Final Pathogen TMDL for the Narragansett/Mt. Hope Bay Watershed
July 2010
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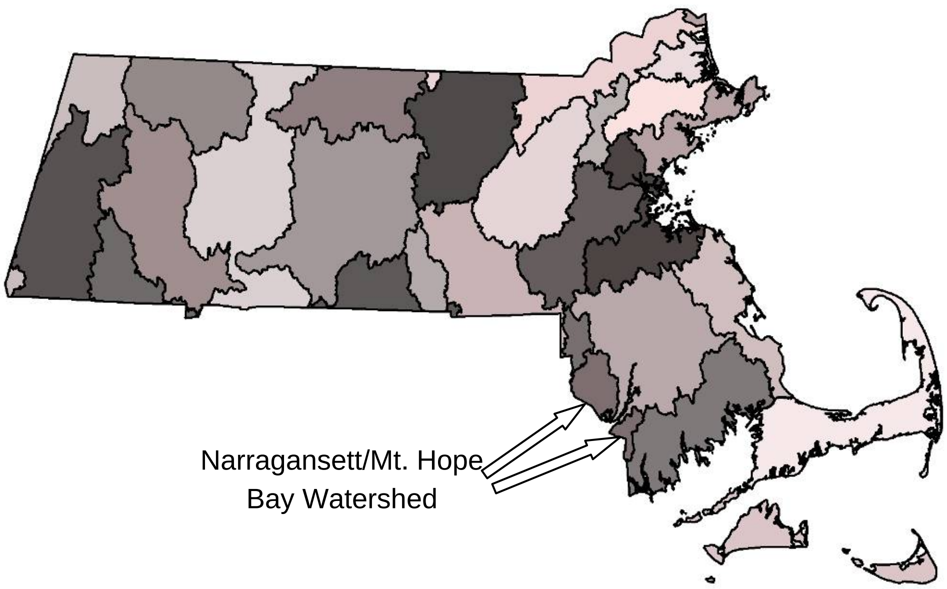

Prepared as a cooperative effort by:

Massachusetts DEP
1 Winter Street
Boston, Massachusetts 02108

USEPA New England Region 1
1 Congress Street, Suite 1100
Boston, Massachusetts 02114

ENSR International
2 Technology Park Drive
Westford, MA 01886

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627 Main Street
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DISCLAIMER

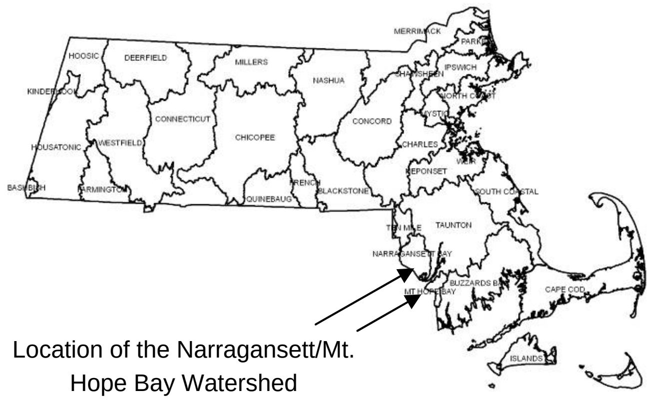
References to trade names, commercial products, manufacturers, or distributors in this report constituted neither endorsement nor recommendations by the Division of Watershed Management for use.

Much of this document was prepared using text and general guidance from the previously approved Charles River Basin, Cape Cod, Buzzards Bay, Neponset River Basin and the Palmer River Basin Bacteria Total Maximum Daily Load documents.

Acknowledgement

This report was originally developed by ENSR through a partnership with Research Triangle Institute (RTI) contracting with the United States Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection Agency under the National Watershed Protection Program. MassDEP would also like to thank Elizabeth Scott and Brian Zalewsky from the RIDEM for providing important data which was critical for the development of this TMDL.

Final Total Maximum Daily Loads for Pathogens within the Narragansett/Mt. Hope Bay Watershed



Location of the Narragansett/Mt.
Hope Bay Watershed

Key Features: Pathogen TMDL for the Narragansett/Mt. Hope Bay Watershed

Location: EPA Region 1

Land Type: New England Coastal

303(d) Listings: Pathogens
Runnins River (MA53-01)
Warren River Pond (MA53-06)
Lee River (MA61-01 & MA61-02)
Cole River (MA61-04)
Mt. Hope Bay (MA61-06 & MA61-07)

Data Sources: MassDEP 2002. Narragansett/Mt. Hope Bay Watershed 1999 Water Quality Assessment Report; RIDEM Dry and Wet Weather Monitoring 2006; Massachusetts Division of Marine Fisheries

Data Mechanism: Massachusetts Surface Water Quality Standards for Fecal Coliform; The Federal BEACH Act; Massachusetts Department of Public Health Bathing Beaches; Massachusetts Division of Marine Fisheries Shellfish Sanitation and Management; Massachusetts Coastal Zone Management

Monitoring Plan: Massachusetts Watershed Five-Year Cycle; Local Volunteer Groups; Division of Marine Fisheries; Massachusetts Coastal Zone Management

Control Measures: Watershed Management; Stormwater Management (e.g., illicit discharge removals, public education/behavior modification); Combined Sewer Overflow (CSO) & Sewer System Overflow (SSO) Abatement; Agricultural and other BMPs; No Discharge Areas; By-laws; Ordinances; Septic System Maintenance/Upgrades.

EXECUTIVE SUMMARY

PURPOSE AND INTENDED AUDIENCE

This document provides a framework to address bacterial and other fecal-related pollution in surface waters of Massachusetts. Fecal contamination of our surface waters is most often a direct result of the improper management of human wastes, excrement from barnyard animals, pet feces and agricultural applications of manure. It can also result from large congregations of birds such as geese and gulls. Illicit discharges of boat waste are of particular concern in coastal areas. Inappropriate disposal of human and animal wastes can degrade aquatic ecosystems and negatively affect public health. Fecal contamination can also result in closures of shellfish beds, beaches, swimming holes and drinking water supplies. The closure of such important public resources can erode quality of life and diminish property values.

Who should read this document?

The following groups and individuals can benefit from the information in this report:

a) towns and municipalities, especially Phase I and Phase II stormwater communities, that are required by law to address stormwater and/or combined sewage overflows (CSOs) and other sources of contamination (e.g., broken sewerage pipes and illicit connections) that contribute to a waterbody's failure to meet Massachusetts Water Quality Standards for pathogens;

b) watershed groups that wish to pursue funding to identify and/or mitigate sources of pathogens in their watersheds;

c) harbormasters, public health officials and/or municipalities that are responsible for monitoring, enforcing or otherwise mitigating fecal contamination that results in beach and/or shellfish closures or results in the failure of other surface waters to meet Massachusetts standards for pathogens;

d) citizens that wish to become more aware of pollution issues and may be interested in helping build local support for funding remediation measures.

e) government agencies that provide planning, technical assistance, and funding to groups for bacterial remediation.

TMDL OVERVIEW

The Narragansett/Mt. Hope Bay Watershed drains approximately 112 square miles of the Massachusetts' southwestern shore including the Taunton River Watershed which is the second largest watershed in Massachusetts. All or parts of eight Commonwealth communities are located within the Narragansett/Mt. Hope Bay Drainage area (MassDEP 2002a) including Attleboro, Dighton, Rehoboth, Seekonk, Somerset, Swansea and Westport and the City of Fall River. The watershed is made up of six main river systems that include the Taunton River, Lee River, Cole River, Kickamuit River, Palmer River and Runnins River (MassDEP 2002a).

In Massachusetts, eastern Mt. Hope Bay and the tidal portion of the Taunton River Estuary south of Route 24 are classified as SB Waters and shall be suitable for shellfish harvesting with depuration (Restricted and Conditionally Restricted Shellfish Areas). The portion of Mount Hope Bay west of a line drawn from Brayton Point to Buoy #4 and the estuarine portions of the Lee's and Cole Rivers are classified by the Massachusetts Water Quality Standards as SA waterbodies. These waters are designated to be suitable for shellfish harvesting without depuration (Approved and Conditionally Approved Shellfish Areas). Data collected by several sources (see section 4.0) indicate that the majority of Mt. Hope Bay does not meet Water Quality Standards for bacteria. As a result seven segments including the Lee, Coles, and Runnins River, Warren River Pond, and Mt. Hope Bay proper have been listed as impaired (2008 Massachusetts Integrated Report in Category 5) and requiring a TMDL. The goal of this TMDL is to provide a framework for restoring water quality by identifying necessary fecal coliform reductions, locating pollution sources where known, and outlining an implementation strategy to abate these sources such that water quality standards can ultimately be attained during all weather conditions.

The TMDL analysis has determined that the most significant point source contributors of fecal coliform to the Massachusetts portions of Mount Hope Bay (all of MA 61-06, and the eastern portion of MA 61-07) include the direct pollution effects of the City of Fall River, and secondary effects from the City of Taunton. The main stem Taunton River drains directly into the Massachusetts (MA) and Rhode Island (RI) Mount Hope Bay areas. Flows from the Taunton River carry Combined Sewer Overflow (CSO) discharges from both cities following wet weather directly into these Mount Hope Bay areas. Additionally, general overland stormwater draining directly into the Taunton River from both urban areas during wet weather is another important bacteria pollution contributor to the Bay. It should be noted that $115 million in capital improvements have been made to the Fall River collection system over the last several years to address the CSO issue including the completion and implementation of a rock tunnel storage system that went on line in 2009. The extensive upgrade to the collection and treatment systems at Fall River is expected to result in significant water quality improvements. Additional discussion on this issue is provided later in this report.

In the remainder of the Narragansett/ Mount Hope Bays Watershed, including the western portion of Mount Hope Bay MA 61-07, the majority of bacteria sources are directly related to non point sources (NPS) of pollution, including stormwater (ESS, 2002). NPS pollution predominantly originates from: (1) densely developed residential areas with septic systems built in areas of high groundwater and/ or poorly drained soils; and (2) agricultural areas with either pig farms, cattle, or crops with absent or under performing BMP's to control runoff. Other nonpoint sources such as septic systems, illicit marine vessel discharges, illicit connections to storm sewers, and congregating flocks of waterfowl may occasionally contribute to the degradation of the sanitary quality in the study area at local scales.

This report provides guidance for local governments and stakeholder groups for implementing best management practices (BMPs) to meet bacteria water quality standards in Mount Hope Bay and its tributaries. The Implementation Section of this report links target pollutant reduction allocations in Mount Hope Bay with specified sets of actions to be taken in the watershed. The management actions outlined capitalize on existing and planned programs and efforts within the watershed such as the ongoing CSO abatement project being implemented by the City of Fall River, as well as existing Phase II stormwater programs implemented by municipalities.

In an effort to provide guidance for setting bacterial implementation priorities within the Narragansett/ Mount Hope Bay Watershed, a summary table is provided (Table ES- 1). Pathogen-impaired segments prioritized as high and medium will require additional bacterial source tracking work and stepwise implementation of structural and non-structural Best Management Practices (BMPs). Since limited source information and data are available in each impaired segment, a simple scheme was used to prioritize segments based on fecal coliform concentrations. High priority was assigned to those segments where either dry or wet weather concentrations (end of pipe or ambient) were equal to or greater than 10,000 cfu/100 ml. Medium priority was assigned to segments where concentrations ranged from 1,000 to 9,999 cfu/100ml. Low priority was assigned to segments where concentrations were observed less than 1,000 cfu/100 ml. MassDEP believes the higher concentrations are indicative of the potential presence of raw sewage and therefore they pose a greater risk to the public. It should be noted that in all cases, waters exceeding the water quality standards identified in Table ES- 1 are considered impaired.

Also, prioritization is adjusted upward based on proximity of waters, within the segment, to sensitive areas such as Outstanding Resource Waters (ORW's), or designated uses that require higher water quality standards than Class B, such as Class A, or SA waters, public water supply intakes, public swimming areas, or shellfish areas. Best professional judgment was used in determining this upward adjustment. Generally speaking, waters that were determined to be lower priority based on the numeric range identified above were elevated up one level of priority if that segment was adjacent to or immediately upstream of a sensitive use. An asterisk * in the priority column of the specific segment would indicate this situation. Double asterisk ** represents two special situations where priorities are elevated: (1) the Runnins River MA53-01, because of adjoining downstream waters in Rhode Island (RI) being a Special Resource Protection Water (SRPW) similar to ORWs in MA, and also downstream adjoining waters in RI being classified as shellfishing SA waters; and (2) The Lee River, MA 61-01 Class B, because the immediate downstream segment, Lee River MA 51-02, Class SA, has a higher Water Quality Standard .

Table ES-1. Prioritized List of Pathogen Impaired Segments

Segment ID	Segment Name	Segment Type	Size[1]	Segment Description	Priority "Dry"	Priority "Wet"
MA53-01	Runnins River, Class B	River	3.7	Route 44 to Mobile Dam, Seekonk.	High**	High**
MA53-06	Warren River Pond, Class SA	Estuary	0.06	Salt Pond in Swansea on MA/RI border.	Medium* shellfishing	Medium* shellfishing
MA61-01	Lee River, Class B	River	0.53	From confluence with Lewin Brook, Swansea to Route 6, Swansea/ Somerset. Miles 0.6-0.0	High**	High**
MA61-02	Lee River, Class SA	Estuary	0.51	Route 6, Swansea/Somerset to mouth at Mount Hope Bay, Swansea.	Medium* shellfishing	Medium* shellfishing
MA61-04	Cole River, Class SA	Estuary	0.31	Route 6 to the mouth at Old Railway Grade, Swansea.	Medium* shellfishing	High* shellfishing
MA61-06	Mount Hope Bay, Class SB, CSO	Estuary	2.3	From the Braga Bridge to the MA/RI state border, Swansea/Fall River east of a line from Brayton Point to Buoy #4.	Medium* shellfishing	High* shellfishing
MA61-07	Mount Hope Bay, Class SA	Estuary	1.8	West of a line from Brayton Point to Buoy #4. (Mass. Portion)	Medium* shellfishing	Medium* shellfishing

[1] Units of square miles for estuary segments and miles for river segments

This report represents a TMDL for pathogen indicators (e.g. fecal coliform, *E. coli*, and enterococcus bacteria) in the Narragansett/Mt. Hope Bay watershed, except Palmer River (MA53-03; MA53-04; MA53-05), and the Kickamuit River (MA61-08). A TMDL was previously prepared by MassDEP for the Palmer River segments in 2003. The TMDL for the Kickamuit River (developed by RI DEM, and submitted to EPA for the MA portion of the River) was approved by EPA in September of 2009 (RIDEM 2009). Two of the segments in this TMDL adjoin impaired segments in Rhode Island. Specifically, three of the four RIDEM Mount Hope Bay segments (RI0007032E01A, E01C, E01D), are immediately adjacent to the two MassDEP Mount Hope Bay segments (MA61-06, MA61-07). RIDEM has also recently received EPA approval of their final TMDLs for these adjoining segments as described in "Total Maximum Daily Load Study for Bacteria, Mount Hope Bay and the Kickemuit River Estuary". Efforts to develop TMDLs for adjoining segments were coordinated between MassDEP and RIDEM to ensure consistency in TMDL development and implementation. As a result many of the results and conclusions related to pathogen sources for these particular segments in both MA and RI, as well as implementation recommendations, are similar in both reports. It should be noted that although 70% of Mount Hope Bay is located in Rhode Island, over 90% of its drainage basin (including the Taunton basin) is located in MA. Much of the past and present bacteria/pathogen problems relate to CSO's, stormwater, and other discharges from the upstream urban areas of Taunton. A pathogen TMDL for the Taunton River has also been developed (CN 0256).

Since quantitative estimates of existing sources are generally unavailable, it is difficult to estimate the pollutant reductions for specific sources. For the illicit sources, the goal is complete elimination (100% reduction). However, overall wet weather indicator bacteria load reductions can be estimated using typical stormwater bacteria concentrations. These data indicate that in general two to three orders of magnitude (i.e., greater than 90%) reductions in stormwater fecal coliform loading will be necessary, especially in developed areas. This goal is expected to be accomplished through implementation of the CSO control plan at Fall River and Phase II storm water best management practices in the other surrounding MS4 communities.

TMDL goals for each type of bacteria source are provided in Table ES-2. Municipalities are the primary responsible parties for eliminating many of these sources. TMDL implementation to achieve these goals should be an iterative process with selection and implementation of mitigation measures followed by monitoring to determine the extent of water quality improvement realized. Recommended TMDL implementation measures include identification and elimination of prohibited sources such as leaky or improperly connected sanitary sewer flows and best management practices to mitigate stormwater runoff volume. Certain towns in the watershed are classified as Urban Areas by the United States Census Bureau and are subject to the Stormwater Phase II Final Rule that requires the development and implementation of an illicit discharge detection and elimination plan. Combined sewer overflows will be addressed through the on-going long-term control plans.

In most cases, authority to regulate non-point source pollution and thus successful implementation of this TMDL is limited to local government entities and will require cooperative support from local volunteers, watershed associations, and local officials in municipal government. Those activities can take the form of expanded education, obtaining and/or providing funding, and possibly local enforcement. In some cases, such as subsurface disposal of wastewater from homes, the Commonwealth provides the framework, but the administration occurs on the local level. Federal and state funds to help implement this TMDL are available, on a competitive basis, through the Non-Point Source Control (CWA Section 319) Grants, Water Quality (CWA Section 604(b)) Grants, and the State Revolving (Loan) Fund Program (SRF). Most financial aid requires some local match as well. The programs mentioned are administered through the MassDEP. Additional funding and resources available to assist local officials and community groups can be referenced within the Massachusetts Non-point Source Management Plan-Volume I Strategic Summary (2000) "Section VII Funding / Community Resources". This document is available on the MassDEP's website at: www.mass.gov/dep/water/resources/nonpoint.htm.

Table ES-2: Waste Load Allocations (WLAs) and Load Allocations (LAs) as Daily Concentrations (Cfu/100mL).

Surface Water Classification	Pathogen Source	Waste Load Allocation Indicator Bacteria (cfu/100 mL)[1]	Load Allocation Indicator Bacteria (cfu/100 mL)[1]
B, SA, SB (prohibited)	Illicit discharges to storm drains	0	
	Leaking sanitary sewer lines	0	Not Applicable
	Failing septic systems	Not Applicable	0
B	Any regulated discharge- including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges [7,9], and combined sewer overflows[6].	Either; a) E. coli <=geometric mean[5] 126 colonies per 100 ml; single sample <=235 colonies per 100 ml; or b) Enterococci geometric mean[5] <= 33 colonies per 100 ml and single sample <= 61 colonies per 100 ml	Not Applicable
	Nonpoint source stormwater runoff[4]	Not Applicable	Either a) E. coli <=geometric mean[5] 126 colonies per 100 ml; single sample <=235 colonies per 100 ml; or b) Enterococci geometric mean[5]<= 33 colonies per 100 ml and single sample <= 61 colonies per 100 ml
SA (Designated for shellfishing)	Any regulated discharge - including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges[7,9], and combined sewer overflows[6].	Fecal Coliform <= geometric mean, MPN, of 14 organisms per 100 ml nor shall 10% of the samples be >=28 organisms per 100 ml	Not Applicable
	Nonpoint Source Stormwater Runoff[4]	Not Applicable	Fecal Coliform <= geometric mean, MPN, of 14 organisms per 100 ml nor shall 10% of the samples be >=28 organisms per 100 ml
SA & SB[10] (Beaches[8] and non-designated shellfish areas)	Any regulated discharge - including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges[7,9], and combined sewer overflows[6].	Enterococci - geometric mean[5] <= 35 colonies per 100 ml and single sample <= 104 colonies per 100 ml	Not Applicable

Surface Water Classification	Pathogen Source	Waste Load Allocation Indicator Bacteria (cfu/100 mL)[1]	Load Allocation Indicator Bacteria (cfu/100 mL)[1]
	Nonpoint Source Stormwater Runoff[4]	Not Applicable	Enterococci -geometric mean[5] <= 35 colonies per 100 ml and single sample <= 104 colonies per 100 ml
SB (Designated for shellfishing w/depuration)	Any regulated discharge - including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges[7,9], and combined sewer overflows[6].	Fecal Coliform <= median or geometric mean, MPN, of 88 organisms per 100 ml nor shall 10% of the samples be >=260 organisms per 100 ml	Not Applicable
	Nonpoint Source Stormwater Runoff[4]	Not Applicable	Fecal Coliform <= median or geometric mean, MPN, of 88 organisms per 100 ml nor shall 10% of the samples be >=260 organisms per 100 ml

Table ES-2 Footnotes

[1] Waste Load Allocation (WLA) and Load Allocation (LA) refer to fecal coliform densities unless specified in table.
[2] In all samples taken during any 6 month period
[3] In 90% of the samples taken in any six month period;
[4] The expectation for WLAs and LAs for stormwater discharges is that they will be achieved through the implementation of BMPs and other controls.
[5] Geometric mean of the 5 most recent samples is used at bathing beaches. For all other waters and during the non-bathing season the geometric mean of all samples taken within the most recent six months, typically based on a minimum of five samples.
[6] Or other applicable water quality standards for CSO's
[7] Or shall be consistent with the Waste Water Treatment Plant (WWTP) National Pollutant Discharge Elimination System (NPDES) permit.
[8] Massachusetts Department of Public Health regulations (105 CMR Section 445)
[9] Seasonal disinfection may be allowed by the Department on a case-by-case basis.
[10] Segments designated as CSO have long term control plans in place and are expected to meet water quality goals.

Note: this table represents waste load and load allocations based on water quality standards current as of the publication date of these TMDLs. If the pathogen criteria change in the future, MassDEP intends to revise the TMDL by addendum to reflect the revised criteria.

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List of ACRONYMS	
7Q10	Seven Day Ten Year Low Flow
BCSO	Waters occasionally subject to short-term impairment of swimming or other recreational uses due to untreated CSO discharges in a typical year, and the aquatic life community may suffer adverse impact yet is still generally viable. In these waters, the uses for Class B waters are maintained after the implementation of long term control measures described in the approved CSO long term control plan.
BMP	Best Management Practice
BWSC	Boston Water and Sewer Commission
CFU	colony forming units
CSO	Combined Sewer Overflow- overflows form a combined sewer system that are discharged into a receiving water without going to the headwork's of a publicly owned treatment works.
CWA	Clean Water Act, Federal
CWA § 303(d)	Section 303 (d) of the CWA and the implementing regulations at 40 CFR 130.7 require states to identify those waterbodies that are not expected to meet surface water quality standards after the implementation of technology-based controls and to prioritize and schedule them for the development of a total maximum daily load (TMDL).
CZM	Coastal Zone Management
DFW	Division of Fisheries and Wildlife
DMF	Division of Marine Fisheries
DWM	Division of Watershed Management
EEA	Energy and Environmental Affairs
EMC	Event Mean Concentration
EPA	United States Environmental Protection Agency
EQIP	Environmental Quality Incentive Program
FWA	Fluorescent Whitening Agent
GIS	Geographic Information System
IDDE	Illicit Discharge Detection and Elimination System
LA	Load Allocation
LID	Low Impact Development
LTCP	Long Term CSO Control Plan
MADPH	Massachusetts Department of Public Health
MADMF	Massachusetts Division of Marine Fisheries
MassDEP	Massachusetts Department of Environmental Protection
MEP	Maximum Extent Practicable
MEPA	Massachusetts Environmental Policy Act
MG	Million Gallons

List of ACRONYMS	
MHD	Massachusetts Highway Department
MOS	Margin of Safety
MPN	Most Probable Number
MSD	Marine Sanitary Device
MS4	Municipal Separate Storm Sewer Systems
NDA	No Discharge Area
NPDES	National Polluant Discharge Elimination System
NRCS	Natural Resource Conservation Service
ORW	Outstanding Resource Water
POTW	Publically Owned Treatment Works
RIDEM	Rhode Island Department of Environmental Management
RTI	Research Triangle Institute
SBCSO	Waters occasionally subject to short-term impairment of swimming or other recreational uses due to untreated CSO discharges in a typical year, and the aquatic life community may suffer adverse impact yet is still generally viable. In these waters, the uses for Class SB waters are maintained after the implementation of long term control measures described in the approved CSO long term control plan.
SRF	State Revolving Fund
SSO	Sanitary Sewer Overflows
SWMP	Stormwater Management Plan
SWPP	Stormwater Protection Plan
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USACOE	United States Army Corps of Engineers
VEMN	Voluntary Environmental Monitoring Network
WLA	Waste Load Allocation
WQS	Water Quality Standards
WWTP	Waste Water Treatment Plant

1.0 Introduction

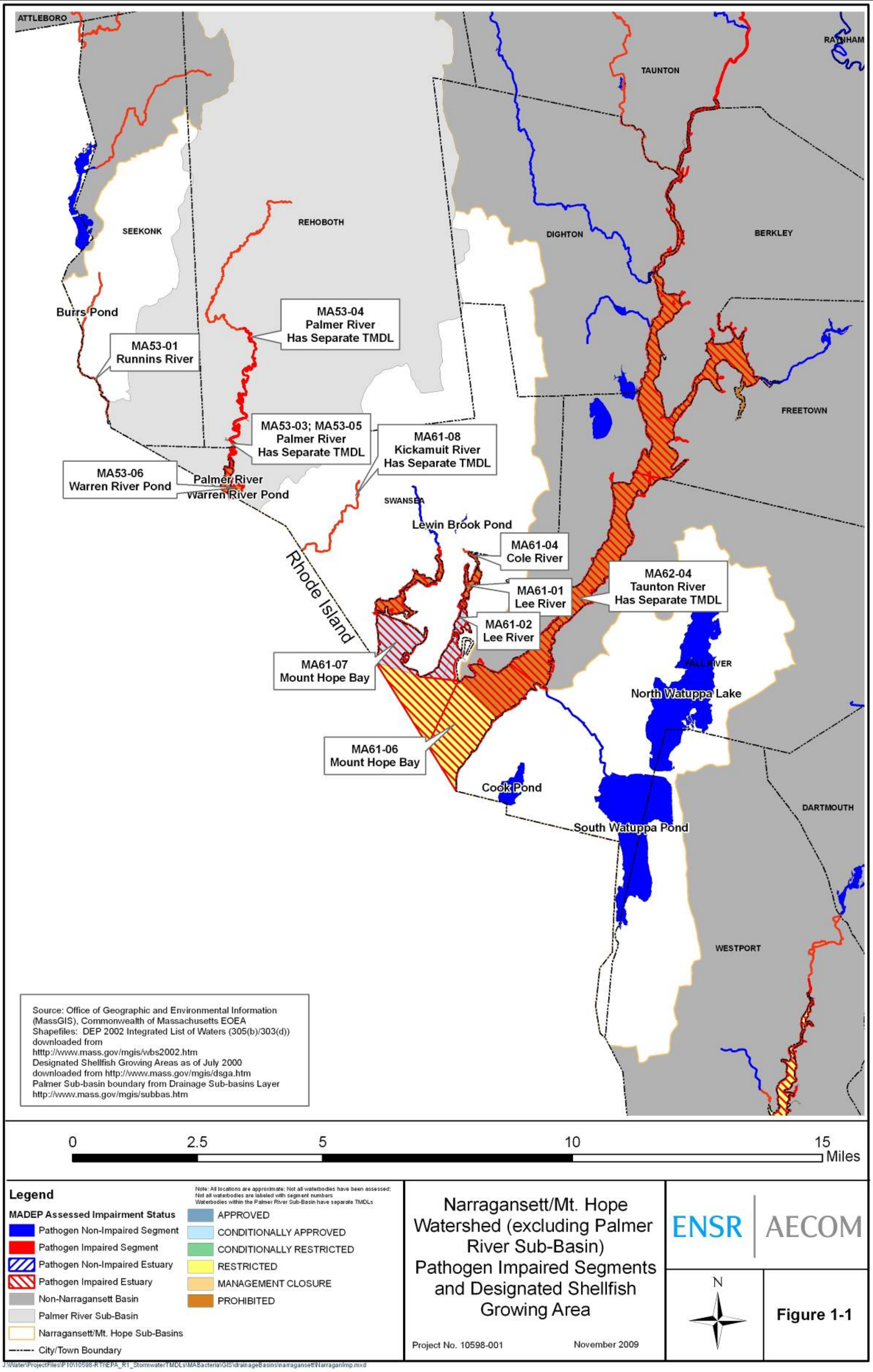
Section 303(d) of the Federal Clean Water Act (CWA) and Environmental Protection Agencies (EPA's) Water Quality Planning and Management Regulations (40 CFR Part 130) require states to place waterbodies that do not meet established water quality standards on a list of impaired waterbodies (commonly referred to as the “303d List”) and to develop Total Maximum Daily Loads (TMDLs) for listed waters and the pollutant(s) contributing to the impairment. In Massachusetts, impaired waterbodies are included in Category 5 of the “*Massachusetts Year 2008 Integrated List of Water: Part 2- Final Listing of Individual Categories of Waters*” (*2008 List*; MassDEP 2008). Figure 1-1 provides a map of the Narragansett/Mt. Hope Bay Watershed with pathogen impaired segments indicated. Please note that not all segments have been assessed by the Massachusetts Department of Environmental Protection (MassDEP) for pathogen impairment. As shown in Figure 1-1, seven Narragansett/Mt. Hope Bay waterbodies are listed as a Category 5 “impaired or threatened for one or more uses and require a TMDL” due to excessive indicator bacteria concentrations.

TMDLs are to be developed for water bodies that are not meeting designated uses under technology-based controls only. TMDLs determine the amount of a pollutant that a waterbody can safely assimilate without violating water quality standards. The TMDL process establishes the maximum allowable loading of pollutants or other quantifiable parameters for a waterbody based on the relationship between pollutant sources and instream conditions. The TMDL process is designed to assist states and watershed stakeholders in the stepwise implementation of water quality-based controls specifically targeted to identify sources of pollution in order to restore and maintain the quality of their water resources (USEPA 1999). TMDLs allow watershed stewards to establish measurable water quality goals based on the difference between site-specific instream conditions and state water quality standards.

A major goal of this TMDL is to achieve meaningful environmental results with regard to the designated uses of the Narragansett/Mt. Hope Bay waterbodies. These include water supply, shellfish harvesting, fishing, boating, and swimming. This TMDL establishes the necessary pollutant load (as defined by concentration) to achieve designated uses and applicable water quality standards. The companion document entitled; *Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts*” provides guidance for the implementation of this TMDL (MassDEP 2005).

Historically, water and sediment quality studies have focused on the control of point sources of pollutants (i.e., discharges from pipes and other structural conveyances) that discharge directly into well-defined hydrologic resources, such as lakes, ponds, or river segments. Examples of these would be the effluent discharges and CSO discharges associated with the Taunton and Fall River WWTP’s. While this localized approach may be appropriate under certain situations, it typically fails to characterize the more subtle and chronic sources of pollutants that are widely scattered throughout a broad geographic region such as a watershed (e.g., roadway runoff, failing septic systems in high groundwater, areas of concentrated wildfowl use, pet waste, and certain agricultural sources). These so called nonpoint sources of pollution often contribute significantly to the decline of water quality through their cumulative impacts.

Figure 1-1. Narragansett/Mt. Hope Bay Watershed and Pathogen Impaired Segments.



A watershed-level approach that uses the surface drainage area as the basic study unit enables managers to gain a more complete understanding of the potential pollutant sources impacting a waterbody and increases the precision of identifying local problem areas or “hot spots” which may detrimentally affect water and sediment quality. It is within this watershed-level framework that the MassDEP commissioned the development of watershed based TMDLs.

1.1. Pathogens and Indicator Bacteria

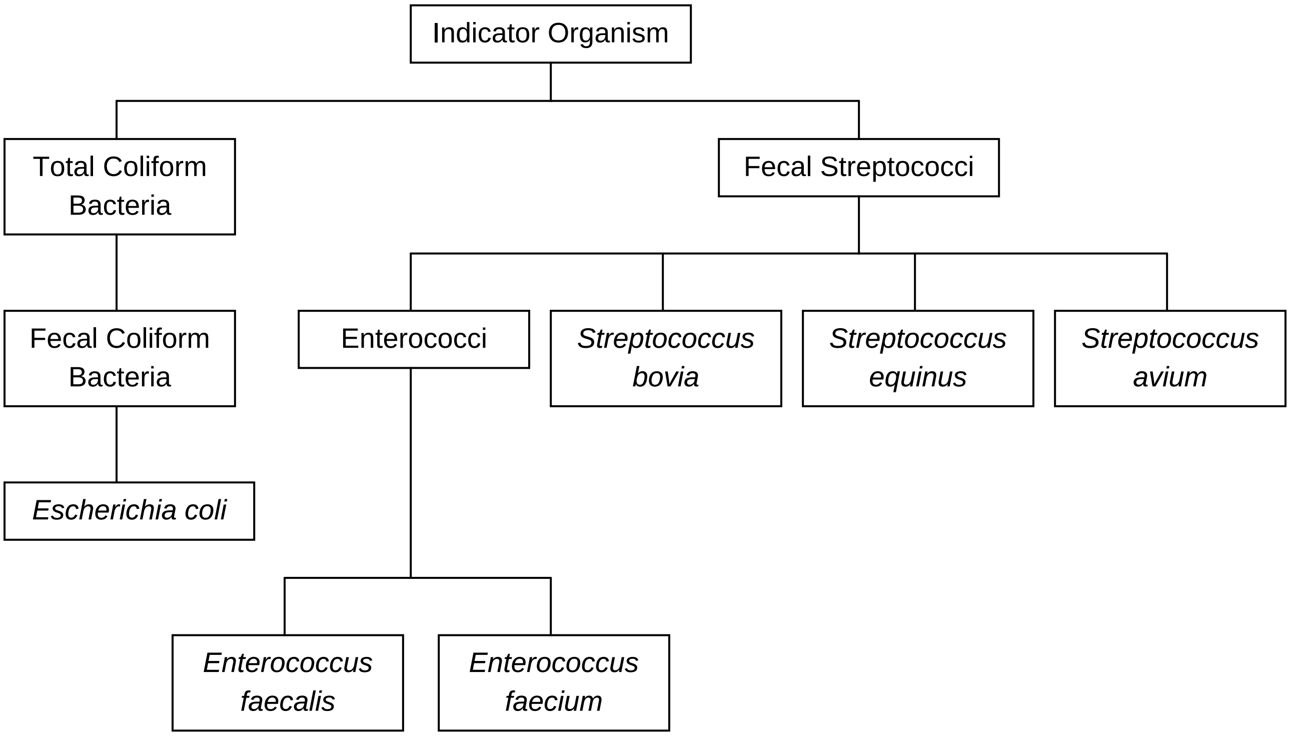
The Narragansett/Mt. Hope Bay Watershed Pathogen TMDL is designed to support reduction of waterborne disease-causing organisms, known as pathogens, to reduce public health risk. Waterborne pathogens enter surface waters from a variety of sources including sewage and the feces of warm-blooded wildlife. These pathogens can pose a risk to human health due to gastrointestinal illness through exposure via ingestion and contact with recreational waters, ingestion of drinking water, and consumption of filter-feeding shellfish.

Waterborne pathogens include a broad range of bacteria and viruses that are difficult to identify and isolate. Thus, specific nonpathogenic bacteria have been identified that are typically associated with harmful pathogens in fecal contamination. These associated nonpathogenic bacteria are used as indicator bacteria as they are easier to identify and measure in the environment. High densities of indicator bacteria increase the likelihood of the presence of pathogenic organisms.

Selection of indicator bacteria is difficult as new technologies challenge current methods of detection and the strength of correlation of indicator bacteria and human illness. Currently, coliform and fecal streptococci bacteria are commonly used as indicators of potential pathogens (i.e., indicator bacteria). Coliform bacteria include total coliforms, fecal coliform and *Escherichia coli* (*E. coli*). Fecal coliform (a subset of total coliform) and *E. coli* (a subset of fecal coliform) bacteria are present in the intestinal tracts of warm blooded animals. Presence of coliform bacteria in water indicates fecal contamination and the possible presence of pathogens. Fecal streptococci bacteria are also used as indicator bacteria, specifically enterococci a subgroup of fecal streptococci. These bacteria also live in the intestinal tract of animals, but their presence is a better predictor of human gastrointestinal illness than fecal coliform since the die-off rate of enterococci is much lower (i.e., enterococci bacteria remain in the environment longer) (USEPA 2001). The relationship of indicator organisms is provided in Figure 1-2. The EPA, in the “*Ambient Water Quality Criteria for Bacteria – 1986*” document, recommends the use of *E. coli* or enterococci as potential pathogen indicators in fresh water and enterococci in marine waters (USEPA 1986).

Massachusetts now uses *E. coli* and enterococci as indicator organisms of potential harmful pathogens in fresh water. The Massachusetts water quality standards (WQS) that apply for fresh water were updated in 2007 when *E. coli* replaced fecal coliform as the indicator organism for pathogens (view the WQS at http://www.mass.gov/dep/service/regulations/314cmr04.pdf) (MassDEP2007). Fecal coliform are used by Massachusetts Division of Marine Fisheries (DMF) in their classification of shellfish growing areas. Enterococci or *E. coli* are used as the indicator organism for freshwater beaches and for marine beaches enterococci are used, as required by the Federal Beaches Environmental Assessment and Coastal Act of 2000 (Beach Act), an amendment to the CWA.

Figure 1-2. Relationships Among Indicator Organisms (USEPA 2001).



The Narragansett Watershed pathogen TMDLs have been developed using fecal coliform as an indicator bacterium for shellfish areas and enterococci for bathing in marine waters. Any future changes in the Massachusetts pathogen water quality standard will apply to this TMDL at the time of the standard change. Massachusetts believes that the magnitude of indicator bacteria loading reductions outlined in this TMDL will be both necessary and sufficient to attain WQS for pathogens.

1.2. Comprehensive Watershed-based Approach to TMDL Development

Consistent with Section 303(d) of the CWA, the MassDEP has chosen to complete pathogen TMDLs for all waterbodies in the Narragansett/Mt. Hope Bay Watershed at this time, regardless of current impairment status (i.e., for all waterbody categories in the *2008 Integrated List*). MassDEP believes a comprehensive management approach carried out by all watershed communities is needed to address the ubiquitous nature of pathogen sources present in the Narragansett/Mt. Hope Bay Watershed. Watershed-wide implementation is needed to meet WQS and restore designated uses in impaired segments while providing protection of desirable water quality in waters that are not currently impaired.

As discussed below, this TMDL applies to seven of the pathogen impaired segments of the Narragansett/Mt. Hope Bay Watershed that are currently listed on the CWA § 303(d) list of impaired waters and determined to be pathogen impaired in the "*Narragansett/Mt. Hope Bay Watershed 1999 Water Quality Assessment Report*" (WQA; MassDEP 2002a) (see Figure 1-1, Table 4-3). MassDEP recommends however, that the information contained in this TMDL guide management activities for all other waters throughout the watershed to help maintain and protect existing water quality. For these non-impaired waters, Massachusetts is proposing "pollution prevention TMDLs" consistent with CWA § 303(d)(3).

The analyses conducted for the pathogen impaired segments in this TMDL would apply to the non-impaired segments, since the sources and their characteristics are equivalent. The waste load and/or load allocation for each source and designated use would be the same as specified herein. Therefore, the pollution prevention TMDLs would have identical waste load and load allocations based on the sources present and the designated use of the water body segment (see Table ES-2 and Table 7-1).

This Narragansett/Mt. Hope Bay Watershed TMDL may, in appropriate circumstances, also apply to segments that are listed for pathogen impairment in subsequent Massachusetts CWA § 303(d) Integrated Lists of Waters. For such segments, this TMDL may apply if, after listing the waters for pathogen impairment and taking into account all relevant comments submitted on the CWA § 303(d) list, the Commonwealth determines with EPA approval of the CWA § 303(d) list that this TMDL should apply to future pathogen impaired segments.

There are 18 waterbody segments assessed by the MassDEP in the Narragansett/Mt. Hope Bay Watershed (MassGIS 2005). These segments include seven estuary segments, six river segments, and five lake segments. Five of the estuary segments and two of the six river segments are pathogen impaired and appear as such on the official list of impaired watershed (303(d) List) (Figure 1-1). A pathogen TMDL has been previously prepared and approved for the Palmer River (MA53-03; MA53-04; MA53-05) segments. A pathogen TMDL for the Kickamuit River segment (MA61-08) has been developed by the RI DEM, and submitted to EPA to cover the MA portion. Pathogen impairment has been documented by the MassDEP in previous reports, including the MassDEP WQA, resulting in the impairment determination. In this TMDL document, an overview of pathogen impairment is provided to illustrate the nature and extent of the pathogen impairment problem. Since pathogen impairment has been previously established only a summary is provided herein.

The watershed based approach applied to complete the Narragansett/Mt. Hope Bay Watershed pathogen TMDL is straightforward. The approach is focused on identification of sources, source reduction, and implementation of appropriate management plans. Once identified, sources are required to meet applicable WQS for indicator bacteria or be eliminated. This approach does not include water quality analysis or other approaches designed to link ambient concentrations with source loadings. For pathogens and indicator bacteria, water quality analyses are generally resource intensive and provide results with large degrees of uncertainty. Rather, this approach focuses on sources and required load reductions, proceeding efficiently toward water quality restoration activities.

The implementation strategy for reducing indicator bacteria is an iterative process where data are gathered on an ongoing basis, sources are identified and eliminated if possible, and control measures including Best Management Practices (BMPs) are implemented, assessed and modified as needed. Measures to abate probable sources of waterborne pathogens include everything from public education, to improved stormwater management, to reducing the influence from inadequate and/or failing sanitary sewer infrastructure.

1.3. TMDL Report Format

This document contains the following sections:

- Watershed Description (Section 2) – provides watershed specific information
- Water Quality Standards (Section 3) – provides a summary of current Massachusetts WQS as they relate to indicator bacteria

- Problem Assessment (Section 4) – provides an overview of indicator bacteria measurements collected in the Narragansett/Mt. Hope Bay watershed
- Identification of Sources (Section 5) – identifies and discusses potential sources of waterborne pathogens within the Narragansett/Mt. Hope Bay watershed
- Prioritization and Known Sources (Section 6)- identifies potential sources and prioritizes segments by pollution magnitudes and sensitive human uses of waters
- TMDL Development (Section 7) – specifies required TMDL development components including:
    - Definitions and Equation
    - Load and Waste Load Allocations (concentration and percent reduction)
    - Margin of Safety
    - Seasonal Variability
- Implementation Plan (Section 8) – describes specific implementation activities designed to remove pathogen impairment. This section and the companion "*Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts*" (MassDEP 2005) document should be used together to support implementing management actions.
- Monitoring Plan (Section 9) – describes recommended monitoring activities
- Reasonable Assurances (Section 10) – describes reasonable assurances the TMDL will be implemented
- References (Section 11), and
- Public Participation (Appendix A) – describes the public participation process.

2.0 Watershed Description

The Narragansett/Mt. Hope Bay Watershed drains approximately 112 square miles of the Massachusetts' southwestern shore. All or parts of eight Commonwealth communities (e.g., Attleboro, Dighton, Fall River, Rehoboth, Seekonk, Somerset, Swansea and Westport) are located within the Narragansett/Mt. Hope Bay Drainage area (MassDEP 2002a). The watershed is made up of five main river systems: Lee River, Cole River, Kickamuit River, Palmer River and Runnins River (MassDEP 2002a). Also, the Taunton River Watershed is an important contributor to drainage into Mount Hope Bay, (issues related to the Taunton River are covered in a separate Pathogen TMDL for that watershed). Mt. Hope Bay has along history as a productive fishing ground for many important species, especially flounder, lobster and shellfish." (MassDEP 2002a).

The Narragansett/Mt. Hope Bay Watershed contains extensive areas of forest, open space, rural towns, and highly urbanized communities (Table 2-1; Figure 2-1). Surface waters in the watershed are commonly used for primary and secondary contact recreation (swimming and boating), public drinking water, viewing wildlife, habitat for aquatic life, lobster fishing, shellfishing and beachfront. Locations of public and semi-public marine beaches are illustrated on Figure 2-2. Detailed information regarding water quality at swimming beaches (both fresh and marine waters) can be obtained from the beach quality annual reports available for download at the Massachusetts Department of Public Health website: mass.digitalhealthdepartment.com/public_21/index.cfm). There are no offshore areas protected against the disposal of treated or untreated sewage from vessels in this watershed.

Table 2-1. Narragansett/Mt. Hope Bay Watershed Land Use as of 1999 (excluding the Palmer River subbasin).

Land Use Category	% of Total Watershed Area
Pasture	1.2
Urban Open	2.0
Open Land	4.6
Cropland	5.2
Woody Perennial	0.2
Forest	42.3
Wetland/Salt Wetland	1.9
Water Based Recreation	<0.1
Water	10.7
General Undeveloped Land	**68.3**
Spectator Recreation	<0.1
Participation Recreation	1.4
> 1/2 acre lots Residential	6.4
1/4 - 1/2 acre lots Residential	9.6
< 1/4 acre lots Residential	5.7
Multi-family Residential	0.3
Mining	0.2
Commercial	3.6
Industrial	2.0
Transportation	2.3
Waste Disposal	0.2
General Developed Land	**31.7**

Figure 2-1. Narragansett/Mt. Hope Bay Watershed (excluding the Palmer River subbasin) Land Use as of 1999.

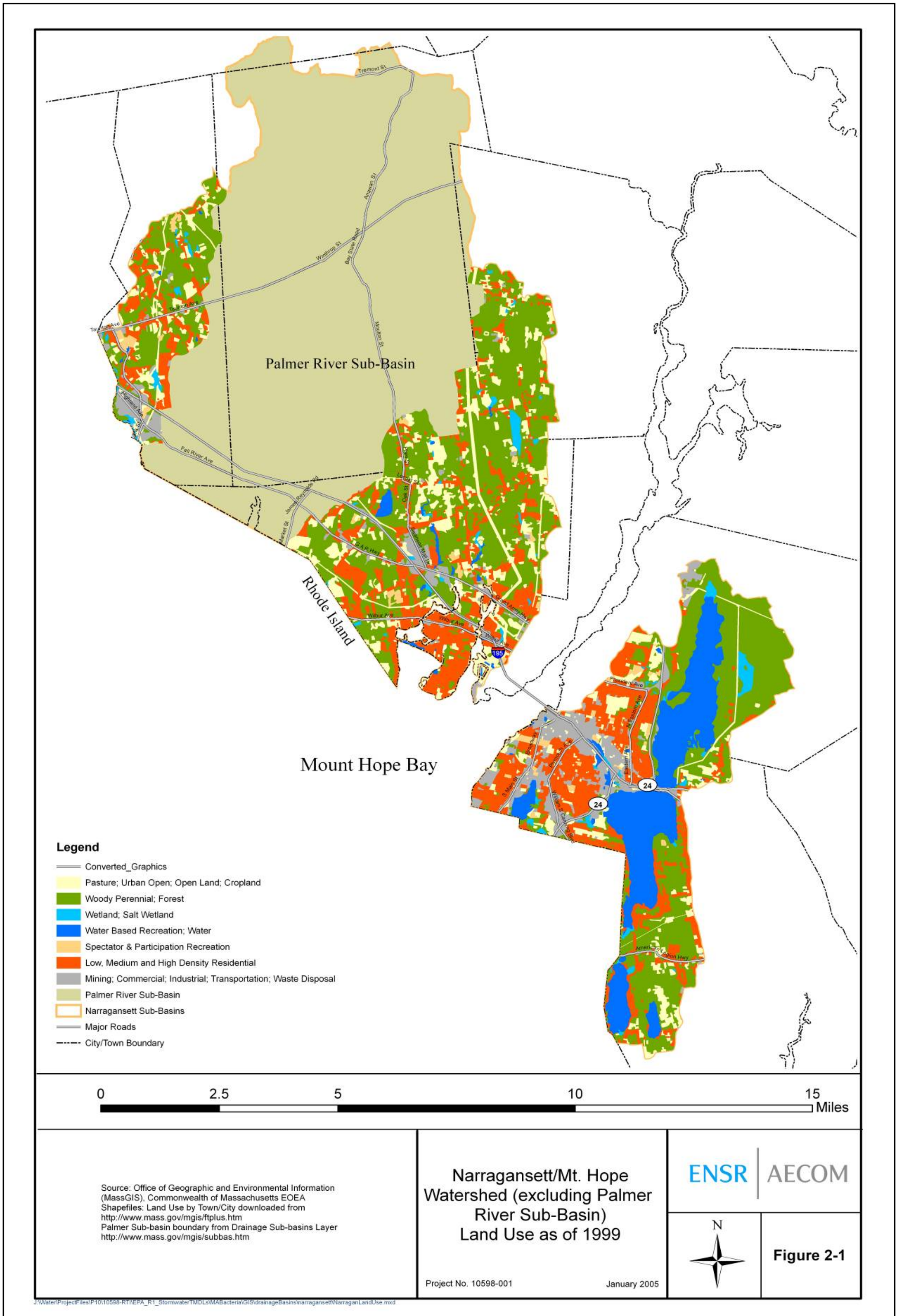
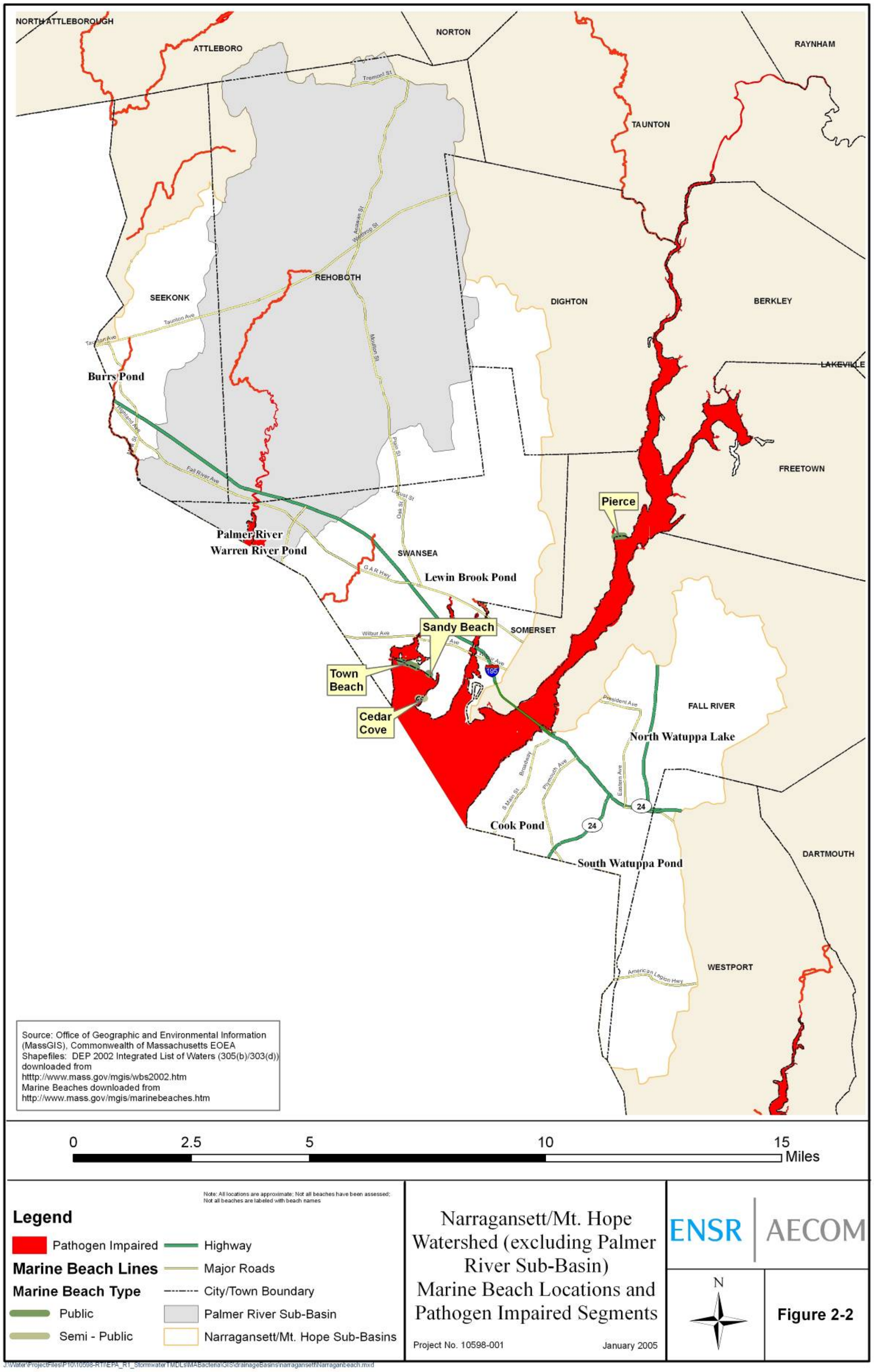


Figure 2-2. Narragansett/Mt. Hope Bay Watershed Marine Beach Locations and Pathogen Impaired Segments.



3.0 Water Quality Standards

The Surface Water Quality Standards (WQS) for the Commonwealth of Massachusetts establish chemical, physical and biological standards for the restoration and maintenance of the most sensitive uses (MassDEP 2000a). The WQS limit the discharge of pollutants to surface waters for the protection of existing uses and attainment of designated uses in downstream and adjacent segments.

The Narragansett/ Mount Hope Bay Watershed contains waterbodies classified as Class B, SA, and SB According the Mass Water Quality Standards these waters should be suitable for the following uses: (1) habitat for fish, other aquatic life, wildlife, (2) primary and secondary contact recreation, (3) shellfish harvesting in approved areas (were designated), and (4) should have consistently good aesthetic value (SA should be excellent). The pathogen impairments (exceedences of Fecal coliform, enterococci, and *E. coli* bacteria criteria) associated with the waterbody's of interest in this report affect all these uses. Because the WQS were in transition during the development of statewide pathogen TMDLs, and were formally changed after the draft reports were produced, the new bacteria indicator standards are presented in Table ES-1, and 7-1, and can be accessed at the following web address link: http://www.mass.gov/dep/service/regulations/314cmr04.pdf.

Fecal coliform, enterococci, and *E. coli* bacteria are found in the intestinal tract of warm-blooded animals, soil, water, and certain food and wood processing wastes. "Although they are generally not harmful themselves, they indicate the possible presence of pathogenic (disease-causing) bacteria, viruses, and protozoans that also live in human and animal digestive systems." (USEPA 2004a) These bacteria are often used as indicator bacteria since it is expensive and sometimes difficult to test for the presence of individual pathogenic organisms.

Massachusetts revised its freshwater WQS in 2007 by replacing fecal coliform with *E. coli* and enterococci as the regulated indicator bacteria, as recommended by the EPA in the "*Ambient Water Quality Criteria for Bacteria – 1986*" document (USEPA 1986). The WQS can be accessed at: http://www.mass.gov/dep/service/regulations/314cmr04.pdf. The state had previously done so for public beaches through regulations of the Massachusetts Department of Public Health as discussed below. Up until January of 2007 Massachusetts used fecal coliform as the indicator organism for all waters except for marine bathing beaches, where the Federal BEACH Act requires the use of enterococci. Massachusetts adopted *E. coli* and enterococci for all fresh waters and enterococci for all marine waters, including non-bathing marine beaches. Fecal coliform will remain the indicator organism for shellfishing areas, however.

Pathogens can significantly impact humans through ingestion of, and contact with recreational waters, ingestion of drinking water, and consumption of filter-feeding shellfish. In addition to contact recreation, excessive pathogen numbers impact potable water supplies. The amount of treatment (i.e., disinfection) required to produce potable water increases with increased pathogen contamination. Such treatment may cause the generation of disinfection by-products that are also harmful to humans. Further detail on pathogen impacts can be accessed at the following EPA websites:

- Water Quality Criteria: Microbial (Pathogen)
  http://www.epa.gov/waterscience/criteria/humanhealth/microbial
- Human Health Advisories:
  - Fish and Wildlife Consumption Advisories
  http://www.epa.gov/ebtpages/humaadvisoriesfishandwildlifeconsumptionadvi.html
  - Swimming Advisories
  http://www.epa.gov/ebtpages/humaadvisoriesswimmingadvisories.html

Shellfish growing areas are classified by the Massachusetts Division of Marine Fisheries (DMF). The classification system is provided below (MassGIS 2005). Figure 1-1 provides designated shellfish growing areas status as of 2009.

> **Approved** – "Open for harvest of shellfish for direct human consumption subject to local rules and state regulations." (MassGIS 2005) "The area is shown to be free of bacterial contaminants under a variety of climatological and hydrographical situations (i.e. assumed adverse pollution conditions)." (MassDEP 2002b).
>
> **Conditionally Approved** - "During the time area is approved it is open for harvest of shellfish for direct human consumption subject to local rules and state regulations." (MassGIS 2005) "This classification category may be assigned for growing areas subject to intermittent and predictable microbiological contamination that may be present due to operation of a sewage treatment plant, rainfall, and/or season." (MassDEP 2002b).
>
> **Conditionally Restricted** – "During the time area is restricted it is only open for the harvest of shellfish with depuration subject to local rules and state regulations." (MassGIS 2005) "A classification used to identify a growing area that meets the criteria for the restricted classification except under certain conditions described in a management plan." (MassDEP 2002b).
>
> **Restricted** – "Open for harvest of shellfish with depuration subject to local rules and state regulations or for the relay of shellfish." (MassGIS 2005) "A classification used to identify where harvesting shall be by special license and the shellstock, following harvest, is subject to a suitable and effective treatment process through relaying or depuration. Restricted growing areas are mildly or moderately contaminated only with bacteria." (MassDEP 2002b).
>
> **Management Closure** – "Closed for the harvest of shellfish. Not enough testing has been done in the area to determine whether it is fit for shellfish harvest or not." (MassDEP 2002b).
>
> **Prohibited –** "Closed for harvest of shellfish." (MassGIS 2005) "A classification used to identify a growing area where the harvest of shellstock is not permitted. Growing area waters are so badly contaminated that no reasonable amount of treatment will make the shellfish safe for human consumption. Growing areas must also be classified as Prohibited if there is no or insufficient information available to make a classification decision." (MassDEP 2002b).

In general, shellfish harvesting use is supported (i.e., non-impaired) when shellfish harvested from approved open shellfish areas are suitable for consumption without depuration and shellfish harvested from restricted shellfish areas are suitable for consumption with depuration. For an expanded discussion on the relationship between the DMF shellfish growing areas classification and the MassDEP designated use support status, please see any of the completed MassDEP Water Quality Assessment Reports available on the worldwide web (for example the "*Buzzards Bay Watershed 2000 Water Quality Assessment Report*" available at: www.mass.gov/dep/water/resources/wqassess.htm.

In addition to the WQS, the Commonwealth of Massachusetts Department of Public Health (MADPH) has established minimum standards for bathing beaches (105 CMR 445.000) under the State Sanitary Code, Chapter VII (mass.digitalhealthdepartment.com/public_21/index.cfm). The MADPH bathing beach standards are generally the same as those which were recommended in the "*Ambient Water Quality Criteria for Bacteria – 1986"* document published by the EPA (USEPA 1986). In the above referenced document, the EPA recommended the use of enterococci as the indicator bacterium for marine recreational waters and enterococci or *E. coli* for fresh waters. As such, the following MADPH standards have been established for bathing beaches in Massachusetts:

> Marine Waters - (1) No single enterococci sample shall exceed 104 colonies per 100 mL and the geometric mean of the most recent five enterococci levels within the same bathing season shall not exceed 35 colonies per 100 mL.
>
> Freshwaters - (1) No single *E. coli* sample shall exceed 235 colonies per 100 mL and the geometric mean of the most recent five *E. coli* samples within the same bathing season shall not exceed 126 colonies per 100 mL; or (2) No single enterococci sample shall exceed 61 colonies per 100 mL and the geometric mean of the most recent five enterococci samples within the same bathing season shall not exceed 33 colonies per 100 mL.

The Federal BEACH Act of 2000 established a Federal standard for marine beaches. These standards are essentially the same as the MADPH marine beach standard (i.e., single sample not to exceed 104 cfu/100mL and geometric mean of a statistically sufficient number of samples not to exceed 35 cfu/100mL). The Federal BEACH Act and MADPH standards can be accessed at www.epa.gov/waterscience/beaches/rules/act.html

Figure 2-2 provides the location of marine bathing beaches, where the MADPH Marine Waters and the Federal BEACH Act standards would apply. A map of freshwater beaches is not available at this time. However, a list of beaches (fresh and marine) by community with indicator bacteria data can be found in the annual reports on the testing of public and semi-public beaches provided by the MADPH. These reports are available for download from the MADPH website located at: mass.digitalhealthdepartment.com/public_21/index.cfm .

4.0 Problem Assessment

Pathogen impairment has been documented at numerous locations throughout the Narragansett/Mt. Hope Bay Watershed, as shown in Figure 1-1. Excessive concentrations of indicator bacteria (e.g., fecal coliform, enterococci, *E. coli* etc.) can indicate the presence of sewage contamination and possible presence of pathogenic organisms. The amount of indicator bacteria and potential pathogens entering waterbodies is dependent on several factors including proximity to sources, watershed characteristics and meteorological conditions. Indicator bacteria levels generally increase with increasing development activities, including increased impervious cover, illicit sewer connections, and failed septic systems.

Indicator bacteria levels also tend to increase with wet weather conditions as storm sewer systems overflow and/or stormwater runoff carries fecal matter that has accumulated to the river via overland flow and stormwater conduits. In some cases, dry weather bacteria concentrations can be higher when there is a constant source that becomes diluted during periods of precipitation, such as with illicit connections. The magnitude of these relationships is variable, however, and can be substantially different temporally and spatially throughout the United States or within each watershed.

Tables 4-1 and 4-2 provide ranges of fecal coliform concentrations in stormwater associated with various land use types. Pristine areas are observed to have low indicator bacteria levels and residential areas are observed to have elevated indicator bacteria levels. Development activity generally leads to decreased water quality (e.g., pathogen impairment) in a watershed. Development-related watershed modification includes increased impervious surface area which can (USEPA 1997):

- increase flow volume,
- increase peak flow,
- increase peak flow duration,
- increase stream temperature,
- decrease base flow, and
- change sediment loading rates.

Many of the impacts associated with increased impervious surface area also result in changes in pathogen loading (e.g., increased sediment loading can result in increased pathogen loading). In addition to increased impervious surface impacts, increased human and pet densities in developed areas increase potential fecal contamination. Furthermore, stormwater drainage systems and associated stormwater culverts and outfall pipes often result in the channelization of streams which leads to less attenuation of pathogen pollution.

Pathogen impaired estuary segments represent 100.0% of the total estuary area assessed (5.2 impaired square miles; 5.2 total square miles assessed; includes areas associated with two Palmer River estuaries with an existing TMDL). Pathogen impaired river segments represents 77% of the total river miles assessed (12.4 impaired miles; 16.1 total miles assessed; includes river miles associated with Kickamuit and Palmer Rivers with an existing or pending TMDL). In total, seven segments, each in need of a TMDL, contain indicator bacteria concentrations in excess of the Massachusetts WQS for Class A, SA, B, or SB waterbodies (314 CMR 4.05)[1], the MADPH standard for bathing beaches[1], and/or the BEACH Act.

Table 4-1. Wachusett Reservoir Stormwater Sampling (as reported in MassDEP 2002c) original data provided in MDC Wachusett Stormwater Study (June 1997).

Land Use Category	Fecal Coliform Bacteria[1] cfu/100 mL
Agriculture, Storm 1	110 – 21,200
Agriculture, Storm 2	200 – 56,400
"Pristine" (not developed, forest), Storm 1	0 – 51
"Pristine" (not developed, forest), Storm 2	8 – 766
High Density Residential (not sewered, on septic systems), Storm 1	30 – 29,600
High Density Residential (not sewered, on septic systems), Storm 2	430 – 122,000

[1] Grab samples collected for four storms between September 15, 1999 and June 7, 2000

Table 4-2. Lower Charles River Basin Stormwater Event Mean Bacteria Concentrations (data summarized from USGS 2002)[1].

Land Use Category	Fecal Coliform (cfu/100 mL)	Enterococcus Bacteria (cfu/100 mL)	Number of Events
Single Family Residential	2,800 – 94,000	5,500 – 87,000	8
Multifamily Residential	2,200 – 31,000	3,200 – 49,000	8
Commercial	680 – 28,000	2,100 – 35,000	8

[1] An Event Mean Concentration (EMC) is the concentration of a flow proportioned sample throughout a storm event. These samples are commonly collected using an automated sampler which can proportion sample aliquots based on flow.

MassDEP collected the data that formed the basis for impairment listings, which are summarized in the *2008 Integrated List* (MassDEP 2008). For more information regarding the basis for listing particular segments for pathogen impairment, please see the Assessment Methodology section of the MassDEP Water Quality Assessment report (WQA) for this watershed.

A list of pathogen impaired segments requiring TMDLs is provided in Table 4-3. This TMDL does not, however, apply to the Palmer River (MA53-03; MA53-04; MA53-05) in Rehoboth and Kickamuit River (MA61-08) in Swansea, as pathogen TMDLs for these segments have been previously developed. It should be noted that in 2009 the Lee and Coles Rivers have recently been opened to shellfishing (May 1 – November 30), however, they are both subject to rain closure (5 days) for events exceeding 0.3 inches of precipitation (measured at 8 AM). There also has been a recent proposal to designate Mt. Hope Bay as a no discharge zone. As of the date of this report the designation has not been made as not all the local boat pump-outs are in operation.

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[1] or [2] **See Table ES-2, or Table 7-1, or web address link**:
http://www.mass.gov/dep/service/regulations/314cmr04.pdf

Table 4-3. Narragansett/Mt. Hope Bay Watershed Pathogen Impaired Segments Requiring TMDLs (adapted from MassGIS 2005 and MassDEP 2005a).

Segment ID	Segment Name	Segment Type	Size[1]	Segment Description
MA53-01	Runnins River	River	3.7	Route 44 to Mobile Dam, Seekonk.
MA53-06	Warren River Pond	Estuary	0.06	Salt Pond in Swansea on MA/RI border.
MA61-01	Lee River	River	0.53	From confluence with Lewin Brook, Swansea to Route 6, Swansea/Somerset. Miles 0.6-0.0
MA61-02	Lee River	Estuary	0.51	Route 6, Swansea/Somerset to mouth at Mount Hope Bay, Swansea.
MA61-04	Cole River	Estuary	0.31	Route 6 to the mouth at Old Railway Grade, Swansea.
MA61-06	Mount Hope Bay	Estuary	2.3	From the Braga Bridge to the MA/RI state border, Swansea/Fall River east of a line from Brayton Point to Buoy #4.
MA61-07	Mount Hope Bay	Estuary	1.8	West of a line from Brayton Point to Buoy #4. (Mass. Portion)

[1] Units = Miles for river segments and square miles for estuaries

A summary and overview of the Narragansett/Mt. Hope Bay Watershed water quality in relation to pathogen impairment is provided below. Data from the *Narragansett/Mt. Hope Bay Watershed 1999 Water Quality Assessment Report,* (MassDEP 2002a) and recent RIDEM Water Quality Surveys was reviewed and summarized by segment for illustrative purposes. It should be noted that not all data presented herein were used to determine impairment listing, due to a variety of reasons (including data quality assurance and quality control). The MassDEP used only a subset of the available data to generate the *2008 Integrated List*. Other data presented in this section are for illustrative and comparison purposes only.

Data from the Massachusetts Division of Marine Fisheries (DMF) were used, in part, as the basis for pathogen impairment for many of the estuarine areas (Figure 1-1). Numerous samples have been collected throughout the Narragansett/Mt. Hope Bay Watershed by the DMF. DMF has a well-established and effective shellfish monitoring program that provides quality assured data for each shellfish growing area. In addition, each growing area must have a complete sanitary survey every 12 years, a triennial evaluation every three years and an annual review in order to maintain a shellfishing harvesting classification with the exception of those areas already classified as Prohibited. The National Shellfish Sanitation Program establishes minimum requirements for sanitary surveys, triennial evaluations, annual reviews and annual fecal coliform water quality monitoring and includes identification of specific sources and assessment of effectiveness of controls and attainment of standards. Each year water samples are collected by the DMF at 2,320 stations in 294 growing areas in Massachusetts's coastal waters at a minimum frequency of five times while open to harvesting (DMF 2002) Due to the volume of data collected by the DMF, a subset of recent relevant data are summarized in this report. For future updates on indicator bacteria sampling data, please contact your local city or town shellfish constable or DMF's Shellfish Project.

In addition, the Massachusetts Department of Public Health (MADPH) publishes annual reports on the testing of public and semi-public beaches for both marine and fresh waters. These documents provide water quality data for each bathing beach by community and note if there were exceedences of water quality criteria. There is also a list of communities that did not report testing results. These reports can be downloaded from mass.digitalhealthdepartment.com/public_21/index.cfm. Please see the MADPH annual beach report for specific details regarding swimming beaches.

The following sections provide a summary of available data for impaired segments listed on the state 2008 Integrated List. In some cases the data may be dated but are provided to demonstrate the various degree of contamination observed over time. Data summarized in the following subsections can be found at:

- **MassDEP WQA** – Narragansett/Mt. Hope Bay River Watershed 1999 Water Quality Assessment Report available for download at www.mass.gov/dep/water/resources/wqassess.htm.
- **RI DEM -** TMDL for Mount Hope Bay and the Kickamuit Estuary http://www.dem.ri.gov/programs/benviron/water/quality/rest/pdfs/mthope.pdf,
- **RIDEM -** Fecal Coliform TMDL Runnins River http://www.dem.ri.gov/programs/benviron/water/quality/rest/pdfs/runfinal.pdf

Runnins River Segment MA53-01

This segment is a 3.7 mile Class B warm water fishery that extends from Seekonk, Massachusetts to the Rhode Island border. At the Rhode Island border, this river becomes the Barrington River, a Class SA water in RI. There are no National Pollutant Discharge Elimination System (NPDES) permits to this segment listed in the WQA (MassDEP 2002a). However, the town of Seekonk holds a municipal separate storm sewer system (MS4) NPDES permit (MAR041156) for the discharge of stormwater through the town's municipal separate storm sewer system. Massachusetts, Division of Marine Fisheries (MADMF) Shellfish Growing Area Status as of 2009 is Prohibited (Figure 1-1).

In July 1999 DWM collected fecal coliform and *E. coli* bacteria from two stations (RU01 and RU03) on this segment of the Runnins River and on a small-unnamed tributary to the Runnins River. These sampling events were indicative of dry weather conditions. The Runnins River fecal coliform bacteria counts were 4,400 cfu/100mL at the upstream station (upstream of Old Grist Mill and Burrs Ponds) and 7,900 cfu/100mL at the downstream station (School Street). *E. coli* counts at the same two stations were 760 and 3,900 cfu/100mL respectively. Florescent Whitening Agents (FWA), used primarily in source identification, was not detected at any of the stations.

RIDEM began a dry weather monitoring program in 1995 to identify dry weather sources of fecal coliform bacteria and their loadings to the Runnins River (RIDEM 2002). Samples were typically collected at eight stations on the Runnins River between October 1995-1997. Between Grist Mill Pond and the Cemetery Stream confluence (the middle reach of this segment of the Runnins River) no fecal coliform bacteria counts exceeded 300 cfu/100mL.

During the same time period, as part of RIDEM's Runnins River TMDL studies, wet weather bacteria sampling was conducted in 1995 and 1998. Results of this data indicate moderate to high levels of bacteria throughout most all reaches of the River. All fecal coliform bacteria samples collected as part of the 1998 survey at School Street were greater than 400 cfu/100mL and five were greater than 4,000 cfu/100mL (RIDEM 2002). At the same time, a separate RIDEM bacteria characterization study found numerous elevated levels (>400 cfu/100mL) at several stations in the middle reaches of this segment above School Street during the primary contact recreation season, with Station (1A), sampled on the upstream side of the Pleasant Street Bridge (upstream of Burrs Pond and Grist Mill Pond) having a geometric mean of 63,615 cfu/100mL. RIDEM stated in their TMDL report, "Fecal Coliform TMDL for the Runnins River, Rhode Island", that on- site wastewater disposal system failures were observed just downstream from the

Route 6 Bridge on the Massachusetts side of the border. The systems failures included businesses with older malfunctioning systems and cesspools, undersized systems, and systems with waste loads beyond their capacity. Also, at the time of TMDL sampling in the late 1990s, a sewer pump station in East Providence periodically surcharged in wet weather events; however, this concern has subsequently been resolved. Summer peaks in bacteria levels were observed to correlate with increased water consumption. In the southern part of Seekonk, south of School Street, the source regions of the Runnins River are comprised of a network of wetlands and marshes with Phragmities. According to RI DEM, conditions in this area are prime for bacteria to accumulate and multiply (RIDEM 2002).

While the above RIDEM studies were occurring, Mr. Doug Rayner, a member of the Pokanoket Watershed Alliance, was conducting a separate study between 1990 and 1998 to develop an extensive wet and dry weather fecal coliform bacteria data base at the School Street station (RIDEM 2002). The Rayner dry weather data were used in the RIDEM Runnins River TMDL Study to illustrate historical trends, seasonal variations, and to provide a comparison with data collected by RIDEM (see Table 4-4 below). However, RIDEM data were used to develop their TMDL.

The Rayner data was selected by MassDEP for use in this TMDL because of the large number of samples that were collected in both dry and wet weather, and the fact that the School Street location (within the MA segment) is an excellent representation water quality conditions in the mid to southern portion of this watershed. Therefore, for this particular TMDL, the School Street station data set was utilized in determining loading percent reductions later in this report (see Section 7.3).

Table 4-4 below summarizes year round wet and dry weather Fecal Coliform sampling results from the Rayner Seasonal dry weather sampling, between 1990- 1998 at the School Street station (289 samples), and Rayner 1990-1998 seasonal wet weather sampling over the same period at the School Street station (265 samples). All RIDEM data is available in the Appendix Section of the report, "Fecal Coliform TMDL for the Runnins River, Rhode Island" (RIDEM, 2009). The RIDEM and Rayner data sources confirm the presence of elevated levels of pathogen bacteria. MassDEP summarized the most recent year round (1998) wet weather Rayner School Street studies to illustrate wet weather ambient conditions were still elevated for bacteria. The most recent wet weather data collected in 1998 was used to calculate loadings reductions that would be required for this particular segment to meet pathogen water quality standards in section 7.3.

Table 4-4. MA53-01 Runnins River RIDEM; Rayner, School Street Indicator Bacteria Data Summary.

Station(s)	Range of Fecal Coliform (cfu/100mL) (No. of Samples/Year- round)	Geometric Mean (cfu/100 ml)	90^{th} Percentile (cfu/100 ml)
Dry Weather (1990-1998) School Street, Rayner Studies	2 - 9,000 (289)	300	Not available
Wet weather (1990-1998) School Street Rayner Studies	2 - 83,000 (265)	1,054	Not available
Wet weather 1998 only School Street Rayner Studies	20- 12,000 (15)	298	3,728

More recently, the MassDEP SERO Bacteria Source Tracking (BST) tracking Program conducted dry weather bacteria monitoring (using Colilert tm and Enterolert tm testing) on the MA portions of the River during the 2007- 2009 time period. Eight stations were sampled once in 2007, 18 stations were sampled 1-3 times in 2008, and 11 stations were sampled once in 2009. Results, indicated the principal problem area being the triangle section of the River between Mink Street and School Street, Seekonk MA. A total of eight stations within this locality were sampled between one and three times, with E. coli counts often in the 1,000- 9,000 MPN range. The principal source area was identified as approximately 100 to 330 feet upstream of the School Street Bridge. Suspected sources are either phragmities wetland systems, or (yet) unidentified stormdrain manholes draining into the area.

The Pokanoket Watershed Alliance sampled for Fecal Coliform at 3 locations (School Street, Mink Street, and Burrs Road) on four dates, (a total of 12 samples taken), between September and December, 2006. The results ranged between 5- 23,000 cfu/100mL. Two results at School Street, and one result at Mink Street, were 5,100 cfu/100mL or higher. The more recent data sets collected by the MassDEP SERO Bacteria Source Tracking (BST) tracking Program and the Pokanoket Watershed Alliance indicate the bacteria levels are comparable to the levels recorded by Rayner in 1998.

Warren River Pond Segment MA53-06

This segment is a 0.06 square mile Class SA warm water fishery located in the town of Swansea. It adjoins the Lower Palmer River near the MA/RI border. The pond is a salt pond and was therefore assessed as an estuarine river segment. There are no regulated discharges in this segment (MassDEP 2002a). However, the town of Swansea holds a MS4 permit (MAR041163) for the discharge of stormwater through the municipal separate storm sewer system.

MADMF conducted fecal coliform sampling within this segment very sporadically between April 1979 and September 1999. Three of the four highest levels were on wet days with at least .20 inches of rain on the sampling day. One sampling station (#2) in the northeast quadrant of the pond was sampled: 4/1979, 9/1995, and 7/1997 and readings were observed to range between 6- 80 cfu/100mL. Another station (#1) in the southern most part of the pond near the RI border was sampled in 4/1979, 5/1979, 9/1995, and 7/1997. Readings were observed to range between 28- 420 cfu/100mL. Station (#6), located in the western most part of the pond, was sampled in 4/1979, 5/1979, 7/1997, 8/1997, 8/1999, and 9/1999 with readings observed between 10- 460 cfu/100mL.

Data were limited in the Warren River segment and the most recent wet weather MA DMF data collected in 1997 is summarized in Table 4-5 below. As a result of limited data the 1997 information was used to calculate loadings reductions that would be required for this particular segment to meet pathogen water quality standards in section 7.3.

Table 4-5. MA53-06 Warren River Pond MA DMF Indicator Bacteria Data Summary.

Stations	Range of Fecal Coliform cfu/100mL (No. of Samples)	Geometric Mean (cfu/100 mL)	90^{th} Percentile (cfu/100 mL)
Stations (1997) #3, #4, #5, #6, #7, #8	230- 1,000 (6)	412	755

Massachusetts, Division of Marine Fisheries (MADMF) Shellfish Growing Area Status as of 2009 is Prohibited (Figure 1-1).

Lee River Segment MA61-01

This segment is a 0.53 mile Class B warm water fishery. The segment starts at the confluence with Lewin Brook and ends at Route 6 in Swansea/Somerset. It adjoins the Lee River Segment MA61-02 immediately downstream (a Class SA segment). There are no regulated discharges listed in the WQA for this segment (MassDEP 2002a). However, the Town of Swansea holds an MS4 permit (MAR041163) for the discharge of stormwater through the town's municipal separate storm sewer system.

The MassDEP DWM collected grab samples for fecal coliform and *E. coli* at five ambient stations during August and September 1999. Two stations along the Lee River mainstem had Fecal Coliform counts (n=4) ranging between 50- 81 cfu/100mL. Three stations along an unnamed tributary, in the vicinity of Elm St., Swansea, connecting to the Lee River had Fecal Coliform counts (n=5) ranging between 330- 2,900 cfu/100mL (see Table 4-6 below). It should be noted that the sampling in the unnamed tributary followed dry weather. For a complete listing of MassDEP DWM data please see Appendix B of the WQA (MassDEP 2002a).

MassDEP selected the data from the unnamed tributary near Elm St., Swansea, to calculate loadings reductions that would be required for this particular segment to meet pathogen water quality standards (see Table 4-6 below). Massachusetts, Division of Marine Fisheries (MADMF) Shellfish Growing Area Status as of 2009 is Prohibited (Figure 1-1).

Table 4-6. MA61-01 Lee River MassDEP Indicator Bacteria Data Summary.

Stations	Range of Fecal coliform , cfu/100mL. (No. of Samples)	Geometric Mean (cfu/100 mL)	90^{th} Percentile (cfu/100 mL)
Stations (1999) LR 07A, LR 07, LR 08	330- 2,900 (5)	1061	2,300

Lee River Segment MA61-02

This segment is a 0.51 square mile Class SA waterbody. The segment begins at Route 6 in Swansea/Somerset and continues into Mt. Hope Bay, (Mt. Hope Bay MA 61-07, a Class SA segment) in Swansea. Dominion Energy Brayton Point, L.L.C., maintains a NPDES permit (MA0003654) to discharge non-contact cooling water to Mt. Hope Bay. The towns of Swansea (MAR041163) and Somerset (MAR041159) hold permits for the discharge of stormwater through their MS4s.

The MADMF collected 199 fecal coliform samples from five stations within this segment[1] between January 1996 and July 2001. Fecal coliform counts ranged between 1.9 and 312 cfu/100mL (MassDEP 2002a). Between September 2003, and March 2009 the MA DMF also collected 229 fecal coliform samples from the same five stations within this segment. Counts ranged between less than 1 and greater then 312 cfu/100mL.

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1 DMF data, 1996- 2001, and 2003- 2009 not utilized in due to not being current, and /or maximum sample reading limitation of either 80 or 312 cfu/100mL.

The Rhode Island Department of Environmental Management (RIDEM), in cooperation with the Massachusetts Division of Marine Fisheries (MADMF), conducted an ambient water quality investigation for bacteria in 2006 to support a Rhode Island TMDL evaluation of Mount Hope Bay and the Kickemuit River in Rhode Island. Part of the study was to also monitor (by MADMF) adjoining Massachusetts Waters in the MA segments: MA 61-02, Lee River; MA61-04, Cole River; MA 61-06, Mount Hope Bay; MA 61-07, Mount Hope Bay. For the Massachusetts portions there were 5 sampling days between June 1-6, 2006: June 1st was just before a major rain event; June 3rd during the first part of the rain event; June 4th, during the last part of the rain event (total rain ~2.50 inches); June 5th, just after the conclusion of the rain event; and June 6th, one day after the rain event. There were 4 DMF stations sampled within this segment, which were sampled 5 times over the 6 day period (RIDEM 2006). Fecal Coliform readings ranged between 3-460 cfu/100mL (20 total samples).

The data from DMF station MHB 3-4 (survey described above) with the highest geometric average is summarized in Table 4-7 below and was used to calculate loadings reductions that would be required for this particular segment to meet pathogen water quality standards in section 7.3.

Table 4-7. MA61-02 Lee River MADMF Indicator Bacteria Data Summary.

Stations	Range of Fecal Coliform cfu/100mL (No. of Samples)	Geometric Mean (cfu/100 mL)	90th Percentile (cfu/100 mL)
MHB 3.4 (2006)	10- 312 (5)	108	312

MADMF also conducted a sanitary survey of a number of stormdrains within the segment on 3 occasions following rain events between August, 2008 and April, 2009. Fecal coliform results ranged between less than 100 to greater than 8,000 cfu/100mL, with many results greater than 1,600 cfu/100mL. Stormwater runoff was identified as the principal source of pollution. Selected sampling following dry weather generally had acceptable low levels. As a result of ambient 2003-2009 monitoring data and stormwater controls put in place by the Town of Swansea (including septic system maintenance), the DMF Shellfish Growing Area Status was amended as of the end of 2009. Specifically, shellfishing areas (MHB 3.1, Lower River) up to Route 103 were reclassified to "Conditionally Approved" and open to shellfishing when less than .3 inches of rain falls. However, four small shellfishing areas on the periphery of the Lower River area, MHB 3.0 (northern end of the river), MHB 3.2 (#42, Lands End Way), MHB 3.3 (#24 Lands End Way), and MHB 3.4 (#70 Lees River Drive) remain "Prohibited" with no shellfishing permitted.

<u>Cole River Segment MA61-04</u>

This segment is a 0.31 square mile Class SA waterbody. This segment begins at Route 6 in Swansea and extends to the mouth at Old Railway Grade in Swansea, (into Mt. Hope Bay MA 61-07, a Class SA segment). This segment is considered tidal with a salt marsh border of varying widths. The Swansea Plant Complex holds a multi-sector general NPDES stormwater permit (MAR05C096) to discharge stormwater to this segment. This segment also receives stormwater from the town of Swansea (MS4 permit MAR041163).

The MADMF collected 201 fecal coliform samples from five stations within this segment[1] between January 1996 and July 2001. Fecal coliform counts ranged between 1.9 and 312 cfu/100mL (MassDEP 2002a). The MADMF also collected 437 fecal coliform samples from between five and ten stations within this segment between September 2003, and March 2009. Counts ranged between less than 1 and greater than 312 cfu/100mL.

The Rhode Island Department of Environmental Management (RIDEM), in cooperation with the Massachusetts Division of Marine Fisheries (MADMF), conducted an ambient water quality investigation for bacteria in 2006 to support a Rhode Island TMDL evaluation of Mount Hope Bay and the Kickemuit River in Rhode Island. Part of the study was to monitor (by MADMF) adjoining Massachusetts Waters in the MA segments: MA 61-02, Lee River; MA61-04, Cole River; MA 61-06, Mount Hope Bay; MA 61-07, Mount Hope Bay. For the Massachusetts portions, there were 5 sampling days between June 1-6, 2006 (see Table 4-8 below): As noted in the summary above June 1 was just before a major rain event; June 3, during the first part of the rain event; June 4, during the last part of the rain event (total rain ~2.50 inches); June 5, just after the conclusion of the rain event; and June 6, one day after the rain event. There was one station at the southernmost extreme end of the segment that was sampled 5 times over the 6 day period. Fecal Coliform results (16 total samples) ranged 14- 4,500 cfu/100 mL with a geometric mean of 251 cfu 100/mL.

MassDEP also summarized the 1999 data (total of 5 samples) from 3 of the stations (CO01, CO03A, CO04), in close proximity of approximately a mile of each below. Measurements ranged from 290 to 4,500 cfu/100mL with a geometric mean of 980 cfu/100mL. For a complete listing of these data please see Appendix B of the WQA (MassDEP 2002a). This data was used to calculate loadings reductions that would be required for this particular segment to meet pathogen water quality standards (see Section 7.3). It should be noted that 3 of the 6 samples were taken after a rainfall event of approximately 0.4 inches of rain. Therefore, data from this station are to be interpreted as representative of wet weather conditions. Multiple FWAs were identified at levels just above their detected limits at station CO04 and CO01 that indicate anthropogenic sources. The 1999 MassDEP results are comparable to the 2006 RIDEM water quality survey.

Table 4-8. MA61-04 Cole River MassDEP Indicator Bacteria Data Summary.

Stations	Range of Fecal Coliform (cfu/100mL) (No. of Samples)	Geometric Mean (cfu/100 mL)	90^{th} Percentile (cfu/100 mL)
3 stations (1999) CO01, CO03A, CO04	290- 4,500 (5)	980	3,300

MADMF also conducted a sanitary survey of a number of stormdrains within the segment on 3 occasions following rain events on August 5, 11, and November 25, 2008. Results for these three events ranged from 100 to greater than 80,000 cfu/100mL. Stormwater runoff was identified as the principal source of pollution.

1 DMF data, 1996- 2001, and 2003- 2009 not utilized in due to not being current, and /or maximum sample reading limitation of either 80 or 312 cfu/100mL.

As a result of improvements in recent DMF dry weather ambient data, and stormwater controls put in place by the Towns of Swansea and Somerset (including improved septic system maintenance) in recent years, the DMF Shellfish Growing Area Status was reclassified as of the end of 2009. Specifically the majority of the main body of the lower section of the Coles River was upgraded to “Conditionally Approved”, and open to shellfishing when less than .3 inches of rain falls, however, three small areas within the lower section, MHB 4.3 (Swansea Marina), MHB 4.2 (Pearse Road), MHB 4.0 (Upper River) remain “Prohibited”, and closed to shellfishing.

Mt. Hope Bay Segment MA61-06

This segment is a 2.3 square mile Class SB, waterbody that extends from the Braga Bridge in Swansea/Fall River to the Massachusetts/Rhode Island border in the Swansea/Fall River. Twenty-five percent of Mt. Hope Bay is located within Massachusetts.

The Fall River WWTP is permitted (MA0100382) to discharge treated sewage and stormwater. The plant has the capacity to treat 50 MGD (full treatment) of sewage with wet weather treatment capacity recently increased to 106 MGD (primary, chlorination and dechlorination). The CSO program included the construction of a 20-foot Diameter Deep Rock Tunnel, 3 miles long and 100 feet deep that provides 85 million gallons of storage capacity. The purpose of the CSO tunnel is to provide storage for wet weather events for later treatment. This water is later gravity fed to the WWTP for full secondary treatment during dry weather.

There is one current screening and disinfection station (Cove Street). Three other discharges (CSO’s) have until 2012-2015 for elimination, sewer separation or other (treatment or screening and chlorination. The CSO system is designed to handle a 3 month storm (1.72 inches of precipitation in a 12 hour period). The Long Term CSO Control Plan (LTCP) and Facilities Management Plan which, when completed, will reduce the untreated CSO discharges from 691 to less than 4 per year and the annual average CSO volume from 1508 to 116 million gallons per year. The Administrative Order requires both dry and wet weather sampling to determine if conditions have improved.

The Taunton WWTP is permitted (MA0100897) to discharge 8.5 MGD to a Taunton River segment which flows into Mt. Hope Bay. Taunton has one CSO, which presently has only a bar rack (no chlorination). The City of Taunton is currently testing the sewer system in an attempt to reduce inflow and infiltration. They are currently under an Administrative Order that has a December 31, 2010 deadline to eliminate this CSO or implement either stormwater retention and/or treatment (chlorination).

Dominion Energy Brayton Point, L.L.C., (at Brayton Point Station) is permitted to discharge non-contact cooling water, industrial generated wastewater, backwash, intake screen wash, and stormwater via 12 outfalls within this segment of Mt. Hope Bay, with a maximum discharge of 1452.5 MGD (MA0003654). There are four multi-sector NPDES stormwater permittees in this Mt Hope Bay segment: Tillotson Complex (MAR05C009), Duro Plant No. 2 (MAR05B947), Duro Textile Printeres (MAR05B946), and Duro Finishing (MAR05B945) (MassDEP 2002a). In addition, segment 61-06 receives stormwater from the MS4 communities of Fall River (MAR041113) and Somerset (MAR041159).

The MADMF collected 201 fecal coliform samples from nine stations within this segment[1] between May 1996 and July 2001. Fecal coliform counts ranged between 1.9 and 312 cfu/100mL (MassDEP 2002a). The MADMF Shellfish Status Report of October 2000 indicates that shellfish growing areas MHB 1.1, and MHB 2.1 (totaling 2.2 mi^2) are restricted while shellfish growing areas MHB 1.2, and MHB 2.3 (totaling 0.2 mi^2) are prohibited (DFWELE 2000). These shellfish growing areas encompass this entire segment of Mt. Hope Bay.

The Rhode Island Department of Environmental Management (RIDEM), in cooperation with the Massachusetts Division of Marine Fisheries (MADMF), conducted an ambient water quality investigation for bacteria in 2006, to support a Rhode Island TMDL evaluation of Mount Hope Bay and the Kickemuit River in Rhode Island. Part of the study was to also monitor (by MADMF) adjoining Massachusetts Waters in the MA segments: MA 61-02, Lee River; MA61-04, Cole River; MA 61-06, Mount Hope Bay; MA 61-07, Mount Hope Bay. As previously described for the Massachusetts portions, there were 5 sampling days between June 1-6, 2006: June 1st was just before a major rain event; June 3rd was during the first part of the rain event; June 4th, during the last part of the rain event (total rain ~2.50 inches); June 5th just after the conclusion of the rain event; and June 6th one day after the rain event. There were 7 RIDEM/ MADMF stations sampled within this segment which were sampled 4-6 times over the 6 day period. There was a second wet weather event between October 11- 17, where 3 stations were sampled 7 times within this segment. The rain event (~total of 1.59 inches) was at maximum on 12 October. The Fecal Coliform readings from all the MADMF June and October, 2006 sampling (a total of 56 readings) ranged between 2-2,400 with a geometric mean of 36 cfu/100/mL.

MassDEP summarized the 2006 data from the station (MHB 2-4) that had the highest geometric average (from a total of 5 samples) during these two sampling periods in Table 4-9. This data was used to calculate loadings reductions that would be required for this particular segment to meet pathogen water quality standards (see Section 7.3).

Table 4-9. MA61-06 Mount Hope Bay RIDEM Indicator Bacteria Data Summary.

Station	Range of Fecal Coliform cfu/100mL. (No. of Samples)	Geometric Mean (cfu/100 mL)	90th Percentile (cfu/100 mL)
MHB 2-4 (2006)	23- 2,400 (5)	271	1624

Just upstream from this segment, in the Taunton River segment (MA62-04), the RIDEM and MADMF had 8 sampling stations which extend as far as the City of Taunton. These were sampled 4 times between June 1 -5 (see Table 4-10 below). Fecal coliform levels ranged between 3- 1,500 cfu/100mL.

[1] DMF data, 1996- 2001, not utilized due to not being current, and maximum sample reading limitation of 312 cfu/100mL.

Table 4-10. MA62-04 Taunton River Segment (just upstream of Mount Hope Bay MA61-06 Segment) RIDEM and MADMF Ambient 2006 Indicator Bacteria Data Summary.

Stations	Range of Fecal Coliform cfu/100mL (No. of Samples)	Geometric Mean (cfu/100mL)	90th Percentile (cfu/100mL)
8 stations, sampled 5 times, June 1-6, 2006	3- 1,500 (40)	133	460

It is important to emphasize as part of the development of this TMDL the very obvious water quality impacts observed in the eastern part of Mount Hope Bay, segment MA61-06 (which is adjacent to the City of Fall River), following a rain event. The elevated levels appear to be the result of CSO discharges from the City of Fall River. Also, several data points in the RI Study on the Taunton River above Fall River indicate some bacteria increases following wet weather, which may indicate urban or other impacts coming from upstream areas in the Taunton Watershed. Two figures (see Figure 4-1 below) from the RIDEM Report “Total Maximum Daily Load Study for Bacteria, Mount Hope Bay and the Kickemuit River Estuary” (RIDEM 2009) ably demonstrate this point. Data collected on June 1, 2006 (prior to the rain event) clearly identify remarkably low fecal coliform bacteria levels, with all readings meeting MA WQ Standards. Data collected on June 3, 2006, just after a significant rain event, document a dramatic increase of bacteria levels in both the Taunton River MA62-04, and Mount Hope Bay MA61-06, particularly in waters adjacent to the City of Fall River. It is also important to note that since 2006 the City of Fall River has made over $150 million in CSO infrastructure improvements, including a CSO tunnel that went on- line during the summer 2010 which should have a dramatic beneficial reduction to the bacteria levels in the adjacent Taunton River and Mount Hope Bay waters.

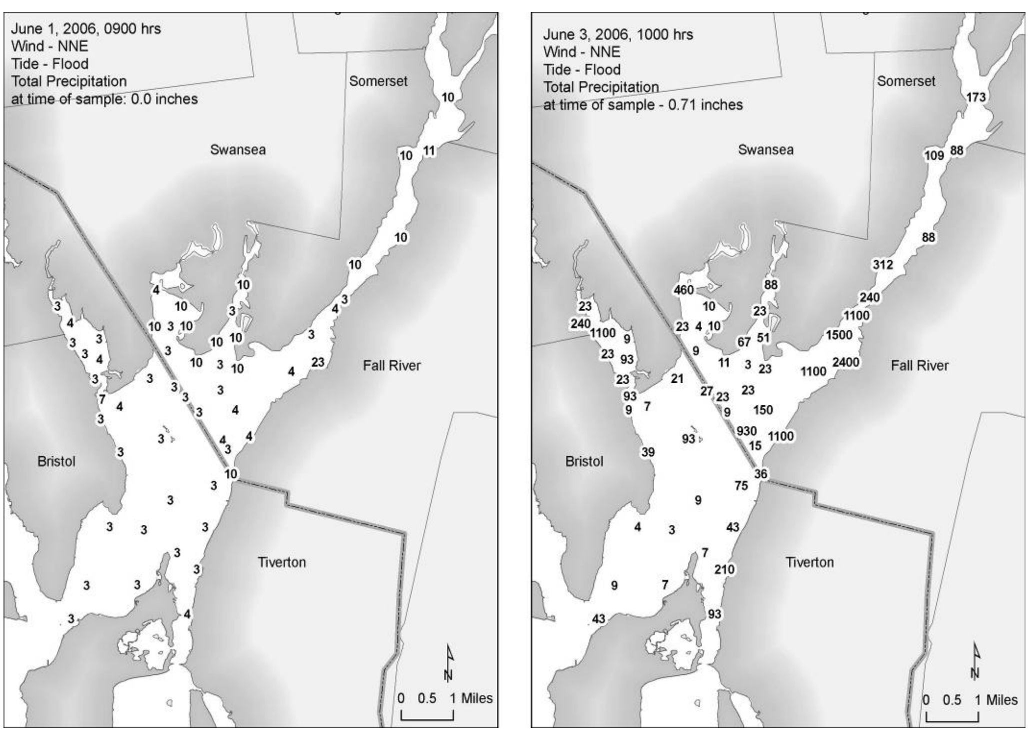

Figure 4.1 Mount Hope Bay Ambient Monitoring Data (Fecal coliform CFU/100mL) June 1 and June 3, 2006 Courtesy of RIDEM.

Mt Hope Bay Segment MA61-07

This segment is a 1.8 square mile Class SA waterbody located west of a line from Brayton Point to Buoy #4 (Massachusetts portion) in the Mt Hope Bay estuary. The segment receives discharges from the town of Swansea who holds an MS4 permit (MAR041163) for the discharge of stormwater through the municipal separate storm sewer system. The DMF Shellfish Status Report of October 2000 indicates that shellfish growing areas MHB1.1, MHB3.1, and MHB4.1 are restricted (DFWELE 2000). These shellfish growing areas encompass this entire segment of Mt. Hope Bay.

There are three public beaches located in Swansea along the shoreline of this segment of Mount Hope Bay: Town Beach, Sandy Beach, and Cedar Cove. The water quality relative to primary contact recreation criteria are summarized below. It should be noted that the Department of Public Health recently changed is regulations to require testing for E*nterrococci* from fecal coliform. Although MassDEP did not use this data to develop loadings for this segment it is provided here to document that elevated levels of bacteria are having an impact on recreational uses in this segment.

Town Beach in Swansea (see Figure 2-2): One *Enterococci* bacteria sample was collected in 2003, while weekly *Enterococci* samples were collected during the summers of 2004, 2005, and 2006 (n= 13, 12, and 13 samples, respectively) (MA DPH 2003, 2004, 2005, 2006, and 2007). There was only one reported exceedence and the beach was posted for two days in June 2006.

Sandy Beach in Swansea (see Figure 2-2): Seven *Enterococci* bacteria samples were collected in 2003, while weekly *Enterococci* samples were collected during the summers of 2004, 2005, and 2006 (n= 13, 12, and 14 samples, respectively) (MA DPH 2003, 2004, 2005, 2006, and 2007). There were two reported exceedences in 2003 but no postings (MA DPH 2004). There were no exceedences or postings in 2004 or 2005 and two reported exceedences and postings at this beach in 2006 (two days in June and one day in August).

Cedar Cove Beach in Swansea (see Figure 2-2): Seven *Enterococci* bacteria samples were collected in 2003, two *Enterococci* samples were collected in 2004, and 10 samples were collected during the summer of 2006 (MA DPH 2003, 2004, 2005, 2006, and 2007). There were no reported exceedences or postings in 2003 or 2004 and two reported exceedences and postings at this beach in 2006 (two days in June and one day in August).

The DMF also collected 311 fecal coliform samples from 11 stations within this segment[1] between January 1996 and July 2001. Fecal coliform counts ranged between 1.9 and 312 cfu/100mL (MassDEP 2002a). The Rhode Island Department of Environmental Management (RIDEM), in cooperation with the Massachusetts Division of Marine Fisheries (MADMF), conducted an ambient water quality investigation for bacteria in 2006 (see Table 4-11 below) to support a Rhode Island TMDL evaluation of Mount Hope Bay and the Kickemuit River in Rhode Island. Part of the study was to also monitor (by MADMF) adjoining Massachusetts Waters in the MA segments: MA 61-02, Lee River; MA61-04, Cole River; MA 61-06, Mount Hope Bay; MA 61-07, Mount Hope Bay. As previously noted, for the Massachusetts portions, there were 5

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[1] DMF data, 1996- 2001, not utilized due to not being current, and maximum sample reading limitation of 312 cfu/100mL.

sampling days between June 1-6, 2006: June 1st -just before a major rain event; June 3rd - during the first part of the rain event; June 4th -, during the last part of the rain event (total rain ~2.50 inches); June 5th - just after the conclusion of the rain event; and June 6th - one day after the rain event. There were 11 RIDEM/ MADMF stations sampled within this segment which were sampled 5 times over the 6 day period. There was a second wet weather event between October 11- 16, where 1 station was sampled 7 times within this segment. The rain event (~total of 1.59 inches) was at maximum on October 12th. The Fecal Coliform readings from all the MADMF June and October, 2006 sampling (a total of 63 readings) ranged between 2- 1,500 with a geometric mean of 21 cfu/100mL.

MassDEP summarized the 2006 data from the station (MHB 4-1) that had the highest geometric average (from a total of 6 samples) during these two sampling periods. The readings ranged between 4 and 1,500 with a geometric mean of 158 cfu/100mL. This data set was employed to calculate loadings reductions that would be required for this particular segment to meet pathogen water quality standards (see Section 7.3).

Table 4-11. MA61-07 Mount Hope Bay RIDEM and MADMF Indicator Bacteria Data Summary.

Station	Range of Fecal Coliform cfu/100mL. (No. of Samples)	Geometric Mean(cfu/100 mL)	90th Percentile (cfu/100 mL)
MHB 4-1 (2006)	4- 1,500 (5)	158	1084

5.0 Potential Sources

The Narragansett/Mt. Hope Bay Watershed has seven segments, located throughout the watershed, that are listed as pathogen impaired requiring TMDLs. Potential sources of indicator bacteria in the Narragansett/Mt. Hope Bay Watershed are many and varied.

Some dry weather sources may include:

- animal feeding operations,
- animal grazing in riparian zones,
- leaking sewer pipes,
- stormwater drainage systems (illicit connections of sanitary sewers to storm drains),
- failing septic systems,
- wildlife, including birds,
- recreational activities, and
- illicit boat discharges.

Some wet weather sources may include:

- wildlife and domesticated animals (including pets),
- stormwater runoff including municipal separate storm sewer systems (MS4),
- combined sewer overflows (CSOs), and
- sanitary sewer overflows (SSOs).

Some insight on potential sources of bacteria is gained using dry or wet weather bacteria concentrations as a benchmark for reductions. Where a segment is identified as having high dry weather concentrations, sources such as permitted discharges, failing septic tanks, illicit sanitary sewers connected to storm drains, leaking sewers, and/or agricultural sources may be the primary contributors. Where elevated levels are observed during wet weather, potential sources may include flooded septic systems, surcharging sewers (combined sewer overflows or sanitary sewer overflows), and/or stormwater runoff. Data collected in 2006 clearly indicated that the City of Fall River CSO's were having a negative impact on water quality during wet weather. The City has developed a LTCP that calls for a dramatic reduction in the volume of untreated CSOs. When fully implemented the Fall River combined system will be able to handle a 12 hour/1.72 inch storm event. Additionally, in urban areas like Fall River, other sources of elevated bacteria concentrations can include runoff in areas with high populations of domestic animals or pets. In agricultural areas, sources may include runoff from farms, poorly managed manure piles or areas where wild animals or birds congregate. Other potential sources include sanitary sewer connected to storm drains that result in flow that is retarded until the storm drain is flushed during wet weather.

It is difficult to provide accurate quantitative estimates of indicator bacteria contributions from the various sources in the Narragansett/Mt. Hope Bay Watershed, because the data collected was of an ambient nature and not from specific sources. Also many of the sources are diffuse and intermittent, and extremely difficult to monitor or accurately model. Therefore, a general level of quantification according to source category is provided (e.g., see Tables 5-1 and 5-2). This approach is suitable for the TMDL analysis, because it indicates the magnitude of the sources and illustrates the need for controlling them. Additionally, many of the sources (failing septic systems, leaking sewer pipes, sanitary sewer overflows, and illicit sanitary sewer connections) are prohibited, because they indicate a potential health risk and, therefore, must be eliminated.

Agriculture
Land used primarily for agriculture is likely to be impacted by a number of activities that can contribute to indicator bacteria impairments of surface waters. Activities with the potential to contribute to high indicator bacteria concentrations include:

- Field application of manure,
- Runoff from grazing areas,
- Direct deposition from livestock in streams,
- Animal feeding operations,
- Leaking manure storage facilities, and
- Runoff from barnyards.

Indicator bacteria numbers are generally associated with sediment loading. Reducing sediment loading often results in a reduction of indicator bacteria loading as well. Brief summaries of some of these techniques are provided in the "*Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts*" (MassDEP 2005).

Sanitary Waste
Leaking sewer pipes, illicit sewer connections, sanitary sewer overflows (SSOs), continuing combined sewer overflows (CSOs) from the Cities of Fall River and Taunton, and failing septic systems represent a direct threat to public health since they result in discharge of partially treated or untreated human wastes to the surrounding environment. Quantifying these sources is extremely speculative without direct monitoring of the source, because the magnitude is directly proportional to the volume of the source and its proximity to the surface water. Typical values of fecal coliform in untreated domestic wastewater range from 10^4 to 10^6 MPN/100mL (Metcalf and Eddy 1991).

Illicit sewer connections into storm drains result in direct discharges of sewage via the storm drainage system outfalls. The existence of illicit sewer connections to storm drains is well documented in many urban drainage systems, particularly older systems that may have once been combined. It is probable that numerous illicit sewer connections exist in storm drainage systems serving the older developed portions of the basin.

Monitoring of storm drain outfalls during dry weather is needed to document the presence or absence of sewage in the drainage systems. Approximately 36.5 percent of the Narragansett/Mt. Hope Bay watershed is classified as Urban Areas by the United States Census Bureau and is therefore subject to the Stormwater Phase II Final Rule that requires the development and implementation of an illicit discharge detection and elimination plan. See Section 8.3 of this report for information regarding illicit discharge detection guidance.

Septic systems designed, installed, operated and maintained in accordance with 310 CMR 15.000: Title 5, are not significant sources of fecal coliform bacteria. Studies demonstrate that wastewater located four feet below properly functioning septic systems contain on average less than one fecal coliform bacteria organism per 100 mL (Ayres Associates 1993). Failed or non-conforming septic systems, however, can be a major contributor of fecal coliform to the Narragansett/Mt. Hope Bay Watershed. Wastes from failing septic systems enter surface waters either as direct overland flow or via groundwater. Wet weather events typically increase the rate of transport of pollutant loadings from failing septic systems to surface waters because of the wash-off effect from runoff and the increased rate of groundwater recharge.

Recreational use of waterbodies is a source of pathogen contamination. Swimmers themselves may contribute to bacterial impairment at swimming areas. When swimmers enter the water, residual fecal matter may be washed from the body and contaminate the water with pathogens. In addition, small children in diapers may contribute to contamination of the recreational waters. These sources are likely to be particularly important when the number of swimmers is high and the flushing action of waves or tides is low.

Another potential source of pathogens is the discharge of sewage from vessels with onboard toilets. These vessels are required to have a marine sanitation device (MSD) to either store or treat sewage. When MSDs are operated or maintained incorrectly they have the potential to discharge untreated or inadequately treated sewage. For example, some MSDs are simply tanks designed to hold sewage until it can be pumped out at a shore-based pump-out facility or discharged into the water more than three miles from shore. Uneducated boaters may discharge untreated sewage from these devices into near-shore waters. In addition, when MSDs designed to treat sewage are improperly maintained or operated they may malfunction and discharge inadequately treated sewage. Finally, even properly operating MSDs may discharge sewage in concentrations higher than allowed in ambient water for fishing or shellfishing. Vessels are most likely to contribute to bacterial impairment in situations where large numbers of vessels congregate in enclosed environments with low tidal flushing. Many marinas and popular anchorages are located in such environments.

Wildlife and Pet Waste

Animals that are not pets can be a potential source of pathogens. Geese, gulls, and ducks are speculated to be a major pathogen source, particularly at lakes and stormwater ponds where large resident populations have become established (Center for Watershed Protection 1999).

Household pets such as cats and dogs can be a substantial source of bacteria – as much as 23,000,000 colonies/gram, according to the Center for Watershed Protection (1999). A rule of thumb estimate for the number of dogs is ~1 dog per 10 people producing an estimated 0.5 pound of feces per dog per day. Uncollected pet waste is then flushed from the parks, beaches and yards where pets are walked and transported into nearby waterways during wet-weather.

Stormwater

Stormwater runoff is another significant contributor of pathogen pollution. As discussed above, during rain events fecal matter from domestic animals and wildlife are readily transported to surface waters via the stormwater drainage systems and/or overland flow. The natural filtering capacity provided by vegetative cover and soils is dramatically reduced as urbanization occurs because of the increase in impervious areas (i.e., streets, parking lots, etc.) and stream channelization in the watershed.

Extensive stormwater data have been collected and compiled both locally and nationally (e.g., Tables 4-1, 4-2, 5-1 and 5-2) in an attempt to characterize the quality of stormwater. Bacteria are easily the most variable of stormwater pollutants, with concentrations often varying by factors of 10 to 100 during a single storm. Considering this variability, stormwater bacteria concentrations are difficult to accurately predict. Caution must be exercised when using values from single wet weather grab samples to estimate the magnitude of bacteria loading, because it is often unknown whether the sample is representative of the "true" mean. To gain an understanding of the magnitude of bacterial loading from stormwater and avoid overestimating or underestimating bacteria loading, event mean concentrations (EMC) are often used. An EMC is the concentration of a flow proportioned sample throughout a storm event. These samples are commonly collected using an automated sampler which can proportion sample aliquots based on flow. Typical stormwater event mean densities for various indicator bacteria in Massachusetts watersheds and nationwide are provided in Tables 5-1 and 5-2. These EMCs illustrate that stormwater indicator bacteria concentrations from certain land uses (i.e., residential) are typically at levels sufficient to cause water quality problems.

Table 5-1. Lower Charles River Basin Stormwater Event Mean Bacteria Concentrations (data summarized from USGS 2002) and Necessary Reductions to Meet Class B WQS.

Land Use Category	Fecal Coliform EMC (cfu/100 mL)	Number of Events	Class B WQS[1]	Reduction to Meet WQS (%)
Single Family Residential	2,800 – 94,000	8	10% of the samples shall not exceed 400 organisms/ 100 mL	2,400 – 93,600 (85.7 – 99.6)
Multifamily Residential	2,200 – 31,000	8		1,800 – 30,600 (81.8 – 98.8)
Commercial	680 – 28,000	8		280 – 27,600 (41.2 – 98.6)

[1] Former Class B Standard: Shall not exceed a geometric mean of 200 organisms in any set of representative samples, nor shall 10% of the samples exceed 400 organisms. Used 400 to illustrate required reductions since a geometric mean of the samples were not provided.

Table 5-2. Stormwater Event Mean Fecal Coliform Concentrations (as reported in MassDEP 2002c; original data provided in Metcalf & Eddy, 1992) and Necessary Reductions to Meet Class B WQS.

Land Use Category	Fecal Coliform[1] cfu/ 100 mL	Class B WQS[2]	Reduction to Meet WQS (%)
Single Family Residential	37,000	10% of the samples shall not exceed 400 organisms/ 100 mL	36,600 (98.9)
Multifamily Residential	17,000		16,600 (97.6)
Commercial	16,000		15,600 (97.5)
Industrial	14,000		13,600 (97.1)

[1] Derived from NURP study event mean concentrations and nationwide pollutant buildup data (USEPA 1983)[2] Former Class B Standard: Shall not exceed a geometric mean of 200 organisms in any set of representative samples, nor shall 10% of the samples exceed 400 organisms. Used 400 to illustrate required reductions since a geometric mean of the samples were not provided.

6.0 Prioritization and Known Sources

With respect to most of the MA portions of Mount Hope Bay, (all of MA 61-06, and the eastern portion of MA 61-07), the direct pollution effects of the City of Fall River, and secondary effects of the upstream (on the Taunton River) City of Taunton, have a marked water quality effect on these waters. The main stem Taunton River drains directly into the MA and RI Mount Hope Bay areas. Flows from the Taunton River carry Combined Sewer Overflow discharges from both cities following wet weather directly into these Mount Hope Bay MA and RI areas. Additionally, general overland stormwater draining directly into the Taunton from both urban areas during wet weather is another important bacteria pollution contributor to the Bay.

The Fall River WWTP is permitted to discharge 50 MGD of treated effluent to the Mount Hope Bay (segment MA 61-06) and provides primary treatment and chlorination/dechlorination for up to 106 MGD for treatment of wet weather events. The CSO program in Fall River recently completed all nine of the drop shafts that lead to an 85 MGD storage tunnel. The CSO system must be able to handle a 3 month storm (1.72 inches of precipitation in a 12 hour period). The MADEP Administrative Order requires both dry and wet weather sampling to determine if conditions have improved. Additional improvements that are currently underway at Fall River include:

- Bay testing in 2010-2011
- Central Street pump station rehabilitation 2010-2011
- North End CSO construction 2012-2016 (CSO's at President Ave., City Pier and Alton St.)
- Sewer Separation 2015-2018.

After all plans are implemented in Fall River, CSO discharges will be limited to up to four events per year.

The Taunton WWTP is permitted to discharge 8.5 MGD to a Taunton River segment which flows into Mt. Hope Bay. There is currently one CSO which has only a bar rack (no chlorination). The City of Taunton is currently testing the sewer system in an attempt to reduce inflow and infiltration. A MADEP Administrative Order has a December 31, 2010 deadline to eliminate this CSO or utilize either stormwater retention and/or treatment (chlorination).

In the remainder of the Narragansett/ Mount Hope Bays Watershed, including the western portion of Mount Hope Bay MA 61-07, a majority of bacteria sources of pollution are directly related to non point sources (NPS) of pollution, including stormwater (ESS, 2002). In this basin, NPS pollution predominantly originates from (1) densely developed residential areas with septic systems built in areas of high groundwater and/ or poorly drained soils; and (2) agricultural areas with either pig farms, cattle, or crops with poor BMP's to control runoff.

A sewer needs assessment study (CDM 1996) conducted for the Town of Seekonk in the Runnins River subwatershed provides an example of septic related sources. The 1996 study revealed that five residential areas within Seekonk, all essentially on septic systems located in very poor soil drainage areas with high groundwater had numerous septic system failures: (1) Area #5, Field Wood Estates; (2) between Route #6 and Benson Avenue; (3) Arcade Avenue to East Providence, RI border; (4) Mink St./School St./Leavitt St residential area; (5) Grist Mill Pond residential area (also observed geese flocks). The CDM sewer needs assessment study recommended sewering for many areas within Seekonk, and the ESS (ESS 2001) Nonpoint Study indicated that many of the other areas within the basin, such as in the towns of Swansea and Rehoboth, would benefit from sewering. Section 8 of this report will review progress that towns have made in the direction of sewering, as well as putting Phase II stormwater controls in place. The recommendations of a CDM sewering assessment project in Seekonk is mirrored throughout the basin, (i.e., that wastewater treatment plant upgrades or construction, as well as construction of connecting sewer lines to WWTP's would eliminate most all septic systems for residences and businesses).

Likewise the relationship between agriculture and bacteria related water quality impairments have been well documented in the 2001 ESS NPS study (ESS 2001). One example in the watershed is the numerous cattle grazing on a farm right into the Rocky Run tributary, which connects directly to the Runnins River (Segment MA 53-05) without any apparent BMP's in place. Other similar instances were observed in other portions of this basin, as well as in the adjoining Ten Mile River Basin.

The Lee River subwatershed and adjoining estuary areas connect with the Mount Hope Bay Estuary, and these all fall within the towns of Swansea and Somerset. The land- use and soil conditions mirror that of the Runnins and Palmer River basins, in that these areas have high density residential and commercial development with poorly drained soils. Examples of large residential areas include Garner's Neck Island, and Little Neck Island.

The Cole River subwatershed encompasses the towns of Dighton, Rehoboth, and Swansea. All these areas drain into Mount Hope Bay. There are four large residential areas with high density, all served by septic systems: (1) Seaview Avenue; (2) Ocean Grove area; (3) The Bluffs area; (4) Mount Fair Circle Road. At Compton's Corner on the Cole River, there is one discharge pipe that has had documented very high bacteria counts in its discharge, which has been fixed by the town of Swansea. However, numerous other storm drains (at least 33) south of Route 195 on the Cole River have suspect bacteria contributions that need to be sampled by the town. Another residential area that borders this subwatershed is Rocky Run Estates, which discharges into an unnamed tributary that connects to the Cole River. There are several pig farms in that same area that could have a bacteria pollution impact (from stormwater runoff) in that same tributary.

In an effort to provide guidance for setting bacterial implementation priorities within the Narragansett/ Mount Hope Bays Watershed, a summary table is provided. Table 6- 1 below identifies the priority level for pathogen-impaired segments covered by this TMDL report. Each segment will require additional bacterial source tracking work and implementation of structural and non-structural Best Management Practices (BMPs). Since limited source information and data are available in each impaired segment, a simple scheme was used to prioritize segments based on fecal coliform concentrations. High priority was assigned to those segments where either dry or wet weather concentrations (end of pipe or ambient) were equal to or greater than 10,000 cfu/100 ml. Medium priority was assigned to segments where concentrations ranged from 1,000 to 9,999 cfu/100ml Low priority was assigned to segments where concentrations were observed less than 1,000 cfu/100 ml. MassDEP believes the higher concentrations are indicative of the potential presence or raw sewage and therefore they pose a greater risk to the public. It should be noted that in all cases, waters exceeding the water quality standards identified in Table 6- 1 are considered impaired.

Also, prioritization is adjusted upward based on proximity of waters, within the segment, to sensitive areas such as Outstanding Resource Waters (ORW's), or designated uses that require higher water quality standards than Class B, such as Class A, or SA waters, public swimming areas, or shellfish areas. Best practical judgment was used in determining this upward adjustment. Generally speaking, waters that were determined to be lower priority based on the numeric range identified above were elevated up one level of priority if that segment was adjacent to or immediately upstream of a sensitive use. An asterisk * in the priority column of the specific segment would indicate this situation. Double asterisk ** represents two special situations where priorities are elevated: (1) the Runnins River MA53-01, because of adjoining downstream waters in Rhode Island (RI) being a Special Resource Protection Water (SRPW) similar to ORWs in MA, and also downstream adjoining waters in RI being classified as shellfishing SA waters; (2) The Lee River, MA 61-01 Class B, because the immediate downstream segment, Lee River MA 51-02, Class SA, has a more stringent WQS.

Table 6-1. Prioritized List of Pathogen Impaired Segments.

Segment ID	Segment Name	Segment Type	Size [1]	Segment Description	Priority "Dry"	Priority "Wet"
MA53-01	Runnins River, Class B	River	3.7	Route 44 to Mobile Dam, Seekonk.	High**	High**
MA53-06	Warren River Pond, Class SA	Estuary	0.06	Salt Pond in Swansea on MA/RI border.	Medium * (shellfishing)	Medium* (shellfishing
MA61-01	Lee River, Class B	River	0.53	From confluence with Lewin Brook, Swansea to Route 6, Swansea/Somerset. Miles 0.6-0.0	High**	High**
MA61-02	Lee River, Class SA	Estuary	0.51	Route 6, Swansea/Somerset to mouth at Mount Hope Bay, Swansea.	Medium* shellfishing	Medium* shellfishing
MA61-04	Cole River, Class SA	Estuary	0.31	Route 6 to the mouth at Old Railway Grade, Swansea.	Medium* shellfishing	High* shellfishing
MA61-06	Mount Hope Bay, Class SB, CSO	Estuary	2.3	From the Braga Bridge to the MA/RI state border, Swansea/Fall River east of a line from Brayton Point to Buoy #4.	Medium* shellfishing	High* shellfishing
MA61-07	Mount Hope Bay, Class SA	Estuary	1.8	West of a line from Brayton Point to Buoy #4. (Mass. Portion)	Medium* shellfishing	Medium* shellfishing

[1] Units of square miles for estuary segments and miles for river segments.

MassDEP believes that segments ranked as high priority in Table 6-1 pose the leading risk to the public due to the potential presence of raw sewage. Elevated dry weather bacteria concentrations could be the result of illicit sewer connections or failing septic systems. As a result, the first priority should be given to bacteria source tracking activities in those segments where sampling activities show elevated levels of bacteria during dry weather. A summary of dry weather MassDEP (Southeast Regional Office or SERO) bacteria source tracking work in the Runnins River is summarized in Section 4 of this report. Identification and remediation of dry weather bacteria sources is usually more straightforward and successful than tracking and eliminating wet weather sources. If illicit bacteria sources are found and eliminated it should result in a dramatic reduction of bacteria concentration in the segment in both dry and wet-weather. Segments that remain impaired during wet weather should be evaluated for stormwater BMP implementation opportunities starting with less costly non-structural practices first (such as street sweeping, and/or managerial approaches using local regulatory controls), and lastly, more expensive structural measures. Structural stormwater BMP implementation may require additional study to identify cost efficient and effective technology.

7.0 Pathogen TMDL Development

Section 303 (d) of the Federal Clean Water Act (CWA) requires states to identify waters that do not meet the water quality standards on a list of impaired waterbodies. The *2008 Integrated List* identifies a total of 7 segments within the Narragansett/ Mount Hope Bay Watershed for use impairment caused by excessive indicator bacteria concentrations. Two of the segments in this TMDL adjoin impaired segments in Rhode Island. Specifically, three of the four RI DEM Mount Hope Bay segments (RI0007032E01A, E01C, E01D), are immediately adjacent to the two MassDEP Mount Hope Bay segments (MA61-06, MA61-07). Rhode Island RIDEM has received EPA approval of their final TMDLs for these adjoining segments as described in "Total Maximum Daily Load Study for Bacteria, Mount Hope Bay and the Kickemuit River Estuary" (RIDEM 2009). Efforts to develop TMDLs for adjoining segments were coordinated between MassDEP and RIDEM to ensure consistency in TMDL development and implementation. As a result many of the results and conclusions related to pathogen sources for these particular segments in both MA and RI, as well as implementation recommendations, are similar in both reports.

The CWA requires each state to establish Total Maximum Daily Loads (TMDLs) for listed waters and the pollutant contributing to the impairment(s). TMDLs determine the amount of a pollutant that a waterbody can safely assimilate without violating the water quality standards. Both point and non-point pollution sources are accounted for in a TMDL analysis. EPA regulations require that point sources of pollution (those discharges from discrete pipes or conveyances) subject to NPDES permits receive a waste load allocation (WLA) specifying the amount of a pollutant they can release to the waterbody. Non-point sources of pollution (all sources of pollution other than point) receive load allocations (LA). In the case of stormwater, it is often difficult to identify and distinguish between point source discharges that are subject to NPDES regulation and those that are not. Therefore EPA has stated that it is permissible to include all point source stormwater discharges in the WLA portion of the TMDL. MassDEP has taken this approach. In accordance with the CWA, a TMDL must also account for seasonal variations and a margin of safety, which account for any lack of knowledge concerning the relationship between effluent limitations and water quality. Thus:

TMDL = WLAs + LAs + Margin of Safety (MOS)

Where:

WLA = Waste Load Allocation which is the portion of the receiving water's loading capacity that is allocated to each existing and future point sources of pollution.

LA = Load Allocation which is the portion of the receiving water's loading capacity that is allocated to each existing and future non-point source of pollution.

MOS = Margin of Safety which in this TMDL is implicit in that it is incorporated into the TMDL analysis through conservative assumptions (see section 7.6).

7.1 – General Approach: Development of TMDL Targets

MassDEP applied two methods to calculate daily TMDL targets consistent with RIDEM TMDL development and EPA guidance. Both approaches assure loading capacities are equal to or less than the Water Quality Standards and are described below in order of ease of understanding and applicability for guiding implementation:

1) Daily concentration TMDL (WLA/LA) targets were set for all potential pathogen sources by category (i.e., stormwater, NPDES, etc) and surface water classification. Expressing a loading capacity for bacteria in terms of concentrations set equal to the Commonwealth's adopted criteria, as provided in Table 7-1, provides the clearest and most understandable expression of water quality goals to the public and to groups that conduct water quality monitoring. MassDEP recommends that the concentration targets be used as the primary guide for implementation (See Section 7.2)

2) Estimates of the necessary percent reductions needed in each segment were developed using a conservative analysis based on comparing ambient bacteria concentrations to water quality criteria. MassDEP considers the percentage reduction targets the next most useful TMDL expressions for guiding implementation (See Section 7.3).

Mount Hope Bay forms the northeast corner of the Narragansett Bay estuary with the RI- MA state boundary traversing the area in a southeasterly direction. Although 70% of Mount Hope Bay is located in Rhode Island, over 90% of its drainage basin (including the Taunton basin) is located in MA. Much of the past and present bacteria/pathogen problems relate to CSO, stormwater, and other discharges from the urban areas of Taunton and Fall River. Surveys by the U.S. Food and Drug Administration (FDA) in 1987 indicated that, of all the potential sources of sewage contamination, CSO's represented the largest source, masking all other inputs of fecal contaminants to Mount Hope Bay. During one wet weather event monitored by the FDA, CSO's were estimated to account for 96% of total fecal coliform loading to Mount Hope Bay (Dixon et al.1991). Both the RI DEM TMDL Study and this TMDL report emphasize that much of the present bacteria related water quality problems emanate from the Massachusetts portion of the drainage basin. Although MassDEP and RIDEM used different methodologies to develop individual TMDL's, the results were very similar. As such, both TMDL's provide estimates of the needed percent reductions in each segment to obtain water quality standards.

7.2 Waste Load Allocations (WLAs) and Load Allocations (LAs) As Daily Concentration (cfu/ 100 mL)

For most pollutants, TMDLs are expressed on a mass-loading basis (e.g., kilograms per day). For indicator bacteria (i.e., fecal coliform, e. coli, enterococci), however, it is the number of organisms in a given volume of water (i.e. their concentration), and not their mass or total number that is significant with respect to public health risk and protection of beneficial uses. Daily bacteria loads can be established by multiplying the concentration times the volume of receiving water (cfu/day). Expressing the loading capacity for bacteria in terms of loadings (e.g., numbers of organisms per day, cfu/day), although valid as a TMDL, is more difficult for the public to understand because the "allowable" loading number varies with flow over the course of the day and season. Also, the daily loading numbers are very large (i.e. billions or trillions of bacteria per day) and therefore difficult to interpret as they do not relate directly to the State

Water Quality Standards or public health criteria. MassDEP emphasizes the simplest and most readily understood way of meeting the TMDL is to have a goal of bacteria sources not exceeding the WQS criteria at the point of discharge. In addition, the applicable bacteria water quality standard is the technically relevant criterion for assessing the relative impact of pollution sources, the quality of the shellfish harvesting area, and the public-health risk. EPA protocol (EPA 2001) on the development of pathogen TMDLs recommends establishing a TMDL in this manner (concentration-based) for a pollutant that is not readily controllable on a mass basis. Therefore, this TMDL plan establishes concentration-based TMDLs expressed in terms of the applicable water quality standard. This criterion applies on a daily basis regardless of weather condition and ensures attainment with water quality standards throughout the waterbody, In this TMDL, the allowable concentration and required percent concentration reductions are determined on a waterbody segment basis (See Section 7-3). Table 7-1 presents the TMDL indicator bacteria WLAs and LAs for the various source categories as daily concentration targets for the Narragansett/Mount Hope Bay Watershed. WLAs (to address point sources of pollution) and LAs (to address non-point sources of pollution) are presented by applying WQS
(see for Mass WQS http://www.mass.gov/dep/service/regulations/314cmr04.pdf).

Sources of indicator bacteria in the Narragansett/ Mount Hope Bay Watershed are varied, however data indicate that most of the bacteria sources are likely either CSO or stormwater related. (Sections 4, 5 and 6 of this document discuss in more detail the types of sources identified as well as their prioritization for implementation). Point sources for bacteria within the Narragansett- Mount Hope Bay Watershed include the Fall River wastewater treatment plant (WWTPs) and other MS4 NPDES-permitted wastewater discharges. NPDES wastewater discharge WLAs are set at the water quality standards. All piped discharges are, by definition, point sources regardless of whether they are currently subject to the requirements of NPDES permits. Therefore a WLA set equal to the WQS criteria will be assigned to the portion of the stormwater that discharges to surface waters via storm drains. For any illicit sources including illicit discharges to stormwater systems and sewer system overflows (SSO's) the goal is complete elimination (100% reduction). Source categories representing discharges of untreated sanitary sewage to receiving waters are prohibited, and therefore, assigned WLAs and LAs equal to zero. The specific goal for controlling combined sewer overflows (CSO's) is meeting water quality standards through implementation of long- term control plans.

Table 7-1: Waste Load Allocations (WLAs) and Load Allocations (LAs) as Daily Concentrations (CFU/100mL)

Surface Water Classification	Pathogen Source	Waste Load Allocation Indicator Bacteria (cfu/100 mL)[1]	Load Allocation Indicator Bacteria (cfu/100 mL)[1]
B, SA, SB (prohibited)	Illicit discharges to storm drains	0	
	Leaking sanitary sewer lines	0	Not Applicable
	Failing septic systems	Not Applicable	0

Surface Water Classification	Pathogen Source	Waste Load Allocation Indicator Bacteria (cfu/100 mL)[1]	Load Allocation Indicator Bacteria (cfu/100 mL)[1]
B	Any regulated discharge-including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges [7,9], and combined sewer overflows[6].	Either; E. coli <=geometric mean[5] 126 colonies per 100 ml; single sample <=235 colonies per 100 ml; or Enterococci geometric mean[5] <= 33 colonies per 100 ml and single sample <= 61 colonies per 100 ml	Not Applicable
	Nonpoint source stormwater runoff[4]	Not Applicable	Either; E. coli <=geometric mean[5] 126 colonies per 100 ml; single sample <=235 colonies per 100 ml; or Enterococci geometric mean[5]<= 33 colonies per 100 ml and single sample <= 61 colonies per 100 ml
SA (Designated for shellfishing)	Any regulated discharge - including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges[7,9], and combined sewer overflows[6].	Fecal Coliform <= geometric mean, MPN, of 14 organisms per 100 ml nor shall 10% of the samples be >=28 organisms per 100 ml	Not Applicable
	Nonpoint Source Stormwater Runoff[4]	Not Applicable	Fecal Coliform <= geometric mean, MPN, of 14 organisms per 100 ml nor shall 10% of the samples be >=28 organisms per 100 ml
SA & SB[10] (Beaches[8] and non-designated shellfish areas)	Any regulated discharge - including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges[7,9], and combined sewer overflows[6].	Enterococci - geometric mean[5] <= 35 colonies per 100 ml and single sample <= 104 colonies per 100 ml	Not Applicable
	Nonpoint Source Stormwater Runoff[4]	Not Applicable	Enterococci -geometric mean[5] <= 35 colonies per 100 ml and single sample <= 104 colonies per 100 ml
SB (Designated for shellfishing w/depuration)	Any regulated discharge - including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges[7,9], and combined sewer overflows[6].	Fecal Coliform <= median or geometric mean, MPN, of 88 organisms per 100 ml nor shall 10% of the samples be >=260 organisms per 100 ml	Not Applicable
	Nonpoint Source Stormwater Runoff[4]	Not Applicable	Fecal Coliform <= median or geometric mean, MPN, of 88 organisms per 100 ml nor shall 10% of the samples be >=260 organisms per 100 ml

Surface Water Classification	Pathogen Source	Waste Load Allocation Indicator Bacteria (cfu/100 mL)[1]	Load Allocation Indicator Bacteria (cfu/100 mL)[1]

Table 7.1 footnotes

[1] Waste Load Allocation (WLA) and Load Allocation (LA) refer to fecal coliform densities unless specified in table.
[2] In all samples taken during any 6 month period
[3] In 90% of the samples taken in any six month period;
[4] The expectation for WLAs and LAs for stormwater discharges is that they will be achieved through the implementation of BMPs and other controls.
[5] Geometric mean of the 5 most recent samples is used at bathing beaches. For all other waters and during the non-bathing season the geometric mean of all samples taken within the most recent six months, typically based on a minimum of five samples.
[6] Or other applicable water quality standards for CSO's
[7] Or shall be consistent with the Waste Water Treatment Plant (WWTP) National Pollutant Discharge Elimination System (NPDES) permit.
[8] Massachusetts Department of Public Health regulations (105 CMR Section 445)
[9] Seasonal disinfection may be allowed by the Department on a case-by-case basis.
[10] Segments designated as CSO have long term control plans in place and are expected to meet water quality goals.
Note: this table represents waste load and load allocations based on water quality standards current as of the publication date of these TMDLs. If the pathogen criteria change in the future, MassDEP intends to revise the TMDL by addendum to reflect the revised criteria.

It is recommended that these concentration targets be used to guide implementation. The goal to attain WQS at the point of discharge is environmentally protective, and offers a practical means to identify and evaluate the effectiveness of control measures. In addition, this approach establishes clear objectives that can be easily understood by the public and others responsible for monitoring activities. Success of the control efforts and subsequent conformance with the TMDL can be determined by documenting that a sufficient number of valid bacteria samples from the receiving water meet the appropriate indicator criteria (WQS) for the water body.

7.3 – TMDLs Percent Reduction

As described above the estimates of the necessary percent reductions needed in each segment were developed using a conservative analysis based on comparing ambient bacteria concentrations to water quality criteria. Section 4 summarized available water quality survey information that has been collected over the last decade or so in Narragansett/ Mount Hope Bay Watershed. Data was collected by a variety of agencies often spanning many years and included data sets with different indicator organisms.

Numeric TMDL targets for the most sensitive designated uses (shellfish harvesting and primary contact recreation) assigned to these waterbodies are summarized below in Table 7.2 for both Massachusetts and Rhode Island. In Massachusetts Fecal coliform is the applicable indicator for protection of Shellfishing uses while either *E.coli* or enterococci are the indictors applied for protection of primary contact recreation uses in fresh water systems. Enterococci is the indictor applied for protection of primary contact recreation uses in marine systems. In Rhode Island Fecal coliform is the applicable indicator for protection of shellfishing uses and a less stringent Fecal coliform standard is applied for the protection of primary contact recreation in Class SB, SB1 and SB1{a} waters.

In Massachusetts the water quality standards for shellfish harvesting are the most stringent of the applicable uses (shellfishing or primary contact) for both Class SA and SB[1] water bodies, and therefore, the shellfishing criteria (Class SA = a geometric mean of fecal coliform of 14 cfu/100 ml and a 90th percentile of 28 cfu/100ml, Class SB = geometric mean of fecal coliform equal to 88 cfu/100ml and a 90th percentile 260 cfu/100/ml) were applied to Class SA and SB segments in this TMDL. Primary contact recreation numeric targets are applicable for any Class B fresh water segments (e.coli geometric mean of 126 cfu/100 and single sample maximum of 235 cfu/100/ml (75th percentile concentration) or for enterococci a geometric mean of 33 cfu/100ml and a single sample maximum of 61 cfu/100/ml (75th percentile concentration)). To determine the percent reduction needed to meet standards, calculations were developed using both the ambient geometric mean as well as the 90th percentile criterion. The most stringent downstream classification was applied to adjoining upstream segments.

Table 7-2. Water Quality Targets for Narragansett/Mount Hope Bay Estuary.

	Massachusetts Applicable Surface Water Quality Criteria			
	Shellfishing		**Primary Contact Recreation**	
Waterbody Class	Geometric Mean	10% of samples not to exceed	Geometric Mean	Single Sample Maximum (25% of samples not to exceed)
B	None	None	126 [a]	235 [a]
	None	None	33 [b]	61 [b]
SA	14 [c]	28 [c]	35 [b]	104 [b]
SB	88 [c]	260 [c]	35 [b]	104 [b]
	Rhode Island Applicable Surface Water Quality Criteria			
	Shellfishing		**Primary Contact Recreation**	
Waterbody Class	Geometric Mean	10% of samples not to exceed		
SA	14[c]	49[c]	50[c]	400[c]
SB	None	None	50[c]	400[c]
SB1	None	None	50[c]	400[c]
SB1[a}	None	None	50[c]	400[c]

[a] e.coli is the indicator
[b] enterococci is the indicator
[c] Fecal coliform is the indicator

MassDEP reviewed RIDEM's approach for adjoining segments to ensure consistency between the two states. Due to dynamic circulation patterns dominated by tide, river flow, and wind, as well as spatial and temporal variability in pathogen sources and contributions, watershed characteristics, and other factors, RIDEM made a simplifying assumption that the Class SA shellfishing criteria should be uniformly applied to all segments regardless of class. As a result the allowable concentration established by RIDEM was set equal to the percentile portion of the applicable RI state water quality standard for fecal coliform bacteria (49 MPN 10% of samples not to exceed) and the existing concentration was set to the greatest of the pooled station wet weather percentile values. The percent concentration reduction was then calculated by RI from the difference between these two values.

[1] No enterococci data are available for the Class SB segment. For protection of swimming uses to <19 illnesses per 1000 swimmers the former fecal coliform standard of geometric mean = 200 cfu/100 ml would apply which is less stringent than the SB shellfishing criteria (geometric mean = 88 cfu/100/mL).

MassDEP assessed downstream uses before applying water quality criteria to Massachusetts waterbody's under evaluation in this TMDL (see Figures 7.1 and 7.2). Figure 7.1 shows adjoining segments downstream of the Cole River (MA61-04), Lee River (MA61-01, MA61-02) and Mount Hope Bay (MA61-06, MA61-07). As shown in the Figure, the Cole River (MA61-04) and Mount Hope Bay (MA61-07) segments are both Class SA and these segments abut Rhode Island Class SA, and SB, downstream segments (01A, 01C). In this case the application of Massachusetts Class SA shellfishing criteria is protective of the downstream segments in Rhode Island. The Lee River Class B MA61-01 segment joins Massachusetts Lee River Class SA segment MA61-02. Therefore, the more stringent Class SA shellfishing criteria was applied to the upstream Class B segment in order to be protective of downstream segment in MA. Finally, Massachusetts Class SB segment MA61-06 abuts Rhode Island Class SB and SB1 segment (01C and 01D) and the Massachusetts Class SB shellfishing criteria was applied for purposes of calculating the TMDL for this segment. That criteria is protective of the RI primary contact recreation criteria for the 90th percentile.

Figure 7.2 shows adjoining segments downstream of the Runnins River (MA53-01) and the Warren River Pond (MA53-06) segments in Massachusetts. Runnins River is Class B in Massachusetts and adjoins a Class SA segment in RI that is designated as a Special Resource Protection Water. Therefore, the Class SA Massachusetts Shellfishing criteria apply to the Runnins River segment. Warrens River Pond (MA53-06) is Class SA and designated for shellfishing. This segment adjoins a Class SA segment in RI. As a result the Class SA shellfishing criteria are applicable to the Warren River Pond segment in Massachusetts. Applying the water quality target associated with the most sensitive designated use downstream is protective of Rhode Island water quality objectives, Massachusetts targets are comparable to the targets applied by RIDEM in the development of the TMDLs for restoration of segments in Rhode Island and are therefore protective of downstream waters.

The following summarizes the steps used by MassDEP to estimate the percent reductions needed to achieve the water quality standards in each Massachusetts segment:

1. Calculate the geometric mean of all bacteria data samples taken in each station within the segment (all data collected were during/ following wet weather, except in one segment, Lee River MA61-01).
2. Select the station, or group of stations, with the most recent water quality exhibiting the highest geometric mean for the bacteria data.
3. Compute the 90th percentile value for this same station, or group of stations.
4. Using the station, or group of stations, in each segment with the highest geometric mean value, determine the required segment percent reduction required to meet the applicable geometric mean standard.
5. Using the station in each segment with the highest geometric mean value, determine the required segment percentage reduction required to meet the applicable 90th percentile standard.
6. Compare the percentages determined from steps 4 and 5 and select the higher of the two values as the reduction target to apply to the entire segment (this scenario is underlined in bold in Table 7-3). Choosing the greater of steps 4 and 5 provides assurance that the standard will be met and affords and an implicit margin of safety.

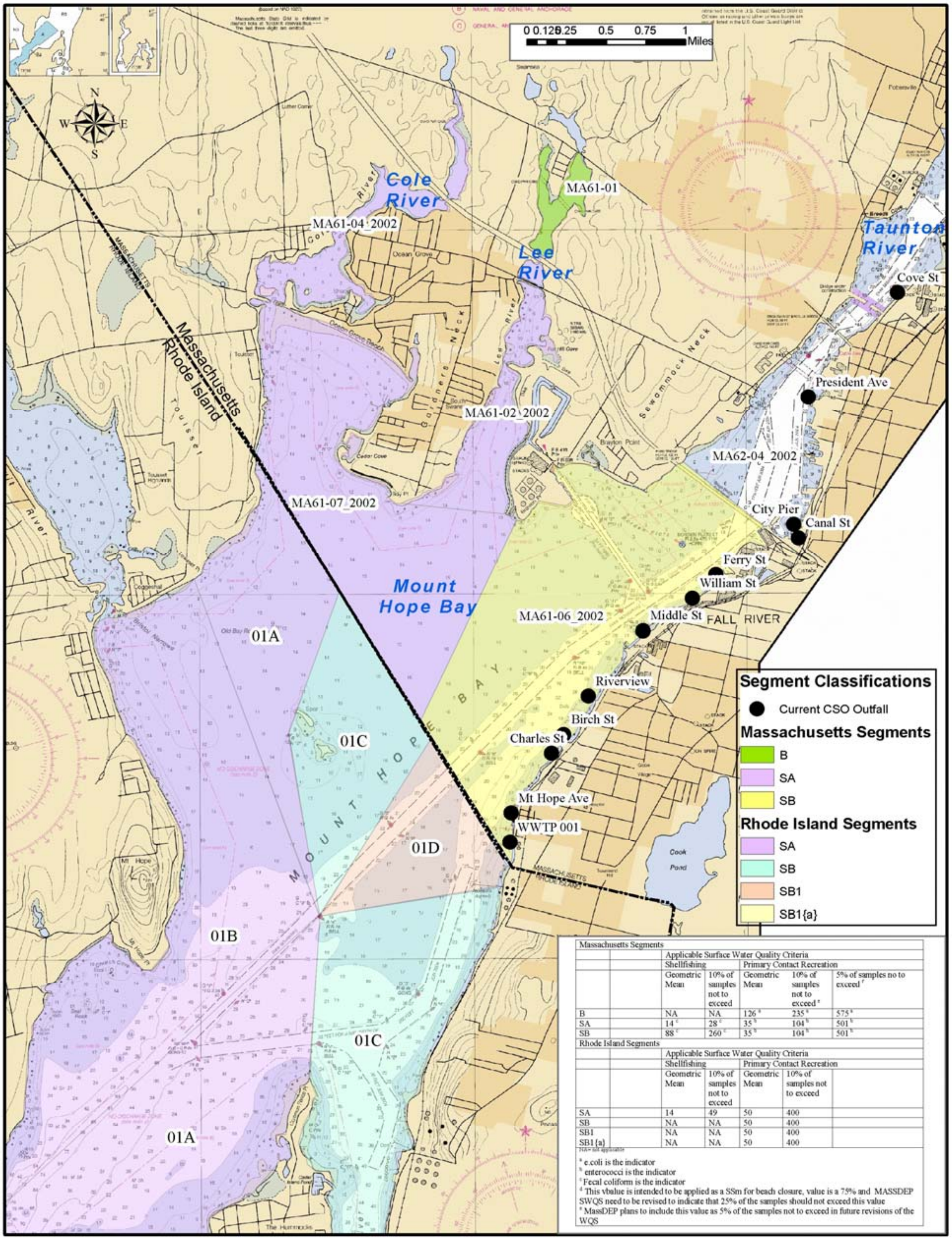

Figure 7.1 Map Showing RI DEM Waterbody's Downstream of Massachusetts Segments for the Cole River (MA61-04), Lee River (MA61-01, MA61-02) and Mount Hope Bay (MA61-06, MA61-07).

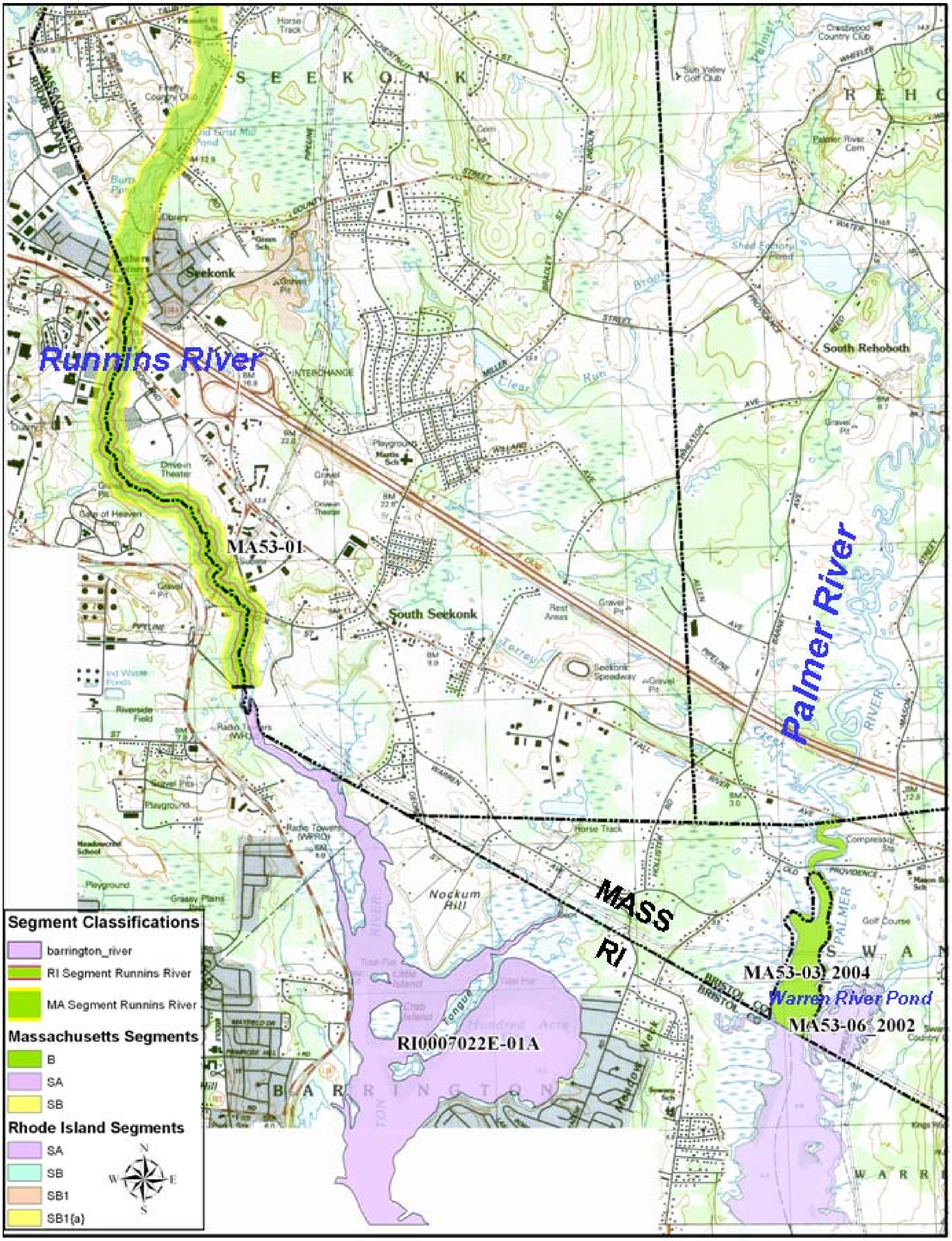

Figure 7.2 Map Showing RI DEM Waterbody's Downstream of Massachusetts Segments for the Runnins River (MA53-01) and Warrens River Pond (MA53-06).

Table 7.3 presents a summary of segment identifications and names, applicable standards and criteria that were applied to each segment, and ambient station(s) within each segment with the highest geometric mean (determined following wet weather events, unless otherwise noted). The 90th percentile associated with the highest overall geometric mean station within each segment is also identified. Table 7-3 provides two columns on the right side of the Table where: (1) percent reductions required are listed for each segment (using the highest overall geometric mean stations within each segment) to meet the particular geometric mean standard; and (2) percentage reductions required using the 90th percentile for the segment to meet the 90th percentile standard. The percentages in the geometric mean and the 90th percentile columns are then compared, with the highest percentage applied to the entire segment (underlined in bold in Table 7-3).

As shown in Table 7.3, the worst case scenario waterbody segment reductions (underlined) are all either close to or above 90%. Reductions from low to high are 84.0 % for Mount Hope Bay MA62-06; 91.0 % for Lee River MA61-02; 96.6 % for Warren River Pond MA53-06; 97.4 % Mount Hope Bay MA61-07; 98.8 % for Lee River MA61-01; 99.2 percent on the Cole River MA61-04; and 99.2 % for Runnins River MA53-01. These concentration reductions are based on meeting Fecal Coliform SA Standards (MA waters), in six of the seven segments, equal to 14 cfu/100mL, and not more than 10% of samples to exceed 28 cfu/100mL, and meeting Fecal Coliform SB Standards, in one of the seven segments, equal to 88 cfu/100mL, and not more than 10% of samples exceeding 260 cfu/100mL.

The Total Maximum Daily Load Study for Bacteria for the Mount Hope Bay and Kickemuit River Estuary recently developed by the Rhode Island Department of Environmental Management (RI DEM, 2009) requires a 56% to 95% reduction in bacteria concentrations in all waterbody segments of Mount Hope Bay that border MA. The RIDEM TMDL was based on a conservative set of assumptions that the Class SA shellfishing criteria (90^{th} percentile of 49 cfu/100/mL Fecal coliform) should be uniformly applied to all segments in Mount Hope Bay (RIDEM 2009).

7.4 Segment Specific Load and Waste Load Allocations

Within the Narragansett/ Mt. Hope Bay watershed bacteria sources include the wastewater treatment plant effluent, CSOs and MS4 permitted discharges from Fall River (MA0100382, MAR041113). Drainage from the Taunton River Watershed also contributes to the bacteria load in Narragansett/ Mt. Hope Bay from Taunton NPDES-permitted wastewater discharges (MA0100897), CSOs and MS4 stormwater. NPDES Wastewater discharge WLAs are set at the WQS. In addition there are numerous stormwater discharges from storm drainage systems throughout the watershed in the towns of Seekonk, Swansea, and Somerset. All piped discharges are, by definition, point sources regardless of whether they are currently subject to the requirements of NPDES permits. Therefore, a WLA set equal to the WQS is assigned to stormwater that discharges to surface waters via storm drains.

Establishing WLAs and LAs that only address dry weather indicator bacteria sources would not ensure attainment of standards because of the significant contribution of wet weather indicator bacteria sources to WQS violations. Illicit sewer connections and deteriorating sewers leaking to storm drainage systems represent the primary dry weather point sources of indicator bacteria, while failing septic systems and possibly leaking sewer lines represent the non-point sources. During dry weather, the sanitary quality in much of the study area is fully or partially supportive of the designated uses of shellfish harvesting and primary and secondary contact recreation (similar findings as in: RIDEM 2009). These areas are occasionally impacted by sources such as wildlife, waterfowl, failing residential septic systems,

Table 7-3: Estimated Reductions Needed to Meet WQS.

Seg. ID	Segment Name, (Class)	Applicable Criteria	Water Quality Monitoring Data [a,b]		Calculation of Percent Reduction	
			Geometric Mean Source, Station(s), year, No. Sample	**90th Percentile**	**Percent Reduction to Meet Geometric Mean Criterion**	**Percent Reduction or 90th percentile Criterion**
MA53-01	Runnins River, (B)	Apply SA Shellfish as adjoining downstream RI segment is designated as Special Resource Protection Water (SRPW) and Class SA shellfishing	298 Rayner Data, school street, 1998, n= 15	3,728	95.3	**99.2**
MA53-06	Warren River Pond, (SA)	Apply SA Shellfish criteria	412 MA DMF , 3,4,5,6,7,8, 1997, n=6 [c]	755	**96.6**	96.3
MA61-01	Lee River, (B)	Apply SA Shellfish criteria because of SA segment down stream	1060 MassDEP, LR07, 07A, 08, 1999, n=5 [d]	2,300	98.7	**98.8**
MA61-02	Lee River, (SA)	Apply SA Shellfish criteria	108 RI DEM, MHB 3-4, 2006,n=5	312	87.1	**91.0**
MA61-04	Cole River, (SA)	Apply SA Shellfish criteria	980 MassDEP Data, CO01,CO3A, CO04, 1999, n=5	3300	98.6	**99.2**
MA61-06	Mount Hope Bay, (SB, CSO)	Apply SB Shellfish criteria	271 RI DEM, MHB2-4, 2006, n=5	1,624	67.5	**84.0****
MA61-07	Mount Hope Bay, (SA)	Apply SA Shellfish criteria	158 RI DEM, MHB 4-1, 2006, n= 5	1,084	91.2	**97.4**

a **Fecal Coliform is the indicator**
[b] **For the Station (s) with most recent highest measures value, Seasonal Data, for Wet Weather (except as indicated)**
[c] **Mixed wet and dry weather samples collected**
[d] **Dry weather data**
***** 90th percentile shellfishing criteria more stringent than RI Class SB Primary Contact Recreation Criteria.**

transitory dry weather discharges such as leaking sewer lines or illicit connections to storm drains, and marine vessel discharges. Input from these types of sources may result in markedly elevated bacteria concentrations at various established water quality stations or shellfish monitoring stations. The exception to these generally supportive levels is in the Runnins River MA 53-01, which does demonstrate more high level dry weather counts than most other areas, probably because of more frequent wastewater disposal system failures. This has resulted from businesses with older failing cesspools and systems, undersized systems, and systems with waste loads beyond their capacity. Dry weather high counts also occur in an unnamed tributary that drains into the Lee River MA 61-01 at Elm St., Swansea/ Somerset.

In contrast to dry weather, the sanitary quality in the study area during wet weather is generally not supportive of designated uses (similar findings as in: RIDEM 2009). The area most notably affected by wet weather includes all of the Mount Hope Bay segment, MA81-06, which is adjacent to the City of Fall River, MA. Other areas affected by wet weather discharges from the Fall River area include the eastern and northern part of Mount Hope Bay MA81-07 segment, as well as three RIDEM Mount Hope Bay segments that are adjacent to the two MassDEP Mount Hope Bay segments. Other MA segments negatively impacted by wet weather include: the Cole River MA 61-04, the Lee River MA 61-02, and the Runnins River MA53-01. By far, the largest and most persistent wet weather sources of bacteria to the MA and RI Mount Hope Bay waterbodies are CSO discharges and stormwater runoff from the City of Fall River, with the most persistent sources of bacteria to the remaining MA impacted water bodies covered in this report primarily being stormwater runoff from MA and RI municipalities.

EPA guidance requires that load allocations be assigned to either point (waste load) or nonpoint (load) sources. As is the case for most bacteria impairments, insufficient data exist to accurately differentiate between point and nonpoint sources of bacteria. In addition, there is no meaningful method to determine specific bacterial loading from multiple stormwater systems distributed through a combined watershed area of over 112 square miles.

As recommended by EPA Region 1, all bacteria source reductions for this TMDL are combined into the waste load allocation. However, in implementing this TMDL, both point and nonpoint controls in RI and MA will be necessary to meet the TMDL plan‘s water quality targets. Both RI and MA are adopting a similar approach with waste load allocations. As a source, stormwater runoff, as well as all other NPDES discharges and CSOs will receive 100% of the waste load allocation. Sources of fecal coliform bacteria such as failing septic systems that flow (via groundwater seeps and/or overland flow) into storm drains, illegal connections to storm drains, leaking sanitary sewer lines, and marine vessel discharges will receive a waste load allocation of zero (0) since they are prohibited.

Point sources within the study area include The city of Fall River wastewater treatment plant and MS4-permitted wastewater discharges. NPDES wastewater discharge WLAs are set at the water quality standards. All piped discharges are, by definition, point sources regardless of whether they are currently subject to the requirements of NPDES permits. Therefore, a WLA set equal to the WQS criteria will be assigned to stormwater that discharges to surface waters via storm drains. For any illicit sources including illicit discharges to stormwater systems and sewer system overflows

(SSO's) the goal is complete elimination (100% reduction). Source categories representing discharges of untreated sanitary sewage to receiving waters are prohibited, and therefore, assigned WLAs and LAs equal to zero. The specific goal for controlling combined sewer overflows (CSO's) is meeting water quality standards.

These waste load allocations would apply to all MA municipalities including the Towns of Somerset, Swansea, and the City of Fall River, which have various point source discharges directly to Mount Hope Bay near the RI/MA border. The waste load allocations within the MA portion of the Bay are meant to attain the reductions of fecal coliform concentrations outlined in Table 7-3 above. The vast majority (over 75%) of stormwater from the City of Fall River discharges to the City's CSO system. The City has recently implemented a CSO abatement plan that will improve water quality in Mount Hope Bay. This TMDL sets a waste load allocation for both CSO's and all regulated stormwater discharges at the applicable water quality standard, which in the case of a class SB segment is a geometric mean of: 88 Fecal Coliform organisms per 100 ml., and not more than 10% of the samples (90th percentile) can be greater than 260 Fecal Coliform organisms per 100 ml.

There is evidence that illicit connections, failing septic systems and/or sanitary sewer leaks are causing the observed bacteria elevations during wet weather in some of these stormwater problem areas. Priority must be given to eliminating illicit connections and ensuring adequate sanitary waste disposal as a first step, where relevant.

It is difficult to determine the scale of reductions specifically necessary for regulated stormwater discharges such that water quality criteria will be met in the Bay during wet weather. However, the WLA given to stormwater for these municipalities will require that the Phase II mandated six minimum measures be fully implemented and following an adaptive management approach, that non-structural and structural best management practices be implemented to treat priority stormwater discharges such that fecal coliform loads are reduced to the maximum extent feasible. A summary of waste load allocations and their relation to pollution sources, by waterbody segment, is briefly described below.

Runnins River MA53-01 (Class B)

RI DEM has stated in their TMDL report, "Fecal Coliform TMDL for the Runnins River, Rhode Island" (RIDEM 2009) , that just downstream from the Route 6 Bridge on the MA side there is an area where documented failed on- site wastewater disposal system failures have been occurring. This has comprised of businesses with older failing cesspools and systems, undersized systems, and systems with waste loads beyond their capacity. Also, at the time of TMDL sampling in the late 1990s, a sewer pump station in East Providence periodically surcharged in wet weather events; this has subsequently been resolved. Summer peaks in bacteria levels correlate with increased water consumption. In the southern part of Seekonk, south of School Street, the source regions of the Runnins River comprise of a network of wetlands and marshes with Phragmities, in which, according to RI DEM, conditions are prime for bacteria to accumulate and multiply. On the MA side of the river, stormwater runoff is also thought to be a prime bacteria contributor. The final required concentration reduction (worst case scenario) for this segment is 99.2%. As a source, stormwater runoff will receive 100% of the wasteload allocation in all segments. A wasteload allocation of zero (0) is set for illicit discharges to stormdrains, leaking sanitary sewer lines, and failing septic systems.

Warren River Pond MA53-06 (Class SA)

This is a salt water tidal flat segment that straddles the border of MA and RI that lies adjacent to the main stem Palmer River to the west, and has a golf course lying just to the east and north. Utility gas pipelines run south to north (beneath) through the middle of the salt pond. It is believed that infiltration from the Palmer River (just to the west) through salt marshes separating the river from the pond is the source of most pathogen pollution in the pond. MA DMF is the only entity that has sporadically sampled this segment for bacteria over the past 20 years. There is one DMF shellfish bed that is prohibited for shellfishing. The final required concentration reduction for this segment is 96.6%. As a source, stormwater runoff will receive 100% of the wasteload allocation in all segments. A wasteload allocation of zero (0) is set for illicit discharges to stormdrains, leaking sanitary sewer lines, and failing septic systems.

Lee River MA61-01 (Class B)

Industrial and commercial activity exists on the west side and northern most reaches of this segment (in Swansea). An unnamed tributary drains from the northeast in Somerset into the Lee River, which has high bacteria counts following dry weather. There is high density residential housing, with some commercial establishments within this tributary watershed. Pathogen data indicate suspected dry weather sources, from failing septic systems and/or illicit connections. The final required concentration reduction for this segment is 98.8%. As a source, stormwater runoff will receive 100% of the wasteload allocation in all segments. A wasteload allocation of zero (0) is set for illicit discharges to stormdrains, leaking sanitary sewer lines, and failing septic systems.

Lee River MA61-02 (Class SA)

This is a salt water segment with a high density concentration of mixed commercial, industrial, and residential land- use. Along with this, the Brayton Point Power Plant, with a large- scale non- contact cooling water operation (and permit) is located on the southeast side of the segment next to Mount Hope Bay. Sources of pathogens likely include stormwater, leaking sanitary sewer lines, illicit connections, wildlife/ waterfowl, and boating waste discharges. The final required concentration reduction for this segment is 91.0%. As a source, stormwater runoff will receive 100% of the wasteload allocation in all segments. A wasteload allocation of zero (0) is set for illicit discharges to stormdrains, leaking sanitary sewer lines, and failing septic systems.

Cole River MA61-04 (Class SA)

West of Route 195, this segment is basically a tidal, salt water inlet and marsh, surrounded by mostly high density residential land- use on the west side, and a mix of high density residential and commercial on the east side. The land edges of the segment, north of Route 195 to the Route 6 bridge, consist of medium density housing and tidal marshes. Pathogen sources are likely to be mainly stormwater, as pathogen levels are higher during and just following wet weather events.

Leaking sewer lines, illicit connections, boat wastes, and wildlife may also be contributors. The final required concentration reduction for this segment is 99.2%. As a source, stormwater runoff will receive 100% of the wasteload allocation in all segments. A wasteload allocation of zero (0) is set for illicit discharges to stormdrains, leaking sanitary sewer lines, and failing septic systems.

Mount Hope Bay MA61-06 (Class SB, CSO)

The largest sources of bacteria during wet weather are combined sewer overflows from the City of Fall River, MA and stormwater runoff from MS4s from Fall River and Somerset. Other important sources likely include combined sewer overflows from further up the Taunton River from the Taunton WWTP in Taunton, and stormwater runoff from MS4s throughout the watershed of the Taunton River. Illicit discharges to stormdrains, leaking sanitary sewer lines, failing septic systems, and wildlife and waterfowl, and boating waste discharges also represent possible sources present during both wet and dry weather. The required concentration reduction for this Mount Hope Bay segment is 84.0%. As a source, all NPDES discharges within the Mt. Hope Bay and Taunton River systems must meet the water quality standard at the point of discharge. Stormwater runoff must also meet the water quality standard of the receiving water in which it discharges to. A wasteload allocation of zero (0) is set for illicit discharges to stormdrains, leaking sanitary sewer lines, failing septic systems, and boating waste discharges. The specific goal for controlling combined sewer overflows (CSO's) is meeting water quality standards through the implementation of the Long-Term CSO Control Plan..

Mount Hope Bay MA61-07 (Class SA)

MA61-07 abuts the preceding Mount Hope Bay MA61-06 segment and therefore may be subject to bacteria loads during wet weather from the City of Fall River combined sewer overflows and stormwater runoff from MS4s from Fall River. Important contributors would also be stormwater runoff from the communities of Somerset, Ocean Grove and South Swansea. Less important contributors would be combined sewer overflows from further up the Taunton River from the Taunton WWTP in Taunton, and stormwater runoff from MS4s throughout the watershed of the Taunton River. Other possible sources throughout the area, present during both wet and dry weather, may include (and have historically included) illicit discharges to stormdrains, leaking sanitary sewer lines, failing septic systems, and wildlife and waterfowl, and boating waste discharges. The required concentration reduction for this Mount Hope Bay segment is 97.4%. As a source, all NPDES discharges within the Mt. Hope Bay and Taunton River systems must meet the water quality standard at the point of discharge. Stormwater runoff must also meet the water quality standard of the receiving water in which it discharges into. A wasteload allocation of zero (0) is set for illicit discharges to stormdrains, leaking sanitary sewer lines, failing septic systems, and boating waste discharges. The specific goal for controlling combined sewer overflows (CSO's) is meeting water quality standards through the implementation of the Long-Term CSO Control Plan.

7.5 Application of the TMDL To Unimpaired or Currently Unassessed Segments

This TMDL applies to the 7 pathogen impaired segments of the Narragansett/ Mount Hope Bay Watershed that are currently listed on the 2008 CWA § 303(d) Integrated list of impaired waters. MassDEP recommends however, that the information contained in this TMDL guide management activities for all other waters throughout the watershed to help maintain and protect existing water quality. For these non-impaired waters, Massachusetts is proposing “pollution prevention TMDLs” consistent with CWA § 303(d)(3).

The analyses conducted for the pathogen-impaired segments in this TMDL would apply to the non-impaired segments, since the sources and their characteristics are equivalent. The concentration waste load and/or load allocation for each source and designated use would be the same as specified herein. Therefore, the pollution prevention TMDLs would have identical waste load and load allocations based on the sources present and the designated use of the water body segment (see Table 7.1). Any new construction that complies with state stormwater standards and permits is presumed to comply with antidegradation requirements of the state water quality standards.

This Narragansett/ Mount Hope Bay Watershed TMDL may, in appropriate circumstances, also apply to segments that are listed for pathogen impairment in subsequent Massachusetts CWA § 303(d) Integrated List of Waters. For such segments, this TMDL may apply if, after listing the waters for pathogen impairment and taking into account all relevant comments submitted on the CWA § 303(d) list, the Commonwealth determines with EPA approval of the CWA § 303(d) list that this TMDL should apply to future pathogen impaired segments.

7.6 Margin of Safety

This section addresses the incorporation of a Margin of Safety (MOS) in the TMDL analysis. The MOS accounts for any uncertainty or lack of knowledge concerning the relationship between pollutant loading and water quality. The MOS can either be implicit (i.e., incorporated into the TMDL analysis through conservative assumptions) or explicit (i.e., expressed in the TMDL as a portion of the loadings). This TMDL uses an implicit MOS, through inclusion of three conservative assumptions. First, the TMDL does not account for mixing in the receiving waters and assumes that zero dilution is available. Realistically, influent water will mix with the receiving water and become diluted below the water quality standard, provided that the receiving water concentration does not exceed the TMDL concentration. Second, the goal of attaining standards at the point of discharge does not account for losses due to die-off and settling of indicator bacteria that are known to occur. Third, the highest (most conservative) percentage reduction was applied for each segment of the two approaches evaluated: (1) percent reduction to meet the geometric mean of the highest station(s) within the segment; and (2) percent reduction to meet the 90th percentile value of that same station.

7.7 Seasonal Variability

In addition to a Margin of Safety, TMDLs must also account for seasonal variability. Pathogen sources to the Narragansett- Mount Hope Bay Watershed waters arise from a mixture of continuous and wet-weather driven sources, and there may be no single critical condition that is protective for all other conditions. This TMDL has set WLAs and LAs for all known and suspected source categories equal to the Massachusetts WQS independent of seasonal and climatic conditions. This will ensure the attainment of water quality standards regardless of seasonal and climatic conditions. Controls that are necessary will be in place throughout the year, protecting water quality at all times.

8.0 Implementation Plan

Setting and achieving TMDLs should be an iterative process, with realistic goals over a reasonable timeframe and adjusted as warranted based on ongoing monitoring. The goals set out in the TMDL represent reductions that will require substantial time and financial commitment to be attained. A comprehensive control strategy is needed to address the numerous and diverse sources of pathogens in the Narragansett/Mt. Hope Bay Watershed.

Elevated dry weather bacteria concentrations could be the result of illicit sewer connections, leaking sewer pipes, sanitary sewer overflows, or failing septic systems. These sources are illegal and must be eliminated, so first priority overall should be given to bacteria source tracking activities to investigate potential illicit bacteria sources in segments impaired by bacteria during dry weather. Tracking and remediation of dry weather bacteria sources is usually more straightforward and successful than tracking and eliminating wet weather sources. If illicit bacteria sources are found and eliminated it should result in a dramatic reduction of bacteria concentration in the segment in both dry and wet weather. A comprehensive program is needed to ensure illicit sources are identified and that appropriate actions will be taken to eliminate them.

Stormwater runoff represents another major source of pathogens in the Narragansett- Mount Hope Bay Watershed, and the current level of control is inadequate for standards to be attained in several segments. Improving stormwater runoff quality is essential for restoring water quality and recreational uses. It may not be cost effective or even possible to track and identify all wet weather sources of bacteria, therefore segments impaired during wet weather should be evaluated for stormwater BMP implementation opportunities starting with intensive application of less costly non-structural practices (such as street sweeping, and/or managerial strategies using local controls). Periodic monitoring to evaluate the success of these practices should be performed and, depending on the degree of success of the non-structural stormwater BMPs, more expensive structural controls may become necessary to meet water quality standards. This adaptive management approach to controlling stormwater contamination is the most practical and cost effective strategy to reduce pathogen loadings as well as loadings of other stormwater pollutants (e.g., pathogens) contributing to use impairment in the Narragansett- Mount Hope Bay Watershed .

Controls on several types of pathogen sources will be required as part of the comprehensive control strategy. Many of the sources in the Narragansett/Mt. Hope Bay Watershed including sewer connections to drainage systems, leaking sewer pipes, sanitary sewer overflows, and failing septic systems, are prohibited and must be eliminated. The goal for meeting water quality standards from combined sewer overflows (CSO's) is to meet water quality standards through the development and implementation of CSO long-term control plans (LTCP). All individual sources must be first identified in the field before they can be abated. Pinpointing sources typically requires extensive monitoring of the receiving waters and tributary stormwater drainage systems during both dry and wet weather conditions. A comprehensive program is needed to ensure illicit sources are identified and that appropriate actions will be taken to eliminate them.

For these reasons, a basin-wide implementation strategy is recommended. The strategy includes a mandatory program for implementing stormwater BMPs and eliminating illicit sources. The "*Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts*" (MassDEP 2005) was developed to support implementation of pathogen TMDLs. TMDL implementation-related tasks are shown in Table 8-1. The MassDEP working with EPA, Massachusetts Bay Program (MBP), and other team partners shall make every reasonable effort to assure implementation of this TMDL. These stakeholders can provide valuable assistance in defining hot spots and sources of pathogen contamination as well as the implementation of mitigation or preventative measures.

Table 8-1. Tasks

Task	Organization
Writing TMDL	MassDEP/EPA
TMDL public meeting	MassDEP/EPA
Response to public comment	MassDEP
Organization, contacts with volunteer groups	MassDEP/Save the Bay
Development of comprehensive stormwater management programs including identification and implementation of BMPs	Narragansett/Mt. Hope Bay Watershed Communities, where applicable
Expand Massachusetts "No discharge Areas" to include Narragansett/Mt. Hope Bay	MassCZM
Illicit discharge detection and elimination	Narragansett/Mt. Hope Bay Watershed Communities, where applicable
Leaking sewer pipes and sanitary sewer overflows	Narragansett/Mt. Hope Bay Watershed Communities, where applicable
CSO management	Narragansett/Mt. Hope Bay Watershed Communities, where applicable
Inspection and upgrade of on-site sewage disposal systems as needed	Homeowners, Narragansett/Mt. Hope Bay Watershed Communities (Boards of Health)
Organize implementation; work with stakeholders and local officials to identify remedial measures and potential funding sources	Narragansett/Mt. Hope Bay Watershed Communities
Organize and implement education and outreach program	Narragansett/Mt. Hope Bay Watershed Communities, Save the Bay
Write grant and loan funding proposals	Narragansett/Mt. Hope Bay Watershed Communities, Watershed Groups
Inclusion of TMDL recommendations in Executive Office of Energy and Environmental Affairs (EOEEA) Watershed Action Plan	EOEEA
Surface Water Monitoring	MassDEP, Division of Marine Fisheries (DMF), and Narragansett/Mt. Hope Bay Watershed Communities
Provide periodic status reports on implementation of remedial activities	MassDEP, Narragansett/Mt. Hope Bay Watershed Communities.

8.1 Summary of Activities within the Narragansett/Mt. Hope Bay Watershed

Data supporting this TMDL indicate that bacteria enter the Narragansett/Mt. Hope Bay Watershed from a number of contributing sources under a variety of conditions. Activities that are currently ongoing and/or planned to ensure that the TMDL can be implemented are summarized in the following subsections. The "*Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts*" (MassDEP 2005) provides additional details on the implementation of pathogen control measures summarized in the following subsections as well as additional measures not provided herein, such as by-law, ordinances and public outreach and education.

There are three major organizations in the Narragansett/Mt. Hope Bay Watershed that are working to improve water quality within the basin are described below.

Save the Bay – "The mission of Save the Bay is to ensure that the environmental quality of Narragansett Bay and its watershed is restored and protected from the harmful effects of human activity" (Save The Bay 2005). In support of this mission, Save the Bay conducts education campaigns, monitors government actions, and initiating direct action to clean up the bay and its surroundings (Save the Bay 2005).

The Narragansett Bay Estuary Program – "The mission of the Narragansett Bay Estuary Program is to protect and preserve Narragansett Bay through partnerships that conserve and restore natural resources, enhance water quality and promote community involvement" (NEP 2005). The Narragansett Bay Estuary Program is involved in a number of activities to support this goal including field surveys of water quality, developing legislation and regulations, training local officials, funding studies, and others.

The Massachusetts Office of Coastal Zone Management (CZM) – The mission of CZM is to balance the impacts of human activity with the protection of coastal and marine resources. As a networked program, CZM was specifically established to work with other state agencies, federal agencies, local governments, academic institutions, nonprofit groups, and the general public to promote sound management of the Massachusetts coast. CZM is funded primarily through the Commonwealth of Massachusetts, the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Environmental Protection Agency (EPA)." (CZM 2005a).

In 1990, Congress added the Coastal Nonpoint Source Pollution Control Program to the Reauthorization of the Coastal Zone Management Act. This legislation gives states the opportunity to work with federal agencies and already existing programs to develop and implement enforceable measures to restore and protect coastal waters from nonpoint source (NPS) pollution. The legislation also gives states the flexibility to design measures that are both environmentally and economically sound. The Massachusetts Coastal Zone Management Office [CZM] and the Department of Environmental Protection [MassDEP], in cooperation with a variety of other state agencies, are responsible for developing the Coastal Nonpoint Source Pollution Control Program for the Commonwealth." (CZM 2005b).

Through the Coastal Nonpoint Pollution Control Program, CZM is working with federal and state agencies, local officials, industry representatives, environmentalists, and the public to develop enforceable measures to restore and protect coastal waters from nonpoint source (NPS) pollution, which is currently the number one pollution problem in U.S. coastal waters. NPS pollution occurs when contaminants are picked up by rain water and snow melt and carried over land, in groundwater, or through drainage systems to the nearest waterbody.

Two grant programs administered by CZM support the implementation of the Coastal Nonpoint Pollution Control Program.

- The Coastal Pollutant Remediation (CPR) Grant Program provides funding to municipalities in Massachusetts coastal watersheds to reduce stormwater impacts from roads, highways, or parking areas and to install municipal boat pumpout facilities.

- The Coastal Nonpoint Source Pollution (Coastal NPS) Grant Program complements CPR and addresses more general areas of nonpoint source control. These grants, awarded to municipalities, as well as other public and non-profit groups, can be used for the following types of projects: assessment, identification, and characterization of nonpoint sources; targeted assessment of the municipal stormwater drainage system (runoff from municipal roadways, parking lots and bridges); the development of transferable tools (nonstructural best management practices), such as guidance documents, model by-laws, and land use planning strategies to improve nonpoint source control and management; and the implementation of innovative and unique demonstration projects.

Both the CPR and Coastal NPS grant programs have been developed to provide resources to municipalities for assessing and managing nonpoint sources of pollution. Projects funded through these grants can stand-alone or they can be discrete components of multi-year projects. For example, a municipality might use Coastal NPS funds to identify pollution sources in a subwatershed during year one of a project, and then apply for CPR funds to develop best management practices to remediate the identified roadway related pollutants during year two. CZM encourages the incorporation of long-term, progressive pollution mitigation planning components into proposals for both programs.

Also as part of the Coastal Nonpoint Pollution Control Program, CZM developed the *Massachusetts Clean Marina Guide*. This reference for owners and operators of marine boating facilities provides information on cost-effective strategies and practices aimed at reducing marina and boating impacts on the coastal environment (CZM 2005c). For more information regarding CZM programs and grants, please visit their website at http://www.mass.gov/czm/czm.htm.

GeoSyntec Consultants prepared a *"2004 Mount Hope and Narragansett Bay Watershed Five-Year Action Plan"* for the Executive Office of Environmental Affairs (EOEA) (GeoSyntec 2004). This plan establishes and prioritizes the following recommended watershed actions:

1. Water Quality Improvement and Protection (*Top Priority*)
2. Open Space, Land Use & Growth (*High Priority*)
3. Recreation and Access
4. Wildlife Habitat / Watershed Ecology (*High Priority*)
5. Public Outreach & Education

Specific objectives outlined in the action plan relating to water quality include:

1. Develop a formal agreement between RI and MA state agencies to guide improved water quality planning for Narragansett Bay
2. Accelerate upgrades at sewage treatment facilities.
3. Develop a comprehensive inventory of storm drains discharging directly to the river and major tributaries of the Palmer, Runnins, Kickemuit, Cole and Lees.
4. Implement recommendations from Phase 2 of Palmer River TMDL
5. Assess and implement the most effective measures for managing wastewater disposal throughout the watershed.

Other objectives identified include:

1. Provide support to Save the Bay for ongoing monitoring
2. Develop a bay-wide comprehensive monitoring plan based on "ecological indicators", such as shellfish surveys, fish, macroinvertebrates, etc. Ongoing surveys conducted by RIDEM, Dominion Energy Brayton Point, L.L.C., and consultants for the Swansea desalinization plant already include trawl and seine surveys, the scope of which could potentially be extended by volunteer efforts.
3. Conduct water quality sampling and vegetation mapping for South Wattupa Pond and the Upper Quequechan River (Fall River)
4. Implement recommendations from MA-DEP 1999 Narragansett/Mt. Hope Bay Watershed Water Quality Assessment Report (http://www.mass.gov/dep/brp/wm/wqassess.htm).

The Action Plan provides a detailed description of tasks required to accomplish these goals and objectives and identifies responsible parties. A copy of the Action Plan is available for download on the EOEEA website at http://www.mass.gov/envir/water/publications.htm.

Additional activities in the watershed were initiated through several DEP grant projects including a $ 147,000 Massachusetts Watershed Initiative Project, entitled "Narragansett and Mount Hope Bays and Ten Mile Basin Nonpoint Source Pollution Assessment". Under this project the following activities were conducted: land- use assessment, inventory and mapping of potential nonpoint pollution sources, water quality monitoring (with an approved QAPP), modeling of pollutant loadings (including bacteria) in the Ten Mile and Palmer River Watersheds, and preparation of a comprehensive nonpoint source pollution management plan for these watersheds. This project concluded that the relatively high percentage of residential land use and agriculture in this basin (forest ~ 60%; Residential ~26%; Agriculture ~14%) confirm the causes and sources of bacteria pollution. With residential, a very high percentage of residences and commercial establishments depend upon septic systems for wastewater disposal. Much of the area has poorly draining soils for proper functioning of these systems: that is why there are numerous septic system failures throughout the region, which is a major contributor to bacteria related pollution. This study recommends sewering and WWTP upgrades and construction, and elimination of septic systems where practicable throughout the region. Additionally, there are a lot of diversified agriculture and animal husbandry activities without the application of BMPs to retard pollution. Pig farms, horse stables, cattle farms, agricultural crops and manure application are all contributors to bacteria pollution from overland flows during and following rain events. The study recommends widespread conservation education on the application of proper BMP's, as well as financial assistance and help from NRCS and other entities to install BMP's where practicable. A list of funded activities is summarized below:

EPA funded 604b project ($81,000) - Through the "Mount Hope Bay: Estuaries Water Quality Monitoring" project extensive water quality and flow monitoring were conducted throughout the Mount Hope Bay Estuaries area. However, since nutrient parameters were the focus there was no bacteria monitoring included in the scope of work of this project.

EPA funded 604b project ($84,000) – The "Assessment of Stormwater Management Systems and Nonpoint Source Pollution" project for the town of Swansea created a stormwater management plan in conformance with the EPA NPDES Phase II Stormwater program, including identification and mapping of the town's stormwater infrastructure (including locations on GIS). Nonpoint source pollution at Compton's Corners Estuary was identified for investigation, including water quality monitoring from key outfalls. The stormwater management plan will include: locations and current status of stormwater management infrastructure, methodology for detecting illicit discharges as well as their principal locations, location and general character of non point and point sources of pollution, bacteria testing, and development of effective stormwater ordinances for controlling pollution.

Rhode Island DEM conducted several bacteria related monitoring projects in both the Lower Palmer River basin and in Mount Hope Bay adjacent to, and on both sides of the RI/MA border. This data was provided to MassDEP by RIDEM for inclusion in this TMDL.

The MA Division of Marine Fisheries (DMF) conducted significant bacteria related monitoring in the estuary waters of Narragansett/ Mount Hope bays area from 1995 to the present.

The City of Fall River has established a CSO Abatement Plan, which includes expansion of the regional wastewater treatment plant and construction of a rock tunnel. The rock tunnel that recently went on line during 2009 will facilitate a dramatic decrease in CSO discharges during wet weather events (see section 8.3 for further detail).

8.2 Agriculture

A number of techniques have been developed to reduce pathogen contamination from agricultural activities. There are also many methods intended to reduce sediment loads from agricultural lands.

Since bacteria are often associated with sediments, these techniques are also likely to result in a reduction in bacterial loads in run off as well. Techniques generally include BMPs for field application of manure, animal feeding operations, barnyards, and managing animal grazing areas. Brief summaries of some of these techniques are provided in the "*Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts*" (MassDEP 2005).

Since bacteria related problems in this watershed seem to be (partially) generated from various animal farms, e.g., pig, cattle, and horse farms, identified bacteria pollution sources with respect to these land- uses might benefit from some of the assistance and grant programs offered by the US Department of Agriculture, Natural Resource Conservation Services. There is an office in Littleton, MA that covers much of the Massachusetts area.

8.3 Illicit Sewer Connections, Failing Infrastructure and CSOs

Elimination of illicit sewer connections, repairing failing infrastructure and controlling impacts associated with CSOs are of extreme importance. Implementation of the Stormwater Phase II Final Rule requires that municipalities detect and eliminate sewage discharges to storm sewer systems including illicit sewer connections (USEPA 2000). Implementation of this rule will thus help communities achieve bacteria TMDLs.

Combined Sewer Overflows:

The City of Fall River

The City of Fall River presently operates a combined wastewater/stormwater collection and treatment system transporting both sanitary and stormwater flows from approximately 75% of the sewered areas of the City. These facilities serve about 90,000 residents and have the capacity to collect, transport and treat (secondary) dry-weather daily flow of 50-million gallons per day. The present peak hydraulic capacity for combined dry and wet-weather flow is 106-million gallons per day (primary, chlorination, dechlorination). The collection system consists of 179-miles of sewer pipeline, 13-pumping stations, 4,500 manholes, 5,000 catch basins and 19 Combined Sewer Overflow (CSO) outfalls. The system until recently has historically discharged approximately 1.5 billion gallons per year of untreated and/or partially treated sewage to Mt. Hope Bay (Burns 2001).

Water quality studies conducted by the U.S. Food and Drug Administration (FDA) in 1987 and Applied Science Associates (ASA) Inc. confirmed in 1990 that CSO's represent the largest source of sewage contamination in Mount Hope Bay - potentially masking all other inputs of fecal contaminants. During one wet weather event monitored by the FDA, CSO's accounted for 96% of total fecal coliform loading to Mount Hope Bay (Dixon et al. 1990).

As a result of a Federal Court Order, the City has prepared a Long Term CSO Control Plan (LTCP) and Facilities Management Plan which, when completed, would capture 48.3 million gallons of combined sewage from 19 CSO's, thereby reducing CSO discharges to less than four discharge events per year. The CSO Abatement Program includes expansion of the Regional Wastewater Treatment Plant primary treatment and disinfection capacity to 106-million gallons per day (completed), and construction of an 85-million gallon rock tunnel with surface piping and partial sewer separation of selected CSO areas along the waterfront (completed). The 20 foot diameter storage tunnel and nine connecting shafts are, at the time of this report, online and operational and receiving flow from six (6) of the combined sewer overflows located in the southern portion of the City. Upgrades are currently underway at the Cove and Central Street Pump Stations. At present, the Central Street Pump Station is the largest pump station, which conveys water through the Main Interceptor South (60 inch diameter) to the WWTF. This pump station is being increased to 30 mgd to allow for additional treatment at the WWTP. Plans also call for the addition of screening and disinfection facilities to treat discharges from the City Pier, President's Ave., Cove Street, and Alton Street CSO drainage areas.

Beginning in March of 2009, the City began a year long evaluation and assessment of the operation of the South /Central Tunnel System and the Cove Street CSO Screening and Disinfection Facility. This information, along with the monitoring program described below, will provide the data needed to develop the scope of work needed for construction of the remaining screening and disinfection facilities.

It is difficult to quantitatively assess water quality improvements that will be realized as a result of the recently completed LTCP upgrades. However, it is anticipated that water quality improvements are likely to be significant. Ongoing efforts under the Long Term Control Plan (LTCP) for the City (under the Court Order) are to conduct an extensive water quality monitoring study during 2010- 2011 in Mount Hope Bay adjacent to the City of Fall River, to determine the level of improvements that have occurred from the construction activity thus far, as well as be a guide for modifying the type and level of future upgrade and improvement efforts in the LTCP (specifically, the Phase IIB.2 North End CSOs) that will be necessary in the future. Planned efforts (2010- 2016) currently underway include: (1) Upgrading the capacity at the Central Street Pump Station to 30 mgd, to better control flow to the two overflow chambers (part of the City Pier CSO into the Taunton River); (2) North End CSO Rehabilitation and Separation Project involving a feasibility study of alternatives, leading to construction of screening and disinfection facilities of the CSOs in the Northern part of the City (Alton Street, Cove Street, President Avenue, City Pier, and Canal Street); (3) Increasing resources and the effectiveness of the Sewer Department in performing continuous collection system cleaning and inspections (including maximization of system storage and conveyance capacity), and (4) carrying out the components of the other nine minimum controls, including street sweeping and catch basin cleaning. These efforts along with the anticipated construction of disinfection facilities will eliminate all untreated CSO discharges from the central and northern portions of the City.

Sewer Separation work during the 2015 - 2018 timeframe will continue in the central and northern parts of the City, while the Tunnel storage capacity and further separation work during the same time period in the Southern portion of the City will eliminate CSO problems (except possibly intermittent flows in a greater than 3 month storm) from six past CSO flows in the Southern portions of the City (Mt. Hope Ave.; Charles St.; Birch St.; Riverview St.; Middle St.; William St). Ultimately under the LTCP, all CSOs will be controlled or treated within the three month storm (1.72 inches).

The City of Taunton

The Taunton Wastewater Treatment Facility collects and treats municipal wastewater from a portion of the surrounding municipal area. The facility provides advanced treatment and one stage ammonia-nitrogen removal. Portions of the collection system are over 100 years old, and are subject to large amounts of inflow and infiltration. During springtime high ground water conditions, flows to the plant may reach 22.4 mgd, from a dry weather average flow of 6.5 mgd (2004 M&E Sewer System Evaluation Survey).

There is a single CSO in the City of Taunton, located on West Water Street (Outfall 004). The City of Taunton has been subject to several enforcement actions for high flow related effluent violations, including EPA administrative orders No. 94-31 issued in 1994 and No. 96-04 issued in 1996 and a MassDEP order issued in 2005. RIDEM's Shellfish Program staff are notified when overflows occur from the West Water Street outfall. The overflows are associated with heavy rainfall events and are due primarily to infiltration and inflow (I/I) into the system. Infiltration is groundwater that enters the collection system through physical defects such as cracked pipes, or deteriorated joints. Inflow is extraneous flow entering the collection system through point sources such as roof leaders, yard and area drains, sump pumps, manhole covers, tide gates, and cross connections from stormwater systems. Significant I/I in a collection system may displace sanitary flow reducing the capacity and the efficiency of the treatment works causing bypasses to secondary treatment and overflows into the Taunton River. The long- term CSO Plan for Taunton is total elimination of flows from this CSO.

It is unclear whether these overflows cause discernable water quality impacts in Mount Hope Bay, since the overflow site is approximately 35 km (56 miles) upstream of the MA/RI border in Mount Hope Bay. In addition, impacts from Taunton's overflow events have likely been masked by the simultaneous occurrence of combined sewer overflows from the City of Fall River.

Elimination of illicit sewer connections and repairing failing infrastructure within all adjacent communities are of extreme importance. EPA's Phase II rule specifies an MS4 community must develop, implement, and enforce a stormwater management program that is designed to reduce the discharge of pollutants to the maximum extent practicable, protect water quality, and satisfy the applicable water quality requirements of the Clean Water Act. Illicit discharge detection and elimination (IDDE) is one of the six minimum control measures that must be included in the stormwater management program. The other control measures are:

- Public education and outreach on stormwater impacts
- Public involvement and participation
- Construction site stormwater runoff control
- Post-construction stormwater management in new development and redevelopment
- Pollution prevention and good housekeeping for municipal operations

As part of their applications for Phase II permit coverage, MS4 communities must identify the best management practices they will use to comply with each of these six minimum control measures and the measurable goals they have set for each measure.

In general, a comprehensive IDDE Program must contain the following four elements:

1) Develop (if not already completed) a storm sewer system map showing the location of all outfalls, and the names and location of all waters of the United States that receive discharges from those outfalls.

2) Develop and promulgate municipal regulations that require the municipality to comply with Phase II regulations including prohibition of illicit discharges and appropriate enforcement mechanisms.

3) Develop and implement a plan to detect and address illicit discharges, including illegal dumping, to the system. EPA recommends that the plan include the following four components: locating priority areas; tracing the source of an illicit discharge; removing the source of an illicit discharge; and program evaluation and assessment.

4) Inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper disposal of waste. IDDE outreach can be integrated into the broader stormwater outreach program for the community. Fulfilling the outreach requirement for IDDE helps the MS4 community to comply with this mandatory element of the stormwater program.

Communities that are not covered under the Phase II rule (i.e., not designated as MS4 communities) are encouraged to implement a program for detecting and eliminating sewage discharges to storm sewer systems including illicit sewer connections. Implementation of the Phase II rule (USEPA 2000), whether voluntarily or mandated will help communities achieve bacteria TMDLs.

Guidance for implementing an illicit discharge detection and elimination program is available in several documents. EPA New England developed a specific plan for the Lower Charles River (USEPA 2004b) to identify and eliminate illicit discharges (both dry and wet weather) to their separate storm sewer systems. Although originally prepared for the Charles River watershed it may be applicable to other watersheds throughout the Commonwealth, however, it represents just one of the approved methodologies available. More generic guidance is provided in a document prepared for EPA by the Center for Watershed Protection and the University of Alabama entitled Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments (EPA 2004c). In addition, practical guidance for municipalities is provided in a New England Interstate Water Pollution Control Commission publication entitled Illicit Discharge Detection and Elimination Manual, A Handbook for Municipalities (NEIWPCC 2003). Implementation of the protocol outlined in these guidance documents satisfies the Illicit Discharge Detection and Elimination requirement of the NPDES program.

8.4 Stormwater Runoff

Stormwater runoff can be categorized in two forms 1) point source discharges and 2) non-point source discharges (includes sheet flow or direct runoff). Many point source stormwater discharges are regulated under the NPDES Phase I and Phase II permitting programs when discharged to a Waters of the United States. Municipalities that operate regulated municipal separate storm sewer systems (MS4s) must develop and implement a stormwater management plan (SWMP), which must employ and set measurable goals for the following six minimum control measures:

1. public education and outreach particularly on the proper disposal of pet waste,
2. public participation/involvement,
3. illicit discharge detection and elimination,
4. construction site runoff control,
5. post construction runoff control, and
6. pollution prevention/good housekeeping.

Portions of towns in this watershed are classified as Urban Areas by the United States Census Bureau and are subject to the Stormwater Phase II Final Rule. This rule, as noted above, requires the development and implementation of an illicit discharge detection and elimination plan.

The NPDES permit does not, however, establish numeric effluent limitations for stormwater discharges. Maximum extent practicable (MEP) is the statutory standard that establishes the level of pollutant reductions that regulated municipalities must achieve. The MEP standard is a narrative effluent limitation that is satisfied through implementation of SWMPs and achievement of measurable goals.

Non-point source discharges are generally characterized as sheet flow runoff and are not categorically regulated under the NPDES program and can be difficult to manage. However, some of the same principles for mitigating point source impacts may be applicable. Individual municipalities not regulated under the Phase I or II should implement the exact same six minimum control measures minimizing stormwater contamination. A review of the progress in the Phase II Stormwater program for each community residing within the Mt. Hope Bay Watershed follows (http://www.epa.gov/ne/npdes/stormwater/ma.html).

Attleboro- Public education on stormwater has included the production and distribution of approximately 16,000 stormwater control related brochures through City offices, and in mailings, (e.g., in utility bills). The City website has included articles and information on stormwater and related non- point source pollution. The City received a 604b Grant for a stormwater education effort on the Ten Mile River (immediately adjacent to the Taunton and Mount Hope Bay watershed). An environmental planner was hired in 2006, with part of this person's duties assigned to specifically work on stormwater projects, such as facilitating the Stormwater Management Plan effort, broadcasting its progress periodically on the local cable TV channel, reporting on its progress at the City's annual meeting, and facilitating stormwater related environmental education efforts in the public schools. The animal control officer has put into effect a pet waste management program, which has installed pet waste disposal signs, with litter bag- receptacle stations in public parks. The City has mapped, with GIS, its stormwater collection system, which includes all pipelines, catch basins, and 549 outfalls. Most of the outfalls (409) have been screened, and 6 of these have been identified for dry weather flows and possible illicit connections. A City ordinance prohibiting illicit connections to MS4 stormwater conveyances was approved and put into effect in August, 2008. Housekeeping activities include the sweeping of all streets and public parking lots in the spring, with sweeping in all downtown streets carried out twice a week during the warmer months. Approximately 10 -20% of the 3,730 catch basins are cleaned annually.

Dighton The Town's 2009 annual stormwater report submitted to EPA indicates that stormwater information has been integrated into some of the public school curricula. In particular, relevant materials and concepts are integrated into the soil science component of the high school earth science curriculum. Stormwater related brochures have been produced and distributed via Town bulk mailings (e.g., notices and bills) to all Town residents. A series of public meetings have been held to develop a waiver to the current by- laws, which would allow for infiltration basins to be constructed and or maintained for the purpose of more efficient stormwater treatment and disposal in appropriate areas within the Town. A stormwater by-law to control illicit connections was approved and put in place by the Town in 2007. All stormwater conveyances and outfalls have been mapped with GIS. The Town has annual training for all appropriate staff on relevant stormwater management principles, with an emphasis on identification of illicit storm drain connections. All streets are swept, and all catch basins cleaned once per year.

Fall River- The 2007-2008 report indicates that the town is investing in long term funding, totaling $185 million, to build a CSO remediation tunnel, plus other CSO remediation and sewer separation projects, which will improve overall water quality in the entire Mount Hope Bay estuary area. Most of the City's resources spent on environmental protection have been going toward that effort (see Section 8.3). During 2007, two twin invert man- holes were discovered and removed by tying their drainage systems into the new CSO storage tunnel. Ultimately with all the technological control applications and improvements, CSO events will be limited to no more than 4 events per year. Better CSO controls will enhance the ability of the City to address stormwater pollution problems. With public education, the City has updated its website to include stormwater information. It also sponsors an annual cleanup day in some estuary- beach areas. The City maintains a stormwater information table at the annual Earth Day event. Stormwater notices and posters have been prepared and displayed in public locations such as the public library. Stormwater conveyance mapping is updated annually in GIS. In 2006-2007 two rounds of dry weather outfall screening were completed. The 2007 report indicates that a number of illicit connections were discovered and removed. A stormwater BMP manual for the City is being prepared. Stormwater training is provided to city employees once a year. Housekeeping activities include sweeping all streets once in the spring and through out the year in downtown areas. A new Tymco Regenerative Air Street Sweeper, costing $183, 000, has been purchased to assist with this work. Catch basins are cleaned once per year.

Rehoboth- In April 2008, the Town of Rehoboth stormwater by-law went into effect. This includes controls governing illicit connections going into stormwater conveyances. Signage has been purchased and erected in public resource areas needing extra protection and public awareness about the effects of stormwater pollution. Stencils have been created to mark catch basins in town to further protect the resource areas from stormwater runoff. Additional trash receptacles have been purchased and placed in areas where the Committee has become aware of the existence of excess trash. The Stormwater Committee has continued to follow up on residents' complaints and concerns. The Committee worked diligently during 2008 to create and finalize stormwater permit applications for any construction related to single family homes or commercial properties. Procedures are in place for yearly street sweeping and annual catch basin cleaning.

<u>Seekonk-</u> A public education program is in place that involves the display of NPS control posters in all municipal buildings. A stormwater information message plays monthly on the local cable channel, as well as in the Town's website. A stormwater action committee meets frequently, and holds quarterly review meetings on the Town's stormwater management plan with various interests in Town. With illicit connection detection, a by- law prototype (following an EPA model) was developed and put on the Town's website for the public to review. An all- town meeting was held on 8/30/05 to review/ modify the draft by- law, and in May, 2006, Town Meeting approved a final by- law, including enforcement sanctions. During 2007-2008, the Board of Health, and Department of Public Works began enforcement of the by- law through required inspections and corrective actions. All of the Town's stormwater outfalls have been identified and mapped with GIS. Housekeeping includes street sweeping of all main and connector roads twice annually, with secondary roads swept once a year. Catch basin cleaning is performed annually through a contractor, with an inventory list produced of vital repairs needed. A water quality management study of the Runnins River was completed by the Town in 2006. Regulation signs governing the feeding of waterfowl have been posted in all major public parks.

<u>Somerset</u>- Stormwater messages have each been aired on the Town's cable TV station twice per week for a total of six weeks duration. A stormwater management plan was developed in 2005-2006, and has been made available for access through a Town website link. Stormwater posters are currently on display at the Conservation Commission, Planning Board, and Board of Health offices. Since 2006, the Town has sponsored a riverbank cleanup day on the Taunton River. The Town has mapped all stormwater conveyance structures using GPS on GIS datasets. Progress is being made on development of an illicit connection prevention and control program. The area planning agency (SRPEDD) has been hired to develop an illicit discharge prohibition by- law component to be added to the existing set of town by- laws. There is the intention to present this component to the Board of Selectmen, and to Town Meeting for passage, but this hasn't occurred yet. All streets are swept, and all catch basins are cleaned once per year. Additionally, streets near the Taunton River are swept twice per year.

<u>Swansea-</u> Public education activities have involved stormwater information links being added to the Town's website. A video has been broadcast on the public cable station which gives information on stormwater controls required with all new construction. A 604b EPA grant project ($84,060 total) was received by the Town, entitled, "Assessment of Stormwater Management Systems and NPS Pollution, Town of Swansea". One major activity accomplished from that project was water quality monitoring in the Compton Corner Estuary. The results and recommendations from this sampling were formally reported to the Board of Selectmen. As of the 2007 annual report to EPA, 50% of the town's drainage system had been mapped on GIS, with all major outfalls identified and mapped. Sampling of suspected outfalls and conveyances has been completed in the Compton Corner area (from the 604b grant award). Odor complaints in the Sandy Beach area have been investigated by the Town, with illicit discharges identified, and affected property owners notified that corrections will be necessary. Street sweeping and catch basin cleaning are performed annually.

Westport- A stormwater education flyer was developed and made available at town offices. In addition, the Westport River Watershed Alliance (WRWA) helped to mail this flyer to every residence in Town. A stormwater management committee was formed in 2006, and with the help of the WRWA, the committee developed a draft stormwater management plan, and a draft stormwater regulation governing control of illicit connections. The committee, along with WRWA, has been conducting an annual meeting with the Town to update progress on carrying out the stormwater management plan, and to provide educational materials and information on stormwater (including illicit connections) to all interested citizens. The WRWA has assisted the committee and the Town to produce a draft illicit connection detection and elimination by- law, which is currently being considered by the Town for formal adoption. At the same time, the Town has completed GIS mapping of the entire stormwater conveyance system, including all major outfalls. This will prove useful in identifying potential illicit connection problems to be fixed in the future. The future housekeeping program in the Town will be aided by development of a formalized housekeeping workplan program and guide, which is currently being developed by an outside consultant.

In addition to the above, the Massachusetts Department of Environmental Protection's proposed new "Stormwater Management Regulations," that would establish a statewide general permit program aimed at controlling the discharge of stormwater runoff from certain privately-owned sites containing large impervious surfaces.

The proposed regulations would require private owners of land containing five or more acres of impervious surfaces to apply for and obtain coverage under a general permit; implement nonstructural best management practices (BMPs) for managing stormwater; install low impact development (LID) techniques and structural stormwater BMPs at sites undergoing development or redevelopment; and submit annual compliance certifications to the Department.

Where the Department has determined that stormwater runoff is causing or contributing to violations of the Massachusetts Surface Water Quality Standards, the proposed regulations would allow MassDEP to impose the same requirements on certain private owners of land with less than five acres of impervious surfaces and require the owners of such land to design and implement the LID techniques and stormwater BMPs needed to address these violations.

8.5 Failing Septic Systems

Septic system bacteria contributions to the Narragansett/Mt. Hope Bay Watershed may be reduced in the future through septic system maintenance and/or replacement. Additionally, the implementation of Title 5, which requires inspection of private sewage disposal systems before property ownership may be transferred, building expansions, or changes in use of properties, will aid in the discovery of poorly operating or failing systems. Because systems which fail must be repaired or upgraded, it is expected that the bacteria load from septic systems will be significantly reduced in the future. As recommended in other portions of this report, sewering in many areas will aid in the reduction of pathogen loads, as many septic systems are failing or not functioning properly due to poorly draining soils in many parts of the watershed. Regulatory and educational materials for septic system installation, maintenance and alternative technologies are provided by the MassDEP on the worldwide web at www.mass.gov/dep/water/wastewater/septicsy.htm.

8.6 Wastewater Treatment Plants

WWTP discharges are regulated under the NPDES program when the effluent is released to surface waters. Each WWTP has an effluent limit included in its NPDES or groundwater permit. Some permits are listed on the following websites: www.epa.gov/region1/npdes/permits_listing_ma.html, www.mass.gov/dep/water/resources/groundwater.htm.

With respect to areas not presently supported by WWTP's, the Narragansett/ Mount Hope Bays area relies primarily on septic disposal systems for residential and businesses. Much of the area does not have favorable soils for adequate leaching system processes, so many systems are failing to one degree or another. Several studies, already alluded to in Section 6 above, highly recommend sewering for as much of the area as possible, particularly in the towns of Seekonk and Swansea. This would mean either WWTP construction, or sewer tie-ins with existing WWTP's. The later situation is the case with Seekonk where recommendations have been made for construction of sewer lines, and tie- ins to the Attleboro WWTP. The DEP Southeast Regional Office Wastewater Management (DEP 2006) reports that sewering has been discussed for nearly a decade in Seekonk. The town of Swansea is proceeding with the development of a Comprehensive Wastewater Management Plan, which includes full examination of the pros and cons of the sewering option. The sewering option would most likely mean the need for constructing a new WWTP in town.

8.7 Recreational Waters Use Management

Recreational waters receive pathogen inputs from swimmers and boats. To reduce swimmers' contribution to pathogen impairment, shower facilities can be made available, and bathers should be encouraged to shower prior to swimming. In addition, parents should check and change young children's diapers when they are dirty. Options for controlling pathogen contamination from boats include:

- petitioning the State for the designation of a No Discharge Area (NDA),
- supporting installation of pump-out facilities for boat sewage,
- educating boat owners on the proper operation and maintenance of marine sanitation devices (MSDs), and
- encouraging marina owners to provide clean and safe onshore restrooms and pump-out facilities.

There are currently no areas proximal to the Narragansett/Mt. Hope Bay watershed established as "no discharge area" (NDA), however, in early 2009 the Massachusetts Department of Coastal Zone Management drafted an application for this purpose. MassCZM is working with the several Towns in the MHB area to resolve concerns associated with this application. A designation by the Commonwealth of Massachusetts with EPA approval provides protection of this area by a Federal Law which prohibits the release of raw or treated sewage from vessels into navigable waters of the U.S. The law is enforced by the Massachusetts Environmental Police. The Massachusetts CZM and Massachusetts Environmental Law Enforcement are also actively pursuing an amendment to

State regulations allowing for the institution of fines up to $2000 for violations within a NDA (USEPA 2004c).

8.8 Funding/Community Resources

A complete list of funding sources for implementation of non-point source pollution is provided in Section VII of the Massachusetts Nonpoint Source Management Plan Volume I (MassDEP 2000b) available on line at http://www.mass.gov/dep/brp/wm/nonpoint.htm. This list includes specific programs available for non-point source management and resources available for communities to manage local growth and development. The State Revolving Fund (SRF) provides low interest loans to communities for certain capital costs associated with building or improving wastewater treatment facilities. In addition, many communities in Massachusetts sponsor low cost loans through the SRF for homeowners to repair or upgrade failing septic systems.

8.9 Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts

For a more complete discussion on ways to mitigate pathogen water pollution, see the "*Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts*" (MassDEP 2005).

9.0 Monitoring Plan

The long term monitoring plan for the Narragansett/Mt. Hope Bay watershed includes several components:

1. continue with the current monitoring of the Narragansett/Mt. Hope Bay Watershed (local watershed conservation organizations, DMF and local governments),
2. continue with MassDEP watershed five-year cycle monitoring,
3. Targeted work by the MassDEP SERO BST (Bacteria Source Tracking) Team efforts,
4. monitor areas within the watershed where data are lacking or absent to determine if the waterbody meets the use criteria,
5. monitor areas where BMPs and other control strategies have been implemented or discharges have been removed to assess the effectiveness of the modification or elimination,
6. assemble data collected by each monitoring entity to formulate a concise report where the basin is assessed as a whole and an evaluation of BMPs can be made, and
7. add/remove/modify BMPs as needed based on monitoring results.
8. The City of Fall River, as required in its Administrative Consent Order, will be conducing both wet and dry weather testing during 2010 and 2011 in Mount Hope Bay adjacent to the City of Fall River to confirm the degree of water quality improvements that have occurred as a result of nearly $150 Million in CSO implementation and improvement activities over the past decade.

The monitoring plan is an ever changing document that requires flexibility to add, change or delete sampling locations, sampling frequency, methods and analysis. At the minimum, all monitoring should be conducted with a focus on:

- capturing water quality conditions under varied weather conditions,
- establishing sampling locations in an effort to pin-point sources,
- researching new and proven technologies for separating human from animal bacteria sources, and
- assessing efficacy of BMPs.

10.0 Reasonable Assurances

Reasonable assurances that the TMDL will be implemented include both application and enforcement of current regulations, availability of financial incentives including low or no-interest loans to communities for wastewater treatment facilities through the State Revolving Fund (SRF), and the various local, state and federal programs for pollution control. In addition, when developing the TMDL no point sources were assigned a less stringent WLA based on reductions from nonpoint sources. Stormwater NPDES permit coverage is designed to address discharges from municipal owned stormwater drainage systems. Enforcement of regulations controlling non-point discharges includes local enforcement of the state Wetlands Protection Act and Rivers Protection Act, Title 5 regulations for septic systems and various local regulations including zoning regulations. Financial incentives include Federal monies available under the CWA Section 319 NPS program and the CWA Section 604b and 104b programs, which are provided as part of the Performance Partnership Agreement between MassDEP and the EPA. Additional financial incentives include state income tax credits for Title 5 upgrades, and low interest loans for Title 5 septic system upgrades through municipalities participating in this portion of the state revolving fund program. A brief summary of many of MassDEP's tools and regulatory programs to address common bacterial sources is presented below.

10.1 Overarching Tools

Massachusetts Clean Water Act: The MA Clean Water Act (M.G.L. Chapter 21, sections 26-53) provides MassDEP with specific and broad authority to develop regulations to address both point and non-point sources of pollution. There are numerous regulatory and financial programs, including those identified in the preceding paragraph, that have been established to directly and indirectly address pathogen impairments throughout the state. Several of them are briefly described below. The MA Clean Water Act can be found at the following URL. http://www.mass.gov/legis/laws/mgl/21-26.htm

Surface Water Quality Standards (314 CMR 4.0): The Massachusetts Water Quality Standards (WQS) assign designated uses and establish water quality criteria to meet those uses. Each water body is assigned a classification (Class A, B, and C, for freshwater and SA, SB, and SC for marine waters) and bacteria criteria are established for each individual classification and use. The Massachusetts Surface Water Quality Standards can be found http://www.mass.gov/dep/water/laws/regulati.htm#wqual

Ground Water Quality Standards (314 CMR 6.0): These standards consist of groundwater classifications, which designate and assign the uses for various groundwaters of the Commonwealth that must be maintained and protected. Like the surface water quality standards the groundwater standards provide specific ground water quality criteria necessary to sustain the designated uses and/or maintain existing groundwater quality. The Massachusetts Ground Water Quality Standards can be found at http://www.mass.gov/dep/water/laws/regulati.htm#wqual.

River Protection Act: In 1996 Massachusetts passed the Rivers Protection Act. The purposes of the Act were to protect private or public water supply's; ground water; to provide flood control; to prevent storm damage; to prevent pollution; to protect land containing shellfish; to protect wildlife habitat; and to protect the fisheries. The provisions of the Act are implemented through the Wetlands Protection Regulations, which establish up to a 200-foot setback from rivers in the Commonwealth to control construction activity and protect the items listed above. Although this Act does not directly reduce pathogen discharges it indirectly controls many sources of pathogens close to water bodies. More information on the Rivers Protection Act can be found on MassDEPs web site at http://www.mass.gov/dep/water/laws/laws.htm.

10.2 ADDITIONAL TOOLS TO ADDRESS COMBINED SEWER OVERFLOWS (CSO'S)

Massachusetts, in concert with EPA Region 1, has established a detailed CSO abatement program and policy. CSO discharges are regulated by the Commonwealth in several ways. Like any discharge of pollutants, CSOs must have an NPDES/MA Surface Water Discharge Permit under federal and state regulations. Municipalities and districts seeking funding for wastewater treatment, including CSO abatement, must comply with the facilities planning process at 310 CMR 41.00. Entities obtaining funding or exceeding specific thresholds must also comply with the Massachusetts Environmental Policy Act (MEPA) regulations at 301 CMR 11.00. Each of these regulations contains substantive and procedural requirements. Because both MEPA and facilities planning require the evaluation of alternatives, these processes are routinely coordinated.

All permits for a CSO discharge must comply with Massachusetts Surface Water Quality Standards at 314 CMR 4.00. The water quality standards establish goals for waters of the Commonwealth, and provide the basis for water quality-based effluent limitations in NPDES permits. Any discharge, including CSO discharges, is allowed only if it meets the criteria and the antidegradation standard for the receiving segment. EPA's 1994 CSO Control Policy revised some features of its 1989 version to provide greater flexibility by allowing a minimal number of overflows, which are compatible with the water quality goals of the Clean Water Act. MassDEP's 1995 regulatory revisions correspondingly decreased reliance on partial use designation as the sole regulatory vehicle to support CSO abatement plans[1].

In all cases, NPDES/MA permits require the nine minimum controls necessary to meet technology-based limitations as specified in the 1994 EPA Policy. The nine controls may be summarized as: operate and maintain properly; maximize storage, minimize overflows, maximize flows to Publicly Owned Treatment Works (POTW), prohibit dry weather CSO's, control solids and floatables, institute pollution prevention programs, notify the public of impacts, and observe monitoring and reporting requirements. The nine minimum controls may be supplemented with additional treatment

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[1] DEP's 1990 CSO Policy was based on EPA's 1989 CSO Control Policy and established the goal of eliminating adverse impacts from CSOs, using partial use designation where removal or relocation was not feasible. The three month design storm was identified as the minimum technology-based effluent limitation, which would result in untreated overflows an average of four times a year. Abatement measures to meet these minimum standards were necessary for a CSO discharge to be eligible for partial use designation. Presumably, all CSOs exceeding this standard required downgrading to Class C or SC status. No partial use designations or downgrades to Class C were actually made, but the process was perceived as administratively cumbersome.

requirements, such as screening and disinfection, on a case-by-case basis. The Department's goal is to eliminate adverse CSO impacts and attain the highest achievable water quality. Separation or relocation of CSOs is required wherever it can be achieved based on an economic and technical evaluation. As untreated CSOs cause violations of water quality standards, and thus are in violation of NPDES permits, all of the state's CSO permittees are under enforcement orders to eliminate the CSO through planning, design, and construction of CSO abatement facilities. Each long-term control plan must identify and achieve the highest feasible level of control. The process also requires the permittee to comply with any approved TMDL. Presently, there are twenty–four (24) CSO communities in the Commonwealth.

10.2 Additional Tools to Address Failed Septic Systems

The MassDEP has regulations in place that require minimum standards for the design of individual septic systems (Title 5). Those regulations ensure, in part, protection for nearby surface and groundwaters from bacterial contamination. The regulations also provide minimum standards for replacing failed and inadequate systems. The Department has established a mandatory requirement that all septic systems must be inspected and upgraded to meet Title 5 requirements at the time of sale or transfer of the each property.

10.3 Additional Tools to Address Stormwater

Stormwater is regulated through both federal and state programs. Those programs include, but are not limited to, the federal and state Phase I and Phase II NPDES stormwater program, and, at the state level, the Wetlands Protection Act (MGL Chapter 130, Section 40), the state water quality standards, and the various permitting programs previously identified.

Existing stormwater discharges are regulated under the federal and state Phase 1 and Phase II stormwater program. In Massachusetts there are two Phase 1 communities, Boston and Worcester. Both communities have been issued individual permits to address stormwater discharges. In addition, 237 communities in MA are covered by Phase II. Phase II is intended to further reduce adverse impacts to water quality and aquatic habitat by instituting use controls on the unregulated sources of stormwater discharges that have the greatest likelihood of causing continued environmental degradation including those from municipal separate storm sewer systems (MS4s) and discharges from construction activity.

The Phase II Final Rule, published in the Federal Register on December 8, 1999, requires permittees to determine whether or not stormwater discharges from any part of the MS4 contribute, either directly or indirectly, to a 303(d) listed waterbody. Operators of regulated MS4s are required to design stormwater management programs to 1) reduce the discharge of pollutants to the "maximum extent practicable" (MEP), 2) protect water quality, and 3) satisfy the appropriate water quality requirements of the Clean Water Act. Implementation of the MEP standard typically requires the development and implementation of BMPs and the achievement of measureable goals to satisfy each of the six minimum control measures. Those measures include 1) public outreach and education, 2) public participation, 3) illicit discharge detection and elimination, 4) construction site runoff control, 5) post-construction runoff control, and 6) pollution prevention/good housekeeping. In addition, each permittee must determine if a TMDL has been developed and approved for any water body into which an MS4 discharges. If a TMDL has been approved then the permittee must comply with the TMDL including the application of BMPs or other performance requirements. The permittee's must report annually on all control measures currently being implemented or planned to be implemented to control pollutants of concern identified in TMDLs. Finally, the Department has the authority to issue an individual permit to achieve water quality objectives. Links to the Massachusetts Phase II permit and other stormwater control guidance can be found at: http://www.mass.gov/dep/water/wastewater/stormwat.htm.

A full list of Phase II communities in MA can be found at:
http://www.mass.gov/dep/water/laws/p2help.htm.

In addition to the Phase I and II programs described above the Massachusetts Department of Environmental Protection's proposed new "Stormwater Management Regulations," that would establish a statewide general permit program aimed at controlling the discharge of stormwater runoff from certain privately-owned sites containing large impervious surfaces.

The proposed regulations would require private owners of land containing five or more acres of impervious surfaces to apply for and obtain coverage under a general permit; implement nonstructural best management practices (BMPs) for managing stormwater; install low impact development (LID) techniques and structural stormwater BMPs at sites undergoing development or redevelopment; and submit annual compliance certifications to the Department. Any new construction will have to comply with state stormwater standards and permits and with the antidegradation requirements of the state water quality standards.

Where the Department has determined that stormwater runoff is causing or contributing to violations of the Massachusetts Surface Water Quality Standards, the proposed regulations would allow MassDEP to impose the same requirements on certain private owners of land with less than five acres of impervious surfaces and require the owners of such land to design and implement the LID techniques and stormwater BMPs needed to address these violations.

The MassDEP Wetlands regulations (310 CMR 10.0) direct issuing authorities to enforce the MassDEP Stormwater Management Policy, place conditions on the quantity and quality of point source discharges, and to control erosion and sedimentation. The Stormwater Management Policy was issued under the authority of the 310 CMR 10.0. The policy and its accompanying Stormwater Performance Standards apply to new and redevelopment projects where there may be an alteration to a wetland resource area or within 100 feet of a wetland resource (buffer zone). The policy requires the application of structural and/or non-structural BMPs to control suspended solids, which have associated co-benefits for bacteria removal. A stormwater handbook was developed to promote consistent interpretation of the Stormwater Management Policy and Performance Standards: Volume 1: Stormwater Policy Handbook and Volume 2: Stormwater Technical Handbook can be found along with the Stormwater Policy at: http://www.mass.gov/dep/water/laws/policies.htm#storm

10.4 FINANCIAL TOOLS

the following section describes the financial tools that are in place in Massachusetts to facilitate TMDL implementation activities.

Nonpoint Source Control Program: MassDEP has established a non-point source program and grant program to address non-point source pollution sources statewide. The Department has developed a Nonpoint Source Management Plan that sets forth an integrated strategy and identifies important programs to prevent, control, and reduce pollution from nonpoint sources and more importantly to protect and restore the quality of waters in the Commonwealth. The Clean Water Act, Section 319, specifies the contents of the management plan. The plan is an implementation strategy for BMPs with attention given to funding sources and schedules. Statewide implementation of the Management Plan is being accomplished through a wide variety of federal, state, local, and non-profit programs and partnerships. It includes partnering with the Massachusetts Coastal Zone Management on the implementation of Section 6217 program. That program outlines both short and long term strategies to address urban areas and stormwater, marinas and recreational boating, agriculture, forestry, hydromodification, and wetland restoration and assessment. The CZM 6217 program also addresses TMDLs and nitrogen sensitive embayments and is crafted to reduce water quality impairments and restore segments not meeting state standards.

In addition, the state is partnering with the Natural Resource Conservation Service (NRCS) to provide implementation incentives through the National Farm Bill. As a result of this effort, NRCS now prioritizes its Environmental Quality Incentive Program (EQIP) funds based on MassDEP's list of impaired waters. The program also provides high priority points to those projects designed to address TMDL recommendations. Over the past several years EQIP funds have been used throughout the Commonwealth to address water quality goals through the application of structural and non-structural BMPs.

Massachusetts in conjunction with EPA, also provides a grant program to implement nonpoint source BMPs that address water quality goals. The section 319 funding provided by EPA is used to apply needed implementation measures and provide high priority points for projects that are designed to address 303d listed waters and to implement TMDLs. MassDEP has funded numerous projects through 319 that were designed to address stormwater and bacteria related impairments. It is estimated that 75% of all projects funded since 2002 were designed to address bacteria related impairments.

The 319 program also provides additional assistance in the form of guidance. The Department is in the process of updating the Massachusetts' Nonpoint Source Management Manual that will provide detailed guidance in the form of BMPs by landuse to address various water quality impairments and associated pollutants.

Finally, it should be noted that the approach and process outlined for implementing this TMDL has been previously demonstrated with documented success. A previous TMDL, which utilized this approach was developed and approved by EPA for the Neponset River Watershed. The recommendations outlined in that TMDL were similar to the current proposal. Since the time of approval, MassDEP worked closely with a local watershed group (Neponset River Watershed Association) to develop a 319 project to implement the recommendations of the TMDL. The total project cost was approximately $472,000 of which $283,000 was provided through federal 319 funds and the additional 40% provided by the watershed association and two local communities.

Other examples include the Little Harbor in Cohasset and the Shawsheen River. Similar TMDLs were developed in these areas. In Little Harbor, the TMDL was used as the primary tool to obtain local approval and funding to design and install sewers around Little Harbor and other additional areas of Town impacted by sewerage contamination. Presently, the Town is seeking additional state funding to construct the sewers. In the Shawsheen Watershed the TMDL was used to obtain a state grant to identify and prioritize specific stormwater discharges for remediation. In addition, MassDEP has received a grant to a conduct additional sampling and refine field and laboratory techniques that will allow us to differentiate between human and non-human sources that will be useful statewide. MassDEP and EPA Region 1 are also working on a compliance & enforcement strategy to address the worst sources. Additional information related to the non-point source program, including the Management Plan can be found at: http://www.mass.gov/dep/water/resources/nonpoint.htm.

State Revolving Fund: The State Revolving Fund (SRF) Program provides low interest loans to eligible applicants for the abatement of water pollution problems across the Commonwealth. MassDEP has issued millions of dollars in loans for the planning and construction of CSO facilities and to address stormwater pollution. Loans have also been distributed to municipal governments statewide to upgrade and replace failed Title 5 systems. These programs all demonstrate the State's commitment to assist local governments in implementing the TMDL recommendations. Additional information about the SRF Program is located at: http://www.mass.gov/dep/water/wastewater/wastewat.htm#srf.

Bacteria Source Tracking Program: Over the last several years MassDEP/DWM has supported regional staff and provided analytical capabilities in three regions (Northeast, Southeast, and West) to work with communities to track, identify and eliminate bacteria sources that contribute to water quality impairments.

In summary, MassDEP's approach and existing programs set out a wide variety of tools both MassDEP and communities can use to address pathogens, based on land use and the commonality of pathogen sources (e.g., combined sewer overflows (CSOs), failing septic systems, stormwater and illicit connections, pet waste, etc.) Since there are only a few categories of sources of pathogens, the necessary remedial actions to address these sources are well established. MassDEP's authority combined with the programs identified above provide sufficient reasonable assurance that implementation of remedial actions will take place.

11.0 References

Ayres Associates 1993. Onsite Sewage Disposal Systems Research in Florida. The Capacity of Fine Sandy Soil for Septic Tank Effluent Treatment: A Field Investigation at an In-Situ Lysimeter Facility in Florida.

Alonso 1998. Journal of Environmental Science and Health, Part A, Volume 33, Issue 6, August, 1998. Quantitative Determination of E coli and Fecal Coliforms in Water Using a Chromogenic Medium.

Burns 2001. Personal Communication from David Burns, Massachusetts Department of Environmental Protection, Southeast regional Office, Lakeville, MA

CDM 1996- Camp Dresser and McKee Inc.,1996. Wastewater Treatment and Sewer Needs Assessment Study for the Town of Seekonk. Cambridge MA.

CDM 1999. Fall River Massachusetts, Evaluation of CSO Abatement Program, DRAFT report, July 1999.

Center for Watershed Protection, 1999. Watershed Protection Techniques. Vol. 3, No. 1.

CZM 2005a. Massachusetts Office of Coastal Zone Management. Information from website, downloaded July 2005. http://www.mass.gov/czm/

CZM 2005b. Massachusetts Office of Coastal Zone Management. The Coastal Nonpoint Source Pollution Control Program in Massachusetts – Introduction. Information from website, downloaded July 2005. http://www.mass.gov/czm/npsintro.htm

CZM 2005c. Massachusetts Office of Coastal Zone Management. Coastal Water Quality Protection in the Massachusetts Coastal Zone. Information from website, downloaded July 2005. http://www.mass.gov/czm/cwq2.htm

Dixon, A.M., C.A. Karp, and C.A. Penniman. 1991. Mount Hope Bay "briefing paper" and proceedings from Narragansett Bay Project Management Committee. (Narragansett Bay Project). Current Report of the Narragansett Bay Project. Report #NBP-91-65. 49 pp.

DMF 2002. Massachusetts Division of Marine Fisheries. Programs and Projects. Shellfish Sanitation and Management. Information from website, downloaded March 2005. http://www.mass.gov/dfwele/dmf/programsandprojects/shelsani.htm

ESS 2002- Environmental Science Services, Inc., 2002. The Ten Mile River/ Narragansett and Mount Hope Bays Watershed NPS Assessment Project, Non Point Source Management Plan. Wellesley MA.

Fall River 2005. Fall River Sewer Commission. Information from website, downloaded August 2005. http://www.fallriverma.org/sewer/sewer_main.asp

GeoSyntec 2004. 2004 Mount Hope and Narragansett Bay Watershed Five-Year Action Plan. Available for download on the EOEA website at: http://www.mass.gov/envir/water/publications.htm

MassDEP 2000a. 314 CMR 4.00: Massachusetts Surface Water Quality Standards. Massachusetts Department of Environmental Protection Bureau of Waste Prevention. Available for download at http://www.mass.gov/dep/service/regulations/314cmr04.pdf

MassDEP 2000b. Nonpoint Source Management Plan Volume I Strategic Summary. Massachusetts Department of Environmental Protection Bureau of Waste Prevention. Available for download at www.mass.gov/dep/water/resources/nonpoint.htm

MassDEP 2002a. Narragansett/Mt. Hope Bay Watershed 1999 Water Quality Assessment Report. Massachusetts Department of Environmental Protection, Division of Water Management. Worcester, Massachusetts. Available for download at www.mass.gov/dep/water/resources/wqassess.htm

MassDEP 2002b. Cape Cod Watershed Water Quality Assessment Report. Massachusetts Department of Environmental Protection, Division of Water Management. Worcester, Massachusetts.

MassDEP 2002c Final Total Maximum Daily Loads of Bacteria for Neponset River Basin. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Division of Watershed Management. Report MA73-01-2002 CN 121.0. Boston, Massachusetts. Available for download at www.mass.gov/dep/water/resources/tmdls.htm

MassDEP 2003. Draft Total Maximum Daily Loads of Bacteria for the Palmer River Basin. Available for download at www.mass.gov/dep/water/resources/tmdls.htm

MassDEP 2003. Massachusetts Year 2002 Integrated List of Waters. Part 2 – Final Listing of Individual Categories of Waters. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Division of Watershed Management. Boston, Massachusetts. Available for download atwww.mass.gov/dep/water/resources/tmdls.htm.

MassDEP 2005. Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts.

MassDEP 2008. Massachusetts Year 2008 Integrated List of Waters. Part 2 – Final Listing of Individual Categories of Waters. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Division of Watershed Management. Boston, Massachusetts. Available for download atwww.mass.gov/dep/water/resources/tmdls.htm.

MassDEP 2006. Department of Environmental Protection, Southeast Regional Office, Wastewater Management Division, personal contact information. Lakeville, MA.

MassGIS 2005. Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs. MassDEP 2002 Integrated List of Waters (305(b)/303(d)) as of 2005; Land Use as of 1999; Town Boundaries as of 2002. Census TIGER Roads as of 2003. Major Drainage Boundaries as of 2003. Designated Shellfish Growing Area as of July 2000. Downloaded January 2005. http://www.mass.gov/mgis/laylist.htm

MDC-CDM. 1997. Wachusett Stormwater Study. Massachusetts District Commission and Camp, Dresser, and McKee, Inc.

Metcalf and Eddy 1991. Wastewater Engineering: Treatment, Disposal, Reuse. Third Edition.

Metcalf and Eddy 1992. Casco Bay Stormwater Management Project.

Metcalf and Eddy 2004. Sewer System Evaluation Survey.

NEP 2005. Narragansett Bay Estuary Program. About the Bay Program. Information from website, downloaded August 2005. Available at http://www.nbep.org/program/index.html

RIDEM 2002. State of Rhode Island, Department of Environmental Management, Water Quality Division. Fecal Coliform TMDL for the Runnins River, Rhode Island. Providence, Rhode Island. http://www.dem.ri.gov/programs/benviron/water/quality/rest/pdfs/runfinal.pdf

RIDEM 2009. State of Rhode Island, Department of Environmental Management, Water Quality Division, a TMDL Report,"Total Maximum Daily Load Study for Bacteria, Mount Hope Bay and the Kickemuit River Estuary". Providence, Rhode Island.

Save The Bay 2005. Save the Bay Website. Information from website, downloaded August 2005. Available at: http://www.savebay.org

Tamara, Garcia- 2007. Canadian Journal of Microbiology, June 1, 2007. Comparison of Culturable Fecal Coliforms and Escherichia coli Enumeration in Freshwaters

USEPA 1983. Results of the Nationwide Urban Runoff Program. Volume I. Final Report. Water Planning Division. Washington, D.C. 159 pp.

USEPA 1986. Ambient Water Quality Criteria for Bacteria – 1986. USEPA 440/5-84-002.

USEPA 1997. Urbanization of Streams: Studies of Hydrologic Impacts. USEPA 841-R-97-009

USEPA 1999. Regional Guidance on Submittal Requirements for Lake and Reservoir Nutrient TMDLs. USEPA, New England Region. November 1999.

USEPA 2000. Stormwater Phase II Final Rule: Illicit Discharge Detection and Elimination Minimum Control Measure. Office of Water, US Environmental Protection Agency. Fact Sheet 2.5. USEPA 833-F-00-007. January.

USEPA 2001. Protocol for Developing Pathogen TMDLs. EPA 841-R-00-002

USEPA 2004a. Monitoring and Assessing Water Quality. Information from website, downloaded December 2004.
http://www.epa.gov/OWOW/monitoring/volunteer/stream/vms511.html

USEPA 2004b. Lower Charles River Illicit Discharge Detection & Elimination (IDDE) Protocol Guidance for Consideration - November 2004 United States Environmental Protection Agency Region I New England

USEPA 2004c. No Discharge Areas in Massachusetts. Information from website, downloaded March 2005. http://www.epa.gov/region01/eco/nodiscrg/ma.html

USGS 2002. Measured and Simulated Runoff to the Lower Charles River, Massachusetts, October 199-September 2000. 02-4129. United States Geological Survey. Northborough, Massachusetts.

Appendix A- Public Participation

RESPONSE TO COMMENTS ON THE DRAFT PATHOGEN TMDL
NARRAGANSETT/MT. HOPE BAY WATERSHED

Public Meeting Announcement Published in the Monitor – January 6, 2010

DEP Press Release - January 7, 2010 (Over 50 other contacts were made to Communities and entities in the area

Dates of Public Meeting: (1) January 21, 2010; (2) January 26, 2010

Locations of Public Meetings:

(1) Bristol Community College, 777 Elsbree St., Hudnall Administration Building, Fall River, MA, Thursday January 21, 6- 8 PM;
(2) Swansea School Administration Building, 1 Gardner's Neck Road, Swansea MA, Wednesday January 27, 2- 4P

Attendees: at Bristol Community College, January 21, 6- 8PM:

Name	Affiliation	E-Mail Address
Brian Zalewski	RI DEM	brian.zalewski@dem.ri.gov
Elizabeth Scott	RI DEM	elizabeth.scott@dem.ri.gov
Kimberly Groff	MassDEP	kimberly.groff@state.ma.us
William Dunn	MassDEP	william.dunn@state.ma.us
Terry Sullivan	City of Fall River	tsullivan@fallriverma.org
Chris Chapin	KBI Flext Pave Inc.	cchapin@kbius.com
Frank D. Arnold	Somerset WPC	swpc@meganet.net
Jim Munger	Stoney Meadows	jimunger908@comcast.net
Erica Medley	Roger Williams	egmedley1@cox.net
Carolyn LaMarre	Taunton Watershed Alliance	director@savethetaunton.org
Everett Castro	Green Futures	info@greenfutures.org
Robert S. Rak	Bristol Community College	robertrak@bristolcc.edu
Leon Bowdoin	Wavers Cove Energy	lbowdoin@waverscove.com
Priscilla Chapman	Mass Audubon Society	pchapman@massaudubon.org

Attendees: at Town of Swansea School Administration Building, January 26, 2- 4PM

Name	Affiliation	E-Mail Address
Elizabeth Scott	RI DEM	elizabeth.scott@dem.ri.gov
Kimberly Groff	MassDEP	kimberly.groff@state.ma.us
William Dunn	MassDEP	william.dunn@state.ma.us
Terry Sullivan	City of Fall River	tsullivan@fallriverma.org
Alex Houtzager	Taunton Watershed Alliance	alex@webitoster.com

Name	Affiliation	E-Mail Address
Frank Menezes	Citizen	fmenezes@comcast.net
Greg Sawyer	MassDMF	gregory.sawyer@state.ma.us
Paul Hogan	Woodard and Curran Inc.	phogan@woodrardcurran.com
Cindy Baumann	CDM Inc.	cbaumannca@cdm.com
Tracie Beasley	MassDEP Lakeville	tracie.beasley@state.ma.us
Jennifer Shepperd	MassDEP Lakeville	jennifer.sheppard@state.ma.us
Lee B. Donn	Seekonk Planning Board, SRPEDD Planning Comm.	phoebeleed@gmail.com
Rachel Calabro	Save the Bay	rcalabro@savebay.org

PART I -- OF THE PUBLIC QUESTIONS—VERBALLY ASKED AT EACH OF THE PUBLIC MEETINGS

Watershed Specific Comments / Responses:
Questions/comments raised during the Bristol Community College Public Meeting – MHB 1/21/10

Question 1: What is done with the sludge that is generated from the Wastewater Treatment Plant at Fall River?

Response: *Sludge is thickened and incinerated at a cost of $750,000/yr. Sludge is thickened (gravity thickeners), dewatered (belt filter presses), and incinerated (multiple hearth furnace) at the WWTF. The ash is transported to New Hampshire for ultimate disposal.*

Question 2: What is the design storm for the Fall River Facility?

Response*: The system is designed to handle the 1.72 inch/12 hour storm (the 3 month storm).*

Question 3: What is the timeline for implementing the controls necessary to achieve the goals for this TMDL?

Response: *Achieving the TMDL will require an iterative process that sets realistic implementation goals and schedules that are adjusted as warranted based on ongoing implementation, monitoring and assessment of control activities. Achieving the pathogen reductions presented in the TMDL will require substantial time and financial commitment to be attained. While much progress has been made in controlling impacts for CSOs, additional controls will need to be identified and implemented to locate and address the numerous sources of pathogens nutrients in the MHB watershed.*

Question 4: Why hasn't the Taunton River TMDL been finalized?

Response: *Massachusetts was the first state in New England to develop watershed wide pathogen TMDLs. There were a number of issues raised by EPA with the Draft TMDLs that were developed requiring substantial re-working of these TMDL reports. The approach has been worked out and the state is in the process of finalizing the pathogen TMDLs by watershed. The Charles River Bacteria TMDL was approved by EPA in 2007. Buzzard's Bay, Cape Cod and Three Bays were submitted* *and approved as final by EPA in 2009. DWM is expecting to update and finalize the remaining pathogen TMDLs over the next few years.*

Question 5: What assurances do we have that the Draft Mount Hope Bay (MHB) Bacteria TMDL will become final.

Response: *MassDEP has every intention of producing the Final MHB Bacteria TMDL. MassDEP is very confident that the Final MHB Bacteria TMDL will be approved by EPA. The Draft MHB pathogen TMDL was completed in coordination with RIDEM. The Final RIDEM TMDL for the Mount Hope Bay and the Kickemuit River Estuary has received final approval from EPA, and Mass DEP anticipates the same will occur for this TMDL.*

Question 6: Can we expect to see changes in the inspection frequency of septic systems. In other words can septic system be tested on an annual basis instead of waiting until the property transfers?

Response: *MassDEP Title 5 Regulations give jurisdiction to local Boards of Health in communities to insure the proper operation of septic systems in their respective community. When failing systems are identified, the local Board of Health has the authority to require that these failing systems be fixed. Each Board of Health has its own separate program to insure proper operation and maintenance of these systems. Currently, there is no annual statewide testing program of these systems.*

Watershed Specific Comments / Responses:

Questions/comments raised during the MHB Bacteria TMDL Public Meeting at the Swansea School Administration Building, School Committee Meeting Room, 1/27/10, 2- 4PM.

Question 1: Mass DEP has taken a statewide generic approach to TMDL development. What steps will Mass DEP take to ensure that implementation occurs?

Response: *MassDEP has a number of tools in place to facilitate the implementation process. In summary, MassDEP's approach and existing programs set out a wide variety of tools both MassDEP and communities can use to address pathogens, based on land use and the commonality of pathogen sources (e.g., combined sewer overflows (CSOs), failing septic systems, stormwater and illicit connections, pet waste, etc). Since there are only a few categories of sources of pathogens, the necessary remedial actions to address these sources are well established. In this report, Section 8, Implementation, and Section 10, Reasonable Assurances, describe in detail potential tools and funding sources available to communities and other entities to address pathogen problems. In addition, MassDEP has broad legal authority to address non-point source pollution. Enforcement tools are available for use for cases of egregious neglect. Some examples of additional efforts to improve water quality are explained below.*

Bacteria Source Tracking Program: Over the last several years MassDEP has hired new regional staff which have provided analytical capabilities in three regions (Northeast, Southeast, and West) to *work with communities to track, identify and eliminate bacteria sources that contribute to water quality impairments.*

DMF sampling of Surface waters: The Division of Marine Fisheries (DMF) has, for decades, conducted bacteria sampling and shoreline surveys in many of the coastal- estuary areas (including Mount Hope Bay). DMF will continue with these surveys and forward their results to Town Managers.

EPA Phase II Stormwater Program: *EPA's Phase II rule specifies an MS4 community must develop, implement, and enforce a stormwater management program that is designed to reduce the discharge of pollutants to the maximum extent practicable, protect water quality, and satisfy the applicable water quality requirements of the Clean Water Act. Illicit discharge detection and elimination (IDDE) is one of the six minimum control measures that must be included in the stormwater management program. The other control measures are:*

- *Public education and outreach on stormwater impacts*
- *Public involvement and participation*
- *Construction site stormwater runoff control*
- *Post-construction stormwater management in new development and redevelopment*
- *Pollution prevention and good housekeeping for municipal operations*

As part of their applications for Phase II permit coverage, MS4 communities must identify the best management practices they will use to comply with each of these six minimum control measures and the measurable goals they have set for each measure.

DWM Monitoring *– DWM water quality monitoring surveys generate physical, chemical, biological and fish data. These activities are implemented in accordance with the 5-year watershed cycle. The goal is to fill information gaps, collect important data for assessing our waterbodies, identify impaired waters, develop Total Maximum Daily Loads (TMDLs), and ultimately to make enforcement and permitting decisions. The scope of these field assessments varies depending upon the resources available and the water quality issues within each watershed. MassDEP also evaluates data collected by volunteer groups that have the capability to assist.*

Question 2: DMF appears to have a significant monitoring role and should be identified in Table 8-1.

Response: *DMF monitoring activities will be included in Table 8-1.*

Question 3: How Does the Bacterial Source Tracking (BST) program pick sites to investigate in more detail?

Response: *The BST staff review available data and target sites that show high bacterial numbers during dry weather. Included in this review are potential sites from segments in the 303d Integrated List of impaired waters. Sources of site(s) data include DWM monitoring efforts, town monitoring efforts, and efforts of other entities and organizations such as volunteer groups. Once a site(s) or* *sections of segments are selected, a sampling screening study is undertaken, with more intensive follow-up monitoring studies conducted in order to find the sources of pollution.*

Question 4: What is the design storm for the Fall River CSO system?

Response: *The design storm is 1.72 in/12 hours, or a 3 month storm. The maximum hydraulic capacity of the Wastewater Treatment facility is 106 MGD. The first 50 MGD from of sanitary and CSOs receives full secondary treatment through the WWTP. The second 51 to 106 MGD (sanitary and CSO) receives primary settling, super chlorination, followed by dechlorination. In addition, the CSO tunnel provides storage for an additional 38 million gallons. This water is later gravity fed to the WWTP for full secondary treatment during dry weather.*

Question 5: How are the separated storm sewers located in the North of Fall River managed?

Response: *Those areas will be managed under the EPA Phase II Stormwater program.*

Question 6: How confident is Fall River that the 5 direct outfalls in the south end will be contained in a 0.5 inch storm.

Response: *Fall River is in the process of evaluating the CSO facilities in the south end, and cannot say with certainty what storm event will cause an overflow. The City is monitoring all storm events and this issue will continue to be evaluated. It should be noted that the CSO improvements are expected to reduce the overflow events from 691 to less than 4 per year.*

Question 7: What is the timeframe for implementation of this TMDL?

Response: *It is not possible to set a specific timeline for implementation of the TMDL. One of the biggest hurdles is that there is no definitive source of funding. Overall, the timeframe for implementation includes: completion of WWTP improvements in Fall River as well as Taunton and Brockton (upstream in the Taunton River), adequate control of all CSOs, and then adequate control of stormwater and non- point sources of pollution. The bacteria allocations presented in the TMDL represent reductions that will require substantial time and financial commitment to be attained. Control strategies will need to address a wide variety of funding sources that fall under jurisdiction of a number of agencies, NGOs, towns as well as potentially private individuals.*

Question 8: Will communities need to modify their Stormwater plans to address the TMDL.

Response: *The National Pollutant Discharge Elimination System (NPDES) Stormwater Phase II General Permit Program became effective in Massachusetts in March 2003. The permit requires the regulated entities to develop, implement and enforce a stormwater management program (SWMP) that effectively reduces or prevents the discharge of pollutants into receiving waters to the Maximum Extent Practicable (MEP). Stormwater discharges must also comply with meeting state water quality standards. The Phase II permit uses a best management practice framework and measurable goals to meet MEP and water quality standards. A requirement of the permit is that if a TMDL has been approved for any water body into which the small municipal separate storm sewer system (MS4)* *discharges, the permittee must determine whether the approved TMDL is for a pollutant likely to be found in stormwater discharges from the MS4. If the TMDL includes a pollutant waste load allocation, best management practices (BMPs) or other performance standards for stormwater discharges, the permittee must incorporate them into their SWMP. The permittee must assess whether the pollutant reduction required by the TMDL is being met by existing stormwater management control measures in their SWMP or if additional control measures are necessary. As TMDLs are developed and approved, permittees' stormwater management programs and annual reports must include a description of the BMPs that will be used to control the pollutant(s) of concern, to the maximum extent practicable. Annual reports filed by the permittee should highlight the status or progress of control measures currently being implemented or plans for implementation in the future. Records should be kept concerning assessments or inspections of the appropriate control measures and how the pollutant reductions will be met.*

Question 9: Are there regulations to address sources of bacteria on private land?

Response: T*he Massachusetts Department of Environmental Protection proposed new "Stormwater Management Regulations," in the spring of 2009 that would establish as statewide general permit program aimed at controlling the discharge of stormwater runoff from certain privately-owned sites containing large impervious surfaces.*

The proposed regulations are being revised based on public comment. The proposed regulations are available on the DEP website at (http://www.mass.gov/dep/service/regulations/newregs.htm#storm), and these require: private owners of land containing five or more acres of impervious surfaces to apply for and obtain coverage under a general permit; implement nonstructural best management practices (BMPs) for managing stormwater; install low impact development (LID) techniques and structural BMPs at sites undergoing development and redevelopment; and submit annual compliance certifications to the Department.

Where the Department has determined that stormwater runoff is causing or contributing to violations of the Massachusetts Surface Water Quality Standards, the proposed regulations would allow MassDEP to impose the same requirements on certain private owners or land with less than 5 acres of impervious surfaces and require owners to such land to design and implement the LID techniques and stormwater BMPs needed to address these violations.

PART II (A) OF THE PUBLIC COMMENTS—WRITTEN--

RIDEM Comments on the Narragansett/Mt. Hope Bay Watershed

Draft Total Maximum Daily Load (TMDL) For Pathogens

Comment #1- The Runnins River is categorized in Rhode Island as a Special Resource Protection Water (SRPW) for Critical Habitat (Rare and Endangered Species). It discharges to the Barrington

River, which is a Class SA water. The Barrington River is designated as a shellfish harvesting water and is also a SRPW. These reasons should increase the Runnins River priority to ***high.***

MassDEP response: *MassDEP agrees with the issue RIDEM has raised as the Runnins River portion in RI is a Special Resource Protection Water (SRPW), which is similar in concept to Outstanding Resource Waters (ORWs) in MA. Also, the adjoining water to the Runnins River in RI is classified as an SA water, which has sensitive uses (shellfishing). In the final TMDL report the load reductions calculations were based on the Class SA Massachusetts Water Quality standard rather than the Class B standards in order to protect the downstream uses.*

Comment #2 (Page 18)-. This TMDL relies heavily on the RIDEM 2002 TMDL for the Runnins River. The MA TMDL does not attempt to discuss activities, including sampling, that has been completed on the River since 2000. The Runnins River has an active watershed group (Runnins River Steering Committee) which includes government and citizen representatives, including state representatives from Rhode Island and Massachusetts. They can provide valuable local information about the Runnins River. There is no mention of any of the MassDEP Rotating Basin Sampling Analyses. Also, MassDEP's Bacteria Source Tracking sampling included analysis for E. coli. Additionally, the Pokanoket Watershed Alliance collected water quality samples at three stations in the Runnins River. Fecal coliform samples were collected in 2000 – 2004, while both fecal coliform and enterococci was collected in 2006. While there may be reasons to continue using the older dataset, the newer data should be acknowledged.

In general, we find that the TMDL fails to adequately address the unique water quality problems of the Runnins River. While this River has a significant wet weather problem, it also has a significant dry weather summer problem. The wet weather problems were discussed in the MA TMDL, but the dry weather problems were not.

MassDEP response: *Mass DEP made several inquiries to the Runnins River Steering Committee, however, bacteria data could not be obtained . Mass DEP was able to obtain data from the Pokanoket Watershed Alliance and the results from the 2006 Runnins River MA53-10 portion were summarized in Section 4 of the final report. Highlights from the MassDEP SERO BST work and data results in the Runnins River 2007- 2009, were also include in the revised report (possible pollution sources, in the Runnins River portion). As of the date of this report the BST data have not been fully validated according to DWM QA/QC protocols. Since this data is provisional it has not been used in calculating TMDL load reductions.*

Comment #3-. There are several items that are referenced to a RIDEM 2000 document. In some cases, the more appropriate citation should be the RIDEM 2002 Runnins River TMDL document.

MassDEP response: *The citation references to RIDEM 2002, which refers to the RIDEM 2002 Runnins River TMDL Report were changed.*

Comment #4 (Page 19) -. There are no stations in the Runnins River below School Street. School Street is just above the Mobil Dam, which is the boundary between the Runnins River and the

Barrington River. Access to the Mobil Dam is limited. Station 1A, which was reported as having a geometric mean of 63,615 cfu/100 mL was sampled on the upstream side of the Pleasant Street Bridge. This is not in the lower Runnins River since it is located upstream of Burrs Pond and Grist Mill Pond.

MassDEP response: *The description of where station 1A is located was changed.*

Comment #5 -. As stated in Section 3.3 (page 25) of the Runnins River TMDL Document, "The Rayner dry weather data are used in section 4 to illustrate historical trends, seasonal variations, and provide a comparison with data collected by RIDEM. RIDEM data, however, were used to evaluate compliance with the geometric mean part of the water quality standard for developing the TMDL." The Rayner dataset was used to determine compliance with the percent variability part of the standard (page 58).

MassDEP response: *The information from this quote was incorporated into the first full paragraph, pg 19.*

Comment #6 -. The data presented in Table 4-4 is not correct and is a misrepresentation of the RIDEM TMDL. The 90th percentile value was 12,100 for the Rayner dry and wet weather combined dataset. No 90th percentile value was presented in the TMDL document for the RIDEM data. Also, the Runnins River TMDL (Table 4.5, Page 50) lists the Rayner wet weather geometric mean as 1054.

MassDEP response: *This information contained in Table 4-4 has been revised to address this comment.*

Comment #7 -. Is the MADMF data presented for the Lee River that which was used to re-classify these areas in 2009?

MassDEP response: *DMF based the re- classifications on progress that the town of Swansea has made to control pollution, and DMF data collected between 2003- 2009. These data have been summarized in the Final Report.*

Comment #8 (Page 22) -. Is the MADMF data presented for the Coles River, that which was used to re-classify these areas in 2009?

MassDEP response: DMF based the re- classifications on progress that the town of Swansea has made on control of pollution, and DMF data collected between 2003- 2009. These data have been summarized in the Final Report.

Comment #9 (Page 25) - We don't agree with the statement regarding the impacts of Taunton's CSO, given the lack of data. Our last wet weather sampling date during the June event was on June 6th. On June 7th at 0800 hrs Taunton began to discharge via the SSO. Over one million gallons were reported to have been discharged. Our data would not have picked this up. No SSOs were reported to have occurred during our October sampling event. Not saying that an SSO doesn't impact MHB or the Taunton but just want to clarify that the RIDEM data do not show this.

MassDEP response: *The second sentence in this paragraph has been changed to read.: Also, several data points in the RI Study on the Taunton River above Fall River indicate some bacteria increases following wet weather, which may indicate urban or other impacts coming from upstream areas in the Taunton Watershed.*

Comment #10 (Page 29) -.Given the previously documented significance of the City of Fall River's CSOs to fecal loading to Mt. Hope Bay, specific mention of the CSO's and earlier reports would seem appropriate in this section on Sanitary Waste. Even with construction of the rock tunnel and the tie-in 9 downshafts, there are a number of CSOs that remain unabated and no doubt continue to significantly impact receiving waters. It would be helpful if the TMDL summarized what the consent order requires the City of Fall River to do.

MassDEP response*: As a result of a Federal Court Order, the City has prepared a Long Term CSO Control Plan (LTCP) and Facilities Management Plan which, when completed, will reduce the untreated CSO discharges from 691 to less than 4 per year and the annual average CSO volume form 1508 to 116 million gallons per year. The CSO Abatement Program includes expansion of the Regional Wastewater Treatment Plant primary treatment and disinfection capacity to 106-million gallons per day (already completed), and construction of an 85-million gallon rock tunnel (35 million gallon storage capacity) with surface piping and partial sewer separation of selected CSO areas along the waterfront (already completed). The 20 foot diameter storage tunnel and nine connecting shafts are, at the time of this report, online and operational and receiving flow from six (6) of the combined sewer overflows located in the southern portion of the City. Upgrades are currently underway at the Cove and Central Street Pump Stations. At present, the Central Street Pump Station is the largest pump station, which pumps to the Main Interceptor South (60" diameter) to the WWTF. When the Central Street Pump Station fails, it overflows to the City Pier CSO, which currently discharges (untreated) into the Taunton River.*

Beginning in March of 2009, the City began a year long evaluation and assessment of the operation of the South /Central Tunnel System and the Cove Street CSO Screening and Disinfection Facility. This information, along with the monitoring program described below, will provide the data needed in order determine the scope of work needed for construction of the remaining screening and disinfection facilities.

It is impossible at this point to quantitatively assess water quality improvements as a result of the recent LTCP upgrades that have been completed, but they are likely to be significant. However, part of the Long Term Control Plan (LTCP) for the City (under the Court Order) is to conduct an extensive water quality monitoring study during 2010- 2011 in Mount Hope Bay adjacent to the City of Fall River, to determine the level of improvements that have occurred from the construction activity thus far, as well as be a guide for modifying the type and level of future upgrade and improvement efforts in the LTCP (specifically, the Phase IIB.2 North End CSOs) that will be necessary in the future. Additionally, major planned efforts, 2010- 2016, under the Court Order include: (1) Upgrade the *pumping capacity at the Central Street Pump Station to 30 mgd, to better control future overflows to the two overflow chambers (part of the City Pier CSO into the Taunton River); (2) North End CSO Rehabilitation and Separation Project involving a feasibility study of alternatives, leading to construction of screening and disinfection facilities of the CSOs in the Northern part of the City at: Alton Street, Cove Street, President Avenue, City Pier, and Canal Street; (3) Increase resources and the effectiveness of the Sewer Department in performing continuous collection system cleaning and inspections, (including maximization of system storage and conveyance capacity), and carrying out the components of the other nine minimum controls, including street sweeping and catch basin cleaning. This, along with anticipated construction of disinfection facilities, will eliminate all untreated CSO discharges from the central and northern portions of the City.*

Continued Sewer Separation work during 2015- 2018 will continue in the central and northern parts of the City, while the Tunnel storage capacity and further separation work during the same time period in the Southern portion of the City will eliminate CSO problems (except possibly intermittent flows in a greater than 3 month storm) from six past CSO flows in the Southern portions of the City (Mt. Hope Ave.; Charles St.; Birch St.; Riverview St.; Middle St.; William St).

Thus, under the LTCP, all CSOs will be controlled or treated within the three month storm (1.72") when the project is complete. The expected net result of all the improvements is that water quality objectives should be attained 95% of the time. This information has been included in section 8.3.1 of the TMDL report. The City of Fall River Long-Term CSO control plan (LTCP) (CDM 1999) is expected to be compatible with the Massachusetts water quality standards goals for the segment .

Comment #11 (page 32) -. The last paragraph includes several neighborhoods that appear to be in the Runnins River watershed, not the Palmer River watershed as listed. I don't believe that much of Seekonk is in the Palmer River watershed.

MassDEP comment: *This comment was addressed in the final TMDL report..*

Comment #12 (Page 35) - It would be helpful if this TMDL included the results from the last three years of bacteria source tracking activities that MassDEP has been conducting in the Runnins River.

MassDEP response: *With respect to our MassDEP SERO BST work and data results in the Runnins River 2007- 2009, highlights have been summarized, including possible pollution sources, in the Runnins River portion of Section 4 of the final report. Our QA/QC Officer indicates that the BST data are in the process of being validated.*

Comment #13 (page 41) - The TMDL targets as established for the Runnins are not protective of downstream waters. More specifically, the target for Runnins Rivers (Class B) at its point of discharge to the Barrington River must be protective of the more sensitive SA criteria assigned to the Barrington River. Similarly, to be protective of SA classified segments of Mt Hope Bay segments, the target for all segments including those classified as SB should be set to SA criteria. As noted in the following excerpt, EPA has required that TMDLs developed by RIDEM demonstrate that TMDL targets are protective of downstream waters: Al Basile of EPA, stated in a May 2, 2001 review of a draft RIDEM Barrington River TMDL that, “[a] footnote should be included to state that the Allocated concentrations/loads in the Runnins River and the Palmer River were set at locations upstream in these systems, and that standards will be attained at the point of discharge to the Barrington River.” This means that the Runnins River must meet Class SA standards at its discharge point with the Barrington River (Mobil Dam). There is not enough die-off and dilution between School Street and the Mobil Dam to meet the SA standard at the Dam.

MassDEP Response: *MassDEP agrees with RIDEM’s as well as EPA's concern on this matter. With respect to the Runnins River MA53-01, and the Lee River MA61-02, Mass DEP based the pathogen load reduction calculations in Table 7-3 of the Final Report submittal on Massachusetts Class SA Water Quality Standards. Massachusetts Class SA shellfishing standards (shellfish fecal coliform standard of geometric mean = 14 cfu/100 mL and 90th percentile = 28 cfu/100) are slightly more stringent when compared to the RI Class SA shellfishing standard (shellfish fecal coliform standard of geometric mean = 14 cfu/100 mL and 90th percentile = 49 cfu/100 mL).*

In addition, analysis shows that shellfishing bacteria target criteria applied to the Mount Hope Bay Class SB MA61-06 segment is adequately protective to achieve the RI water quality standards for the two adjoining RI Class SB segments (RI0007032E-01C and E-01D). The RI primary contact recreation criteria (primary contact fecal coliform 90th percentile = 400 cfu/100/mL) for Class SB waters is much less stringent than the Massachusetts Class SB 90th percentile shellfishing criteria (fecal coliform 90th percentile = 260 cfu/100/mL).

As described above in Response number # 10, once the Fall River LTCP is completely implemented it is anticipated that water quality objectives in the vicinity of the Fall River outfalls will be attained 95% of the time. While allowance for dilution is not considered in the TMDL, it is clear that natural bacteria decay processes will be a factor for the 4 overflows that are ultimately expected to result after improvements are completed. The City of Fall River Long-Term CSO control plan (LTCP) (CDM 1999) is expected to be compatible with the Massachusetts water quality standards goals for the segment. In addition, the Fall River NPDES Permit Fact sheet indicates that a dilution factor of 5.7/1 occurs (based on a flow of 30.9 MGD) at the Fall River WWTF outfall. LTCP reductions estimate that on average total of 116 million gallons may be discharged from CSO 4 times per year. Therefore the highest expected overflow in an average year would be approximately 29 MGD per occurrence. For these rare events the CSO discharge would receive screening and disinfection and then be dispersed resulting in a dilution factor significantly higher 5.7:1. Factors including (1) the Long Term CSO Control Plan (LTCP) of the Fall River WWTP calling for chlorination treatment for all wastewater and most CSO discharges; (2) time and travel/ distance from the discharge point to the next segment; and (3) the natural bacterial decay process that occur under ambient conditions combine to provide a high level of confidence that the instream water quality standards will be achieved once the Fall River LCTP is fully implemented. These combined processes will be significant in a large segment such as MA61-06, and thus protective of the two adjoining RI Class SB segments (RI0007032E-01C and E-01D), as well as the adjoining Mount Hope Bay MA61-07 segment. The distance between the Mount Hope Bay MA61-06 (Class SB) segment, and the MA61-07 (Class SA) segment, is more than a mile off the eastern coastal shore of Mount Hope Bay and any effects of CSO discharges from Fall River. In summary, these factors *provide a high level of confidence that the MassDEP required reductions in our Class SB Mount Hope segment (MA61-06) will be adequately protective of Rhode Island's SB segment.*

Mass DEP revised the implementation priority level from "medium' to 'high' for the Runnins River MA51-01 and Lee River MA61-02 in Tables ES-1 and 6-1 have been elevated.

Comment #14 (Page 41) -. The second paragraph states that it is expected that the order of magnitude for the reductions will be the same regardless of which indicator is used. Given the correlation between the indicators, the magnitude of the reduction may be similar, but not the same.

MassDEP response: *MassDEP revised the report and analysis so that the ambient bacteria indicator data (fecal coliform) is the same as the water quality targets used for the purposes of estimating load reductions. Also the target indicators are the same as RIDEMs indicators.*

Comment #15 (Page 42) - Mass DEP is comparing fecal coliform data to its E. coli criteria. Please include the references that allow this to happen. It is our understanding that each criterion was developed for its own indicator based on waterbody use and that one cannot mix and match criteria and indicators. If MassDEP is using fecal coliform data, then it must be compared to the fecal coliform criteria.

MassDEP response: *MassDEP agrees with RIDEM's concern on this matter The Water Quality Standards for Indicators and Criteria in Massachusetts vary for particular classifications and uses. See Tables ES-2 and 7.1 for details. For instance, Class B, Primary Contact waters use either E Coli or Enterococcus as Indicators, while Class SA and SB Shellfishing waters use Fecal Coliform as an indicator (as determined by the Massachusetts Division of Marine Fisheries). While it is true that MA converted its Indicator Standards in January 2007 from Fecal Coliform to E Coli for Class B waters, much of the data (which is used in this report) collected up to that time was Fecal Coliform data. Table 7.2 has been inserted and Table 7.3 has been revised to include the bacteria indicator, as well as the specific numeric criteria that was used for each water body from which the reductions are being calculated.*

Since all loading calculation reductions in Table 7-3 of the Final Report submittal are based upon Massachusetts SA or SB Shellfishing Standards (which have Fecal Coliform indicators), and the data used to calculate the reductions are also Fecal Coliform, MassDEP will not be mixing and matching fecal coliform data with E. coli criteria in the final TMDL.

Comment #16 -. If similar to RIDEM, you have used only wet weather data to set reductions, you should specify that in the description of your methodology.

MassDEP response: *The conditions under which the data were collected were noted that in the methodology, as well as in Table 7-3. One segment did have demonstrated high dry weather data (instead of wet weather).We have clearly indicated that in Table 7-3 of the report.*

Comment #17 -. What is meant by the term average geometric mean? Is this the arithmetic average of several geometric means?

MassDEP response*: The language in the final report was clarified to read 'geometric mean', rather than 'average geometric mean'.*

Comment #18 -. The 90th Percentile Standard listed for E. coli is incorrect. According to the MA Water Quality Standards, 235 is a single sample maximum, not a 90th percentile value.

MassDEP response: *The language in the final report has been corrected. Also since the goal is to also protect downstream uses the percent reductions needed have been revised and are based on protection of the shellfishing use for all segments which is based on both the geometric mean and 90 percentile values.*

Comment #19 (page 42 and 43) -.As noted above, EPA requires RIDEM to set percent reductions that are protective of downstream/adjacent uses, that is that standards must be attained at the point of discharge to the downstream/adjacent waters, and therefore targets for the Class B Runnins River and Class SB Mt. Hope Bay should be revised accordingly.

MassDEP response: *See detailed response to RIDEM comment # 13 above.*

Comment #20 (page 44) -. Table 7-3 - Estimated Reductions Needed to Meet WQS - MassDEP should discuss critical conditions in the Runnins River and show its decision process for using the wet weather Rayner data to set percent reductions since wet weather does not capture the only critical condition in the Runnins River. The RIDEM TMDL makes clear that the Runnins River has a dry weather summer problem at School Street. Doug Rayner's data was used to support this conclusion. His dry weather summer data had a higher fecal coliform (1485 cfu/100 mL) geometric mean than his annual wet weather data presented here. The RIDEM dry weather geometric mean was 1576 cfu/100 mL. Also, the geometric mean data listed for the Runnins River is not RIDEM data; it is Rayner data. Lastly, as mentioned previously, the 90th percentile value (12,100) is not a wet weather value. It includes both wet and dry weather data.

MassDEP response: *MassDEP revised the data summary for the Runnins River (see Tables 4-4, and 7-3, in the Final Report submittal). MassDEP provided a summary of the Rayner School Street data in section 4 of the report. This information was chosen for presentation because the School Street area is considered to be representative of land- use within the river basin, and the large number of samples taken in both wet and dry weather conditions. Table 4-4 summarizes wet and dry weather collected between 1990 and 1999. Table 4-4 summarizes the 1990- 1998 Rayner School Street, year- round, dry weather results that consisted of a total of 289 samples, with a geometric mean of 300 cfu/100mL. The 1990- 1998 Rayner School Street, year round, wet weather results consist of a total of 265 samples, with a geometric mean of 1,054 cfu/100mL. MassDEP used the most recent representative (year round) sampling year (1998) for calculating the percentage load reduction that would be required in order to meet the standards. For 1998, at School Street, there were at total of 15 samples, with a geometric mean of 202 cfu/100ml, and a 90th percentile reading* *of 3,628 cfu/100mL. This was done to address EPA's comment that the most recent sampling data should be used to estimate the necessary load reductions.*

The above data indicate a greater wet weather problem than dry weather, however, MassDEP agrees that there are still significant dry weather sources. MassDEP SERO BST work findings regarding dry weather bacteria pollution sources on the MA side of the Runnins River have been summarized in Section 4 of the Final Report submittal.

Comment #21 (page 45-46) -. The introductory sentence of the Wasteload/Load Allocation section should note that in addition to the NPDES permitted wastewater facilities that CSOs also discharge to these waters. This section also contains some inconsistencies in discussion of the wasteload allocation. More specifically, the statement in the second paragraph on page 46, "As a source, stormwater runoff will receive 100% of the waste load allocation" is not consistent with the next paragraph. It is not clear what "inclusive of these controls" refers to on page 46. Presumably it refers to the CSO controls, which even when completely constructed according to the city's long term control plan would allow for on average 4 overflows per year.

MassDEP response: *CSO's were added to the first sentence of the Wasteload/Load Allocation section .*

Apparently, there is some RIDEM confusion between the statement "As a source, stormwater runoff will receive 100% of the waste load allocation", and a statement (in paragraph 2, pp 45 Final Report) "therefore, a WLA set equal to the WQS criteria will be assigned to the portion of the stormwater that discharges to surface waters via storm drains".

MassDEP's overall intent was for any illicit sources, including illicit discharges to stormwater systems and sewer system overflows (SSO's), the goal is complete elimination (100% reduction). Source categories representing discharges of untreated sanitary sewage to receiving waters via stormwater are prohibited, and therefore, assigned WLAs and LAs equal to zero". In the case of the Mount Hope Bay segment receiving Fall River WWTP and effluent from CSOs a LTCP is in place that is expected to be compatible with the water quality goals for the segment..

MassDEP has removed the wording 'the portion of the' from the second quoted statement above, which will allow that statement (in paragraph 2, pp 45 Final Report) to say instead: "therefore, a WLA set equal to the WQS criteria will be assigned to stormwater that discharges to surface waters via storm drains".

The wording, 'inclusive of these controls', (in paragraph 3, pp 45 Final Report), has been changed to, 'Despite this allocation goal', so that the entire sentence reads 'Despite this allocation goal, it is thought that untreated stormwater runoff from the municipalities in the watershed will continue to cause localized water quality impairments during wet weather'.

Comment #22. Please note that the area with documented on-site wastewater disposal system failures is in Massachusetts, not Rhode Island (there was one failed septic system at a gas station in

RI). Also the East Providence pump station discharged periodically in wet weather during RIDEM TMDL sampling in the late 1990s. The problem has been resolved since the late 1990s. We ask that you revise the first few sentences of the Runnins River section as follows:

RI DEM has stated in their TMDL report, “Fecal Coliform TMDL for the Runnins River, Rhode Island”, that just downstream from the Route 6 Bridge on the MA side there is an area where documented failed on- site wastewater disposal system failures have been occurring. This has comprised of businesses with older failing cesspools and systems, undersized systems, and systems with waste loads beyond their capacity. Also, at the time of TMDL sampling in the late 1990s, a sewer pump station in East Providence periodically surcharged in wet weather events; this has subsequently been resolved. Summer peaks in bacteria levels correlates with increased water consumption. In the southern part of Seekonk, south of School Street, the source regions of the Runnins River comprise of a network of wetlands and marshes with Pragmities, in which, according to RI DEM, conditions are prime for bacteria to accumulate and multiply.

MassDEP response: *The suggested language changes have been substituted into the final report.*

Comment #23 (page 51) -How will this adaptive management approach be tracked – are MS4s required to revise SWMPPs outlining the modifications to their six minimum measure practices and/or plans for periodic monitoring? Who determines when that they need to implement structural BMPs? Are MS4s required to include in their annual reports progress on meeting water quality standards?

MassDEP response: *MassDEP follows the regulations described in USEPA 40 CFR, Section 12, and Federal Clean Water Act 402 regarding the Stormwater Phase II program in Massachusetts. This would include: permit application procedures, as well as annual reporting requirements regarding Phase II Program goals, stormwater pollution control monitoring, development and revising of the SWMPP, reporting on the progress of the six minimum control measures, implementing various BMP’s, and reporting on the communities’ progress toward meeting water quality standards. Tracking the adaptive management approach of all communities who are required to have coverage under the Phase II Program can best be monitored by MassDEP through the required written annual reports that each community is required to prepare and submit to the EPA and MassDEP. Section 8.4, Stormwater Runoff ,in the Draft Bacteria TMDL report, reviews more specifics, such as individual town progress under the Phase II Program, and new MassDEP Stormwater Program initiatives in conjunction with the Phase II program. Section 10, Reasonable Assurances reviews resources and other tools available to citizens and communities to address stormwater.*

Comment #24 (page 57_) - Who is responsible for identifying those agricultural activities that are contributing to the impairment and/or for notifying those agricultural operations that they need to implement BMPs?

MassDEP response: *Please refer to Section 4.0 (subsection 4.4) in “Mitigation Measures to Address Pathogen Pollution in Surface Waters: A TMDL Implementation Guidance Manual for*

Massachusetts". This manual lists various agencies and resources for agricultural issues as it would relate to water quality. Basically, there are multiple approaches to agricultural related pollution problems, including using resources of the MassDEP Bacteria Source Tracking (BST) program, Natural Resource Conservation Service (NRCS) resources, or local Boards of Health. Additionally, under the Massachusetts Clean Water Act, MassDEP has broad authority over major non- point pollution sources that are contributing to water quality impairments. On the local, community level (where most related water quality issues arise), the particular communities' local Board of Health would have significant jurisdiction on such issues, particularly if the public health might be impacted. The local Board of Health might call on the MassDEP, the Mass Department of Public Health, or the Mass Department of Agricultural Resource to step in and advise on a particular situation. The Massachusetts Conservation Districts are a subdivision of State Government and can provide advice on wise management of soils, water and related resources. Additionally, the Natural Resource Conservation Service is linked to the U.S. Department of Agriculture, and has various expertise and Federal Grant programs available to farmers for BMP introduction and implementation.

Comment #25 (page 58) - It would be helpful to describe the next steps for both the Cities of Taunton and Fall River with regards to CSO abatement.

MassDEP response: *See our detailed response to Comment # 10 above. Also see Section 8.3.1 on CSOs within this Final Report.*

Comment #26 (page 60) - This TMDL has determined the receiving waters to be stormwater impaired. Will MassDEP/EPA require that any undesignated communities in the watershed be brought into the Phase II Program since stormwater discharges owned by them may be contributing to the impairment?

MassDEP response: *All communities that lie within the Watershed are designated communities under the Phase II Program.*

Comment #27 (page 61) - This section should be more prescriptive in what MS4s are expected to do as a result of this TMDL. For example, are they required to submit revised SWMPPs describing how the six minimum measures address the pollutant of concern and status of implementation? Are they required to annually report how they will monitor their effectiveness and determine whether structural BMPs are necessary? As noted in our cover letter, we do not believe that implementation of the six minimum measures alone is sufficient to meet water quality standards in the receiving water, much less meet the TMDL target of water quality criteria end of pipe. Similar to Rhode Island's TMDL implementation provisions, we recommend that MS4s be required to submit a prioritized plan for implementation of structural BMPs.

MassDEP response: *See our response to comment # 23 above.*

Additionally, MassDEP believes that segments ranked as high priority in Section 6, Table 6-1, are indicative of the potential presence of raw sewage and therefore they pose a greater risk to the public. Elevated dry weather bacteria concentrations could be the result of illicit sewer connections *or failing septic systems. As a result, the first priority should be given to bacteria source tracking activities in those segments where sampling activities show elevated levels of bacteria during dry weather. Identification and remediation of dry weather bacteria sources is usually more straightforward and successful than tracking and eliminating wet weather sources. If illicit bacteria sources are found and eliminated it should result in a dramatic reduction of bacteria concentration in the segment in both dry and wet-weather. The TMDL recommends that segments that remain impaired during wet weather be evaluated for stormwater BMP implementation opportunities starting with less costly non-structural practices first (such as street sweeping, and/or managerial approaches using local regulatory controls), and lastly, more expensive structural measures. Structural stormwater BMP implementation may require additional study to identify cost efficient and effective technology. Additionally, Phase II Program requirements state that if a WLA allocation in a TMDL has been established involving a particular MS4 community, it must comply with that WLA, and report progress in addressing that TMDL in its annual report to EPA.*

In addition to the above, the Massachusetts Department of Environmental Protection has proposed new "Stormwater Management Regulations", that would establish a statewide general permit program aimed at controlling the discharge of stormwater runoff from certain privately-owned sites containing large impervious surfaces. The proposed regulations would require private owners of land containing five or more acres of impervious surfaces to apply for and obtain coverage under a general permit; implement nonstructural best management practices (BMPs) for managing stormwater; install low impact development (LID) techniques and structural stormwater BMPs at sites undergoing development or redevelopment; and submit annual compliance certifications to the Department.

Comment #28 (Page 62) -. Case in point. By the description provided here, it sounds like Seekonk is meeting its goals for the minimum measures, including street sweeping and yet there is still a wet weather problem in the Runnins River as documented by the more recent water quality data presented at the public meeting. Will Seekonk be required to present a plan for how they intend to implement structural BMPs?

MassDEP response: *The pollution source would first need to be identified through either the MassDEP BST program or sampling by the Town. Once a specific significant bacteria source is found, MassDEP will attempt to work with the town, or other (e.g., private) entity, to locate the causing the problem and ultimately to find and implement a solution to the problem. MassDEP works with stakeholders the help identify appropriate public funding sources, such as SRF, 319, or 604b. The solution could involve any number of measures including (but not limited to): catch basin cleaning, better control of animal feces, public education efforts, fixing failing septic systems, closing off illicit connections, fixing leaking infrastructure, better CSO controls, or putting in non structural or structural BMPs.*

Comment #29 (page 66) -. It would be helpful if the TMDL summarized what the consent order requires the City of Fall River to do.

MassDEP response: *See our detailed response to Comment # 10 above. Also see Section 8.3.1 on CSOs within this Final Report.*

EPA Region I Comments on the Narragansett/Mt. Hope Bay Watershed

Draft Total Maximum Daily Load (TMDL) For Pathogens

*Please Note: the numbering of the comments continues from the last of the RIDEM comments (#29) above.

Comment #30* It is important to be clear about the WLAs, LAs, and required reductions for each of the water bodies for which a TMDL is proposed. Currently, that information is not displayed clearly in one place and it makes understanding the TMDLs much more difficult. It is also not clear which bacteria indicator is being used for each water body, and to which numeric criteria each water body is being held and from which the reductions are calculated. I suggest you establish a single table with all of that information in it, in the TMDL chapter (7) and Executive Summary.

MassDEP response: *The Water Quality Standards for Indicators and Criteria in Massachusetts vary for particular classifications and uses. See Tables ES-2 and 7.1 for details. For instance, Class B, Primary Contact waters use either E Coli or Enterococcus as Indicators, while Class SA and SB, Shellfishing use Fecal Coliform as Indicators (as determined by the Massachusetts Division of Marine Fisheries). While it is true that MA converted its primary contact Indicator Standards in January 2007 from Fecal Coliform to E Coli for Class B waters, much of the data (which is used in this report) collected up to that time was Fecal Coliform data. We have added Table 7.2 to summarize applicable Massachusetts and Rhode Island standards and clarified the language in Table 7-3 to point out which indicator was used for each segment to calculate the percentage reduction needed for the segment to meet water quality standards (Also see response to comment #14).*

Comment #31- Table ES-2 /7.1 is a useful overall presentation of the State's water quality standards, and may be appropriate for the chapter (3.0) on standards, but it is somewhat confusing and contains too much information to represent the WLA and LAs for the water body segments in this bundled TMDL package. If you want to use this table outside of the Chapter 3, I suggest that it be consolidated down to the classifications and bacteria indicators used in this set of TMDLs, and rest be eliminated. For instance, the Class A standard isn't used in these TMDLs, nor is total coliform.

MassDEP response: *: The MassDEP Bacteria TMDL effort represents a statewide, basin by basin, effort. Considerable effort went into developing a table (ES-2 and 7.1) for all Bacteria TMDLs, that best and most expeditiously outlines our rather complex Water Quality Standards, both for indicators and criteria. This approach will be used for cross- referencing information or* *issues between various basins, and allows the opportunity in the future within a particular basin for any new segments, or areas, (including Class A) to be added to the TMDL in the future should that segment, or area, fall under the bacteria impacted category on the 303d Integrated List. To respond to this comment MassDEP revised the table and added Table 7.2 which provides a summary of the applicable criteria for the impaired segments identified in this TMDL along with the applicable RI water quality standards in adjoining segments.*

Comment #32 - In the first paragraph of page 12, it says that both old and new indicators are included in the tables. Now that EPA has approved Mass's revised standards, only the current standards should appear. Otherwise, it will be (and is) confusing. I suggest the table be updated and simplified if it is going to be used.

MassDEP response: *In the final report 'both the old and' was deleted from paragraph 1, page 12.*

Comment #33- It appears that data are being used that are around 10 or more years old while there are more recent data available. The TMDL should use the most recent data available, and especially if there are data available for the indicators the State has recently adopted, and there are enough to fulfill the requirements of the State's CALM.

MassDEP response: *MassDEP used any and all reliable data that was available at the time the Draft report was developed. In several of the segments data was limited and it was necessary to use the data that is currently available in order to develop the loads (e.g., data for some segments dates back to the late 1990s). It should be noted that much of the estuary data reported in this analysis was from RIDEM and MADMF 2006 monitoring efforts.*

MassDEP supplemented the report with SERO BST team 2007-2008 data (provisional) and Pokanoket Watershed *Alliance (does not meet Mass DEP Data Quality Objectives) to link current data observations with measurements in the 1990s. In most cases the more recent provisional data is comparable to the data sets collected by DWM in prior surveys. Significant findings from the BST program are summarized in the Final TMDL submittal (see Section 4, The Runnins River MA53-01 subsection, which discusses data, permitting, etc).*

Comment #34- It appears that in at least two cases and perhaps a third, a water body segment with a lower classification (B or SB) discharges into or abuts a water body segment with a higher classification (SA). In these cases, the Clean Water Act says that the water body segment with the lower classification must meet the standard for the water body with the higher classification at their border. Consequently, the State must hold the lower classified water body to the higher standard. In these cases, Mt Hope Bay segment 06 must be held to segment 07's SA standard, and Lee River segment 01 must be held to segment 02's SA standard as part of the TMDL, with WLAs, LA, and reduction targets set appropriately. If the Runnins River segment discharges into a Class A or SA water body, it must be held to that standard, too. Please update the TMDLs appropriately and include a discussion for all of these water bodies about that process. Also, please clarify into what water body (with what classification) the Runnins River discharges on the Rhode Island side of the border.

MassDEP response: *Please see our detailed response to RIDEM comment # 13 above.*

Comment #35- The map in Figure 1-1 is at such a scale that it is hard to see the labels on the map and the relationships amongst the water bodies. I suggest that higher resolution maps be added to the document for each set of water bodies. If possible, what is on the other side of the state border should also be shown (in grey scale if you wish). That would help the public understand the relationships among the segments.

MassDEP response:*: Figure 1-1 was 'sharpened up' in the Final report submittal. It should be pointed out that printed copies of the report demonstrate a much clearer map.*

Comment #36- In several places in the document, mostly in Chapter 7, a 90th percentile component is cited for both E.coli and enterococci criteria. In the Mass. WQ Standards, for both of these indicators, there is a single sample maximum or "not to exceed" component but not a 90th percentile component. Fecal coliform is the only one of these indicators that has a 90th percentile component. See pages 41-44 for examples.

MassDEP response: *The text of the Final Report submittal was corrected (also see the response to comment #14).*

Comment #37- In the third paragraph of section 7.3, it says the most recent indicator bacteria data are for fecal coliform. The following sentence appears to say that the E.coli standard will be used to judge the data, as it has recently been adopted. If fecal coliform data is being used, the appropriate fecal coliform numeric criteria must be applied. If E.coli criteria is to be used, E.coli data must be used. If this isn't what you mean, please clarify.

MassDEP response: *The Water Quality Standards for Indicators and Criteria in Massachusetts vary for particular classifications and uses. See Tables ES-2 and 7.1 for details. For instance, Class B, Primary Contact waters use either E Coli or Enterococcus as Indicators, while Class SA and SB Shellfishing waters use Fecal Coliform as an indicator (as determined by the Massachusetts Division of Marine Fisheries). While it is true that MA converted its primary contact Indicator Standards in January 2007 from Fecal Coliform to E Coli for Class B waters, much of the data (which is used in this report) collected up to that time was Fecal Coliform data. We have clarified this by identifying in Table 7.3 which bacteria indicator, as well as the specific numeric criteria, was used for each water body from which the reductions are being calculated.*

Since all loading calculation reductions in Table 7-3 of the Final Report submittal are based upon Massachusetts SA or SB Shellfishing Standards (which have Fecal Coliform indicators), and the data used to calculate the reductions are also Fecal Coliform, MassDEP will not be mixing and matching fecal coliform data with E. coli criteria.

Comment #38- It's confusing when, after it says that only fecal coliform data will be used in these TMDLs, the use of other indicators continues to be discussed. Bullet 5 of the methodology section of chapter 7.3 discusses the use of both fecal and E.coli. Please clarify one way or the other.

MassDEP response: *Please see our response to the EPA comment #37 just above.*

Comment #39- I suggest that the various indicators' criteria not be mixed in the text, especially in a string of values in a sentence. It is very confusing. For instance, in the last paragraph on page 41, it appears that the indicators' criteria may be mixed in the string "(126, 88, or 14…)" based on the phrase "either E.coli or fecal coliform bacteria" which precedes it. It would also be helpful if the document better identified what the string represented (for example, Class SA, SB, A…geomean criteria….).

MassDEP comment: *Please see our response to the EPA comment #37 just above.*

Comment #40- For the third full paragraph of page 46, please identify the indicator for which the criteria for WLA for CSOs and regulated stormwater discharges is cited.

MassDEP response: *Fecal Coliform was added to the text in the final report.*

Comment #41- For chapter 6.0, Prioritization and Known Sources, please provide more information about what the goals and/or end point of the CSO plans are for Fall River and Taunton. Do these plans allow a certain number of discharges a year, and if so, how will that affect the water bodies' ability to meet standards?

MassDEP response: *For Taunton, the goal is total elimination of all CSO discharges. Please refer to the Draft Pathogen TMDL for the Taunton River Watershed for more details.*

For Fall River Long Term CSO plans, please refer to the Mass DEP detailed response to the RIDEM comment # 10 above. Also see Section 8.3.1 on CSOs within this Final Report.

Comment #42- In the text discussions of the individual TMDL water body segments, please identify into what water bodies they discharge.

MassDEP response: *Figures &.1 and 7.2 have been added to the report to illustrate the connection between Massachusetts segments that adjoin Rhode Island waterbody's.*

Comment #43- For the margin of safety, the TMDLs rely in part on a "no mixing zone" approach, which implies that the criteria is being applied at the end of pipe. It would be helpful if the discussion would clearly state that.

MassDEP response: *While the goal is achieving pathogen standards at end of pipe, compliance will be based upon sampling surrounding ambient waters. This is so stated in the MOS part in Section 7.*

Comment #44- For the third conservative assumption in the margin of safety, it says that the highest/most conservative geometric mean has been calculated for each segment, and it is not clear what that means. It may mean that the most stringent criteria is being applied as it relates to the impaired condition in each water body, in order to generate the largest reduction. If so, that criteria may be the geometric mean, or the 90th percentile or single sample maximum value, whichever gives the largest reduction when compared to the impairment data. In that case, I suggest it be made clear that, for each water body segment, the TMDL is using the criteria component that gives the largest reduction. If not, please give me a call to discuss what you mean here.

MassDEP response: *The TMDL, in Section 7.3, pp 43-47, including the 'Methodology Subsection' has been revised to* <u>*fully*</u> *explain how the reduction target was determined in each segment. Basically, the percent bacteria reduction selected to meet the TMDL requirements was the highest reduction calculation from two possible percentages: (1) percent reduction to meet geometric mean of highest station within the segment; or (2) percent reduction to meet the 90th percentile reading of that same station.. The information has been included in this last sentence into Section 7.6., Margin of Safety.*

Comment #45- In Chapter 2, Watershed Description, the Taunton River system seems to have been excluded from the list on contributing river systems in the first paragraph, then excluded it from Figure 2-1. Our understanding is that it is the largest volume tributary contributor to Mt. Hope Bay, and the Tauton CSO is the second largest single contributor of bacteria loading after the Fall River CSO. Please explain its exclusion.

MassDEP response: *MassDEP has revised the language in Chapter 2, Watershed Description, to clarify that the Taunton River Watershed is a significant part of the drainage into Mount Hope Bay. Details on WWTPs, CSOs and related infrastructure concerns in the Taunton River Watershed were added to Section 8.3 of this Final Report submittal, 'Illicit Sewer Connections, Failing Infrastructure, and CSOs'. Detailed issues about pollution from the Taunton River Basin are covered in a* <u>*separate*</u> *Pathogen TMDL Report, which will deal with the Taunton River Watershed.*

Comment #46- On page 16, in the fourth full paragraph, it says "…Since pathogen impairment has been previously established and documented on the 2008 Integrated List, it is not necessary to provide detailed documentation of pathogen impairment herein." EPA respectfully differs on this point. It is helpful to include some data demonstrating the water bodies' impairments within the TMDL document even if the data are available somewhere else, as the public should have ready access to the data while viewing the TMDL document. The conditions necessitating the TMDL should be easily understandable to the public without them having to go searching through other sources, and it is helpful to see how many times the criteria are exceeded and by how much, past what a single geomean and/or 90th percentile figure shows.

MassDEP response: *DEP has revised the sentence (in "quotation" above) from the Final TMDL submittal. Reliable pathogen data is summarized in Section 4 of the Draft Report. Section 7 outlines the method that was utilized to develop appropriate target load reductions that are necessary to* *bring the impaired waters to bacteria water quality standards. The report also references prior MassDEP Assessment Reports and 303d Lists where more specific data and information can be accessed:* www.mass.gov/dep/water/resources/wqassess.htm

Comment #47- Implementation:
Please identify the enforcement authority, if any, that the state has over agriculture activities.

MassDEP response: *Please see our detailed response to the RIDEM comment # 24 above.*

Comment #48- What are the State's plans for further work on the Taunton and Fall River CSOs?

MassDEP response: *Please refer to our detailed response to the RIDEM comment # 10 above.*

PART II (C) OF THE PUBLIC COMMENTS—WRITTEN
numbering system continues from #48, EPA comments, just above

Comment #49- On February 26, 2010, MassDEP received a letter from Dominion Resources Services, Inc.,(Pamela F. Faggart, Vice President) 5000 Dominion Blvd, Glen Allen, Virginia 23060, in regards to Dominion's subsidiary, Dominion Energy Brayton Point, L.L.C. The letter states that the Draft TMDL mentions the owner of Brayton Point as "USGEN" or USGEN New England" on pages 21, 23, and 56 of the Draft TMDL Report. The letter specifically asks that the Department edit these references to reflect the current owner as "Dominion Energy Brayton Point, L.L.C."

MassDEP response: *MassDEP has revised the" USGEN (New England)" references on pp 21, 23, 56 to "Dominion Energy Brayton Point, L.L.C". in the Final Report submittal.*

PART II (D) OF THE PUBLIC COMMENTS—WRITTEN

numbering system continues from #4, Dominion Energy Brayton Point L.L.C., comment, just above

Comment #50 - On February 24, 2010, MassDEP received a letter from Citizens of Portsmouth, Town of Portsmouth, Rhode Island and Providence Plantations. It stated:

WE ARE WRITING TO STATE OUR OPPOSITION TO THE PROPOSED CHANGES OUTLINED IN MA-61-TMDL-2. WE HAVE SIGNED A PETITON WHICH YOU WILL RECEIVE COPIES MAILED TO YOU BY OVERNIGHT EXPRESS MAIL FROM THE US POSTAL SERVICE. ORIGINALS WILL BE MAILED TO FEDERAL EPA IN WASHINGTON D.C.
THANK YOU FOR ALL YOU EFFORTS

Three pages followed with 39 signatures of concerned citizens. The caption at the top of each page reads " THE DRAFT PLAN LAW PROPOSED BY THE REGIONAL ENVIRONMENTAL PROTECTION AGENCY REQUIRING THAT TOTAL MAXIMUM DAILY LOADS BE LOWER THAN TREATED DRINKING WATER IS OVERLY BURDENSOME, UNREALISTIC, AND LOWER THAN WHAT OCCURS NATURALLY".

***MassDEP response**: MassDEP understands your concerns, however, The Federal Clean water Act requires TMDLs to be developed when State Water Quality Standards are not achieved.*

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