techniques are developed, they will be tested and, if accepted, a spec will be developed.	X	X	X		X	X	X	X	X	

BMPs versus Pollutant of Concern Matrix

BMP ID #	BMP	MEASURABLE GOALS	POLLUTANT OF CONCERN									
			Sediments	Nutrients	Oxygen-demanding substances	Pathogens	Road salts	Hydrocarbons	Heavy metals	Toxic Pollutants	Temperature	Taste, odor, and color
			Suspended Solids	Phosphorus	Noxious aquatic plants	Fecal coliform bacteria	Chlorides	Petroleum hydrocarbons	Copper	Oil and grease	Thermal modifications	
			Siltation	Unionized Ammonia	Biological oxygen demand	E. coli bacteria	Salinity	Oil and grease	Lead	Pesticides		
			Turbidity	Nitrogen	Chemical oxygen demand		TDS (Total dissolved solids)		Zinc	pH		
	Nitrate and Nitrite	Organic enrichment/Low DO				Cadmium	Priority organics					
		Priority organics										
		Total organic carbon										
4M	Erosion and Sediment Control Field Tests	1) Perform field tests of at least one new E&S materials on MassHighway projects. 2) Create and distribute internal memo summarizing materials effectiveness and recommended use.	X	X	X		X	X	X	X		
4N	Construction Bulletins	Issue annual construction bulletin to each District regarding storm water issues.	X	X	X		X	X	X	X	X	
4O	Solicit Construction Activity Feedback from Public	1) Include contact info for all ongoing construction projects on MH web site. 2) Respond to concerns in a timely manner.	X	X	X		X	X	X	X		
4P	Construction Runoff Control Enforcement	1) If MH Site Engineer determines that a construction project is not complying with local, state or federal pollution control laws, biweekly payment will be withheld until the problem is rectified. 2) Summarize actions taken in annual report.	X	X	X		X	X	X	X		
4Q	Standard Practices Memo	MassHighway issued a memo dated June 16, 2006 regarding procedures to follow on discovery of any illicit discharges during construction.	X	X	X		X	X	X	X	X	
4R	Contractor Inspector Training	MH will modify NPDES SWPPP contract bid item to include half day training requirement.	X	X	X		X	X	X	X		
Minimum Control Measure #5: Post Construction Runoff Control												
5A-1	MassHighway Storm Water Handbook	1) Secure DEP ratification. 2) Require all new construction or redevelopment activities funded by MH to comply with Handbook.	X	X	X	X	X	X	X	X	X	
5A-2	Revise Ch.4 of SW Handbook	1) Complete revision of Ch.4. 2) Reissue Handbook to designers and internal staff.	X	X	X	X	X	X	X	X	X	
5A-3	Revise Ch.5 of SW Handbook	1) Complete revision of Ch.5 within 1 year of release of revised stormwater policy. 2) Reissue Handbook to designers and internal staff.	X	X	X	X	X	X	X	X	X	
5C	TARP	1) Continue to work with DEP to develop review protocol for innovative stormwater BMPs. 2) Summarize in annual report.	X	X	X	X	X	X	X	X	X	
5D	Southeast Expressway BMP Effectiveness Study	Conduct study of WQI and CB effectiveness at TSS removal from highway runoff (Completed 2002).	X									
5E	Highway Runoff Contaminant Model	Develop and calibrate model for a broad range of contaminants (e.g.nutrients, metals, hydrocarbons, and bacteria).	X	X		X	X	X				
5G	Right of Way Parcel Evaluation	1) Develop methodology for evaluating parcels which are candidates for disposal for their storm water management potential. 2) Implement methodology.	X	X	X	X	X	X	X	X	X	
5H-1	Post Construction Runoff Enforcement - Illicit Discharge Prohibition	1) Develop policy for addressing unauthorized connections to the MassHighway's drainage system. 2) Enforce the provisions through referrals to the Attorney General. 3) Summarize actions taken under this BMP in annual report.	X	X	X	X	X	X	X	X	X	
5H-2	Post Construction Runoff Enforcement - Drainage Tie In Policy	1) Develop permitting process for adjacent properties that would like to tie into the MassHighway drainage system. 2) Implement permitting program. 3) Summarize actions taken under this BMP in annual report.	X	X	X	X	X	X	X	X	X	
5H-3	Post Construction Runoff Enforcement - Off-Site Pollution to MassHighway Drainage System	Runoff not meeting the NPDES MS4 requirements which is reaching the MH MS4 and is not covered under 5H-1 or 5H-2 may be considered trespassing and referred to the AG's office by MassHighway counsel at the DHD's discretion.	X	X	X	X	X	X	X	X	X	
5I	Rest Area Leases	1) Include drainage system requirements in all new rest area leases; 2) Summarize new rest area leases in annual report.	X	X	X	X	X	X	X	X	X	
5J	Transportation Evaluation Criteria	Continue to include environmental considerations in the funding prioritization evaluation.	X	X	X	X	X	X	X	X	X	
5K	Federal Enhancement Funding	Continue to participate in quarterly meetings of enhancement committee.	X	X	X	X	X	X	X	X	X	
Minimum Control Measure #6: Pollution Prevention/Good Housekeeping												
6A-1	Source Control: 511 Massachusetts	Maintain the existing 511 project.	X			X		X	X	X		
6A-2	Source Control: Adopt a Highway	1) Continue to support Adopt-a-Highway program by installing signs where program is active. 2) Summarize number of road miles cleaned each year in annual report.	X			X		X	X	X		
6A-3	Source Control: Deicing Programs and Reduced Salt Areas	Continue to support deicing and reduced salt areas programs.	X		X		X	X	X	X		

BMPs versus Pollutant of Concern Matrix

BMP ID #	BMP	MEASURABLE GOALS	POLLUTANT OF CONCERN									
			Sediments	Nutrients	Oxygen-demanding substances	Pathogens	Road salts	Hydrocarbons	Heavy metals	Toxic Pollutants	Temperature	Taste, odor, and color
			Suspended Solids	Phosphorus	Noxious aquatic plants	Fecal coliform bacteria	Chlorides	Petroleum hydrocarbons	Copper	Oil and grease	Thermal modifications	
			Siltation	Unionized Ammonia	Biological oxygen demand	E. coli bacteria	Salinity	Oil and grease	Lead	Pesticides		
			Turbidity	Nitrogen	Chemical oxygen demand		TDS (Total dissolved solids)		Zinc	pH		
	Nitrate and Nitrite	Organic enrichment/Low DO				Cadmium	Priority organics					
		Priority organics										
		Total organic carbon										
6A-4	Source Control: HELP	Continue to provide 22 HELP vans and tow trucks to provide assistance to people with car trouble.						X	X	X		
6A-5	Source Control: Vegetation Management	1) Develop a generic Vegetation Management Plan (VMP) outlining methods of minimizing the discharge of pollutants related to the storage and application of pesticides, herbicides and fertilizers. 2) Prepare Yearly Operational Plan (YOP). 3) Post YOP on website. 4) Summarize actions taken in previous year in annual report.		X	X						X	
6A-6	Source Control: Ridesharing	Continue participation in ridesharing activities.						X	X	X		
6A-7	Source Control: Alternative Transportation	Continue to support alternative transportation through technical funding and assistance.						X	X	X		
6A-8	Source Control: Highway Safety	1) Incorporate safety measures into all new highway designs 2) Provide signage to warn of vehicle hazards including tipping hazards and steep grades. 3) Install VMS on selected roadways to improve driver awareness. 4) Include evolving safety technologies as part of future highway design projects as they are developed.						X	X	X		
6A-9	Source Control: Toxics Use Reduction	Maintain an active PPTF throughout the permit term. 2) Provide summary of actions taken on each pollution prevention initiatives in annual report.	X					X	X	X		
6B-1	Employee Training: MTAP and Baystate Roads Program Training	Continue to support MTAP and Baystate Roads program.	X		X			X	X	X		
6B-2	Employee Training: Environmental Awareness Training	1) Provide annual training to at least 300 maintenance facility personnel regarding good housekeeping -spill prevention. 2) Summarize attendance and topics covered in annual report.						X	X	X	X	
6B-3	Employee Training: Snow and Ice Program	1) Provide annual training to 200 of supervisors and drivers annually on the latest on snow and ice removal. 2) Summarize attendance and topics covered in annual report.	X		X			X	X	X	X	
6B-4	Employee Training: Equipment and Vehicle Safety Training	Ensure all equipment and vehicle operators have received training on the proper operation of the equipment and vehicles they operate. 2) Summarize training in annual report.						X	X	X	X	
6C-1	Maintenance Program	Continue maintenance activities for storm water system as indicated in Appendix E of the SWMP.	X	X	X	X		X	X	X	X	X
6C-2	Maintenance/ Material Storage Yards	1) Review maintenance and material storage yards and create a facility handbook for each that provides information on necessary steps to environmental compliance. Completed 199 5						X	X	X	X	
6C-2	Maintenance/ Material Storage Yards	2) Post EMS Manual on MassHighway website for public information.						X	X	X	X	
6C-2	Maintenance/ Material Storage Yards	3) Post generic Facility Handbook on website for public information.						X	X	X	X	
6C-3	Maintenance Record and Data Management Program	1) Develop work management system. 2) Populate program with infrastructure information from inventory (BMP 7R). 3) Implement system and begin to record maintenance activities in TMDL watersheds.	X	X				X	X	X	X	
6D	Waste Disposal	1) Street sweeping waste will be reused in appropriate slope stabilization and road work projects in compliance with MH SOP. 2) Material which can not be reused will be disposed of according to "Reuse and Disposal of Contaminated Soil at Massachusetts Landfills" DEP Policy #COMM-97-001.	X	X				X				
6E	Catch Basin Accumulation Project	Complete a study of debris accumulation in catch basins by November 2009. Include summary in annual report. Based on the results of the study, revise the existing cleaning schedule and SOP for catch basin cleaning by June 2010.	X	X	X			X				
6F	Snow and Ice Control GEIR – Policy Program Review	MassHighway will continue to at least biannually evaluate its snow and ice control policies and operational programs in order to make adjustments based on data and experience, and to respond to changing conditions.	X					X		X	X	
6G	Snow and Ice Control GEIR – Salt Remediation Program	Continue to provide the Salt Remediation Program with a funding level appropriate to quickly address salt related complaints.	X	X				X		X	X	
6H	Snow and Ice Control GEIR – Clean Well Initiative	Provide a continued level of funding that will allow MassHighway to complete up to 20 replacement wells per year.	X	X				X		X	X	
6I	Salt Management and Storage	Review Sheds: MassHighway will continue to prioritize the identification and selection of parcels being considered for new salt storage facilities, considering operational needs and the environmental setting.	X	X				X		X	X	

BMPs versus Pollutant of Concern Matrix

BMP ID #	BMP	MEASURABLE GOALS	POLLUTANT OF CONCERN									
			Sediments	Nutrients	Oxygen-demanding substances	Pathogens	Road salts	Hydrocarbons	Heavy metals	Toxic Pollutants	Temperature	Taste, odor, and color
			Suspended Solids	Phosphorus	Noxious aquatic plants	Fecal coliform bacteria	Chlorides	Petroleum hydrocarbons	Copper	Oil and grease	Thermal modifications	
			Siltation	Unionized Ammonia	Biological oxygen demand	E. coli bacteria	Salinity	Oil and grease	Lead	Pesticides		
			Turbidity	Nitrogen	Chemical oxygen demand		TDS (Total dissolved solids)		Zinc	pH		
				Nitrate and Nitrite	Organic enrichment/Low DO				Cadmium	Priority organics		
					Priority organics							
					Total organic carbon							
6I	Salt Management and Storage	Review Sand Piles: Review all facilities and implement measures identified.	X	X			X		X	X		
6I	Salt Management and Storage	Personnel: Hire a director of snow and ice operations.	X	X			X		X	X		
6J	Salt Storage BMPs/ Pollution Prevention	Continue to implement salt storage in compliance with DEP guidelines. Follow MH SOP for the Management of Sand and Deicing Chemicals at facilities. Continue to follow Facility Env. Handbook guidelines at maintenance facilities.	X	X			X		X	X		
6K	Equipment Improvements	Expand the use of anti-icing as a standard tool for snow and ice control.	X	X			X					
6L	Enhanced Weather Forecasting Information	Continue to provide sufficient funding to use weather forecasting contractor to provide up-to-date and local weather information during snow and ice season.	X	X			X					
6M	Road Weather Information System	Ensure that the RWIS system stations are maintain so as to remain fully functional.	X	X			X					
6N	Alternative Technologies	Maximize the use of premix and liquid calcium chloride as alternative deicers to reduce the quantity of granular sodium chloride. Monitor reduced salt zones during storms to ensure the proper timing of salt applications and to minimize the potential for overuse of deicing chemicals.					X					
6O	Research	Pursue research programs pertaining to storm water management. Currently, MassHighway has joined the Clear Roads program.	X	X	X	X	X	X	X	X	X	X
Additional Programs												
7A	Wetland Protection Act Compliance	1) All MassHighway projects will comply with the WPA and MESA. 2) When potential impacts are identified, MassHighway will work with the appropriate agencies to design the project to minimize the impacts.	X	X	X	X	X	X	X	X	X	X
7B	401 Water Quality Certification	MassHighway will continue to comply with MA 401 Water Quality Certification which includes review of the project by MA Natural Heritage program and US Fish and Wildlife if endangered species habitat is mapped in the project vicinity.	X	X	X	X	X	X	X	X	X	X
7C	CE Checklist	MassHighway projects which include federal funds must complete this checklist at 25% Design stage. The checklist includes determining if the site is in an area where there are federally listed endangered species or critical habitat and historic properties.										
7D	Environmental Site Data Form	MassHighway will develop this form to review potential impacts of a project to a variety of resource areas as part of compliance with the NPDES Construction and MS4 general permit. This form will include review of discharges for potential impact to state or federally listed endangered species or critical habitat, historic properties, impaired waterbodies and the other critical resource areas described in the general permit. The form will include instructions to the contractor/designer if impacts are identified.	X	X	X	X	X	X	X	X	X	X
7E	TMDL Recommendation Summary Table Update	Update table to include TMDL reports finalized within previous year and progress on implementation of any related measurable goals in annual report.	X	X	X	X	X	X	X	X	X	X
7F, 7G, 7H, 7I, 7J, 7K, 7L, 7M, 7N, 7P, 7Q	Impaired Waterbodies TMDL	MH will review projects which discharge to impaired waterbodies for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue.	X	X	X	X	X	X	X	X	X	X
7O	Salisbury Pond Nutrient TMDL	Sweep streets in this watershed at least once a year (usually in spring) and more often if necessary. All sumped drainage structures will be inspected and cleaned if necessary, twice a year and more often if necessary. MassHighway will inspect/ clean drainage outlet locations where sediment build-up is evident. MassHighway will inspect and repair damaged and/ or clogged drainage conveyances	X	X	X							
7P	Lake Quinsigamond and Flint Pond Nutrient TMDL	Continue to maintain level of staffing and funding to provide maintenance frequencies as outlined in 6-19-02 letter in App. E.	X	X	X							

BMPs versus Pollutant of Concern Matrix

BMP ID #	BMP	MEASURABLE GOALS	POLLUTANT OF CONCERN									
			Sediments	Nutrients	Oxygen-demanding substances	Pathogens	Road salts	Hydrocarbons	Heavy metals	Toxic Pollutants	Temperature	Taste, odor, and color
			Suspended Solids	Phosphorus	Noxious aquatic plants	Fecal coliform bacteria	Chlorides	Petroleum hydrocarbons	Copper	Oil and grease	Thermal modifications	
			Siltation	Unionized Ammonia	Biological oxygen demand	E. coli bacteria	Salinity	Oil and grease	Lead	Pesticides		
			Turbidity	Nitrogen	Chemical oxygen demand		TDS (Total dissolved solids)		Zinc	pH		
				Nitrate and Nitrite	Organic enrichment/Low DO				Cadmium	Priority organics		
		Priority organics										
		Total organic carbon										
7R	TMDL Watershed Drainage Inventory	Review 20% of MassHighway roads contributing to TMDL watersheds each year (as budget allows) and develop conceptual plan for BMPs if review indicates potential contribution to impairment.	X	X	X	X	X	X	X	X	X	
7S	Salt Remediation Program	Continue to provide the Salt Remediation Program with a funding level appropriate to quickly address salt related complaints.	X	X			X		X	X		
7T	Review of Specific Sites for Water Quality Exceedance in Response to Conservation Law Foundation (CLF) et al. Lawsuit	1. Analyze each of the three sites identified in the CLF lawsuit. Develop summary report with modeling methodology and summary of results. 2. For the sites which are determined to contribute to the exceedance of water quality at the stream crossing, construct BMPs to address MassHighway related exceedance by December 2010. 3. Submit a remedial plan to the courts by January 2010.							X			
8A	Cultural Resources Review	Reviews all projects for impacts to historic properties at the 25% Design stage.										

Appendix J

Evaluating Highway Runoff's Effect on Receiving Waters at Three Sites in Massachusetts

Prepared for:
MassHighway Department

Evaluating Highway Runoff's Effect on Receiving Waters at Three Sites in Massachusetts

AECOM, Inc.
October 2009
Document No.: 04489-015-0801

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1.0 Executive Summary

The Findings and Rulings of Civil Action No. 06-11295-WGY requires that MassHighway install Best Management Practices (BMPs) at three stream crossings to address the effect of stormwater runoff on the receiving waters. This requirement was part of compliance with MassHighway's General Permit for EPA's National Pollutant Discharge Elimination System (NPDES) for Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4).

Section I.B.2(k) of the General Permit specifies that MassHighway discharges may not cause or contribute to instream exceedance of water quality standards. Part IX: 401 Water Quality Certification of the general permit indicates that "compliance with conditions of the permit will result in compliance with the applicable water quality standards as required by the Massachusetts Surface Water Quality Standards regulations (314 CMR 4.00) and with 314 CMR 9.04 and that the permittee will be in compliance with Sections 301, 302, 303, 306 and 307 of the Federal Clean Water Act." Specifically, stormwater runoff from MassHighway roads must not cause receiving waters to exceed the EPA Acute Toxicity Criteria. EPA acute toxicity criteria specify the concentration of pollutant that must not be exceeded for a duration of one-hour at the frequency of once in three years, referred to herein as the 1-hour, 3-year concentration. The EPA National Recommended Water Quality Criteria (EPA 822-R-02-047, November 2002) published by the EPA pursuant to Section 304(a) of the Federal Water Pollution Control Act specifies the acute toxicity concentrations of zinc and lead. Massachusetts 314 CMR 4.00 Surface Water Quality Standards, Table 28, Site Specific Criteria, specifies the acute toxicity concentration for copper in the Charles River.

As part of the BMP design to address these sites, MassHighway contracted with AECOM, Inc. to evaluate the effect of highway runoff on the in-stream concentrations of copper, lead, and zinc in the Charles and North Nashua Rivers. The subject sites include:

1. I-495 crossing of the Charles River in Bellingham,
2. I-495 crossing of the Charles River in Milford, and
3. I-190 crossing of the North Nashua River in Lancaster.

AECOM visited each site to evaluate existing field conditions including drainage flow paths, land cover, and stormwater management infrastructure. Then, AECOM adapted an existing numerical model (originally developed by the Federal Highway Administration) to estimate the 3-year peak pollutant concentration in the receiving waters at the subject sites. AECOM compared the estimated 3-year peak pollutant concentrations to the EPA Acute Toxicity Concentrations. AECOM determined that each site had existing stormwater management infrastructure (BMPs), which already provides sufficient retention/detention capacity to eliminate the risk of causing the receiving waters to exceed the EPA acute toxicity criteria and therefore construction of additional BMPs is not warranted.

Section 2.0 provides a detailed description of each subject site including the contributing area, the drainage pathways, and existing stormwater management infrastructure.

Section 3.0 describes the numerical model and lists site characterization values that AECOM used to evaluate each subject site. AECOM adapted a numerical model originally developed by the Federal Highway Administration (FHWA) to predict the 3-year peak pollutant concentration in the receiving water based on the characteristics of the contributing site and the quality of the stormwater runoff.

Section 4.0 describes the method that AECOM used to evaluate the performance of existing BMPs at the subject sites. This was a necessary step because the numerical model described in Section 3.0 does not account for runoff volume reduction and water quality treatment provided by existing on-site BMPs.

Section 5.0 presents the results of the assessment to determine whether highway runoff from the subject sites causes the receiving waters to exceed EPA's Acute Toxicity Criteria.

Section 6.0 presents the conclusions of this study. Model results indicate that existing BMPs at the subject sites reduce the impact of highway stormwater runoff on the subject receiving waters. Runoff does not cause the receiving waters to exceed EPA acute toxicity criteria.

Appendix A contains the FHWA model implementation. Appendix B contains model input and output reports.

2.0 Subject Sites

This section of the report describes the characteristics of the sites evaluated as part of this study. The subject sites include.

1. I-495 crossing of the Charles River in Bellingham
2. I-495 crossing of the Charles River in Milford
3. I-190 crossing of the North Nashua River in Lancaster

AECOM characterized each of the subject sites using information from MassHighway drainage drawings and from site visits conducted during the summer of 2008. During the site visits, AECOM verified the existing contributing drainage area boundaries, land cover, and stormwater management infrastructure.

2.1 Interstate 495/Charles River Crossing in Bellingham

Approximately 20 acres of MassHighway right-of-way drains to the I-495/Charles River crossing in Bellingham. The contributing area is composed primarily of grass and impervious highway. Wetland and forest occupy the remainder of the contributing area. Table 2-1 presents this watershed's land cover areas and percentages.

At this site, I-495 is divided. The northbound and southbound lanes are each approximately 55 feet wide, including the shoulder. The length of highway corridor contributing to the discharge point is approximately 2000 feet. The site has a BMP consisting of a vegetated swale along the highway median that collects runoff from approximately 53 percent of the total contributing area. Figure 1 illustrates the location of the subject site and the MassHighway property contributing to the crossing and to the site BMP. Section 3.3.7.1 of this report provides a detailed description of the BMP at this site.

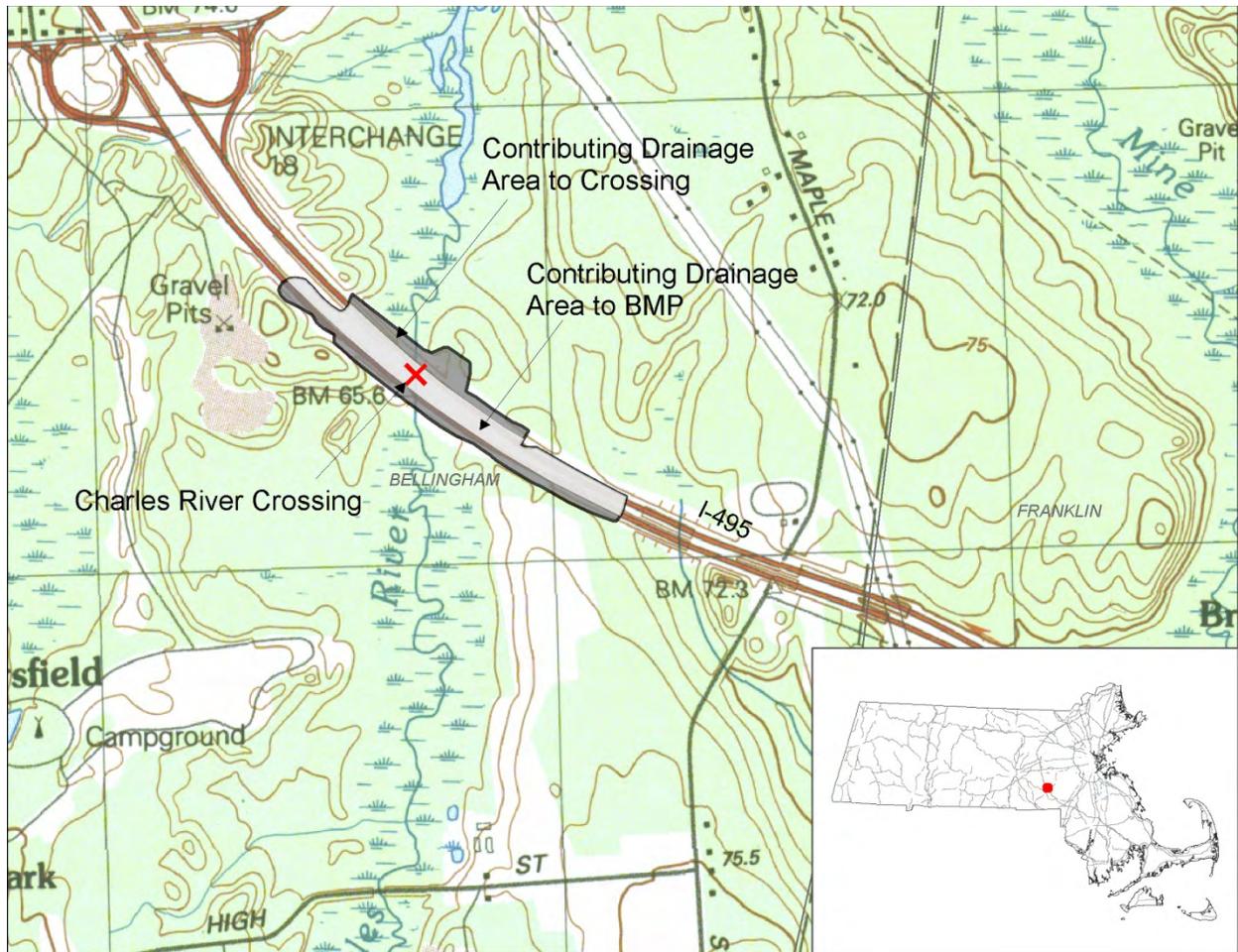


Figure 1. I-495/Charles River, Bellingham

Table 2-1. Contributing Watershed to I-495/Charles River Crossing, Bellingham

Landuse	Area (acres)	Percent of Total Area
Grass	8.5	44%
Impervious	5.9	33%
Forest	3.4	17%
Wetland	1.4	7%
Non Forested Wetland	0.3	2%
Total	19.5	100%

2.2 Interstate 495/Charles River Crossing in Milford

Approximately 53 acres of MassHighway right-of-way drains to the I-495/Charles River crossing in Milford. The contributing area is primarily impervious highway and grass. Forest occupies the remainder of the contributing area. Table 2-2 presents this watershed's land cover areas and percentages.

At this site, I-495 is divided. The northbound and southbound lanes are each approximately 55 feet wide, including the shoulder. The length of highway corridor contributing to the discharge point is approximately 3800 feet. The site has a BMP consisting of a detention basin with a two-stage outlet that collects runoff from approximately 95 percent of the total contributing area. Figure 2 illustrates the location of the subject site and the MassHighway property contributing to the crossing and to the site BMP. Section 3.3.7.2 of this report provides a detailed description of the BMP at this site.

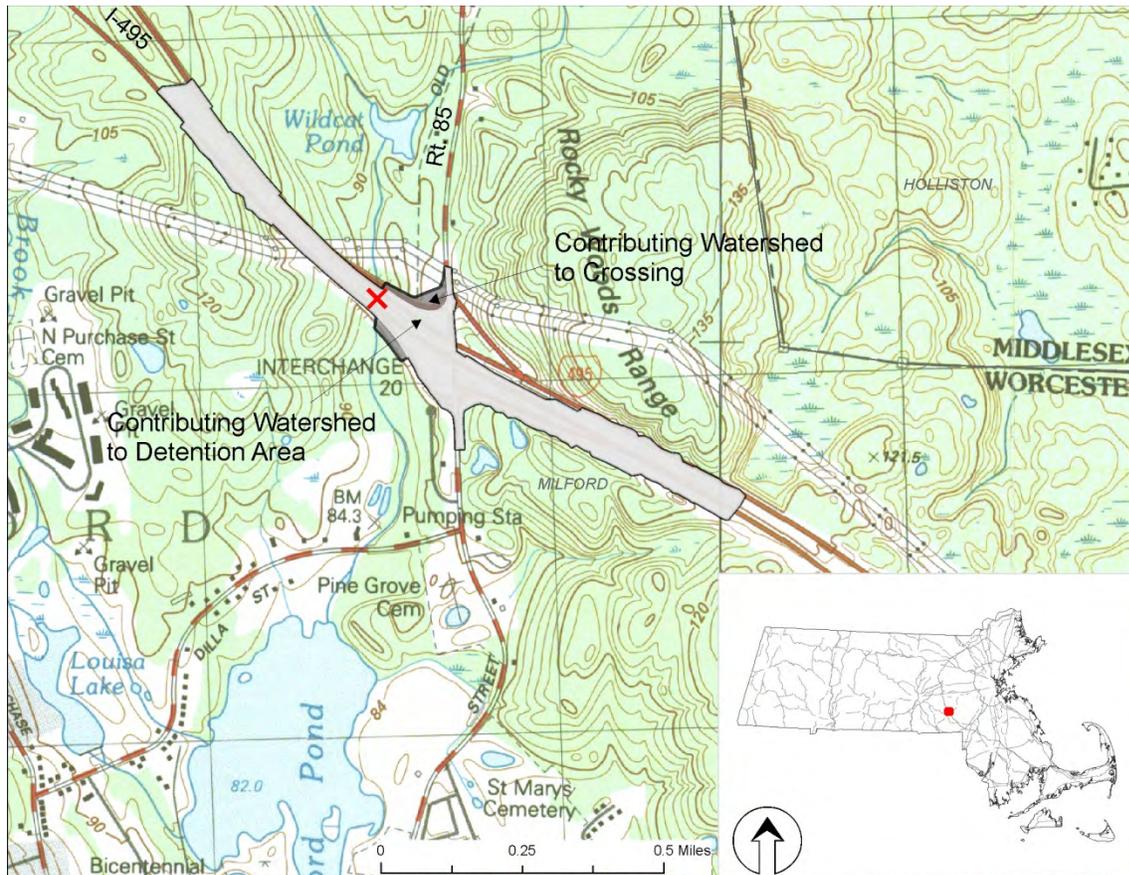


Figure 2. I-495/Charles River, Milford

Table 2-2. Contributing Watershed to I-495/Charles River Crossing, Milford

Land Use	Area (acres)	Percent of Total Area
Impervious	18.3	35%
Grass	22.6	43%
Forest	11.5	22%
Total	52.5	100%

2.3 Interstate 190/North Nashua River Crossing in Lancaster

Approximately 36 acres of MassHighway right-of-way drains to the I-190/North Nashua River crossing in Lancaster. The contributing area is primarily forest and impervious highway. Grass and water occupy the remainder of the contributing area. Table 2-3 presents the land use areas and percentages.

At this site, I-190 is divided. The northbound and southbound lanes are each approximately 44 feet wide, including the shoulder. The length of highway corridor contributing to the discharge point is approximately 3000 feet. The site has two BMPs consisting of retention/recharge basins that collect runoff from approximately 89 percent of the total contributing area. Figure 3 illustrates the location of the subject site and the MassHighway property contributing to the crossing and to the site BMP. Section 3.3.7.3 of this report provides a detailed description of the BMP at this site.

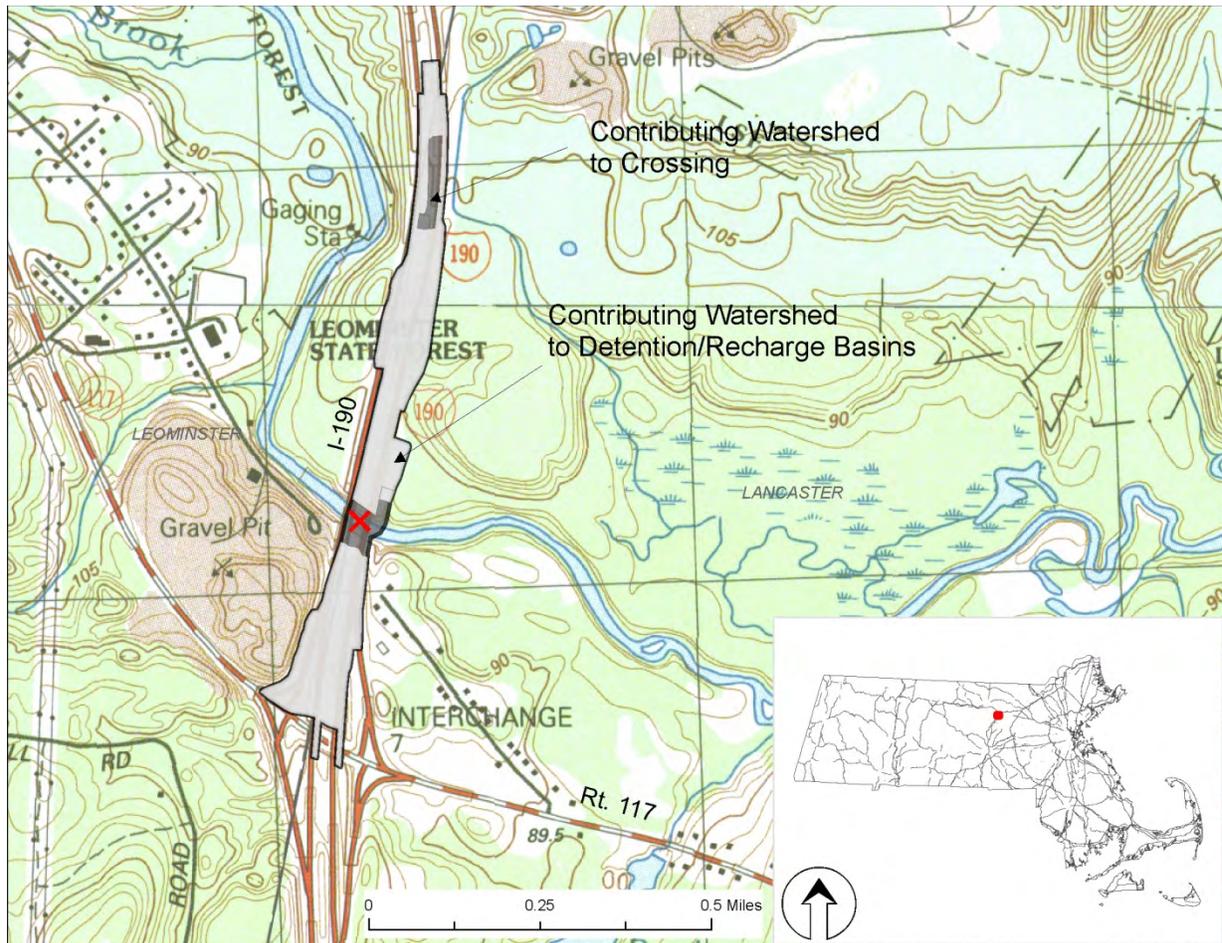


Figure 3. I-190/North Nashua River, Lancaster

Table 2-3. Contributing Watershed to MassHighway Outfall at I-190/North Nashua River Crossing, Lancaster

Land Use	Area (acres)	Percent of Total Area
Forest	14.4	40%
Impervious	11.5	32%
Grass	10.0	28%
Water	0.3	<1%
Total	36.2	100%

3.0 FHWA Model Development

AECOM developed spreadsheet-based implementation of the Federal Highway Administration (FHWA) model described in "Pollutant Loadings and Impacts from Highway Stormwater Runoff" by Eugene Driscoll *et al.*, April 1990, to estimate impacts of highway runoff from the subject sites on receiving waters. The FHWA model estimates the 3-year concentration of the pollutant of interest in the receiving water based on the statistical characteristics of site-specific precipitation, runoff, and streamflow data. The model compares the estimated in-stream concentration to a target concentration, i.e., the EPA Acute Toxicity Concentration. The model output determines whether the subject site would benefit from improvements (e.g., installation of stormwater management infrastructure (BMPs)) to decrease the impact of highway stormwater runoff on the receiving water.

The original FHWA model was built to run on an operating system that is no longer in use on contemporary computers. The USGS intends to release a modified version of the original FHWA model in the fall of 2009. However, the model is not yet available; therefore, AECOM used the original model documentation (USDOT FHWA, 1990a) to adapt the FHWA model to Visual Basic for Excel (v. Microsoft Office 2003) to analyze the sites.

3.1 FHWA Model

In 1990, the Federal Highway Administration developed the FHWA model to estimate impacts of highway runoff on receiving waters. The model estimates the stream concentration exceeded once in three years and compares the results with the target concentration. If the estimated instream concentration is well under the target concentration, the model advises the user to end the evaluation. If the estimated instream concentration is greater than the target concentration, the model advises the user to evaluate (externally) controls (i.e., stormwater management infrastructure) to reduce pollutant loads to the receiving water. If the stream concentration is near the target concentration, the model advises the user to refine the estimates of the site characteristics and evaluate the site again.

The following mass-balance relationship defines the instream concentration (C_o) as a function of runoff and streamflow rates and runoff and streamflow pollutant concentrations:

$$C_o = \frac{Q_r C_r + Q_s C_s}{Q_r + Q_s} \text{ (Equation 1.) where}$$

C_o is the concentration of the pollutant in the receiving stream,
 Q_r is the volumetric flow rate of runoff,
 C_r is the concentration of pollutant in runoff,
 Q_s is the volumetric flow rate of the receiving stream prior to mixing, and
 C_s is the concentration of pollutant in the receiving stream prior to mixing.

The instream concentration may be rewritten as a function of the dilution factor. The dilution factor is the ratio of the runoff rate to the sum of the runoff and streamflow rates.

$$DF = \frac{Q_r}{Q_r + Q_s} \text{ (Equation 2.)}$$

Re-written, the instream concentration becomes:

$$C_o = DF \cdot C_r + (1 - DF) \cdot C_s \text{ (Equation 3.)}$$

The model assumes that flow rates for streamflow and runoff and pollutant concentrations for streamflow and runoff are lognormally distributed. The model also assumes that streamflow and runoff rates are not correlated. This assumption is not true when applied to smaller watersheds; however, model results consistent with this assumption will conservatively overestimate the 3-year instream pollutant concentration.

In statistical notation, the mean instream concentration is:

$$\mu_{C_o} = \mu_{DF} \cdot \mu_{C_r} + (1 - \mu_{DF}) \cdot \mu_{C_s} \text{ (Equation 4)}$$

The standard deviation is:

$$\sigma_{C_o} = \sqrt{\sigma_{DF}^2 \cdot (\mu_{C_r} - \mu_{C_s})^2 + \sigma_{C_r}^2 \cdot (\sigma_{DF}^2 + \mu_{DF}^2) + \sigma_{C_s}^2 \cdot (\sigma_{DF}^2 + (1 - \mu_{DF})^2)} \text{ (Equation 5)}$$

The standard deviation of the instream concentration is dependent on the variability of the dilution factor (which is dependent on the mean and variability of the streamflow and the runoff rates), the runoff concentration, and the stream concentration.

The model estimates the median logarithm of the dilution factor ($\ln[DF_{50}]$) by linearly interpolating between the 5th and 95th percentile dilution factors. The model estimates the standard deviation of the logarithm of the dilution factor, which is dependent on the standard deviations of the runoff and the streamflow.

The instream concentration that is not exceeded at the once in three year frequency:

$$C_{o_z} = e^{\ln(\mu_{C_o}) + Z \cdot \ln(\sigma_{C_o})} \text{ (Equation 6)}$$

Where Z is the normal distribution value corresponding to the probability of experiencing the 3-year precipitation event in any given year.

3.2 VB/Excel Model Development

AECOM developed a Visual Basic/Excel implementation of the FHWA model using information from "Pollutant Loadings and Impacts from Highway Stormwater Runoff" (USDOT FHWA, 1990a). Appendix A presents the functions defined in the VB/FHWA model.

3.3 Data Sources

The FHWA model estimates the 3-year concentration of the pollutant of interest in the receiving water based on the statistical characteristics of site-specific precipitation, runoff, and streamflow data. AECOM characterized each of the subject sites using the following sources of data:

- Precipitation Data
 - FHWA recommended values (USDOT FHWA, 1990a)
- Streamflow Data
 - USGS stream gages
 - Milford Power stream gage
- Concentration Data

- MassHighway runoff concentrations in the USGS/DOT/FHWA database, “Highway Runoff Database: A Data Warehouse and Preprocessor for the Stochastic Empirical Loading and Dilution Model (SELDM), version 1.0.0a September 2009” (referred to herein as the SELDM database)
- USGS, NWIS database
- FHWA recommended values (USDOT FHWA, 1990a)
- Watershed Data
 - AECOM site visits
 - MassHighway drainage plan drawings

This section of the report describes the data sources and model input values used to characterize each site in the FHWA model.

3.3.1 Precipitation Data

The FHWA model uses the statistics derived from hourly precipitation data to estimate the mean and standard deviation of runoff for the 3-year precipitation event. AECOM used estimates of precipitation statistics supplied in the FHWA model documentation (FHWA, 1990a).

The FHWA model documentation defines five characteristics of precipitation events including:

1. Precipitation event – Begins when the hourly precipitation is greater than zero and ends after six hours with no precipitation have elapsed
2. Event volume – The cumulative depth of rainfall during the event
3. Event duration – The total number of hours for which the precipitation is greater than zero
4. Event intensity – The cumulative precipitation depth during the event divided by the duration of the event
5. Event interval – The interval between the midpoints of successive events

The FHWA model uses the mean and standard deviation of items 2 - 5 to characterize the 3-year precipitation event. The FHWA model documentation provides suggested values for the precipitation statistics by region and by major city. Massachusetts falls in Region 1, the northeast United States. Table 3-1 presents the suggested values for Region 1 (Boston).

Table 3-1. FHWA Model Input Values, Precipitation

Abbreviation	Description	Value
MVP	mean volume of precipitation (inches)	0.33
CVVP	coefficient of variation of precipitation	1.67
MDP	mean duration of precipitation (hours)	6.1
CVDP	coefficient of variation of duration	1.03
MIP	mean intensity of precipitation (inches / hour)	0.044
CVIP	coefficient of variation of intensity	1.02
NST	average number of storms per year	128

3.3.2 Streamflow Data

The FHWA model uses the mean and standard deviation of the average daily flow rate of the receiving water to estimate the 3-year instream concentration of pollutant after mixing with runoff. AECOM estimated daily streamflow at the subject sites by applying an area-weighted flow scaling factor to flows measured at nearby stream gages. Table 3-2 presents the source of data for the streamflow at each subject receiving water.

Table 3-2. Streamflow Gage References

Site	Gage Reference	Period of Record
I-495/Charles River, Bellingham	USGS 01103280	11/12/1997 – 6/15/2009
I-495/Charles River, Milford	Milford Power Gage	1/1/2003 – 12/31/2005
I-190/North Nashua River, Lancaster	USGS 01094500	9/17/1935 – 6/15/2009

Table 3-3 FHWA Model Input Values, Streamflow3 presents the area-weighted flow scaling factors and the mean (MQS) and coefficient of variation of the daily flows (CVQS) of each subject receiving water. Streamflow measurements of the receiving waters are not coincident with the subject sites. AECOM did not independently delineate the contributing areas to the receiving waters at the stream gages and at the subject outfalls; AECOM used the values reported in Novotny, 2007. The area-weighted flow scaling factor adjusts the gage-measured streamflow to compensate for the difference in contributing area between the receiving water at the subject site and the receiving water at the stream gage. The coefficient of variation of the streamflow is defined as the ratio of the standard deviation of the streamflow and the mean streamflow.

Table 3-3 FHWA Model Input Values, Streamflow

Site	Contributing Area to Gage, A_g (mi ²)*	Contributing Area to Site, A_s (mi ²)*	Flow Scaling Factor $(A_s/A_g)^{0.81**}$	Mean Stream Flow (MQS) (cfs)	Coefficient of Variation of Streamflow (CVQS)
I-495/Charles River, Bellingham	65.7	23.6	0.44	54.8	1.18
I-495/Charles River, Milford	6.9	2.5	0.44	9.6	0.99
I-190/North Nashua River, Lancaster	110.0	112	1.01	207.8	1.27

*Source: Novotny, 2007.

**Flow scaling factor: Maidment Handbook of Hydrology.

MQS= annual average stream flow (cfs)

CVQS = coefficient of variation of daily flow rates

3.3.3 Runoff

In the FHWA model uses the percent impervious area and the precipitation intensity to estimate the mean runoff rate at each subject site.

The mean runoff rate is defined as:

$$Q_R = R_v \cdot MIP \cdot AROW \cdot \frac{360}{3600} + RBMP \text{ (Equation 7), where}$$

R_v is the runoff coefficient

$$Rv = 0.007 + \frac{100 \cdot AHWY}{AROW} + 0.1 \text{ (Equation 8)}$$

MIP is the mean precipitation intensity, see Table 3-1.

AROW is the total area of the right of way contributing to the discharge point, see Table 3-8.

AHWY is the impervious area of the right of way contributing to the discharge point, see Table 3-9.

RBMP is the peak discharge rate from a site BMP during the 3-year precipitation event, see Section 4-1.

3.3.4 Water Quality Standards

The FHWA model estimates the 3-year peak instream pollutant concentration and compares the results with a user-specified target concentration. For this study, AECOM compared the estimated 3-year peak concentrations to the EPA acute toxicity concentration for the subject pollutants copper, zinc, and lead.

EPA Acute Toxicity Criteria

EPA acute toxicity standards for copper, zinc, and lead specify the allowable aqueous phase (dissolved) concentration of each metal for the one-hour duration at the three year frequency in surface waters. The dissolved component of the metals (not the solid component) is responsible for toxic effects to aquatic life.

The dissolved concentrations of copper, zinc, and lead are dependent on the chemistry of the receiving water. The EPA defines the total allowed dissolved concentrations of the subject pollutants as a function of the measured hardness of the receiving water. For this study, AECOM assumed a value for the total hardness of the receiving waters based on water quality measurements collected at the USGS station 01103500 in Dover (along the Charles River) and USGS station 01094500 near Leominster (along the Nashua River). The total hardness of the receiving bodies is applied to the EPA standard conversion factors for copper, zinc, and lead to determine the maximum allowable concentrations of the metals in the subject receiving waters.

For this study, AECOM assumed a value for existing background concentration of metals in the receiving waters based on water quality measurements collected at the USGS station 01103500 in Dover (along the Charles River) and USGS station 01094500 near Leominster (along the Nashua River). AECOM assumes that the measured total hardness at Dover is applicable to the Milford and Bellingham sites.

AECOM reduced the maximum allowable EPA acute toxicity concentration by the existing background concentration to simplify the analysis. By reducing the EPA acute toxicity concentration by the background concentration, AECOM could isolate the impact of stormwater runoff from the subject site to the receiving water. This method is consistent with the method described in Novotny, 2007.

Table 3-4 presents the values of the EPA Acute Toxicity Concentration Criterion (CTA) and Total Hardness (TH) used in this application of the FHWA model. The total hardness values are consistent with the suggested values presented in the FHWA model documentation (USDOT FHWA, 1990a).

Table 3-4 EPA Acute Concentration Criterion Adjusted to Compensate for Background River Concentrations (TH and CTA)

Site	Total Hardness (mg/L as CaCO ₃)	Copper Standard (mg/L)	Zinc Standard (mg/L)	Lead Standard (mg/L)
Bellingham, Charles River	37.5	0.0033	0.021	0.017
Milford, Charles River	37.5	0.0033	0.021	0.017
Lancaster, North Nashua River	33.1	0.0027	0.016	0.014

Source: Novotny, 2007.

3.3.5 Pollutant Concentration in Runoff Data

The FHWA model uses the median and the coefficient of variation of pollutant concentrations in runoff to estimate the 3-year pollutant concentration in the receiving water.

3.3.5.1 Median Pollutant Concentration

For this study, AECOM estimated the median pollutant concentration in site runoff (TCR) for the subject sites using data from the SELDM database. AECOM estimated the median and coefficient of variation of the pollutant concentrations in runoff using analytical results for unfiltered water samples at sites along I-495, I-190 and Route 2. This subset of the SELDM database was chosen to represent pollutant concentrations at sites with similar average daily traffic (ADT) counts as the subject sites. The analytical results for the unfiltered water samples represent the total mass of pollutant in the runoff, i.e., the reported concentration accounts for both the dissolved and particulate mass of pollutant. The SELDM record includes analytical results for 62 measurements for copper, zinc, and lead at 5 sites.

Table 3-5 compares the median site runoff concentrations used in this study, which were estimated using the SELDM data, to the typical suggested median runoff concentrations presented in the FHWA model documentation. Compared to the non site specific FHWA-suggested values, runoff samples from the MassHighway sites have a higher concentration of copper and zinc and a lower concentration of lead.

Table 3-5 FHWA Input Values, Site Median Concentrations (TCR)

Metal	2009 SELDM Data (mg/L)	FHWA- Suggested Values (mg/L)
Copper	0.0263	0.022
Zinc	0.1730	0.080
Lead	0.0082	0.080

3.3.5.2 Coefficient of Variation

AECOM estimated the coefficient of variation of the pollutant concentrations (CVCR) in runoff using data from the 2009 SELDM database. The coefficients of variation for copper, zinc, and lead estimated using the SELDM data were consistently greater than the FHWA-recommended value (0.71 for all pollutants for urban areas). The CVCR estimates presented in Table 3-6 represent the average coefficient of variation calculated for each metal, where each coefficient of variation is composed of the ratio of the standard deviation and the mean concentration for all samples at all sites. The CVCR estimates are based on the analytical results for 62 total measurements at 5 sites.

Table 3-6 Coefficient of Variation of Pollutants in Runoff (CVCR), MassHighway SELDM database

Metal	Coefficient of Variation of Concentration of Pollutants (CVCR)
Copper	0.93
Zinc	0.99
Lead	1.23

3.3.5.3 Dissolved Concentration

The EPA Acute toxicity criteria specify the total allowable concentration of dissolved pollutants in the receiving water. The site median concentrations reported in Table 3-5 represent the total pollutant in the site runoff, which includes both the particulate and the dissolved components. The FHWA model applies a solubility factor (FSOL) to the total mass of the analyte in runoff to estimate the dissolved concentration of the pollutant in the runoff. Table 3-7 presents the estimates of the soluble fraction (FSOL) of copper, lead, and zinc in runoff from two sources, the FHWA model documentation (USDOT FHWA, 1990a) and a summary of many experimental values reported in USGS, 2000.

USGS, 2000 describes the difference in element partitioning between particulate and soluble phase in natural systems and in highway runoff. USGS, 2000 indicates that previous studies show that in natural systems approaching geochemical equilibrium, the soluble fractions of copper, lead, and zinc, are 5-10%, 0.5-1%, and 0.1-0.5%, respectively. Soluble fractions of the same compounds in pavement runoff are much higher. USGS, 2000 summarizes the results of many studies and indicates that in highway runoff, the mean soluble fractions of copper, lead, and zinc are 52%, 12%, and 65%, respectively.

Table 3-7 FHWA Inputs Values, Soluble Fraction of Pollutant in Highway Runoff (FSOL)

Metal	Soluble Fraction	
	USDOT FHWA, 1990a	USGS, 2000
Copper	0.40	0.52
Zinc	0.40	0.65
Lead	0.10	0.12

For this study, AECOM applied the larger, more conservative solubility factors reported in USGS, 2000.

3.3.6 Watershed Data

The FHWA model estimates runoff volumes and peak rates as a function of percent impervious area of the contributing watershed. First, AECOM reviewed existing MassHighway drainage plans to delineate watersheds to the subject receiving waters. Second, AECOM visited each of the subject sites to confirm and/or update the watershed delineations and identify existing stormwater management infrastructure. Figures 1 through 3 in Section 2 and Figures 4 through 9 in this section illustrate the contributing watershed area, the impervious roadway area, and the existing surface water management infrastructure for each of the subject sites.

The FHWA model requires the user to input three areas that define the study watershed. The areas are:

1. The total contributing area to the outfall
2. The total impervious area to the outfall
3. The total contributing area to the receiving water at the outfall

AECOM estimated the three watershed areas for each of the three subject sites in GIS using site specific topographic data and verified the boundaries during site visits. The following section of the report presents AECOM's estimated contributing areas.

3.3.6.1 Contributing Area to Outfall/ Impervious Area to Outfall

AECOM delineated the contributing area to each site outfall in a GIS environment using data collected from plans, topographic maps, aerial photos, and site visits.

Table 3-8 and Table 3-9 present the right-of-way and impervious areas contributing to the receiving water at each subject site, respectively, used by AECOM in this model. The area of the right-of-way represents the total MassHighway property draining to the receiving water at the subject crossing. The impervious area is a subset of the right-of-way area and represents the paved roadway and shoulder.

Table 3-8 and Table 3-9 also present the components of the total area that drain to and bypass the stormwater management infrastructure at the subject sites. The total area that contributes to the BMP represents the area that is retained, detained, and/or treated in the on-site BMPs. The total area bypassing the BMP represents the area that passes to the receiving water untreated by the on-site BMPs.

Table 3-8 Estimates of the Area of the Right-of-Way (AROW)

Site	AROW (acres)	AROW to BMP (acres)	AROW bypassing BMP (acres)
Bellingham, Charles River	19.5	10.3	9.2
Milford, Charles River	52.5	50.1	2.4
Lancaster, North Nashua River	36.3	32.1	4.2

Table 3-9 Estimates of the Area of the Impervious Highway (AHWY)

Site	AHWY (acres)	AHWY to BMP (acres)	AHWY bypassing BMP (acres)
Bellingham, Charles River	5.9	2.7	3.2
Milford, Charles River	18.2	18.15	0.05
Lancaster, North Nashua River	11.5	10.6	0.9

3.3.7 Stormwater Management Infrastructure (BMPs)

Each of the subject sites has existing stormwater management infrastructure designed and built to mitigate the effects of highway runoff on receiving waters. The following sections describe the runoff flow paths and BMPs at each of the subject sites.

BMP at I-495/Charles River Crossing at Bellingham

Runoff from approximately 53 percent of the contributing area at the I-495/Charles River crossing at Bellingham drains to the site BMP, a vegetated swale along the highway median. The swale occupies approximately 2 acres and is approximately 6 inches deep. Stormwater that exceeds the storage volume of the swale collects in a catchbasin at the lowest point of the vegetated swale discharges to the Charles River via 12-inch pipe. The area that does not flow to the BMP flows overland to the stream crossing or infiltrates into grassy shoulder.

Figure 4 and Figure 5 illustrate the layout of the subject site including the boundaries of the contributing watershed and the location of the stormwater management infrastructure.

3.3.7.1 BMPs at the Charles River/I-495 Crossing in Bellingham

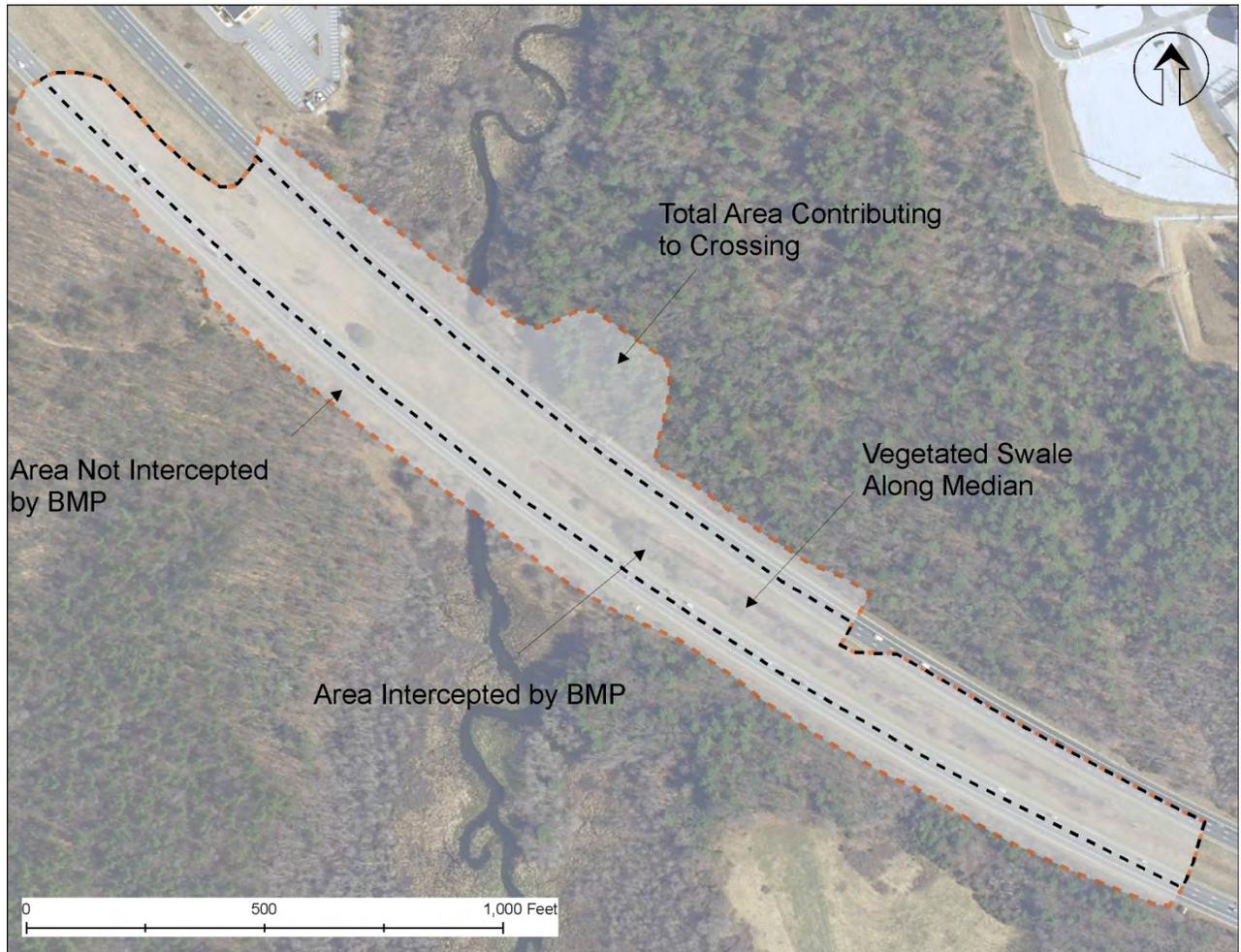


Figure 4. Watershed Area, I-495/Charles River, Bellingham

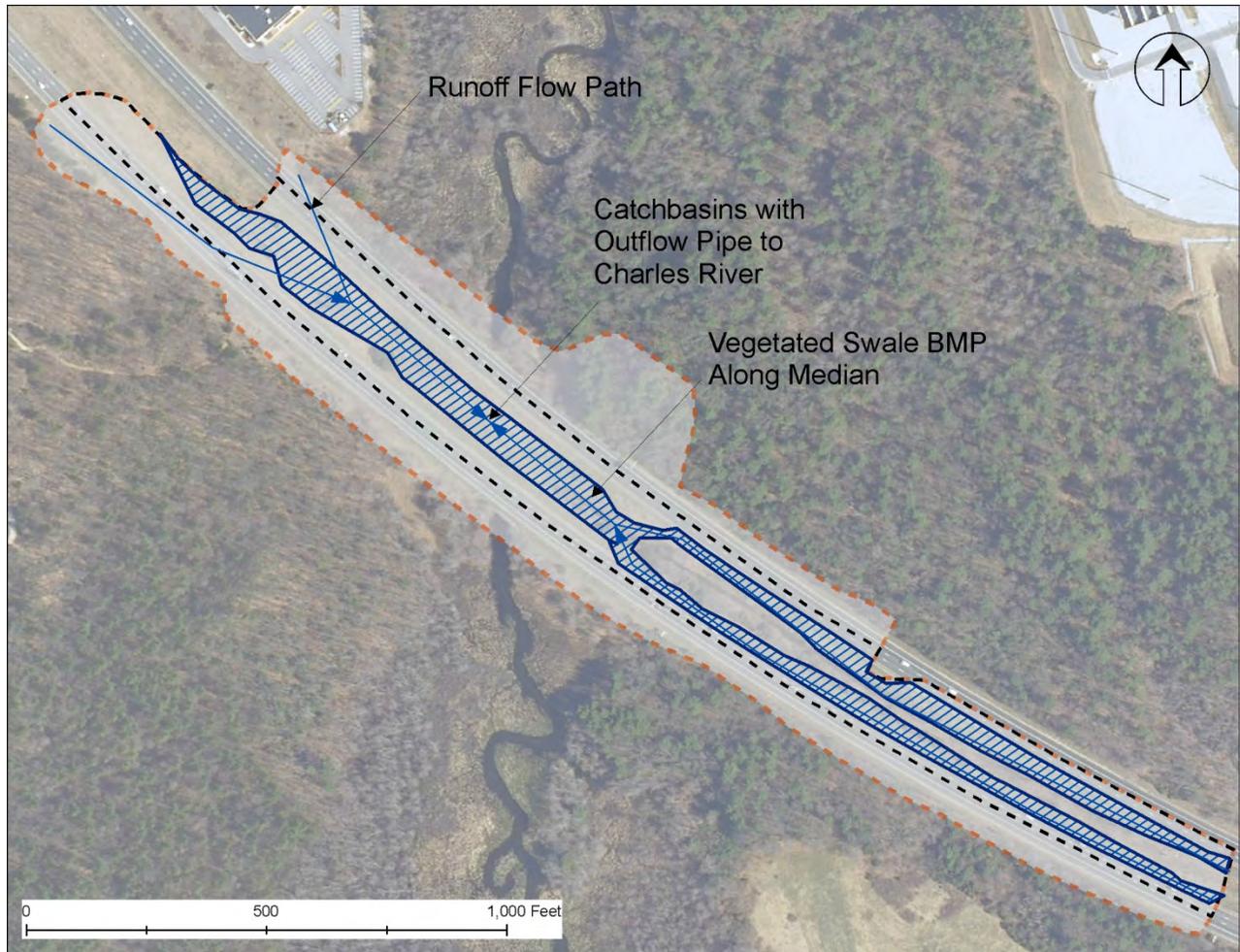


Figure 5. BMP, I-495/Charles River, Bellingham

BMP at I-495/Charles River Crossing at Milford

Runoff from approximately 95 percent of the contributing area to the I-495/Charles River crossing at Milford drains to the site BMP, a detention pond at the access ramps. The detention pond occupies approximately 0.4 acres and has a two-stage outlet. The 36-inch diameter low-stage outlet diverts stormwater south through the Milford MS4 system to Cedar Swamp Pond (aka Milford Pond). A headwall approximately two feet from the bottom of the pond controls flow into the high-stage outlet, which discharges to the Charles River via 48-inch conduit.

Figure 6 and Figure 7 illustrate the layout of the subject site including the boundaries of the contributing watershed and the location of the stormwater management infrastructure.

3.3.7.2 BMPs at the Charles River/I-495 Crossing in Milford

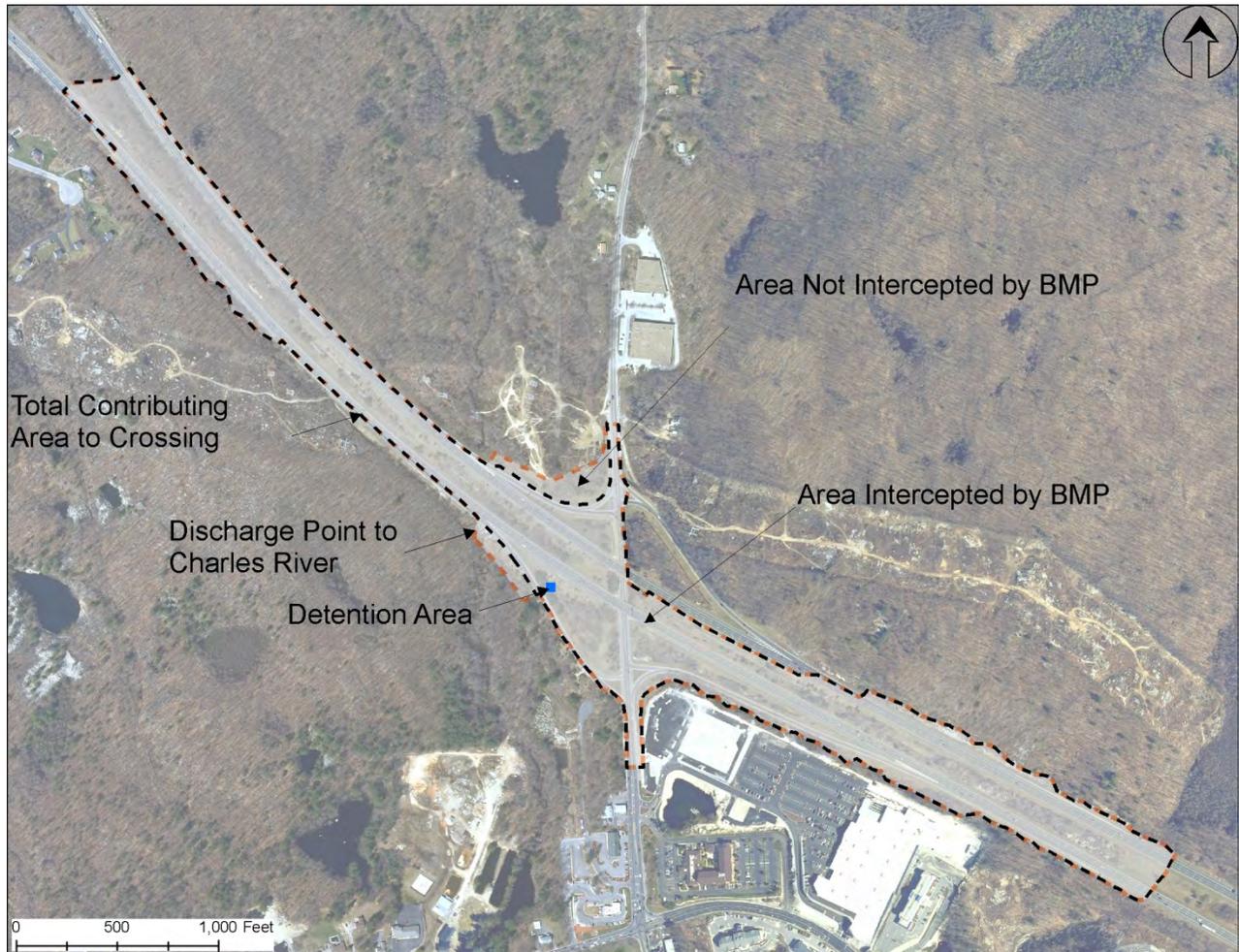


Figure 6. Watershed Area, I-495/Charles River, Milford

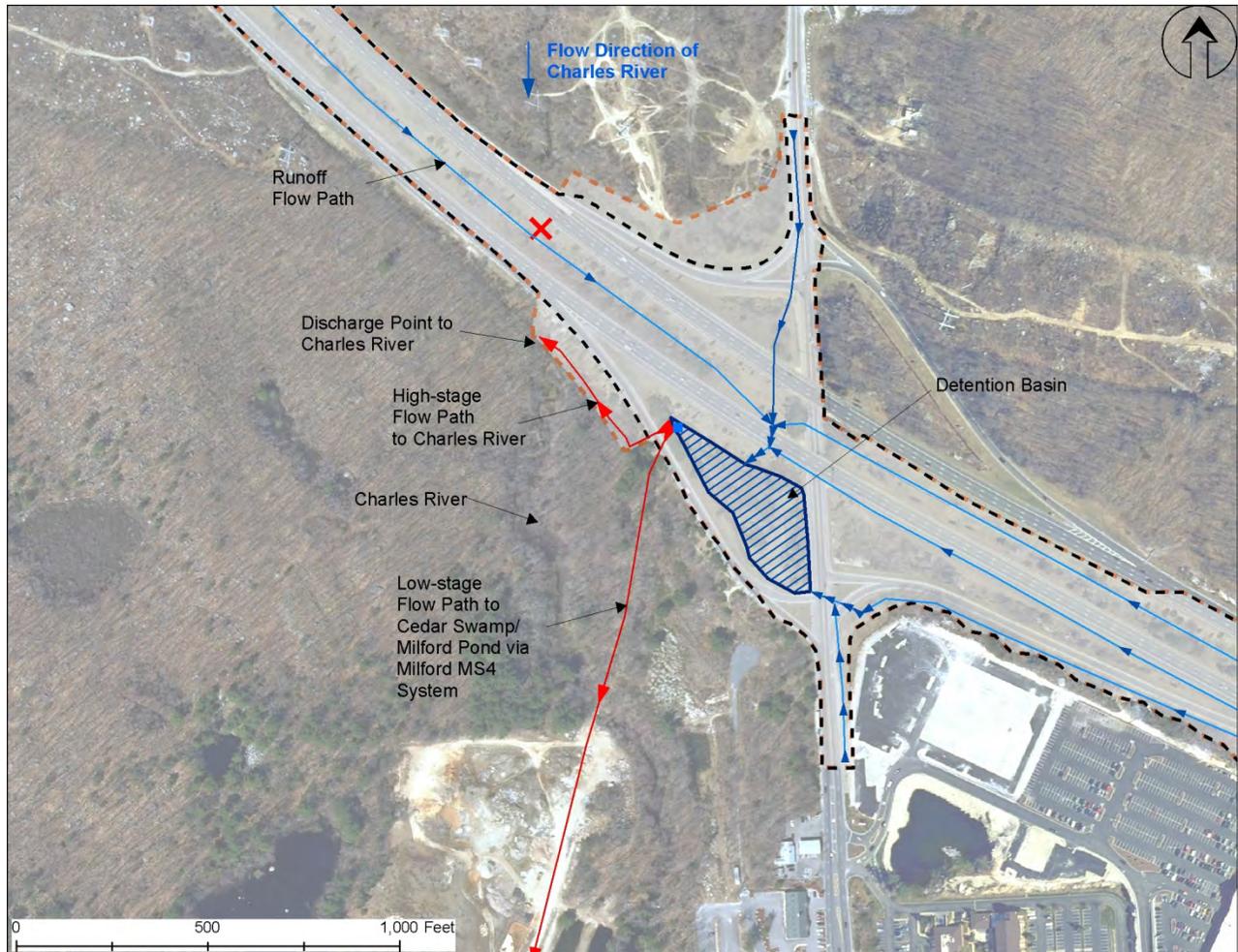


Figure 7. BMP, I-495/Charles River, Milford

BMP at I-190/Nashua River Crossing at Lancaster

Runoff from approximately 89 percent of the contributing area to the I-190/North Nashua River crossing at Lancaster drains to the site BMPs: two retention/recharge areas, one located north and one located south of the river crossing. The retention areas occupy approximately 0.2 and 0.1 acres with a depth of 2 and 3 feet at the north and south sites, respectively. Stormwater that exceeds the storage volume of the recharge basins flows to the Nashua River via 36-inch and 18-inch diameter discharge pipes at the north and south basins, respectively.

Figure 8 and Figure 9 illustrate the layout of the subject site including the boundaries of the contributing watershed and the location of the stormwater management infrastructure.

3.3.7.3 BMPs at the North Nashua River/I-190 Crossing in Lancaster



Figure 8. Watershed Area, I-190/North Nashua River, Lancaster

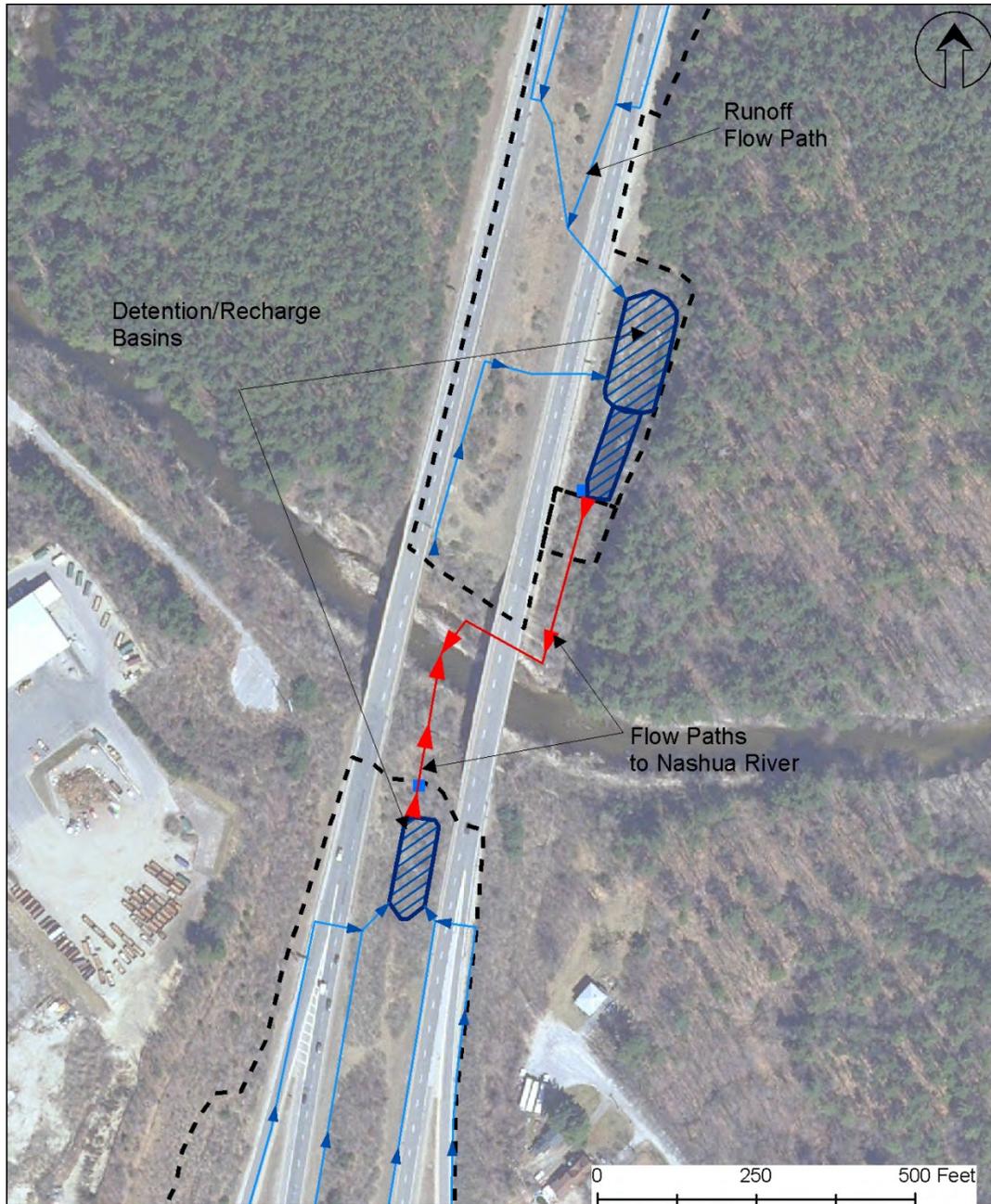


Figure 9. BMP, I-190/North Nashua River, Lancaster

4.0 Evaluation Methodology

AECOM applied the FHWA model to three subject sites to determine the likelihood that highway runoff from the subject sites will cause the receiving waters to exceed EPA acute toxicity criteria. The FHWA model estimates the peak runoff rate and the concentration of pollutant in the receiving water based on watershed characteristics including total area and total impervious area. The model does not explicitly account for detention and treatment of runoff via modifications to land use (e.g., through BMPs). AECOM developed an evaluation method to account for the stormwater mitigation provided by BMPs at the subject sites.

First, AECOM evaluated the performance of the site BMPs during the 3-year, 24-hour precipitation event in an external model. Second, AECOM applied the results of the external evaluation to the model input parameters of the VB/FHWA model by adjusting the area of the contributing watershed to the receiving water and by adjusting the peak runoff rate from the subject site to include discharge from the BMP.

Specifically, if the external model showed that the BMP would not discharge during the 3-year event, AECOM reduced the contributing area to include only the area that does not drain to the BMP. If the external model showed that the site BMP would discharge during the 3-year event, AECOM reduced the contributing area to include only the area that does not drain to the BMP and increased the runoff rate calculated within the FHWA model to include the externally-calculated peak discharge from the BMP. The adjustments assume that the BMP reduces the peak runoff discharge rate to the receiving water. The model adjustments do not account for pollutant removal due to BMP treatment, which may be significant. By assuming that the BMPs do not reduce pollutant concentrations, model results presented herein overestimate the pollutant concentration in the receiving water.

This section of the report describes the external hydrologic and hydraulic model AECOM used to evaluate the performance of the existing on-site BMPs.

4.1 External Hydrologic and Hydraulic Evaluation of BMPs

The FHWA model does not have the capability to simulate the mitigating effect of BMPs on peak runoff rates, volumes, and pollutant concentrations. AECOM evaluated the effect of the site BMPs on peak runoff rates in an external numerical model.

AECOM evaluated the hydrology of each of the subject sites using the (Soil Conservation Service) SCS TR-55 method for the 3-year, 24-hour storm event (SCS Type III distribution). AECOM routed the precipitation events through each BMP using ICPR modeling software (described below) to determine the peak discharge rate and total discharge volume from each of the BMPs. The precipitation depth of the 3-year, 24-hour storm event is 3.3 inches at the Lancaster site and 3.4 inches at the Milford and Bellingham sites. (Cornell, 1993).

AECOM evaluated the hydrology and hydraulic controls at the subject sites with the Advanced Interconnected Channel and Pipe Routing (ICPR) version 3.0 developed by Streamline Technologies, Inc. ICPR is a one-dimensional unsteady-state dynamic stormwater model and includes comprehensive hydrology and hydraulic components. The model uses a hydrologic element to develop runoff hydrographs and a hydraulic element to route the hydrographs through storage, control, and conveyance structures. The hydrologic model element used the SCS runoff curve number method of abstractions and the SCS Unit Hydrograph method. BMPs were simulated as storage nodes with outlet control.

4.1.1.1 I-495/Charles River Crossing at Bellingham

The BMP at the I-495/Charles River crossing in Bellingham consists of a vegetated swale along the highway median. The swale occupies approximately 2 acres and is approximately 6 inches deep. Stormwater that

exceeds the storage volume of the swale collects in a catchbasin at the lowest point of the vegetated swale discharges to the Charles River via 12-inch pipe. The area that does not flow to the BMP flows overland to the stream crossing or infiltrates into grassy shoulder.

ICPR model results indicate that the BMP at this site will contain the entire volume of the 3-year storm event without discharging to the Charles River.

4.1.1.2 I-495/Charles River Crossing at Milford

Runoff from approximately 95 percent of the contributing area to the I-495/Charles River crossing at Milford drains to the site BMP, a detention pond at the access ramps. The detention pond occupies approximately 0.4 acres and has a two-stage outlet. The 36-inch diameter low-stage outlet diverts stormwater south through the Milford MS4 system to Cedar Swamp Pond (aka Milford Pond). A headwall approximately two feet from the bottom of the pond controls flow into the high-stage outlet, which discharges to the Charles River via 48-inch conduit.

ICPR model results indicate that the BMP at this site will route the entire volume of the 3-year storm event to the Milford MS4 system without discharging via the high-stage outlet to the Charles River.

4.1.1.3 I-190/North Nashua River Crossing at Lancaster

Runoff from approximately 89 percent of the contributing area to the I-190/North Nashua River crossing at Lancaster drains to the site BMPs: two retention/recharge areas, one located north and one located south of the river crossing. The retention areas occupy approximately 0.2 and 0.1 acres with a depth of 2 and 3 feet for the north and south sites, respectively. Stormwater that exceeds the storage volume of the retention/recharge areas flows to the Nashua River, via 36-inch and 18-inch discharge pipes from the north and south basins, respectively.

ICPR model results indicate that the BMPs at this site will discharge to the Nashua River during the 3-year storm event with a combined peak rate of approximately 0.1 cubic feet per second.

5.0 Results

The FHWA model estimates the 3-year peak concentration of the pollutant of interest in the receiving water based on the statistical characteristics of the precipitation, runoff, and streamflow at the subject site. The model compares the in-stream concentration to the target concentration, in this application the EPA acute toxicity concentration. This section of the report presents the model results.

5.1 External Model Application: Determine Runoff Rate Reduction by BMP

AECOM performed hydrologic and hydraulic evaluations for the stormwater management infrastructure at the subject sites. As described in Section 4-1, AECOM determined that the BMPs at Bellingham and Milford will not discharge to the Charles River during the 3-year, 24-hour storm event. The BMP at Lancaster will discharge to the North Nashua River during the 3-year 24-hour storm event with a peak discharge rate of 0.1 cubic feet per second.

5.2 Visual Basic (VB)/ FHWA Model Application

AECOM applied the FHWA model to the portion of the Bellingham, Milford and Lancaster sites does not drain to the on-site BMPs. AECOM adjusted the peak runoff rate at the Lancaster site to account for discharge from the BMP during the 3-year event. Table 5-1 presents the model results.

Table 5-1. VB/FHWA Model Results

Site	Pollutant	Peak 3-year concentration in receiving water (mg/L)	EPA Acute Criteria* (mg/L)	Exceeds EPA Criteria
Bellingham	copper	0.002	0.003	No
Bellingham	zinc	0.020	0.021	No
Bellingham	lead	0.000	0.017	No
Milford	copper	0.001	0.003	No
Milford	zinc	0.008	0.021	No
Milford	lead	0.000	0.017	No
Lancaster	copper	0.000	0.003	No
Lancaster	zinc	0.002	0.016	No
Lancaster	lead	0.000	0.014	No

* EPA Criteria concentrations are adjusted to compensate for background concentrations

The BMP at the Bellingham site does not discharge during the 3-year storm event. The model results indicate that untreated runoff at the Bellingham site is not likely to cause exceedances of the EPA acute toxicity criteria for copper, zinc, or lead at the subject crossing.

Similarly, the Milford site BMP does not discharge during the 3-year storm event. According to the model results, untreated runoff at the Milford site is not likely to cause exceedances of the EPA acute toxicity criteria for copper, zinc, or lead at the subject crossing.

The BMP at the Lancaster site discharges at a peak rate of 0.1 cubic feet per second during the 3-year storm event. The model accounts for the peak discharge rate of untreated runoff and the discharge from the BMP. The model does not account for pollutant load reductions resulting from treatment by the BMP. Our model results indicate that runoff from the Lancaster site is not likely to cause exceedances of the EPA acute toxicity criteria for copper, zinc, or lead.

6.0 Conclusions

According to the FHWA model methodology and results, existing BMPs at the subject sites are adequate to maintain compliance with MassHighway's General Stormwater Permit at these sites and therefore, AECOM suggests that MassHighway should not construct additional BMPs at these stream crossings. The model indicates that MassHighway runoff is not likely to cause exceedances of the EPA acute toxicity criteria in the receiving waters at the subject sites. Each of the subject sites has a BMP, or multiple BMPs, that adequately collect and detain(s) MassHighway runoff.

The Bellingham vegetated swale does not discharge to the Charles River during the 3-year, 24-hour precipitation event. The model results indicate that highway runoff that does not drain to the BMP is not likely to cause exceedance of the EPA acute toxicity criteria for copper, zinc, or lead; therefore AECOM concludes that highway runoff from the Bellingham site is not likely to cause the Charles River to exceed EPA acute toxicity criteria for copper, zinc, or lead at this crossing.

Stormwater does not discharge from the Milford detention pond to the Charles River at the subject crossing during the 3-year, 24-hour precipitation event. The model results indicate that highway runoff that does not drain to the BMP is not likely to cause exceedance of the EPA acute toxicity concentration criteria for copper, zinc, or lead. Consequently, AECOM concludes that highway runoff from the Milford site is not likely to cause the Charles River to exceed EPA acute toxicity criteria for copper, zinc, or lead.

The Lancaster retention/recharge basins discharge a minimal amount to the North Nashua River during the 3-year, 24-hour precipitation event. The model results indicate highway runoff that does not drain to the BMP is not likely to cause exceedance of the EPA acute toxicity concentration criteria for copper, zinc, or lead. AECOM concludes that highway runoff from the Lancaster site is not likely to cause the North Nashua River to exceed EPA acute toxicity criteria for copper, zinc, or lead.

7.0 References

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Appendix A

VB/FHWA Model

Table 7-1 lists and defines the VB/FHWA model input variables. All model input variables are described in detail in FHWA USDOT 1990a except for RBMP. The variable RBMP was created for this study. It represents the discharge of a site BMP to the receiving water during the 3-year event.

Input Variable	Description	Units
ADT	Vehicles per day (>30,000 = urban)	
AHWY	Impervious highway area	acres
AROW	Area of the right-of-way	acres
ATOT	Watershed area to receiving water	square miles
CTA	EPA acute toxicity concentration	Mg/L
CVCR	Coef. of variation of site runoff concentration	
CVDP	Coef. of variation of precipitation duration	
CVIP	Coef. of variation of precipitation intensity	
CVQS	Coef. of variation of streamflow	
CVTP	Coef. of variation of precipitation interval	
CVVP	Coef. of variation of precipitation volume	
FSOL	Dissolved fraction of pollutant in runoff	ratio
MDP	Mean duration of a rainfall event	hour
MIP	Mean intensity of a rainfall event	inches/hour
MTP	Mean interval between rainfall events	hour
MVP	Mean volume of a rainfall event	inches
MQS	Mean streamflow of receiving water	cubic feet per second
TCR	Median site runoff concentration	mg/L
TH	Total hardness of receiving water	mg/L
NST	Number of storms per year	
RBMP*	Peak instantaneous discharge rate of site BMP during 3-year event	cubic feet per second

* Variable not present in FHWA model (1990a). Variable defined and used as part of this study.

Table 7-1. Model Input Variables, Defined

Table 7-2 lists the functions and intermediate calculations used within the VB/FHWA model. The functions are straightforward with the exception of the calculation of CO (the 3-year concentration of pollutant in the receiving water). The calculation of CO requires the transformation of model input values into logarithmic space and application of the transformed input values to the normal distribution. Table 7-3 presents the functions used to calculate CO. Refer to Appendix C of USDOT FHWA, 1990a for supporting documentation.

Variable	Function
Impervious Percent Area (IMP_pct)	$IMP_pct = 100 * AHWY / AROW$
Runoff Coefficient (Rv)	$Rv = 0.007 * IMP_pct + 0.1$
Runoff Rate from Mean Precipitation Event (MQR)	$MQR = [Rv * MIP * AROW * 3630 / 3600] + RBMP$
Cv of Runoff Rate (CVQR)	$CVQR = CVIP$
Runoff Volume from Mean Precipitation Event (MVR)	$MVR = Rv * MVP * AROW * 3630$
Cv of Runoff Volume (CVVR)	$CVVR = CVVP$
Mean Concentration in Runoff (MCR)	$MCR = TCR * Sqr(1 + CVCR ^ 2)$
Mean Event Mass Load (M_Mass)	$M_Mass = MCR * MVR * 0.00006245$
Annual Mass Load (ANMASS)	$ANMASS = M_Mass * NST$
Ratio of average Streamflow to MQR (MQS/MQR)	$MQSMQR = MQS / MQR$
Probability of the once-in-three year event (PR)	$PR = 100 * (1 / (NST * 3))$
Once-in-three year concentration of Pollutant in the receiving water (CO)	CO ⁺
Ratio of the once-in-three year concentration in the receiving water to the EPA acute criteria (CRAT)	$CRAT = CO / CTA$

+ Function defined in Table 20.

Table 7-2. Model Calculations in VB/Excel Version of the FHWA model

Input Variable	Description	Units
Runoff concentration	$WCR = \text{Sqr}(\text{Log}(1 + CVCR ^ 2))$	Stdev in log space (W^*)
	$UCR = \text{Log}(MCR / (\text{Sqr}(1 + CVCR ^ 2)))$	Mean in log space (U^*)
	$TCR = \text{Exp}(UCR)$	Mean in real space (T^*)
	$SCR = MCR * CVCR$	Stdev in real space (S^*)
Streamflow rates	$WQS = \text{Sqr}(\text{Log}(1 + CVQS ^ 2))$	Stdev in log space (W^*)
	$UQS = \text{Log}(MQS / (\text{Sqr}(1 + CVQS ^ 2)))$	Mean in log space (U^*)
	$TQS = \text{Exp}(UQS)$	Mean in real space (T^*)
	$SQS = MQS * CVQS$	Stdev in real space (S^*)
Runoff rates	$WQR = \text{Sqr}(\text{Log}(1 + CVQR ^ 2))$	Stdev in log space (W^*)
	$UQR = \text{Log}(MQR / (\text{Sqr}(1 + CVQR ^ 2)))$	Mean in log space (U^*)
	$TQR = \text{Exp}(UQR)$	Mean in real space (T^*)
	$SQR_ = MQR * CVQR$	Stdev in real space (S^*)
Flow ratio (stdev)	$WD = \text{Sqr}(WQS ^ 2 + WQR ^ 2)$	Stdev in log space (W^*)
	$Z95 = 1.65$	
	$Z5 = -1.65$	
Dilution Factor	$DF95 = TQR / (TQR + TQS * \text{Exp}(Z95 * WD))$	Dilution factor in real space
	$DF5 = TQR / (TQR + TQS * \text{Exp}(Z5 * WD))$	Dilution factor in real space
	$UDF = (\text{Log}(DF95) + \text{Log}(DF5)) / 2$	Mean in log space (U^*)
	$WDF = 1 / Z95 * (\text{Log}(DF5) - \text{Log}(DF95)) / 2$	Stdev in log space (W^*)
	$MDF = \text{Exp}(UDF + 0.5 * WDF ^ 2)$	Mean in real space
	$CVDF = \text{Sqr}(\text{Exp}(WDF ^ 2) - 1)$	Coeff. Of var in real space
	$SDF = MDF * CVDF$	Stdev in real space (S^*)
		Mean in real space
Mean concentration of pollutant in stream	$MCO = MCR * MDF + MCS * (1 - MDF)$	
	$A = SDF ^ 2 * (MCR - MCS) ^ 2$	
	$B = SCR ^ 2 * (SDF ^ 2 + MDF ^ 2)$	
	$C = SCS ^ 2 * (SDF ^ 2 + (1 - MDF) ^ 2)$	
	$SCO = \text{Sqr}(A + B + C)$	Stdev in real space (S^*)
	$CVCO = SCO / MCO$	Coeff. Of var in real space
	$WCO = \text{Sqr}(\text{Log}(1 + CVCO ^ 2))$	Stdev in log space (W^*)
	$UCO = \text{Log}(MCO / \text{Sqr}(1 + CVCO ^ 2))$	Mean in log space (U^*)
	$CO5 = \text{Exp}(UCO + Z5 * WCO)$	Concentration in real space
	$CO95 = \text{Exp}(UCO + Z95 * WCO)$	Concentration in real space
Probability of event occurring in one year	$PR = 1 / (3 * NST)$	

Input Variable	Description	Units
Standard Normal Distribution for PR	ZPR =	
Concentration to occur at frequency PR	$COPR = \text{Exp}(UCO + \text{Abs}(ZPR) * WCO)$	Concentration in real space
In-stream concentration	$CO = COPR$	
Correction adjustment*	$X = \text{Log}(MQS / MQR)$	
Correction factor*	$CF = 1.05 + 0.3 * X - 0.05 * X^2$	
In-Stream Concentration of Pollutant CO	$CO = FSOL / CF * CO$	

* See discussion of the dilution factor and correction factor, this appendix

Table 7-3. Calculating CO

Discussion of the Dilution Factor and the subsequent correction factor

USDOT FHWA 1990a Appendix B (page 50) describes the validity of some assumptions used to estimate the concentration of pollutant in the receiving water. In particular, the documentation indicates that for systems where the dilution factor (the ratio of runoff to streamflow) is near one or near zero, calculations of CO have significant error because the assumption that the dilution factor is lognormal no longer holds. The documentation describes a correction factor that is a function of the ratio of stream flow to runoff. The correction factor was developed by comparing estimates of CO using the simplified method described in the FHWA model documentation and using a complex numerical method in the associated numerical software model. Refer to page 49 and 50 of USDOT FHWA 1990a Appendix B for more information.

Application of the correction factor to model results reported in this study resulted in surprising outcomes. Some model results indicated that the presence of a BMP on a study site would result in increases in the in-stream concentration of the receiving water despite the decrease in runoff volume and peak rate from the subject site. Sites experiencing this problem consistently had large dilution ratios (high streamflow, low runoff). At these sites, the correction factor returned a value of less than one and application of the correction value to the estimated in-stream concentrations increased the estimate of the in-stream concentration.

In a situation where a smaller contributing area and a smaller percent impervious area resulted in a higher in-stream concentration in the receiving water, the correction factor was eliminated. The model documentation indicates that eliminating the correction factor introduces error that is almost always conservative, "that is, it projects high concentrations to occur more frequently than they actually would be expected to".

In addition, the analysis to develop the correction factor function indicates that the FHWA USDOT evaluated sites where the streamflow to runoff ratio ranged from 0.5 to 100. Several sites evaluated in this study had streamflow to runoff ratios over 100. It is not clear if the correction factor regression equation can be extrapolated beyond the range presented in the documentation. For models where the ratio of streamflow to runoff exceeded 200, the correction factor was eliminated.

Appendix B

Model Input and Output Reports

Variable	Milford with BMPs		
	copper	zinc	lead
AHWY	0.05	0.05	0.05
AROW	2.4	2.4	2.4
CTA	0.00331	0.0209	0.017175
CTT	0.01775	0.369666667	0.14375
CVCR	0.93	0.99	1.23
CVDP	1.03	1.03	1.03
CVIP	1.02	1.02	1.02
CVQS	0.99	0.99	0.99
CVVP	1.67	1.67	1.67
FSOL	0.52	0.65	0.12
MDP	6.1	6.1	6.1
MIP	0.044	0.044	0.044
MVP	0.33	0.33	0.33
MQS	9.6	9.6	9.6
TCR	0.0263	0.173	0.0082
TH	37.5	37.5	37.5
NST	128	128	128
RBMP	0	0	0

Table 7-4. Input Report, I-495/Charles River Crossing, Milford

Variable	Bellingham with BMPs		
	copper	zinc	lead
AHWY	3.2	3.2	3.2
AROW	9.2	9.2	9.2
CTA	0.00331	0.0209	0.017175
CTT	0.01775	0.369666667	0.14375
CVCR	0.93	0.99	1.23
CVDP	1.03	1.03	1.03
CVIP	1.02	1.02	1.02
CVQS	1.18	1.18	1.18
CVVP	1.67	1.67	1.67
FSOL	0.52	0.65	0.12
MDP	6.1	6.1	6.1
MIP	0.044	0.044	0.044
MVP	0.33	0.33	0.33
MQS	54.8	54.8	54.8
TCR	0.0263	0.173	0.0082
TH	37.5	37.5	37.5
NST	128	128	128
RBMP	0	0	0

Table 7-5. Input Report, I-495/Charles River Crossing, Bellingham

Variable	Lancaster with BMPs		
	copper	zinc	lead
AHWY	0.86	0.86	0.86
AROW	4.2	4.2	4.2
CTA	0.0027	0.0157	0.01375
CTT	0.01775	0.369666667	0.14375
CVCR	0.93	0.99	1.23
CVDP	1.03	1.03	1.03
CVIP	1.02	1.02	1.02
CVQS	1.27	1.27	1.27
CVVP	1.67	1.67	1.67
FSOL	0.52	0.65	0.12
MDP	6.1	6.1	6.1
MIP	0.044	0.044	0.044
MVP	0.33	0.33	0.33
MQS	208	208	208
TCR	0.0263	0.173	0.0082
TH	33.14	33.14	33.14
NST	128	128	128
RBMP	0.1	0.1	0.1

Table 7-6. Input Report, I-190/North Nashua River Crossing, Lancaster

Milford with BMPs			
Variable	copper	zinc	lead
CTA	0.003	0.021	0.017
CTT	0.018	0.370	0.144
CO	0.001	0.008	0.000
CRAT	0.271	0.375	0.005
CRTE	0.051	0.021	0.001

Table 7-7. Output Report, I-495/Charles River Crossing, Milford

Bellingham with BMPs			
Variable	copper	zinc	lead
CTA	0.003	0.021	0.017
CTT	0.018	0.370	0.144
CO	0.002	0.020	0.000
CRAT	0.709	0.976	0.013
CRTE	0.132	0.055	0.002

Table 7-8. Output Report, I-495/Charles River Crossing, Bellingham

Lancaster with BMPs			
Variable	copper	zinc	lead
CTA	0.003	0.016	0.014
CTT	0.018	0.370	0.144
CO	0.000	0.002	0.000
CRAT	0.086	0.128	0.002
CRTE	0.013	0.005	0.000

Table 7-9. Output Report, I-190/North Nashua River Crossing, Lancaster

Appendix K

TMDL Review and Prioritization Tables

Table K-1: Preliminary Review of Applicability of TMDLs to MassHighway

Basin	TMDL Document	MA DEP Identified as Storm Water Impaired? ¹	WLA Potentially Applicable to MassHighway?	BMP Recommendations Specific to MassHighway in TMDL	MassHighway Actions	Further Investigation?	Notes
Blackstone	Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes	No	Yes	MassHighway should regulate road sanding, salting, regular sweeping, and installation of BMPs	MassHighway regulates road sanding and salting through its Snow and Ice Program and the procedures approved in the GEIR. Roads are swept on an annual basis after winter deicing applications. MassHighway District 3 recently completed roadway reconstruction project located in the City of Worcester on Airport Drive. Runoff from this area enters waterways south of Smith Pond and north of Curtis Pond, in the City of Worcester. This project included a significant amount of drainage infrastructure work including three detention ponds (42,200 sq. ft. total area); 30 deep sump CBs with hoods; 1,500 linear feet of stone line drainage swales; and 1,000 linear feet of grass lined drainage swales.	Yes (see note) and Table K-2	Some waterbodies covered by this TMDL do not have BMPs or WLAs for stormwater. These waterbodies will not be investigated further. Those waterbodies with BMPs or TMDLs will be reviewed according to the details given in Table K-2.
	Total Maximum Daily Load of Phosphorus for Leesville Pond	Yes	Yes	Conduct loading study and develop methodology to calculate loadings from highways	USGS is currently performing a loading study for MassHighway. The loading study is scheduled to be completed by the end of the permit term.	Yes (see Table K-2 for details)	
				Initiate twice yearly sweeping and catch basin inspection and cleaning program along I-290 and other roadways. Install additional BMPs as needed to address pollutant loadings.	MassHighway District 3 has committed to an increased schedule of inspection of catch basins every six months, with cleaning as determined necessary in inspections, and annual sweeping of roads in this watershed. District 3 has committed to inspection and cleaning, if necessary, of all sumped drainage structures twice a year and more often if necessary; inspection/cleaning of drainage outlet locations where sediment build up is evident; and inspection and repair of damaged and/or clogged drainage conveyances. MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue.		
				Prepare stormwater management plan for Phase II	MassHighway has received authorization from EPA to discharge storm water under the general permit for discharges in this watershed and has a current Storm Water Management Plan.		
				Reduce impervious surfaces, institute street sweeping program, catch basin cleaning, install detention basins, etc	see above measures		
	Total Maximum Daily Loads of Phosphorus for Salisbury Pond	No	Yes	Initiate intensive roadway sweeping, catch basin cleaning and BMP inspection program	MassHighway has committed to DEP in its January 23, 2002 letter that streets will be swept at least once a year (usually in spring) and more often if necessary. All sumped drainage structure will be inspected and cleaned, if necessary, twice a year and more often if necessary. MassHighway will inspect/ clean drainage outlet locations where sediment build-up is evident. MassHighway will inspect and repair damaged and/ or clogged drainage conveyances.	Yes (see Table K-2 for details)	
				Develop methodology to calculate loadings from highways	USGS is currently performing a loading study for MassHighway. The loading study is scheduled to be completed by the end of the permit term.		
				Conduct pilot project to assess loadings and test BMPs on highways	USGS is currently performing a loading study for MassHighway. The loading study is scheduled to be completed by the Winter 2009/10.		
				Organize and implement education, outreach programs	MassHighway's educational programs are summarized in Section 2.1 of the SWMP.		
	Total Maximum Daily Loads of Phosphorus for Indian Lake	No	Yes	Reduce impervious surfaces, institute increased street sweeping and catch basin cleaning; install detention basins, etc.	MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue.	Yes (see Table K-2 for details)	
Comply with a new Phase II Stormwater discharge permit. In addition, the Regional DEP office in Worcester has submitted a written request to the Regional office of MassHighway to give the roads in the Mill Brook drainage area (including parts of Indian Lake Watershed) priority for increased Best Management Practices such as sweeping and catch basin cleaning.							
Total Maximum Daily Loads of Phosphorus for Lake Quinsigamond and Flint Pond	No	Yes	1. MassHighway should begin the Storm Water Management Plans required under Phase II to reduce discharge of pollutants to the "maximum extent practicable."	MassHighway has received authorization from EPA to discharge storm water under the general permit for discharges in this watershed.	Yes (see Table K-2 for details)		
			2. MassHighway will also be required to apply for the EPA Phase II General Stormwater NPDES Permit by March 10 of 2003.	MassHighway has received authorization from EPA to discharge storm water under the general permit for discharges in this watershed.			
			3. The regional office of MassHighway has offered to target high priority watersheds in the region of higher frequency of BMPs and maintenance.	MassHighway District 3 will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue. District 3 has agreed to increased maintenance schedule within this watershed. Several catch basin were installed in Shrewsbury along Rt. 9 and Quinsigamond Ave for improved sediment capture and reduced pollutant loading.			
			4. Visually inspect the roads monthly and sweep as needed. At a minimum, roads must be swept at least twice a year as soon after snowmelt as possible or by April 1st of each year and again in the fall.	In a letter written to DEP and dated June 19, 2002, District 3 committed to an increased schedule of inspection of catch basins every six months, with cleaning as determined necessary in inspections, and annual sweeping of roads in this watershed.			
			5. Inspect catch basins at least twice a year and any other settling or detention basins once a year to measure depth of solids. If solids are one half or more of design volume for solids, then completely remove all solids.	See response to #4 above regarding maintenance schedule commitments. The letter committed to inspection and cleaning, if necessary of all sumped drainage structures twice a year and more often if necessary; inspection/ cleaning of drainage outlet locations where sediment build up is evident; and inspection and repair of damaged and/or clogged drainage conveyances.			
			6. Inspect and maintain all structural components of stormwater system on a yearly basis.				

Table K-1: Preliminary Review of Applicability of TMDLs to MassHighway

Basin	TMDL Document	MA DEP Identified as Storm Water Impaired? ¹	WLA Potentially Applicable to MassHighway?	BMP Recommendations Specific to MassHighway in TMDL	MassHighway Actions	Further Investigation?	Notes
Blackstone (cont)	Total Maximum Daily Loads of Phosphorus for Lake Quinsigamond and Flint Pond (cont.)	No	Yes	7. Develop methodology to calculate loadings from highways.	USGS is currently performing a loading study for MassHighway. The loading study is scheduled to be completed by the end of the permit term.	Yes (see Table K-2 for details)	
				8. Conduct pilot project to assess loadings and test BMPs on highways			
				9. Initiate twice yearly sweeping and catch basin inspection and cleaning program along I-290 and other roadways. Install additional BMPs as needed to address pollutant loadings identified above.			
Boston Harbor	Total Maximum Daily Loads of Bacteria for the Neponset River Basin	No	Yes	Regulated municipalities should prepare Storm Water Management Plans for Phase II.	MassHighway has received full authorization to discharge under the general permit and has a current Storm Water Management Plan.	Yes (see Table K-2 for details)	
Buzzards Bay	Final Pathogen TMDL for the Buzzards Bay Watershed	No	Yes	Development of comprehensive storm water management programs including identification and implementation of BMPs	MassHighway has implemented a comprehensive Stormwater Management Program. As part of this project, MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue (BMP 4E).	Yes (see Table K-2 for details)	
				A comprehensive program is needed to ensure illicit sources are identified and that appropriate actions will be taken to eliminate them.	MassHighway is starting a comprehensive illicit discharge detection effort. Progress is reported in each annual report.		
Cape Cod	Final Pathogen TMDL for the Cape Cod Watershed	No	Yes	Recommendations limited to implementation of stormwater management regulations and NPDES permits.	MassHighway has received authorization from EPA to discharge storm water under the general permit for discharges in this watershed.	Yes (see Table K-2 for details)	
	Centerville River -East Bay System Total Maximum Daily Loads for Total Nitrogen	No	Yes	None	--	Yes (see Table K-2 for details)	
	Final Little Pond Embayment Systems Total Maximum Daily Loads for Total Nitrogen	No	Yes	None	--	Yes (see Table K-2 for details)	
	Final Oyster Pond Embayment Systems Total Maximum Daily Loads for Total Nitrogen	No	Yes	None	--	Yes (see Table K-2 for details)	
	Final Phinneys Harbor Embayment Systems Total Maximum Daily Loads for Total Nitrogen	No	Yes	None	--	Yes (see Table K-2 for details)	
	Final Pleasant Bay System Total Maximum Daily Loads for Total Nitrogen	No	Yes	None	--	Yes (see Table K-2 for details)	
	Final Popponesset Bay System Total Maximum Daily Loads for Total Nitrogen	No	Yes	None	--	Yes (see Table K-2 for details)	
	Final Quashnet River, Hamblin Pond, Little River, Jehu Pond, and Great River in the Waquoit Bay System Total Maximum Daily Loads for Total Nitrogen	No	Yes	None	--	Yes (see Table K-2 for details)	
	Final Pathogen TMDL for Three Bays Watershed, Barnstable, MA	No	Yes	The Massachusetts Highway Department should determine the Route 28 roadway drainage area discharging to the Marstons Mills River and install best management structures and/or operational practices to the maximum extent practicable and at a minimum, be designed to meet the water quality standard for bacteria in SA waters. Given this is a waterway with an approved TMDL, the MHD must meet the requirements of EPA's NPDES General Permit for Stormwater Discharges from Small MS4s (Phase II), Part I D(1-4), as it pertains to approved TMDLs.	MassHighway will install BMPs during companion construction to meet the TMDL requirements. MassHighway will also use the USGS model once completed to review the inputs from the highway discharges. Two important examples include reducing winter road sand application rates, and stabilizing shoulder areas that erode onto road surfaces. Source reduction measures are described in this NPDES Stormwater Management Plan.	Yes (see Table K-2 for details)	
	Final Three Bays System Total Maximum Daily Loads for Total Nitrogen	No	Yes	None	--	Yes (see Table K-2 for details)	
	Final West Falmouth Harbor Embayment System Total Maximum Daily Loads for Total Nitrogen	No	Yes	None	--	Yes (see Table K-2 for details)	
	Stage Harbor/Oyster Pond, Sulpher Springs/Bucks Creek, Taylors Pond/Mill Creek Total Maximum Daily Load Re-evaluations for Total Nitrogen	No	Yes	None	--	Yes (see Table K-2 for details)	
	Bacteria Total Maximum Daily Load for Frost Fish Creek, Chatham, Mass	No	Yes	The Massachusetts Highway Department should determine the Route 28 roadway drainage discharging to Muddy Creek and install best management structures and/or operational practices to the maximum extent practicable with a goal of meeting the water quality standard for bacteria in SA waters. Given this is a waterway with an approved TMDL, the MHD must meet the requirements of EPA's NPDES General Permit for Stormwater Discharges from small MS4s (Phase II), Part i D(1-4), as it pertains to approved TMDLs.	Because of funding constraints and the condition of the existing roadway, there is no plan to resurface Route 28 within the boundaries of Muddy or Frost Fish Creeks within the next 5 years. District 5 personnel have met with the Town of Chatham and identified their concerns, and some measures may be taken to reduce and/or treat runoff to the creeks if time and funding permits. The District hopes to implement these measure within the next 2 years prior to resurfacing.	Yes (see Table K-2 for details)	
Final Great, Green and Bournes Pond Embayment Systems Total Maximum Daily Loads for Total Nitrogen	No	Yes	None	--	Yes (see Table K-2 for details)		

Table K-1: Preliminary Review of Applicability of TMDLs to MassHighway

Basin	TMDL Document	MA DEP Identified as Storm Water Impaired? ¹	WLA Potentially Applicable to MassHighway?	BMP Recommendations Specific to MassHighway in TMDL	MassHighway Actions	Further Investigation?	Notes
Cape Cod (cont)	Bacteria TMDL for Muddy Creek	No	Yes	The Massachusetts Highway Department should determine the Route 28 roadway drainage discharging to Muddy Creek and install best management structures and/or operational practices to the maximum extent practicable with a goal of meeting the water quality standard for bacteria in SA waters. Given this is a waterway with an approved TMDL, the MHD must meet the requirements of EPA's NPDES General Permit for Stormwater Discharges from small MS4s (Phase II), Part i D(1-4), as it pertains to approved TMDLs.	Because of funding constraints and the condition of the existing roadway, there is no plan to resurface Route 28 within the boundaries of Muddy or Frost Fish Creeks within the next 5 years. District 5 personnel have met with the Town of Chatham and identified their concerns, and some measures may be taken to reduce and/or treat runoff to the creeks if time and funding permits. The District hopes to implement these measure within the next 2 years prior to resurfacing.	Yes (see Table K-2 for details)	
Charles River	Total Maximum Daily Load of Phosphorus for Lower Charles River Basin	No	Yes	Collect source monitoring data and additional drainage area information to better target source areas for controls and evaluate the effectiveness of on-going control practices	MassHighway believes that the most cost-effective approach to improving stormwater quality is to focus on source control measures, rather than end-of-pipe BMPs. Two important examples include reducing winter road sand application rates, and stabilizing shoulder areas that erode onto road surfaces. Source reduction measures are described in this NPDES Stormwater Management Plan. MassHighway will identify problem areas during illicit discharge detection inventory work.	Yes (see Table K-2 for details)	
				While sources are being better characterized, existing stormwater management programs should be enhanced to optimize reductions in nutrient loadings with initial emphasis on source controls and pollution prevention practices	MassHighway believes that the most cost-effective approach to improving stormwater quality is to focus on source control measures, rather than end-of-pipe BMPs. Two important examples include reducing winter road sand application rates, and stabilizing shoulder areas that erode onto road surfaces. Source reduction measures are described in this NPDES Stormwater Management Plan.		
	Final Pathogen TMDL for the Charles River Watershed	No	Yes	A comment was submitted saying that MassHighway continues to evade storm water standards and would like MHD to be specially mentioned in the TMDLs.	The TMDL response to comments indicates that MHD is included in the Storm Water Phase II Program and is responsible for completing the six minimum controls mandated by that program.	Yes (see Table K-2 for details)	
Chicopee	Total Maximum Daily Load of Phosphorus for Selected Chicopee Basin Lakes	Yes	No	MassHighway should regulate road sanding, salting, regular sweeping, and installation of BMPs	1. MassHighway reviews proposed projects within this watershed for opportunities to include additional BMPs if MassHighway determines they will help address the pollutant loading issue. MassHighway included cleaning drainage structures and pipes, stone for pipe ends (help prevent outfall erosion) and hardening the shoulders with dense graded crushed stone (again, assists in preventing erosion) for the Route 9 Resurfacing Project in West Brookfield which is 93% complete. 2. MassHighway regulates road sanding and salting through its Snow and Ice Program and the procedures approved in the GEIR. Roads are swept on an annual basis after winter deicing applications. MassHighway believes that the most cost-effective approach to improving stormwater quality is to focus on source control measures, rather than end-of-pipe BMPs. Two important examples include reducing winter road sand application rates, and stabilizing shoulder areas that erode onto road surfaces. Source reduction measures are described in this NPDES Stormwater Management Plan. 3. During design of a project within the Chicopee basin in Permit Year 4, MassHighway included the design of a deep sump catch basins and a 37 foot wide and 150 foot long infiltration trench to address pollution from the road to Spectacle Pond since it was impaired.	Yes (see Table K-2 for details)	
				Provide Phase II Status reports	Masshighway submits annual reports on the status of their storm water management activities as required by Phase II permit.		
				Develop stormwater management plans for Phase II NPDES	MassHighway has received full authorization to discharge under the general permit and has a current Storm Water Management Plan.		
				Install additional BMPs in identified areas	As part of this project, MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue.		
				Regulate road sanding, salting, regular sweeping, and installation of BMPs.	MassHighway regulates road sanding and salting through its Snow and Ice Program and the procedures approved in the GEIR. Roads are swept on an annual basis after winter deicing applications. MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue. MassHighway believes that the most cost-effective approach to improving stormwater quality is to focus on source control measures, rather than end-of-pipe BMPs. Two important examples include reducing winter road sand application rates, and stabilizing shoulder areas that erode onto road surfaces. Source reduction measures are described in this NPDES Stormwater Management Plan.		
Initiate twice yearly sweeping and catch basin inspection and cleaning program along I-290 and other roadways.	MassHighway has proposed a catchbasin inspection and maintenance record system in its SWMP. MassHighway has very limited maintenance budgets and staff, therefore we feel that the cost-effectiveness, and necessity of sweeping and cleaning catch basins twice per year should be closely evaluated rather than arbitrarily set.						

Table K-1: Preliminary Review of Applicability of TMDLs to MassHighway

Basin	TMDL Document	MA DEP Identified as Storm Water Impaired? ¹	WLA Potentially Applicable to MassHighway?	BMP Recommendations Specific to MassHighway in TMDL	MassHighway Actions	Further Investigation?	Notes
Chicopee	Total Maximum Daily Load of Phosphorus for Quaboag and Quacumquasit Ponds	Yes	Yes	MH along with the town of Spencer, control nonpoint source pollution targeting for State Routes 9, 31 and 49 by requiring roadway sweeping and catch basin inspection/cleaning twice a year or other approved BMPs.	MassHighway has proposed a catchbasin inspection and maintenance record system in its SWMP. MassHighway has very limited maintenance budgets and staff, therefore we feel that the cost-effectiveness, and necessity of cleaning catch basins twice per year should be closely evaluated rather than arbitrarily set.	Yes (see Table K-2 for details)	
				MassHighways and the Town of Spencer must conduct and report on roadway sweeping in the spring and fall on an annual basis. In addition, the Town of Spencer and MassHighways must conduct and report on an annual catchbasin inspection and cleanout program to restore 80% or more of the solids storage volume anytime the available solids storage volume is less than 50%, and maintain or improve all existing BMPs. Alternately, the permittees may install infiltration or other BMPs and document a total reduction of 32% of the total phosphorus loading to receiving waters to control the stormwater discharges within the Quaboag watershed. Both MassHighways and the Town of Spencer should work cooperatively with all parties to reduce runoff from roadways to waters within the Quaboag watershed. This includes installation of infiltration stormwater BMPs along streets and highways where necessary. In particular, the imperviously lined ditches (3 percent slope) along Route 49 near the Sevenmile River should be augmented with water quality swales to encourage infiltration and to eliminate the large discharges as evidenced by the sediment delta at the outfall in the river.	MassHighway believes that the most cost-effective approach to improving stormwater quality is to focus on source control measures, rather than end-of-pipe BMPs. Two important examples include reducing winter road sand application rates, and stabilizing shoulder areas that erode onto road surfaces. Source reduction measures are described in this NPDES Stormwater Management Plan. MassHighway will install BMPs during companion construction to meet the TMDL requirements. MassHighway will also use the USGS model once completed to review the inputs from the highway discharges.		
Connecticut	Total Maximum Daily Load of Phosphorus for Selected Connecticut Basin Lakes	Yes	No	TMDL suggests MassHighway and towns should develop Storm Water Management Plans for Phase II NPDES and initiate additional BMPs in critical areas. MassHighway should regulate road sanding, salting, regular sweeping, and installation of BMPs for these two ponds. TMDL mentions that Rt. 20 is within the watershed of the Loon Pond and Rt. 47 is within the watershed of Lake Warner.	<p>1. MassHighway has received authorization from EPA to discharge storm water under the general permit for Loon Pond area. Lake Warner, Hadley is outside of urbanized area and is therefore not subject to the general permit. MassHighway regulates road sanding and salting through its Snow and Ice Program and the procedures approved in the GEIR. Roads are swept on an annual basis after winter deicing applications. MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue. MassHighway believes that the most cost-effective approach to improving stormwater quality is to focus on source control measures, rather than end-of-pipe BMPs. Two important examples include reducing winter road sand application rates, and stabilizing shoulder areas that erode onto road surfaces. Source reduction measures are described in this NPDES Stormwater Management Plan.</p> <p>2. MassHighway has incorporated additional BMPs into the Parker Street Reconstruction project to address the Loon Pond impairment. BMP's include the installation of a sedimentation chamber and a plunge pool at Loon Pond, two deep sump catch basins, a dewatering chamber utilized during construction and the removal and disposal of drainage system sediments during construction.</p> <p>3. MassHighway incorporated BMPs into the Meadow Street reconstruction over Swamp Brook. Swamp Brook flows into the Mill River which flows into Lake Warner. BMPs installed included 2 deep sump CB's and a 45 foot long grass swale.</p> <p>4. In this watershed, treated timber bridge components and steel bridge components containing deteriorated lead paint were removed as a source control measure.</p>	Yes (see note)	Some Waterbodies covered by this TMDL do not have BMPS or WLAs for stormwater. The watersheds for these waterbodies will not be investigation further.
French	Total Maximum Daily Load of Phosphorus for Selected French Basin Lakes	Yes	Yes	Conduct loading study and develop methodology to calculate loadings from highways	USGS is currently performing a loading study for MassHighway.	Yes (see note and Table K-2 for details)	Some waterbodies covered by this TMDL do not have BMPS or WLAs for stormwater. These waterbodies will not be investigated further. Those waterbodies with BMPs or TMDLs will be reviewed according to the details given in Table K-2.
				Initiate twice yearly sweeping and catch basin inspection and cleaning program along I-395 (MassHighways) I-90 (MassPike) and other roadways	MassHighway has proposed a catchbasin inspection and maintenance record system in its SWMP. MassHighway has very limited maintenance budgets and staff, therefore we feel that the cost-effectiveness, and necessity of sweeping and cleaning catch basins twice per year should be closely evaluated rather than arbitrarily set.		
				Install additional BMPs as needed to address pollutant loadings identified above	MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue. MassHighway believes that the most cost-effective approach to improving stormwater quality is to focus on source control measures, rather than end-of-pipe BMPs. Two important examples include reducing winter road sand application rates, and stabilizing shoulder areas that erode onto road surfaces. Source reduction measures are described in this NPDES Stormwater Management Plan.		
				Prepare stormwater management plan for Phase II	MassHighway has received full authorization to discharge under the general permit and continues to respond to EPA suggestions in finalizing their Storm Water Management Plans.		

Table K-1: Preliminary Review of Applicability of TMDLs to MassHighway

Basin	TMDL Document	MA DEP Identified as Storm Water Impaired? ¹	WLA Potentially Applicable to MassHighway?	BMP Recommendations Specific to MassHighway in TMDL	MassHighway Actions	Further Investigation?	Notes
French	Total Maximum Daily Load of Phosphorus for Selected French Basin Lakes (cont'd)	Yes	Yes	Regulate road sanding, salting, regular sweeping, and installation of BMPs	MassHighway regulates road sanding and salting through its Snow and Ice Program and the procedures approved in the GEIR. Roads are swept on an annual basis after winter deicing applications. MassHighway will review projects within this watershed for opportunities to include additional BMPs within proposed projects if MassHighway determines they will help address the pollutant loading issue. MassHighway believes that the most cost-effective approach to improving stormwater quality is to focus on source control measures, rather than end-of-pipe BMPs. Two important examples include reducing winter road sand application rates, and stabilizing shoulder areas that erode onto road surfaces. Source reduction measures are described in this NPDES Stormwater Management Plan.	Yes (see note and Table K-2 for details)	Some waterbodies covered by this TMDL do not have BMPS or WLAs for stormwater. These waterbodies will not be investigated further. Those waterbodies with BMPs or TMDLs will be reviewed according to the details given in Table K-2.
Island Watershed	Nantucket Harbor Embayment System Total Maximum Daily Loads for Total Nitrogen	No	Yes	None	--	Yes (see Table K-2 for details)	
Millers	Total Maximum Daily Load of Phosphorus for Selected Millers River Basin Lakes	Yes	Yes	TMDL suggests that MassHighway should better manage road sanding, salting, regular sweeping, and installation of BMPs	1. MassHighway believes that the most cost-effective approach to improving stormwater quality is to focus on source control measures, rather than end-of-pipe BMPs. Two important examples include reducing winter road sand application rates, and stabilizing shoulder areas that erode onto road surfaces. Source reduction measures are described in this NPDES Stormwater Management Plan. 2. As a part of various roadway reconstruction projects, MassHighway is installing BMPs to address the impaired waterbodies. BMPs include deep sump and leaching catch basins; water quality swales at new discharge locations; removal and disposal of drainage system sediments; detention basins; stone and grass swales; annual street sweeping; and cleaning paved waterways. 3. Under Design BMPs include the following: stone for pipe ends (help prevent outfall erosion); energy dissipaters at other select discharge points (consisting of stone lined sumps and pads at drainage outfalls); stone stabilization slopes and deep sump catch basins.	Yes (see Table K-2 for details)	
				At least twice yearly sweeping	MassHighway has very limited maintenance budgets and staff, therefore we feel that the cost-effectiveness, and necessity of sweeping twice per year should be closely evaluated rather than arbitrarily set.		
				Catchbasin checking and cleaning on the sections of roads within the watersheds of these ponds	MassHighway has committed to DEP in its January 23, 2002 letter that streets will be swept at least once a year (usually in spring) and more often if necessary. All sumped drainage structure will be inspected and cleaned, if necessary, twice a year and more often if necessary. MassHighway will inspect/ clean drainage outlet locations where sediment build-up is evident. MassHighway will inspect and repair damaged and/ or clogged drainage conveyances. Coppliance with this commitment is tracked in the annual report		
				If sediment problems are observed the installation of swales or other infiltration BMPs should be considered as needed	As a part of various roadway reconstruction projects, MassHighway is installing BMPs to address the impaired waterbodies. BMPs include deep sump and leaching catch basins; water quality swales at new discharge locations; removal and disposal of drainage system sediments; detention basins; stone and grass swales; annual street sweeping; and cleaning paved waterways.		
Narraganset Bay	Fecal Coliform and Total Phosphorus TMDLs Kickemuit River	No	Yes	Phase II Stormwater Management Plans submitted and general permits as required which include six minimum measures and prioritization of outfalls for BMP construction Educational programs on pollution prevention and good housekeeping	MassHighway has received full authorization to discharge under the general permit. The NOI submitted with the application for coverage includes many educational programs on pollution prevention and good housekeeping practices. MassHighway and EPA continue to work together to finalize the programs included in the Storm Water Management Plan.	Yes (see Table K-2 for details)	
	Bacteria TMDL for the Palmer River Basin	No	Yes	None	--	Yes (see Table K-2 for details)	
Nashua River	Final TMDL for Bare Hill Pond	No	No	None	--	No	
Shawsheen	Bacteria TMDL for the Shawsheen River Basin	No	Yes	None	--	Yes (see Table K-2 for details)	
South Coastal	Total Maximum Daily Loads of Bacteria for Little Harbor	No	Yes	None	--	Yes (see Table K-2 for details)	
SuAsCo	Assabet River Total Maximum Daily Load for Total Phosphorus	No	No	None	--	No	
	Total Maximum Daily Loads of Phosphorus for Lake Boon	No	No	None	--	No	
Tauton	Final Pathogen TMDL for the Tauton River Watershed	No	Yes	None	--	Yes (see Table K-2 for details)	
Various	Northeast Regional Mercury Total Maximum Daily Load	No	No	None	--	No	TMDL indicates that mercury from stormwater is considered a <i>de minimus</i> source of mercury. Mercury loading reductions will be achieved by reducing atmospheric deposition.

Table K-2: MassHighway Investigation of TMDL Watersheds
Sorted by Priority

Basin	TMDL	Waterbody	MassHighway Features within Urban Areas in Watershed				Priority For Investigation ³	Preliminary Investigation Schedule ⁴	Completed Actions	Initial Findings	Additional Control Measures to be Installed	Notes
			Road Miles	Outfalls	Outfalls within 500 feet of Impaired Waterbody ²	Outfalls within 500 feet of Waterbody or Tributary ²						
Preliminary Investigation of TMDLs Identified as Storm Water Impaired Waters by Mass DEP in Draft RIA Permit¹												
Charles River	Total Maximum Daily Load of Phosphorus for Lower Charles River Basin	Charles River	177.6	1074	102	603	1		Preliminary inventory of MassHighway assets within watershed	A number of MassHighway urban outfalls existing within watershed according to MassHighway's drainage mapping.		Perform investigation, mapping, IDDE work as part of Statewide-Drainage Inventory and IDDE Related Services contract.
Blackstone	Total Maximum Daily Load of Phosphorus for Leesville Pond	Leesville (includes Auburn, Eddy, Smiths, and Stoneville)	27.4	205	56	124	1		Preliminary inventory of MassHighway assets within watershed	A number of MassHighway urban outfalls existing within watershed according to MassHighway's drainage mapping.		The values include MassHighway roads and outfalls within the Auburn, Eddy, Smiths and Stoneville watersheds. Perform investigation, mapping, IDDE work as part of Statewide-Drainage Inventory and IDDE Related Services contract.
French	Total Maximum Daily Load of Phosphorus for Selected French Basin Lakes	Lowes (includes Hudson, Robinson)	4.2	54	25	47	1		Preliminary inventory of MassHighway assets within watershed	A number of MassHighway urban outfalls existing within watershed according to MassHighway's drainage mapping.		Perform investigation, mapping, IDDE work as part of Statewide-Drainage Inventory and IDDE Related Services contract.
Chicopee	Total Maximum Daily Load of Phosphorus for Selected Chicopee Basin Lakes	Spectacle	0.4	7	7	7	1	Fall 2009	Field investigation and IDDE efforts on the seven outfalls w/in 500 feet of a waterbody or tributary within the watershed	No potential illicit discharges detected. Most of existing outfalls have BMPs including deep manholes for slowing flow velocity and rip rap infiltration pools.		Next steps include assessing the adequacy of existing BMPs. Perform follow up mapping and BMP analysis using USGS model as part of Statewide-Drainage Inventory and IDDE Related Services contract.
Millers	Total Maximum Daily Load of Phosphorus for Selected Millers River Basin Lakes	Parker	1.5	14	4	6	1	Fall 2009	Field investigation and IDDE efforts on the four outfalls w/in 500 feet of a waterbody or tributary within the watershed	MassHighway identified one illicit connection in the form of a hose from a residence into the storm sewer system. MassHighway is working to eliminate this illicit discharge. One outfalls consists of a culvert that drains a significant area that is not operated by MassHighway. The remaining outfalls have severe space constraints to installing BMPs.		Next steps include eliminating the illicit connection and further assessment of the potential for installing BMPs on the outfalls that drain MassHighway roads. Perform follow up mapping and BMP analysis using USGS model as part of Statewide-Drainage Inventory and IDDE Related Services contract.
French	Total Maximum Daily Load of Phosphorus for Selected French Basin Lakes	Texas (includes Cedar Meadow, Dutton, Greenville, and Rochdale)	2.6	9	3	3	1	Fall 2009	Field investigation and IDDE efforts on the three outfalls w/in 500 feet of a waterbody or tributary within the watershed	This investigation determined that these outfalls are located downstream of Texas Pond and therefore do not discharge to the Texas Pond. Dry weather flows were sampled. Results are not indicative of illicit discharge.		Next steps include identifying if these outfalls discharge to another waterbody with a TMDL and incorporating them into that waterbodies outfall count and any necessary follow up analysis.
Millers	Total Maximum Daily Load of Phosphorus for Selected Millers River Basin Lakes	Ramsdall (includes Bents)	7.5	72	3	28	1	Fall 2009	Field investigation and IDDE efforts on the three outfalls w/in 500 feet of a waterbody or tributary within the watershed	No potential illicit discharges were identified. The outfalls all had very limited space for installing additional BMPs.		Next steps include further assessment of the potential for installing BMPs based on spatial constraints.
Blackstone	Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes	Mill	6.6	48	0	26	2					
Blackstone	Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes	Shirley (includes Pondville)	4.0	17	0	8	2					
Millers	Total Maximum Daily Load of Phosphorus for Selected Millers River Basin Lakes	Hilchey	0.3	4	0	4	2					
French	Total Maximum Daily Load of Phosphorus for Selected French Basin Lakes	Pikes	0.2	4	0	3	2					
Blackstone	Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes	Dorothy	1.1	3	0	2	2					
Blackstone	Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes	Stoneville	6.2	12	0	0	3					
Blackstone	Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes	Smiths	3.9	5	0	0	3					
Chicopee	Total Maximum Daily Load of Phosphorus for Selected Chicopee Basin Lakes	Sugden	0.3	2	0	0	3					Outfalls are high in watershed, a significant distance from the impaired waterbody.
Blackstone	Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes	Jordan	0.5	1	0	0	3					One outfall in urban area. May discharge to MS4 system.
Blackstone	Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes	Southwick	0.8	0	0	0	4					
French	Total Maximum Daily Load of Phosphorus for Selected French Basin Lakes	Buffumville (includes Gore, Granite, Pierpoint, and Shepard)	0.1	0	0	0	4					
Blackstone	Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes	Howe	0.1	0	0	0	4					
Millers	Total Maximum Daily Load of Phosphorus for Selected Millers River Basin Lakes	Depot	0.1	0	0	0	4					

Table K-2: MassHighway Investigation of TMDL Watersheds
Sorted by Priority

Basin	TMDL	Waterbody	Road Miles	Outfalls	Outfalls within 500 feet of Impaired Waterbody ²	Outfalls within 500 feet of Waterbody or Tributary ²	Priority For Investigation ³	Preliminary Investigation Schedule ⁴	Completed Actions	Initial Findings	Additional Control Measures to be Installed	Notes
Chicopee	Total Maximum Daily Load of Phosphorus for Selected Chicopee Basin Lakes	Mona (includes Long)	0.0	0	0	0	5					
Blackstone	Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes	Curtis North and South	0.0	0	0	0	5					
Millers	Total Maximum Daily Load of Phosphorus for Selected Millers River Basin Lakes	Greenwood #2	0.0	0	0	0	5					
Blackstone	Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes	Brierly	0.0	0	0	0	5					
Chicopee	Total Maximum Daily Load of Phosphorus for Selected Chicopee Basin Lakes	Wickaboag	0.0	0	0	0	5					
Chicopee	Total Maximum Daily Load of Phosphorus for Selected Chicopee Basin Lakes	Minechoag	0.0	0	0	0	5					
Chicopee	Total Maximum Daily Load of Phosphorus for Quaboag and Quacumquasit Ponds	Quaboag (includes Quacumquasit)	0.0	0	0	0	5					
Connecticut	Total Maximum Daily Load of Phosphorus for Selected Connecticut Basin Lakes	Warner (includes Leverett)	0.0	0	0	0	5					
Connecticut	Total Maximum Daily Load of Phosphorus for Selected Connecticut Basin Lakes	Loon	0.0	0	0	0	5					
Connecticut	Total Maximum Daily Load of Phosphorus for Selected Connecticut Basin Lakes	Wyola	0.0	0	0	0	5					
French	Total Maximum Daily Load of Phosphorus for Selected French Basin Lakes	McKinstry	0.0	0	0	0	5					
French	Total Maximum Daily Load of Phosphorus for Selected French Basin Lakes	Larner (includes Warner)	0.0	0	0	0	5					
French	Total Maximum Daily Load of Phosphorus for Selected French Basin Lakes	Tobins Pond (includes New)	0.0	0	0	0	5					
Millers	Total Maximum Daily Load of Phosphorus for Selected Millers River Basin Lakes	Denison	0.0	0	0	0	5					
Millers	Total Maximum Daily Load of Phosphorus for Selected Millers River Basin Lakes	South Athol	0.0	0	0	0	5					
Millers	Total Maximum Daily Load of Phosphorus for Selected Millers River Basin Lakes	Stoddard	0.0	0	0	0	5					
Millers	Total Maximum Daily Load of Phosphorus for Selected Millers River Basin Lakes	Whites Mill	0.0	0	0	0	5					
Millers	Total Maximum Daily Load of Phosphorus for Selected Millers River Basin Lakes	Whitney (includes Whites Mill)	0.0	0	0	0	5					
Millers	Total Maximum Daily Load of Phosphorus for Selected Millers River Basin Lakes	Reservoir #1	0.0	0	0	0	5					
Millers	Total Maximum Daily Load of Phosphorus for Selected Millers River Basin Lakes	Brazell	0.0	0	0	0	5					
Millers	Total Maximum Daily Load of Phosphorus for Selected Millers River Basin Lakes	Ellis	0.0	0	0	0	5					
Millers	Total Maximum Daily Load of Phosphorus for Selected Millers River Basin Lakes	Bourn-Hadley	0.0	0	0	0	5					

No further action under MassHighway's MS4 program. BMPs will be designed consistent with MassHighway Stormwater Policy when projects are proposed for the roads.

No urban MassHighway roads are located within the impaired waterbody's watershed

Table K-2: MassHighway Investigation of TMDL Watersheds
Sorted by Priority

Basin	TMDL	Waterbody	Road Miles	Outfalls	Outfalls within 500 feet of Impaired Waterbody ²	Outfalls within 500 feet of Waterbody or Tributary ²	Priority For Investigation ³	Preliminary Investigation Schedule ⁴	Completed Actions	Initial Findings	Additional Control Measures to be Installed	Notes
Waters not Identified by MA DEP as TMDL Identified Stormwater Impaired Waters												
Blackstone	Total Maximum Daily Loads of Phosphorus for Salisbury Pond	Salisbury Pond					6					Review for MassHighway roads, need for BMPs and actions needed to address pollutant of concern once other priority areas are complete.
Blackstone	Total Maximum Daily Loads of Phosphorus for Lake Quinsigamond and Flint Pond	Lake Quinsigamond and Flint Pond					6					
Blackstone	Total Maximum Daily Loads of Phosphorus for Indian Lake	Indian Lake					6					
Boston Harbor	Total Maximum Daily Loads of Bacteria for the Neponset River Basin	Neponset River					6					
Buzzards Bay	Final Pathogen TMDL for the Buzzards Bay Watershed	> 50 river segments, brooks, ponds, coves, creeks, harbors, etc					6					
Cape Cod	Stage Harbor/Oyster Pond, Sulpher Springs/Bucks Creek, Taylors Pond/Mill Creek Total Maximum Daily Load Re-evaluations for Total Nitrogen	Stage Harbor/Oyster Pond, Sulpher Springs/Bucks Creek, Taylors Pond/Mill Creek					6					
Cape Cod	Final West Falmouth Harbor Embayment System Total Maximum Daily Loads for Total Nitrogen	Harbor Head					6					
Cape Cod	Final Three Bays System Total Maximum Daily Loads for Total Nitrogen	Seapuit River, Prince Cove, Cotuit Bay, North Bay, West Bay					6					
Cape Cod	Final Quashnet River, Hamblin Pond, Little River, Jehu Pond, and Great River in the Waquoit Bay System Total Maximum Daily Loads for Total Nitrogen	Quashnet River, Hamblin Pond, Little River, Jehu Pond, and Great River					6					Review for MassHighway roads, need for BMPs and actions needed to address pollutant of concern once other priority areas are complete.
Cape Cod	Final Popponesset Bay System Total Maximum Daily Loads for Total Nitrogen	Popponesset Bay, Shoestring Bay, Mashpee River					6					
Cape Cod	Final Pleasant Bay System Total Maximum Daily Loads for Total Nitrogen	Pleasant Bay, Crows Pond, Frost Fish Creek, Ryder Cove, Muddy Creek					6					
Cape Cod	Final Phinneys Harbor Embayment System Total Maximum Daily Loads for Total Nitrogen	Phinneys Harbor, Back River, Eel Pond					6					
Cape Cod	Final Pathogen TMDL for Three Bays Watershed, Barnstable, MA	Seapuit River, Prince Cove, Cotuit Bay, North Bay, West Bay					6					
Cape Cod	Final Pathogen TMDL for the Cape Cod Watershed	>40 river segments, brooks, ponds, coves, creeks, harbors, etc					6					
Cape Cod	Final Oyster Pond Embayment System Total Maximum Daily Loads for Total Nitrogen	Oyster Pond Embayment System					6					
Cape Cod	Final Little Pond Embayment System Total Maximum Daily Loads for Total Nitrogen	Little Pond Embayment System					6					
Cape Cod	Final Great, Green and Bournes Pond Embayment Systems Total Maximum Daily Loads for Total Nitrogen	Great Pond, Perch Pond, Green Pond, Bournes Pond					6					
Cape Cod	Centerville River -East Bay System Total Maximum Daily Loads for Total Nitrogen	Centerville River - East Bay					6					
Cape Cod	Bacteria Total Maximum Daily Load for Frost Fish Creek, Chatham, Mass	Frost Fish Creek					6					
Cape Cod	Bacteria TMDL for Muddy Creek	Muddy Creek					6					
Charles River	Final Pathogen TMDL for the Charles River Watershed	20 river segments in the Charles River					6					

Table K-2: MassHighway Investigation of TMDL Watersheds
Sorted by Priority

Basin	TMDL	Waterbody	Road Miles	Outfalls	Outfalls within 500 feet of Impaired Waterbody ²	Outfalls within 500 feet of Waterbody or Tributary ²	Priority For Investigation ³	Preliminary Investigation Schedule ⁴	Completed Actions	Initial Findings	Additional Control Measures to be Installed	Notes
Islands	Nantucket Harbor Embayment System Total Maximum Daily Loads for Total Nitrogen	Nantucket Harbor, Plopiis Harbor, Sesachacha Pond					6					Review for MassHighway roads, need for BMPs and actions needed to address pollutant of concern once other priority areas are complete.
Narraganset	Bacteria TMDL for the Palmer River Basin	10 brook and river segments					6					
Nashua River	Final TMDL for Bare Hill Pond	Bare Hill Pond					6					
Shawsheen	Bacteria TMDL for the Shawsheen River Basin	Shawsheen River and three tributaries					6					
South Coastal	Total Maximum Daily Loads of Bacteria for Little Harbor	Little Harbor					6					
SuAsCo	Total Maximum Daily Loads of Phosphorus for Lake Boon	Lake Boon					6					
SuAsCo	Assabet River Total Maximum Daily Load for Total Phosphrus	Assabet River					6				No further action	The impairment is primarily due to discharges from waste-water treatment plants. No BMPs are recommended for storm water runoff.
Tauton	Final Pathogen TMDL for the Tauton RiverWatershed	Various segments					6					Review for MassHighway roads, need for BMPs and actions needed to address pollutant of concern once other priority areas are complete.
Various	Northeast Regional Mercury Total Maximum Daily Load	All Mercury Impaired waterbodies	-	-	-	-	6				No further action	TMDL indicates that mercury from stormwater is considered a <i>de minimus</i> source of mercury. Mercury loading reductions will be achieved by reducing atmospheric deposition.

1. List of Stormwater Impaired TMDLs from Massachusetts DEP Draft RIA Permit. List can be found at <http://www.mass.gov/dep/service/regulations/newregs.htm>. This list is based on stormwater impaired waterbodies with TMDLs that identify stormwater from commercial and industrial areas as contributing the impairment. Although, there may be impaired waterbodies that stormwater contributes to that are not on this list, MassHighway used it as a starting point for prioritizing the investigation of impaired waters.

2. The number of outfalls within 500 feet of the impaired waterbody or its tributaries was estimated using GIS and available data.

3. Priority for further investigation is based on the initial investigation. Future efforts may result in findings that change priority of a given watershed.

4. Schedule to be determined during ongoing efforts