

# **NORTH SHORE COASTAL WATERSHEDS**

## **2002 WATER QUALITY ASSESSMENT REPORT**



**COMMONWEALTH OF MASSACHUSETTS**  
**EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS**  
IAN A. BOWLES, SECRETARY  
**MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION**  
ARLEEN O'DONNELL, ACTING COMMISSIONER  
**BUREAU OF RESOURCE PROTECTION**  
GLENN HAAS, ACTING ASSISTANT COMMISSIONER  
**DIVISION OF WATERSHED MANAGEMENT**  
GLENN HAAS, DIRECTOR



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NORTH SHORE COASTAL WATERSHEDS  
2002 WATER QUALITY ASSESSMENT REPORT

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- Bureau of Waste Prevention (BWP)

- Bureau of Waste Site Cleanup (BWSC)

Department of Conservation and Recreation (MA DCR)

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- Division of Marine Fisheries (DMF)

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## LIST OF ACRONYMS AND ABBREVIATIONS

7Q10.....seven day, ten year low flow	MassDEP .....Massachusetts Department of Environmental Protection
ACEC .....Area of Critical Environmental Concern	MA DFG .....Massachusetts Department of Fish and Game
ACOE .....Army Corps of Engineers (United States)	MA DPH .....Massachusetts Department of Public Health
BMP.....best management practice	MS4.....Municipal Separate Stormwater System
BPJ.....best professional judgment	MassGIS .....Massachusetts Geographic Information System
CFU.....colony forming unit	NAWQA .....National Water-Quality Assessment Program
CMR .....Code of Massachusetts Regulations	NPDES.....National Pollutant Discharge Elimination System
CNOEC .....chronic no observed effect concentration	NPS .....non-point source pollution
CPR.....Coastal Pollution Remediation Grant Program	ORW .....Outstanding Resource Water
CSO.....combined sewer overflow	PAH .....polycyclic aromatic hydrocarbons
CWA.....Clean Water Act	PCB .....polychlorinated biphenyls
CZM.....Massachusetts Office of Coastal Zone Management	PWS.....public water supply
DDD .....dichlorodiphenyldichloroethane	QA/QC.....quality assurance/ quality control
DDE .....dichlorodiphenyldichloroethylene	QAPP .....quality assurance project plan
DDT.....dichlorodiphenyltrichloroethane	S-EL .....severe effect level
DMF .....Division of Marine Fisheries	SOP.....standard operating procedure
DO .....dissolved oxygen	SRF .....State Revolving Fund
DPW.....Department of Public Works	SWAP.....Surface Water Assessment Program
DWM .....Division of Watershed Management	SWQS .....Surface Water Quality Standards
DWP.....Drinking Water Program	TMDL .....total maximum daily load
EOEA .....Executive Office of Environmental Affairs	TOXTD .....MassDEP DWM Toxicity Testing Database
EPA .....United States Environmental Protection Agency	USGS .....United States Geological Survey
GIS.....geographic information system	WBID .....waterbody identification code
LC <sub>50</sub> .....lethal concentration to 50% of the test organisms	WBS .....Waterbody System database
L-EL.....low effect level	WMA .....Water Management Act
MA DCR .....Massachusetts Department of Conservation and Recreation	WPCF.....Water Pollution Control Facility
	WWTP.....wastewater treatment plant

## LIST OF UNITS

cfs .....cubic feet per second
cfu.....colony forming unit
cy .....cubic yards
GPM (D) .....gallons per minute (day)
MG.....million gallons
MGD .....million gallons per day
µg/kg .....microgram per kilogram
M .....meter
ml.....milliliters
mg/L .....milligram per liter
ng .....nanograms
NTU .....nephelometric turbidity units
ppb .....parts per billion
ppm .....parts per million
psi .....pounds per square inch
SU .....standard units
TEQ/kg.....toxic equivalents per kilogram
µeq/L.....microequivalents per liter
µS/cm.....micro seimens per centimeter



## EXECUTIVE SUMMARY

See executive summary file (93execsum06.doc)

## INTRODUCTION

The goal of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters (Environmental Law Reporter 1988). To meet this objective, the CWA requires states to develop information on the quality of the Nation's water resources and report this information to the U.S. Environmental Protection Agency (EPA), the U.S. Congress, and the public. Together, these agencies are responsible for implementation of the CWA mandates. Under Section 305(b) of the Federal Clean Water Act, MassDEP must submit a statewide report every two years to the EPA, which describes the status of water quality in the Commonwealth. Until 2002 this was accomplished as a statewide summary of water quality (the 305(b) Report). States are also required to submit, under Section 303(d) of the CWA, a list of impaired waters requiring a total maximum daily load (TMDL) calculation. In 2002, however, EPA required the states to combine elements of the statewide 305(b) Report and the Section 303(d) List of Impaired Waters into one "Integrated List of Waters" (Integrated List). This statewide list is based on the compilation of information for the Commonwealth's 27 watersheds. Massachusetts has opted to write individual watershed surface water quality assessment reports and use them as the supporting documentation for the Integrated List. The assessment reports utilize data compiled

from a variety of sources and provide an evaluation of water quality, progress made towards maintaining and restoring water quality, and the extent to which problems remain at the watershed level. Quality assured in-stream biological, habitat, physical/chemical, toxicity data and other information are evaluated to assess the status of water quality conditions. This analysis follows a standardized process described in Appendix A (Assessment Methodology) of this report.

This report presents the current assessment of water quality conditions in the North Shore Coastal Watershed. The assessment is based on information that has been researched and developed by the Massachusetts Department of Environmental Protection (MassDEP) through the first three years (information gathering, monitoring, and assessment) of the five-year cycle (Figure 6) in partial fulfillment of MassDEP's federal mandate to report on the status of the Commonwealth's waters under the CWA.

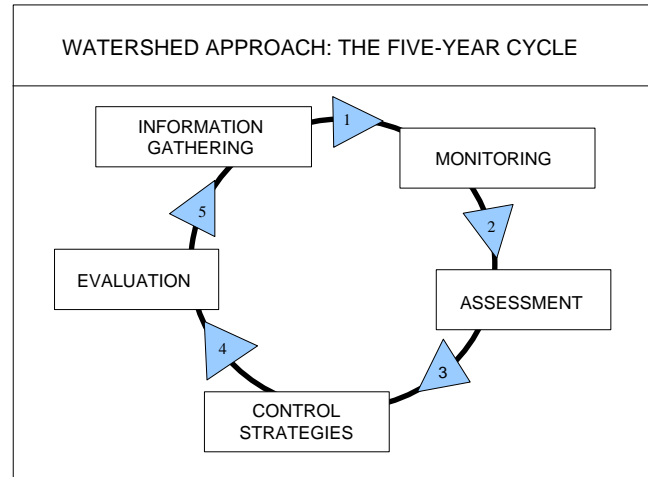


Figure 6. Five-year cycle of the Watershed Approach

## MASSACHUSETTS INTEGRATED LIST OF WATERS

Section 305(b) of the CWA defines the process whereby states monitor and assess the quality of their surface and groundwater and report on the status of those waters every two years. Section 303(d) of the CWA requires states to periodically identify and list those waterbodies for which existing controls on point and nonpoint sources of pollutants are not stringent enough to attain or maintain compliance with applicable surface water quality standards. Through the year 2000 the MassDEP fulfilled the 305(b) and 303(d) reporting requirements in two completely separate documents. In 2001 the EPA released guidance that provided states with the option of preparing a single Integrated List of Waters to be submitted that would meet the reporting requirements of both sections 305(b) and 303(d) of the CWA.

The Massachusetts Year 2004 Integrated List of Waters was submitted to the EPA by the MassDEP in September 2005 (MassDEP 2005). In that report each waterbody segment was placed in one of five major categories. Category 1 included those waters that were meeting all designated uses. No Massachusetts waters were listed in Category 1 because a statewide health advisory pertaining to the consumption of fish precludes any waters from being in full support of the fish consumption use. Waters listed in Category 2 were found to support some of the uses for which they were assessed but other uses were unassessed. Category 3 contained those waters for which insufficient or no information was available to assess any uses.

Waters exhibiting impairment for one or more uses were placed in either Category 4 (impaired but not requiring a TMDL report) or Category 5 (impaired and requiring one or more TMDLs) according to the EPA guidance. Category 4 was further divided into three sub-categories – 4A, 4B and 4C – depending upon the reason that TMDLs were not needed. Category 4A included waters for which the required TMDL(s) had already been completed and approved by the EPA. However, since segments could only appear in one category waters that had an approved TMDL for some pollutants, but not others, remained in Category 5. Category 4B was to include waters for which other pollution control requirements were reasonably expected to result in the attainment of the designated use before the next listing cycle (i.e., 2006). Because of the uncertainty related to making predictions about conditions in the future the MassDEP made a decision not to utilize Category 4B in the 2004 Integrated List. Finally, waters impaired by factors, such as flow modification or habitat alteration, that are not subjected to TMDL calculations because the impairment is not related to one or more pollutants were included in Category 4C.

See individual segment assessments for information pertaining to the 2004 Integrated List category and causes of impairment.

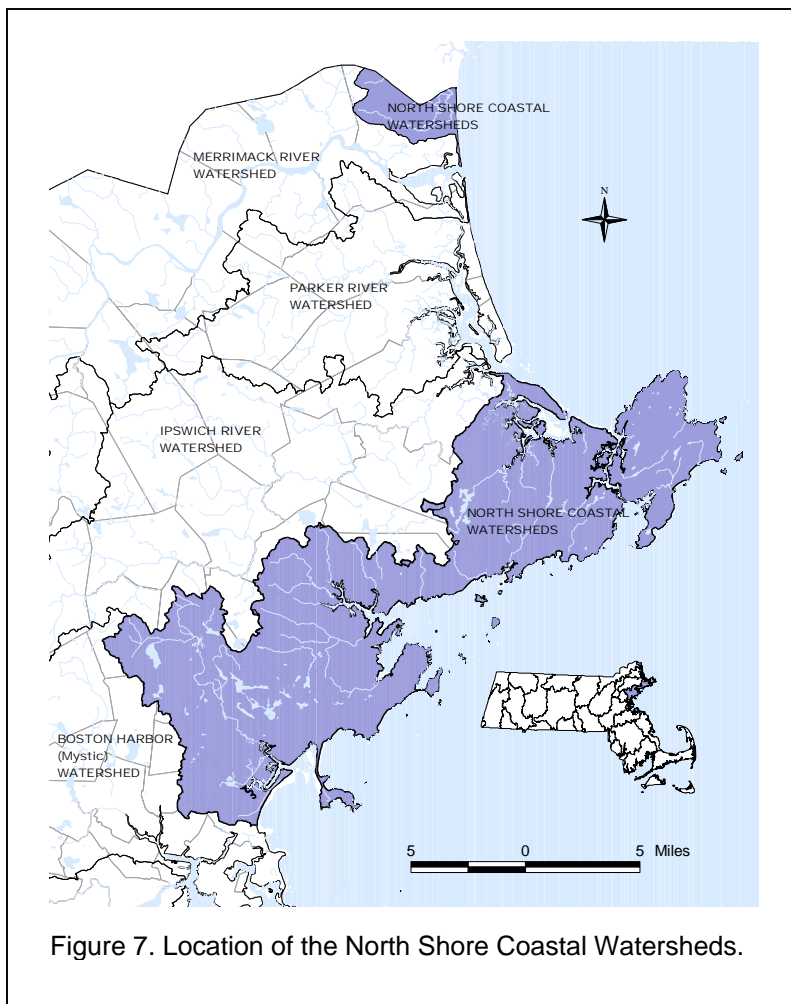
## NORTH SHORE COASTAL WATERSHEDS DESCRIPTION AND CLASSIFICATION

The North Shore Coastal Watersheds (Figure 7) are located in northeastern Massachusetts. In its northern most reaches it contains parts of the extensive Hampton and Seabrook saltmarshes, bordering the Merrimack River. The largest North Coastal Watershed area is bordered by the Ipswich River Watershed to the west and by the Boston Harbor (Mystic) Watershed to the south. Progressing southward from the Ipswich River Watershed area, Cape Ann provides some of the most distinctive rocky features of the Massachusetts coastline. The lower North Shore coastline consists of peninsulas interspersed with embayments, pockets of salt marsh, and estuaries with offshore rocky islands. The Rumney Marshes, which includes all or portions of the Pines and Saugus Rivers and Diamond Creek, are located at the southern extreme of the watershed. The Saugus River estuary is a large and historically degraded saltwater ecosystem with vast areas of wildlife habitat. The construction of a major highway system that intersected the estuary was halted in the 1970's.

The North Shore Coastal Watersheds occupy much of the coastal region of Massachusetts' northshore. Extending from Salisbury to Revere, this area comprises 168 square miles distributed over all or parts of 26 Massachusetts communities in portions of Suffolk and Essex counties in Massachusetts. The communities are: Salisbury, Amesbury, Revere, Everett, Malden, Melrose, Saugus, Stoneham, Reading, Wakefield, Lynnfield, Lynn, Nahant, Swampscott, Marblehead, Salem, Peabody, Danvers, Beverly, Manchester, Wenham, Hamilton, Essex, Ipswich, Gloucester, and Rockport. A small portion of Seabrook, New Hampshire also drains into the North Shore Coastal Watersheds area. While the communities in the southern portions of the region are the most urban in character, almost all of the municipalities are densely populated.

A total of 89 lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) have been identified and assigned PALIS code numbers (Pond and Lake Information System, Ackerman 1989) in the North Coastal Watershed. Seventy of the lakes are less than or equal to 50 acres in total surface area; 50 are less than or equal to ten acres. The total surface open of the North Shore Coastal Watersheds lakes is 2,415 acres.

Note that no waterbodies in the northern portion of the North Shore Coastal Watersheds area (i.e., in Salisbury, MA) are found in this report. MA DFG biologists did collect fish using backpack electrofishing gear at one site in Meader Brook and one site in Smallpox Brook in July 2002. Three species of fish (redfin pickerel - *Esox americanus americanus*, pumpkinseed - *Lepomis gibbosus*, and golden shiner - *Notemigonus crysoleucas*), were found at both locations and American eel (*Anguilla rostrata*) were also found in Smallpox Brook (Richards 2005). A shoreline survey was also conducted along Smallpox Brook in 2000 and problems, assets, and priorities for action were identified.



## OBJECTIVES

This report summarizes information generated in the North Shore Coastal Watersheds since the last water quality assessment report that was published in May 2000 (DeCesare *et al.* 2000). The methodology used to assess the status of water quality conditions of rivers, estuaries and lakes in accordance with EPA's and MassDEP's use assessment methods is provided in Appendix A. Data collected by DWM in 2002 are provided in Appendices B through D of this report. Appendix E provides a summary of Water Management Act (WMA) registration/permit holders and National Pollutant Discharge Elimination System (NPDES) permittees in the North Shore Coastal Watersheds. Not all waters in the North Shore Coastal Watersheds are included in the MassDEP/EPA databases (either the waterbody system database -- WBS, or the newer assessment database -- ADB) or this report.

The objectives of this water quality assessment report are to:

1. Evaluate whether or not surface waters in the North Shore Coastal Watersheds, defined as segments in the MassDEP/EPA databases, currently support their designated uses (i.e., meet surface water quality standards).
2. Identify water withdrawals (habitat quality/water quantity) and/or major point (wastewater discharges) and non-point (land-use practices, storm water discharges, etc.) sources of pollution that may impair water quality conditions.
3. Identify the presence or absence of any non-native macrophytes in lakes.
4. Identify waters (or segments) of concern that require additional data to fully assess water quality conditions.
5. Recommend additional monitoring needs and/or remediation actions in order to better determine the level of impairment or to improve/restore water quality.
6. Provide information for the development of an action plan.

The North Shore Coastal Watersheds included in this report can be broken up into five major drainage areas (Figure 8). The Essex Bay and the Annisquam River systems (exclusive of the Blyman Canal) discharge in a northerly direction into Ipswich Bay. The Outer Cape Ann area is comprised of many small drainage systems. This rocky peninsula forms the northernmost edge of Massachusetts Bay. Salem Sound and Lynn Harbor systems are the two largest drainage areas, which also discharge into Massachusetts Bay and the larger Gulf of Maine (Figure 8). Waterbodies in the northern portion of the North Shore Coastal Watersheds area depicted in Figure 7 are not defined as segments or assessed in this report.

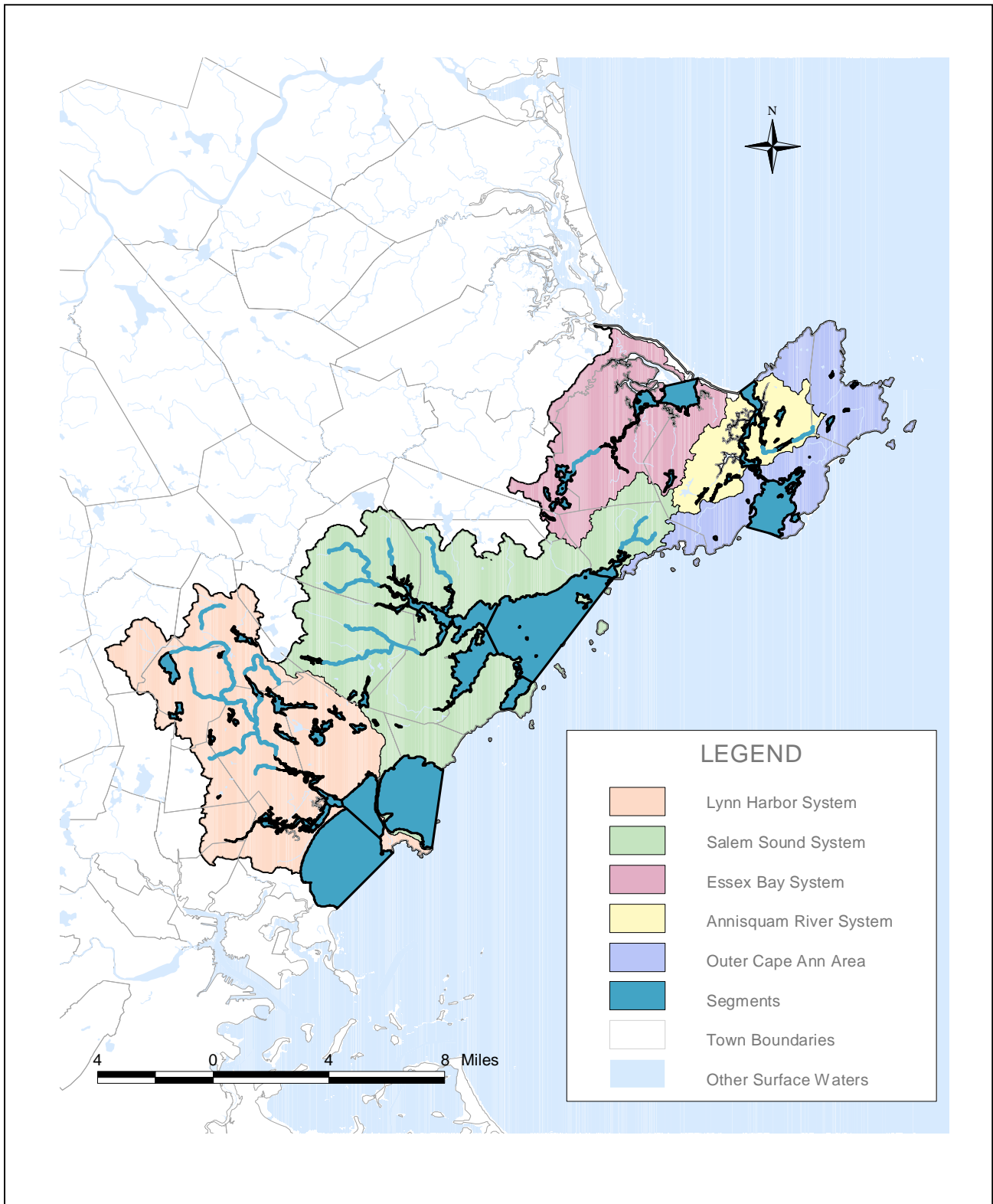


Figure 8. Major drainage areas in the North Shore Coastal Watersheds included in this report.

## IPSWICH BAY

Two drainage systems discharge into Ipswich Bay from the North Coastal River Watershed—Essex Bay and the Annisquam River.

### THE ESSEX BAY SYSTEM

The western drainage area of the Essex Bay system is comprised of Castle Neck Creek, Hog Island Channel, and the Essex River. The Essex River has four named tributaries, which include Soginese, Lufkin, and Ebben creeks and Alewife Brook. Walker Creek, Lanes Creek, and Farm Creek also discharge into Essex Bay along its southeastern shore. Segments in the Essex Bay system are illustrated in Figure 9.

DMF biologists are concerned with the decline in the historically important smelt fishery in the Essex Bay system. Over a 20-year period, the smelt fishery, which was once described as “excellent”, has declined to a very low level of detection and the fishery is essentially gone (Chase 2006a). While a total of six tributaries to the Essex River were surveyed for potential smelt spawning habitat only two were found to contain suitable spawning habitat. These two tributaries, Alewife Brook and Walker Creek, were monitored for smelt by DMF biologists over a two-year period. No smelt eggs were found in Walker Creek during the two seasons of monitoring, although smelt larvae were found in the creek and there were over 400 m<sup>2</sup> of suitable spawning habitat (Chase 2006a). According to Chase (2006a) Walker Creek possesses suitable spawning habitat that most likely used to support a smelt spawning run and was, therefore, identified as one of the better candidates for a smelt restoration project in the North Shore Coastal Watersheds area. Reback *et al.* (2005) state that “A formerly large alewife run in Alewife Brook has also declined in recent decades. The cause of the decline is not certain, although increasing conflicts between beaver activity and alewife passage at the Chebacco Lake outlet are a growing concern.”

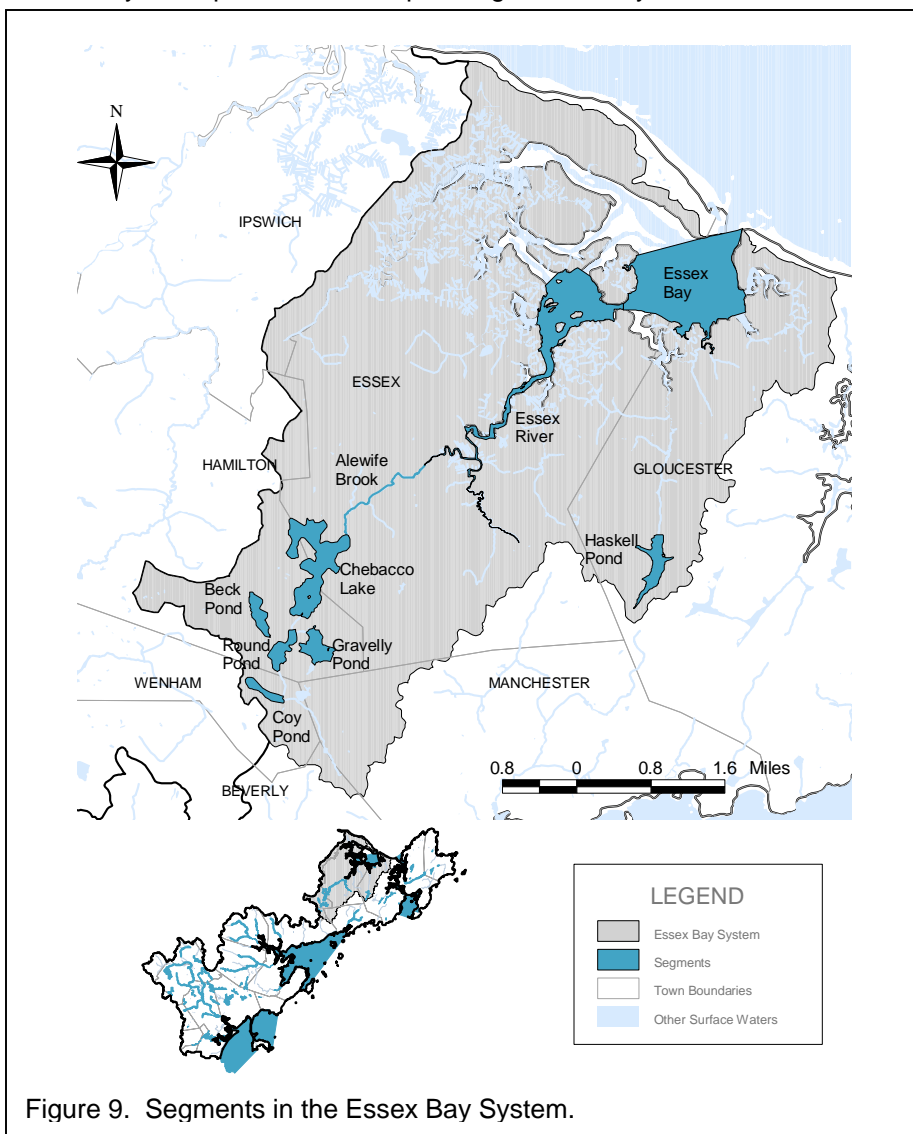


Figure 9. Segments in the Essex Bay System.

## COY POND (SEGMENT MA93016)

Location: Wenham.

Length/area: 23 acres

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of noxious aquatic plants and turbidity (MassDEP 2005).

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### ***Aquatic Life Use***

##### Water Chemistry

Sampling was conducted by DWM staff at one location (W0966) in the pond as part of the 2002 Baseline Lake TMDL Project (Appendix C, Tables C1 and C2).






Although low DO, slightly elevated chlorophyll a concentrations, and Secchi disk measurements near the bathing beach guidance were recorded in Coy Pond, it is best professional judgment that these conditions are likely naturally-occurring. Therefore, the *Aquatic Life Use* is not assessed but is identified with an Alert Status.

#### ***Primary and Secondary Contact Recreation and Aesthetic Uses***

Sampling was conducted by DWM staff at one location W0966 in the pond as part of the 2002 Baseline Lake TMDL Project (Appendix C, Tables C1 and C2).

No bacteria data are available for Coy Pond. Secchi disk measurements (ranged from 1.0 to 1.4m) near the bathing beach guidance were recorded in Coy Pond, however it is best professional judgment that these conditions are likely naturally-occurring given the high color. The water column was clear and no objectionable conditions (e.g., odors, deposits) were noted by DWM field sampling crews in Coy Pond (MassDEP 2002a). Given the marginal Secchi disk measurements, the *Recreational* uses are not assessed but are identified with an Alert Status. The *Aesthetics Use* is assessed as support.

COY POND (SEGMENT MA93016) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED*
Aesthetics		SUPPORT

\* Alert Status issues identified, see details in use assessment

### RECOMMENDATIONS

Conduct more comprehensive water quality monitoring in Coy Pond to evaluate whether conditions are naturally-occurring or are impaired by anthropogenic influences.



## ROUND POND (SEGMENT MA93063)

Location: Hamilton.

Length/area: 38 acres

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 2 - Attaining Some Uses (*Secondary Contact Recreation* and *Aesthetics*); Others Not Assessed (MassDEP 2005).

### WITHDRAWALS AND DISCHARGES






#### WMA (Appendix E, Table E1)

Manchester Water Department registration/permit (31816601/ 9P31816601).

#### NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Round Pond. All designated uses are not assessed.

ROUND POND (SEGMENT MA93063) Use Summary				
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

## GRAVELLY POND (SEGMENT MA93028)

Location: Hamilton.

Length/area: 50 acres

Classification: Class A/PWS/ORW.

This segment is on the 2004 Integrated List of Waters in Category 2 - Attaining Some Uses (*Secondary Contact Recreation* and *Aesthetics*); Others Not Assessed (MassDEP 2005).

### WITHDRAWALS AND DISCHARGES

#### WMA (Appendix E, Table E1)

Manchester Water Department registration/permit (31816601/ 9P31816601).







#### NPDES (Appendix E, Tables E2 and E3)

MAG640003 Town of Manchester-by-the-Sea discharge from the Gravelly Pond Water Treatment Facility

### USE ASSESSMENT

No quality-assured data are available for Gravelly Pond. All designated uses are not assessed.

GRAVELLY POND (SEGMENT MA93028) Use Summary

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

\* The MassDEP Drinking Water Program maintains current drinking water supply data.

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Conduct a site visit to evaluate any potential impacts associated with the Manchester-by-the-Sea Gravelly Pond Water Treatment Facility discharge.

## BECK POND (SEGMENT MA93003)

Location: Hamilton.

Length/area: 35 acres

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2005).

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### ***Aquatic Life Use***

##### Water Chemistry

Sampling was conducted by DWM staff at one location (W0968) in the pond as part of the 2002 Baseline Lake TMDL Project (Appendix C, Tables C1 and C2).






Generally good water quality conditions (adequate DO, low chlorophyll a concentrations, and good Secchi disk measurements) were recorded in Beck Pond. The *Aquatic Life Use* is assessed as support.

#### ***Primary and Secondary Contact Recreation and Aesthetics Uses***

Sampling was conducted by DWM staff at one location (W0968) in the pond as part of the 2002 Baseline Lake TMDL Project (Appendix C, Tables C1 and C2).

Although no objectionable conditions were recorded (MassDEP 2002a), because of the lack of bacteria data the *Primary* and *Secondary Contact Recreational* uses are not assessed. The *Aesthetics Use* is assessed as support.

BECK POND (SEGMENT MA93003) Use Summary

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

### RECOMMENDATIONS

Conduct bacteria sampling to evaluate status of *Primary* and *Secondary Contact Recreational* uses.

## CHEBACCO LAKE (SEGMENT MA93014)

Location: Hamilton/Essex.

Length/area: 204 acres

Classification: Class B.

This segment is included on the 2004 303(d) List of Impaired Waters due to mercury contamination (<http://mass.gov/dep/water/resources/tmdls.htm>). It is also impaired by the presence of exotic (non-native) species.

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### ***Aquatic Life Use***

##### Habitat and Flow

There are no man-made structures to block fish passage at the Chebacco Lake outlet (Reback *et al.* 2005).

##### Biology

Chebacco Lake is infested with two non-native aquatic plants (*Potamogeton crispus* and *Cabomba caroliniana* (DeCesare *et al.* 2000).

The *Aquatic Life Use* for Chebacco Lake is assessed as impaired because of the infestation of non-native aquatic macrophytes.

#### ***Fish Consumption Use***

Fish contaminant monitoring was conducted by MassDEP in Chebacco Lake in June 1998 (DeCesare *et al.* 2000). MA DPH reviewed these data and because of elevated levels of mercury in *Micropterus salmoides* (largemouth bass), issued the following fish consumption advisory: "Children younger than 12 years, pregnant women, and nursing mothers should not consume any of the affected fish species (largemouth bass) from this waterbody" and that "the general public should limit consumption of largemouth bass to two meals per month" (MA DPH 2005a).






Because of the site-specific fish consumption advisory due to mercury contamination, the *Fish Consumption Use* is assessed as impaired.

#### ***Primary and Secondary Contact Recreation and Aesthetics Uses***

There are two beaches along the shoreline of Chebacco Lake: Camp Menorah Beach and Centennial Grove Beach. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

The *Recreational* and *Aesthetics* uses are not assessed.

### CHEBACCO LAKE (SEGMENT MA93014) Use Summary

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non native aquatic macrophyte Source: Unknown
Fish Consumption		IMPAIRED Cause: Mercury Source: Unknown Suspected Source: Atmospheric deposition
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

### RECOMMENDATIONS

An unobstructed channel should be maintained at the outlet of Chebacco Lake to the Essex River to insure that migrating herring will be able to reach the spawning habitat (Reback *et al.* 2005).

Water quality monitoring (*in-situ* measurements for DO, temperature, and other water quality parameters as well as bacteria sampling) should be conducted to better evaluate water quality conditions in Chebacco Lake and to assess the status of the designated uses.

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Support improvement of freshwater Beaches Bill data quality and reporting.

## **ALEWIFE BROOK (SEGMENT MA93-45)**

Location: Headwaters, outlet Chebacco Lake, Essex to Landing Road, Essex

Length/area: 1.4 miles

Classification: Class B.

This is a new segment so it does not appear on the 2004 Integrated List of Waters.

### **WITHDRAWALS AND DISCHARGES**

#### **WMA (Appendix E, Table E1)**

Essex DPW Water Division registration (31809201)

#### **NPDES (see Appendix E, Table E3)**

### **USE ASSESSMENT**

#### ***Aquatic Life Use***

##### Habitat and Flow

There are no man-made structures to block passage at the Chebacco Lake outlet, however encroaching vegetation in the low gradient stream may make it difficult for river herring to reach the spawning area in the lake. Additionally, beavers have created a dam in recent years that can block fish passage. The only obstruction to fish passage along Alewife Brook is a natural elevation change at Essex Falls near Apple Street in Essex, which is overcome by a series of stone stream baffles. Fish passage along this area is reported to be poor/inefficient (Reback *et al.* 2005). Habitat in the lower river is reported to be favorable for rainbow smelt spawning (i.e., substrate comprised largely of clean cobble and gravel, adequate water depths over riffles, ample shading, lack of excessive periphyton growth, and no physical barriers to passage) (Chase 2006a).

Streamflow conditions in Alewife Brook upstream from Apple Street in Essex (W0879) were noted to be very low during the summer months of 2002 (MassDEP 2002a) coincident with drought conditions (advisories and watches were in effect in Massachusetts -- see Appendix B). All of the estimated visible surface velocities were described as either "none" or "low" on the field survey sheets at this sampling station between July and September 2002 (MassDEP 2002a).

##### Biology

MA DFG conducted fish population sampling in Alewife Brook near Essex Park Road in Essex (Site 802) on 15 July 2002 using backpack electroshocking equipment. Only 14 fish, representing two species, were collected (seven individuals each). Species present included American eel (*Anguilla rostrata*) and chain pickerel (*Esox niger*) (Richards 2005).

Very sparse egg deposition was found in 1990 and no eggs were found during the extensive monitoring conducted in 1991 by DMF biologists in the known smelt spawning location in Alewife Brook near Landing Road in Essex (Chase 2006a).

##### Water Chemistry

Sampling was conducted by DWM staff in Alewife Brook upstream from Apple Street in Essex (W0879) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Tables 7 and 8).

Very low DO/saturations (measurements taken during both pre-dawn and daytime) were documented in the brook in July, August and September 2002. The water was slightly acidic (most pH measurements were <6.5 SU). With the exception of one high total phosphorus measurement (0.10 mg/L in September), concentrations were low (<0.048 mg/L). The highest measurement likely represented the influence of local storm events.

Given the extremely low flow conditions encountered during the 2002 survey season the *Aquatic Life Use* is not assessed for Alewife Brook. This use is identified with an Alert Status, however, because of low DO/saturation, the depauperate fish community, the poor utilization of smelt for spawning despite good habitat conditions, and the high concentration of total phosphorus.






### **Primary and Secondary Contact Recreation and Aesthetics Uses**

Bacteria sampling was conducted by DWM staff in Alewife Brook upstream from Apple Street in Essex (W0879) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8). Fecal coliform bacteria counts ranged from 20 to 19,000 cfu/100 mls with a geometric mean of 280 cfu/100 mls. This exceeded the standard of 200 cfu/100 mls for primary contact recreation. The highest fecal coliform bacteria count likely represented the influence of a local storm event. However, it should also be noted that the Town of Essex had problems with contaminated storm drains resulting from failing septic systems, including a drain at Apple Street (Brander 2006d). The Town posted contaminated storm drains with signs. As part of a Court Decree, Essex has been inspecting Title V systems town-wide. Remediation of problems has included removing direct discharges, upgrading systems, and connections to the sewer system. The current statuses of storm drains to Alewife Brook are not known but all failing septic systems should be mitigated by December 2006 (Goodwin 2006).

Field observations were made by DWM personnel during the surveys conducted in Alewife Brook between May and September 2002. No objectionable conditions (odors, deposits, turbidity) were noted during any of the surveys (Station AL01) (MassDEP 2002a).

The *Primary Contact Recreational Use* is assessed as impaired because of elevated fecal coliform bacteria counts. The highest counts likely represented the influence of local storm events. The *Secondary Contact Recreational* and *Aesthetics* uses are assessed as support.

ALEWIFE BROOK (SEGMENT MA93-45) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

\*Alert Status issues identified, see details in use assessment

### **RECOMMENDATIONS**

An unobstructed channel should be maintained to insure that migrating herring will be able to reach the spawning habitat (Reback *et al.* 2005).

Follow-up monitoring should be conducted to evaluate whether or not smelt are utilizing the apparently viable smelt-spawning habitat in Alewife Brook near Landing Road in Essex (Chase 2006a). Smelt population restoration efforts should also be considered for the Essex Bay system, including Alewife Brook. If smelt stock enhancement is initiated by DMF additional monitoring should be conducted to document success and potentially identify factors limiting recruitment.

Conduct additional bacteria sampling along Alewife Brook to evaluate effectiveness of the Town of Essex's remediation of contaminated storm drains discharging to Alewife Brook and their implementation of Phase II NPDES stormwater permit requirements. All failing systems should be mitigated by December 2006. Conduct bacteria source tracking, if needed, to help identify undocumented sources.

More comprehensive water quality monitoring should be conducted along this brook to better characterize water quality conditions and determine source(s) of low DO/saturation to better assess the *Aquatic Life Use*.

## ALEWIFE BROOK (SEGMENT MA93-46)

Location: Landing Road, Essex to confluence with Essex River, Essex

Length/area: 0.01 mi<sup>2</sup>

Classification: Class SA

This is a new segment so it does not appear on the 2004 Integrated List of Waters.

### DISCHARGES

#### NPDES (Appendix E, Tables E2 and E3)

MA0029564 Essex Housing Authority (connected to Essex sewer system in December 2005)

### USE ASSESSMENT

#### *Aquatic Life Use*

##### Toxicity

##### *Ambient*

Water was collected from Alewife Brook between the two ball fields in Memorial Park behind the Essex Town Hall for use as dilution water in the Essex Housing Authority's whole effluent toxicity tests. Survival of *M. beryllina* exposed (7-day) to the river water in the tests conducted in October 1999 and between May 2002 and October 2005 (n=14 tests when river water was collected) ranged from 80 to 100% (TOXTD database).

##### *Effluent*

Sixteen whole effluent toxicity tests were conducted on the Essex Housing Authority effluent between October 1999 and October 2005 (excluding reports for tests done in 2000 and 2001, which were not available for review). With the exception of one test event (October 2005 - LC<sub>50</sub> = 82% effluent), no acute toxicity to *M. beryllina* was detected (i.e., all LC<sub>50</sub>s were >100% effluent). Four of the 15 valid chronic tests conducted were found to exhibit some toxicity to *M. beryllina* (CNOECs ranged from 12.5 to 50% effluent in August 2003, May and August 2005, and October 2005 tests). The effluent exhibited chronic toxicity to *A. punctulata* during four test events (CNOEC ranged from 12.5 to 50% effluent in May 2002, January and May 2004 and August 2005 tests). The other 11 tests were not found to exhibit chronic toxicity (CNOECs = 100% effluent). It should also be noted here that the concentration of total residual chlorine in the facility's effluent was of concern (ranged from <0.05 to 1.12 mg/L (n=16) with 12 of the 16 measurements >0.05 mg/L). The facility was tied into the Essex sewer system in December 2005 (TOXTD database).

##### Water Chemistry

No water quality data were collected from this segment of Alewife Brook. However, it should be noted that very low DO/saturation conditions were documented in the upstream (freshwater) reach of the brook (see Segment MA93-45), which is of concern.

The *Aquatic Life Use* is assessed as support based on the good survival of test organisms exposed (7-day) to the river water. This use, however, is identified with an Alert Status because of low DO/saturations in the freshwater portion and chronic toxicity that was present in the Essex Housing Authority effluent. (It should be noted that chronic whole effluent toxicity is no longer a problem since the facility was tied into the Essex sewer system in December 2005).

#### *Shellfish Harvesting Use*

DMF shellfish status of July 2000 indicates that Area N7.2, which comprises the majority of this segment area, is prohibited. No changes to this status have been made (Kennedy 2006a).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing area is prohibited. Contaminated storm drains are a known problem in the area (Brander 2006d).

#### *Primary and Secondary Contact Recreation and Aesthetics Uses*







No bacteria data were collected from this segment of Alewife Brook although samples were collected both upstream and downstream from this segment. It should be noted that elevated fecal coliform bacteria counts were documented in the upstream (freshwater) reach of the brook (see Segment MA93-45) while



lower counts were documented in the Essex River (see Segment MA93-11). The Town of Essex is under a consent order to remediate contaminated storm drains, some of which are known to discharge to Alewife Brook (Brander 2006d). Failing septic systems should be mitigated by December 2006 (Goodwin 2006).

The *Primary Contact Recreational Use* is not assessed but is identified with an Alert Status because of elevated bacteria counts in the freshwater portion of the brook and the problems with contaminated storm drains. The *Secondary Contact Recreational Use* is assessed as support based on extrapolation of data upstream and downstream from this segment. The *Aesthetics Use* is not assessed.

ALEWIFE BROOK (SEGMENT MA93-46) Use Summary

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems
Primary Contact		NOT ASSESSED*
Secondary Contact		SUPPORT
Aesthetics		NOT ASSESSED

\* Alert Status issues identified, see details in use assessment

## RECOMMENDATIONS

Conduct additional bacteria sampling along Alewife Brook to evaluate effectiveness of the Town of Essex's remediation of contaminated storm drains discharging to Alewife Brook and their implementation of Phase II NPDES stormwater permit requirements. All failing systems should be mitigated by December 2006. Conduct bacteria source tracking, if needed, to help identify undocumented sources.

More comprehensive water quality monitoring should be conducted to better characterize water quality conditions and determine source(s) of low DO/saturation and to better assess the status of the *Aquatic Life Use*.

Implement recommendations in the DMF shellfish management plan for Area N7.2.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

## HASKELL POND (SEGMENT MA93031)

Location: Gloucester.

Length/area: 58 acres

Classification: Class A/PWS/ORW.

This segment is on the 2004 Integrated List of Waters in Category 2 - Attaining Some Uses (*Secondary Contact Recreation* and *Aesthetics*); Others Not Assessed (MassDEP 2005).

### WITHDRAWALS







#### WMA (Appendix E, Table E1)

Gloucester Department of Public Works registration/permit (31810701/9P31810701). The Gloucester Department of Public Works has a Water Loss Prevention Grant Project (2005-09/WLP) in an effort to identify and reduce unaccounted-for water loss from the water works and distribution system to 10% or less.

### USE ASSESSMENT

No quality-assured data are available for Haskell Pond. All designated uses are not assessed. It should be noted, however, that the Haskell Pond dam is a barrier to anadromous fish passage, although MA DMF considers it to be a low priority for restoration due to height of the dam and lack of sustained outflow (Reback *et al.* 2005). (It should also be noted that there is a second dam on Walker Creek near Forest Lane in Gloucester that is also a barrier to anadromous fish passage up to Haskell Pond).

HASKELL POND (SEGMENT MA93031) Use Summary

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

\* The MassDEP Drinking Water Program maintains current drinking water supply data.

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Currently no sustained outflow is maintained at the Haskell Pond Dam (Reback *et al.* 2005). If a smelt restoration project on Walker Creek is undertaken, outflows will need to be maintained during critical periods. Chase (2006a) concluded, "*Walker Creek possesses suitable spawning habitat that most likely previously supported a smelt spawning run. Although not a large amount of potential spawning habitat, outside of the Danvers River, it is one of the better candidates for restoration in the North Coastal Basin. When successful enhancement methods are developed, the Walker Creek should be considered for an enhancement project. This project should include stream grooming techniques to improve the creek channel and the substrate at spawning riffles.*"

## **ESSEX RIVER (SEGMENT MA93-11)**

Location: Source east of Southern Avenue, Essex to mouth at Essex Bay, Essex.

Length/area: 0.50 mi<sup>2</sup>

Classification: Class SA/ORW

The lower portion of this segment is in the Parker River/Essex Bay ACEC.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

### **DISCHARGES**

**NPDES (see Appendix E, Table E3)**

### **USE ASSESSMENT**

#### ***Aquatic Life Use***

##### Water Chemistry

Sampling was conducted by DWM staff in the Essex River at the Route 133 Bridge in Essex (W0890) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Tables 7 and 8).

Low DO/saturations (measurements taken during both pre-dawn and daytime on both incoming and outgoing tides) were documented in July, August and September 2002. Given the extensive salt marsh area in the vicinity of the sampling station it is best professional judgment that these conditions, which are of concern, are likely naturally-occurring. No data are available in the outer estuary.

The *Aquatic Life Use* is not assessed for the Essex River because of the limited water quality data available (one station is not representative of the large area). This use is identified with an Alert Status, however, because of the low DO/saturation in the upper reach of the estuary.

#### ***Shellfish Harvesting Use***

DMF shellfish status of July 2000 indicates that Area N7.0 is conditionally approved and areas N7.2 and 7.3 are prohibited. No changes to this status have been made (Kennedy 2006a).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing areas are either prohibited or conditionally approved.




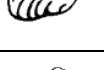


#### ***Primary and Secondary Contact Recreation and Aesthetics Uses***

Bacteria sampling was conducted by DWM staff in the Essex River at the Route 133 Bridge in Essex (W0890) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8). Fecal coliform bacteria counts ranged from 6 to 1,000 cfu/100 mls with a geometric mean of 60 cfu/100 mls. This met the standard of 200 cfu/100 mls for primary contact recreation. The highest fecal coliform bacteria count represented dry weather sampling conditions. However, it should also be noted that the Town of Essex had problems with contaminated storm drains resulting from failing septic systems including drains upstream from this segment (Brander 2006d). The Town posted contaminated storm drains with signs. As part of a Court Decree, Essex has been inspecting Title V systems town-wide. Remediation of problems have included removing direct discharges, upgrading systems, and connections to the sewer system. The current status of storm drains to Alewife Brook (upstream from this segment) are not known at this time, but failing septic systems are expected to be mitigated by December 2006 (Goodwin 2006).

Field observations were made by DWM personnel during the surveys conducted in this segment of the Essex River between May and September 2002. With the exception of some turbidity noted on two occasions, no other objectionable conditions (odors, oils, deposits) were noted during any of the surveys (Station ER01) (MassDEP 2002a).

The *Primary and Secondary Contact Recreational and Aesthetics uses* are assessed as support for the Essex River. This assessment is based on the bacteria data collected from the inner estuary area (considered to be representative of the lowest water quality condition) and the conditionally approved status of the shellfishing area in the outer estuary area (indicative of low bacteria levels).

# ESSEX RIVER (SEGMENT MA93-11) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems
Primary Contact		SUPPORT
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

\* Alert Status issues identified, see details in use assessment

## RECOMMENDATIONS

Conduct additional bacteria sampling to evaluate effectiveness of the Town of Essex's remediation of contaminated storm drains discharging to Alewife Brook and their implementation of Phase II NPDES stormwater permit requirements. All failing systems are expected to be mitigated by December 2006. Conduct bacteria source tracking, if needed.

More comprehensive water quality monitoring should be conducted to better characterize water quality conditions and evaluate DO/saturation levels in the estuary.

Implement recommendations in the DMF shellfish management plan for areas N7.0, N7.2 and N7.3.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

## ESSEX BAY (SEGMENT MA93-16)

Location: The waters landward of Ipswich Bay contained within an imaginary line drawn from the northwestern tip of Gloucester near Coffins Beach to the southern tip of Castle Neck, Ipswich to the eastern most point of Dilly Island, Essex (mouth of Castle Neck River) and then from Cross Island, Essex to Conomo Point, Essex (mouth of Essex River) excluding Walker, Lanes, and Farm creeks in Essex/Ipswich/Gloucester.

Length/area: 0.97 mi<sup>2</sup>

Classification: Class SA/ORW

This area is part of the Parker River/Essex Bay ACEC.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### *Shellfish Harvesting Use*

DMF shellfish status of July 2000 indicates that areas N7.0 and N7.6, which comprise this segment area, are conditionally approved. No changes to this status have been made (Kennedy 2006a).







The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing areas are conditionally approved. Failing septic systems along Walker Creek are a potential source.

#### *Primary and Secondary Contact Recreation and Aesthetics Uses*

Although weekly *Enterococci* bacteria testing was conducted, there were no postings of Crane Beach (the southern tip of which is located at the mouth of Essex Bay) during the 2002, 2003, and 2004 bathing beach seasons (MA DPH 2003, MA DPH 2004, and MA DPH 2005b).

The *Primary and Secondary Contact Recreational and Aesthetics* uses are assessed as support for Essex Bay. This assessment is based on the lack of any beach postings at Crane Beach (the mouth of the Bay) the conditionally approved status of the shellfishing area in Essex Bay, and best professional judgment.

ESSEX BAY (SEGMENT MA93-16) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, failing septic systems along Walker Creek
Primary Contact		SUPPORT
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

## RECOMMENDATIONS

Implement recommendations in the DMF shellfish management plan for areas N7.0 and N7.6.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

## THE ANNISQUAM RIVER SYSTEM

The Annisquam River system (which is also hydraulically connected to Gloucester Harbor through the Blynman Canal) includes the Jones, Little and the Mill rivers. Although neither the Jones nor the Little rivers are currently reported on in this document (there are no segments defined for these rivers/estuaries), there is a habitat restoration project being developed for the Little River in Gloucester. The portion of the river needing restoration is adjacent to the City-owned water filtration plant. When the water filtration plant was constructed the river was channelized in a fish ladder and routed underground for about 200 yards before emptying back to the river next to the sludge lagoon (O'Brien 2006). Restoration opportunities include the removal and replacement of an antiquated concrete channel and former sludge lagoon with a natural streambed. Plans are underway to tie the discharge from the West Gloucester Filtration Plant (MAG640013 see Appendix E, Table E2) into the City's sewer system. Multiple aquatic species stand to benefit from the restoration and a more natural stream configuration will greatly enhance flood capacity and aesthetic conditions of the river (MA DFG 2006a). Segments in the Annisquam River system are illustrated in Figure 10.

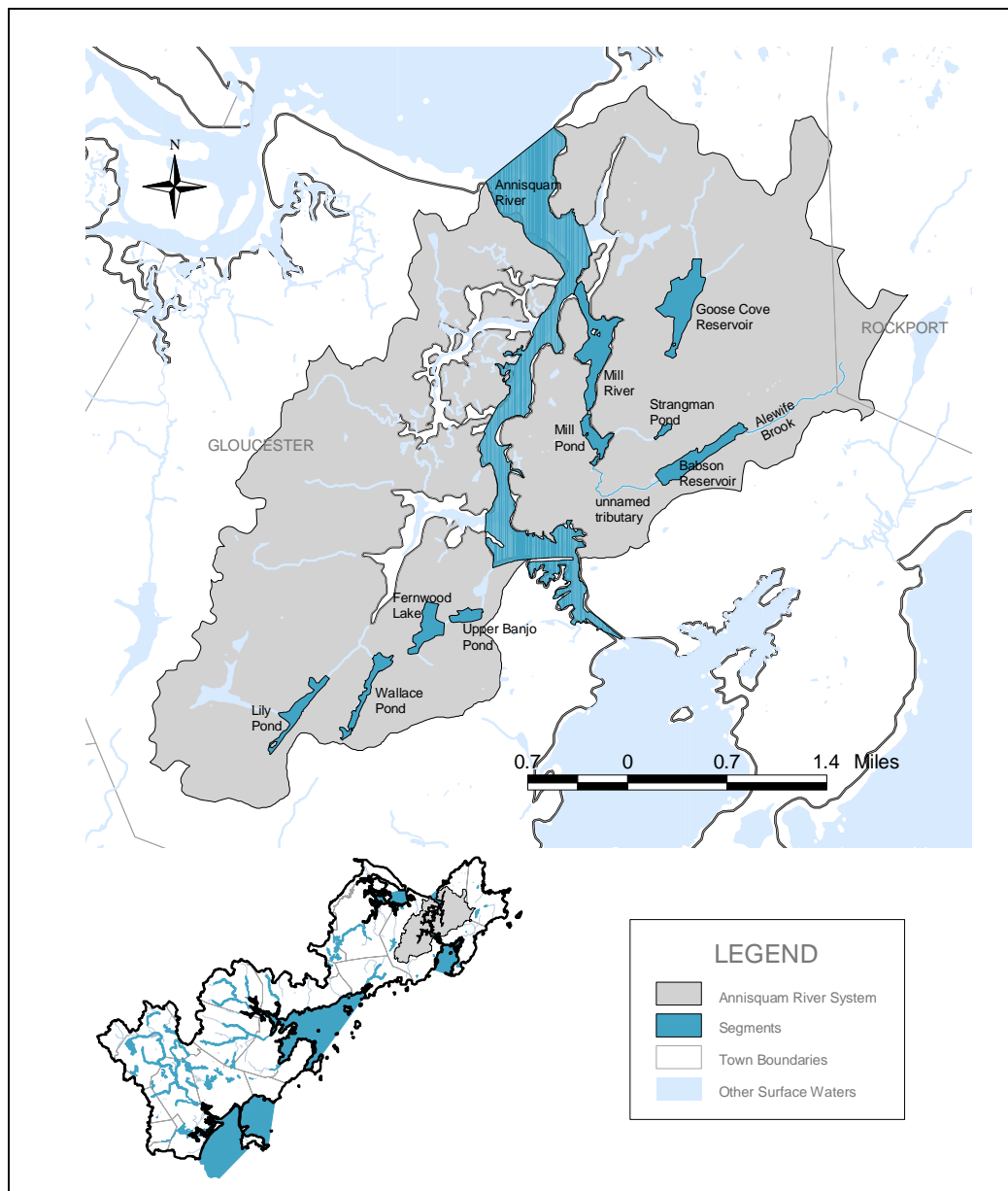


Figure 10. Locations of segments in the Annisquam River system.

## LILY POND (SEGMENT MA93039)

Location: Gloucester.

Length/area: 24 acres

Classification: Class B.






This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL due to the presence of noxious aquatic plants and turbidity (MassDEP 2005).

There are two fishways present at the Lily Pond Dam; a stone stream baffle and a wooden Denil ladder, both of which are passable and considered to be in fair and good condition, respectively (Reback *et al.* 2005). The stone stream baffles allow herring to traverse the elevation change and the wooden Denil ladder, which was replaced in 2000, provides passage at the dam into the spawning/nursery area of Lily Pond (Reback *et al.* 2005).

### USE ASSESSMENT

No recent quality-assured water quality data are available for Lily Pond. All designated uses are not assessed.

LILY POND (SEGMENT MA93039) Use Summary

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.



## WALLACE POND (SEGMENT MA93085)

Location: Gloucester.

Length/area: 22 acres

Classification: Class A/PWS/ORW

This segment is on the 2004 Integrated List of Waters in Category 2 - Attaining Some Uses (*Secondary Contact Recreation* and *Aesthetics*); Others Not Assessed (MassDEP 2005).







### WITHDRAWALS

#### WMA (Appendix E, Table E1)

Gloucester Department of Public Works registration/permit (31810701/9P31810701). The Gloucester Department of Public Works has a Water Loss Prevention Grant Project (2005-09/WLP) in an effort to identify and reduce unaccounted-for water loss from the water works and distribution system to 10% or less.

### USE ASSESSMENT

No quality-assured data are available for Wallace Pond. All designated uses are not assessed.

WALLACE POND (SEGMENT MA93085) Use Summary					
Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

\* The MassDEP Drinking Water Program maintains current drinking water supply data.

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

## FERNWOOD LAKE (SEGMENT MA93022)

Location: Gloucester.

Length/area: 25 acres

Classification: Class A/PWS/ORW.

This segment is on the 2004 Integrated List of Waters in Category 2 - Attaining Some Uses (*Secondary Contact Recreation* and *Aesthetics*); Others Not Assessed (MassDEP 2005).







### WITHDRAWALS

#### WMA (Appendix E, Table E1)

Gloucester Department of Public Works registration/permit (31810701/9P31810701). The Gloucester Department of Public Works has a Water Loss Prevention Grant Project (2005-09/WLP) in an effort to identify and reduce unaccounted-for water loss from the water works and distribution system to 10% or less.

### USE ASSESSMENT

No quality-assured data are available for Fernwood Lake. All designated uses are not assessed.

FERNWOOD LAKE (SEGMENT MA93022) Use Summary					
Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

\* The MassDEP Drinking Water Program maintains current drinking water supply data.

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

## UPPER BANJO POND (SEGMENT MA93080)

Location: Gloucester.

Length/area: 11 acres






Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL due to the presence of noxious aquatic plants and turbidity (MassDEP 2005).

### USE ASSESSMENT

No quality-assured data are available for Upper Banjo Pond. All designated uses are not assessed.

UPPER BANJO POND (SEGMENT MA93080) Use Summary

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

## GOOSE COVE RESERVOIR (SEGMENT MA93093)

Location: Gloucester.

Length/area: 58 acres

Classification: Class A/PWS/ORW.

This segment is on the 2004 Integrated List of Waters in Category 2 - Attaining Some Uses (*Secondary Contact Recreation* and *Aesthetics*); Others Not Assessed (MassDEP 2005).

There is an earthen berm dam at the outlet of Goose Cove Reservoir, which has a submerged outlet. There is no fishway present (Reback *et al.* 2005). There are no development plans for anadromous fisheries due to the existence of several difficult obstructions.

### WITHDRAWALS AND DISCHARGES

#### WMA (Appendix E, Table E1)







Gloucester Department of Public Works registration/permit (31810701/9P31810701). The Gloucester Department of Public Works has a Water Loss Prevention Grant Project (2005-09/WLP) in an effort to identify and reduce unaccounted-for water loss from the water works and distribution system to 10% or less.

#### NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Goose Cove Reservoir. All designated uses are not assessed.

GOOSE COVE RESERVOIR (SEGMENT MA93093) Use Summary

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

\* The MassDEP Drinking Water Program maintains current drinking water supply data.

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

## MILL RIVER SYSTEM

### ALEWIFE BROOK (SEGMENT MA93-26)

Location: Headwaters just north of B&M Railroad, Rockport to inlet Babson Reservoir, Gloucester.

Length/area: 1.0 river mile

Classification: Class A/PWS/ORW.

This segment is on the 2004 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2005).

## DISCHARGES

NPDES (see Appendix E, Table E3)

## USE ASSESSMENT

### *Aquatic Life Use*

#### Habitat and Flow

DWM conducted a habitat assessment of Alewife Brook upstream from Babson Reservoir, Gloucester (Station AB01) on 31 July 2002. In-stream habitat was good (total habitat score of 154 out of 200) (MassDEP 2002b). Poor in-stream cover for fish (water was very shallow) and limited velocity/depth combinations limited the habitat quality in the sampling reach the most.






Only limited data are available and, therefore, the *Aquatic Life Use* is not assessed for Alewife Brook.

### *Primary and Secondary Contact Recreation and Aesthetics Uses*

DWM biologists did note that Alewife Brook upstream from Babson Reservoir, Gloucester (Station AB01) was turbid on 31 July 2002 however no other objectionable conditions were noted (e.g., oils, odors, other deposits) (MassDEP 2002b).

Only limited data are available and, therefore, the *Primary and Secondary Contact Recreational* and *Aesthetics* uses are not assessed for Alewife Brook.

ALEWIFE BROOK (SEGMENT MA93-26) Use Summary

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

## RECOMMENDATIONS

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary and Secondary Contact Recreational* uses.

## BABSON RESERVOIR (SEGMENT MA93001)

Location: Gloucester.

Length/area: 40 acres

Classification: Class A/PWS/ORW.

This segment is on the 2004 Integrated List of Waters in Category 2 - Attaining Some Uses (*Secondary Contact Recreation* and *Aesthetics*); Others Not Assessed (MassDEP 2005).

It should be noted that the Babson Reservoir Dam is a barrier to anadromous fish passage although MA DMF considers it to be a low priority for restoration due to the lack of sustained outflow and the presence of a brackish pond downstream (Reback *et al.* 2005).

### WITHDRAWALS AND DISCHARGES

#### WMA (Appendix E, Table E1)







Gloucester Department of Public Works registration/permit (31810701/9P31810701). The Gloucester Department of Public Works has a Water Loss Prevention Grant Project (2005-09/WLP) in an effort to identify and reduce unaccounted-for water loss from the water works and distribution system to 10% or less.

#### NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Babson Reservoir. All designated uses are not assessed.

BABSON RESERVOIR (SEGMENT MA93001) Use Summary

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

\* The MassDEP Drinking Water Program maintains current drinking water supply data.

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

## UNNAMED TRIBUTARY (SEGMENT MA93-27)

Location: Outlet Babson Reservoir, Gloucester to inlet of Mill Pond, Gloucester.

Length/area: 0.7 miles

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2005).

Currently there is no anadromous fish passage to this tributary. The brackish nature of Mill Pond makes this stream a poor candidate for anadromous fish development (Reback *et al.* 2005).

## WITHDRAWALS AND DISCHARGES

### WMA (Appendix E, Table E1)

Gloucester Department of Public Works registration/permit (31810701/9P31810701). The Gloucester Department of Public Works has a Water Loss Prevention Grant Project (2005-09/WLP) in an effort to identify and reduce unaccounted-for water loss from the water works and distribution system to 10% or less.



### NPDES (Appendix E, Tables E2 and E3)

City of Gloucester, Babson Filtration Plant (MAG640012).

## USE ASSESSMENT

No water quality data are available. All uses are not assessed.

UNNAMED TRIBUTARY (SEGMENT MA93-27) Use Summary

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

## RECOMMENDATIONS

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

## STRANGMAN POND (SEGMENT MA93076)

Location: Gloucester.

Length/area: 3 acres

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL due to the presence of noxious aquatic plants and turbidity (MassDEP 2005).






### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Strangman Pond. All designated uses are not assessed.

STRANGMAN POND (SEGMENT MA93076) Use Summary

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.



## MILL POND (SEGMENT MA93050)

Location: Gloucester.

Length/area: 18 acres

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 2 - Attaining Some Uses (*Secondary Contact Recreation* and *Aesthetics*); Others Not Assessed (MassDEP 2005).

There is no fishway at the concrete dam and tidegate at Mill Pond Dam.





### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No water quality data are available so all uses are not assessed.

MILL POND (SEGMENT MA93050) Use Summary

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

### RECOMMENDATIONS

Chase (2006a) recommends the following: *“The Mill River system may offer one of the few opportunities to establish a smelt run in the Cape Ann region. Alterations to the tidegate may improve the attraction flows for adult smelt and upstream freshwater flow management and habitat improvement could provide suitable spawning habitat. Increased flushing at the tidegate would benefit marine life in Mill Pond regardless of the outcome for smelt restoration. It is recommended that the ongoing cooperative effort to improve flushing in the Mill River tidegate is supported and smelt restoration is evaluated as a component of this effort”.*

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

## **MILL RIVER (SEGMENT MA93-28)**

Location: Headwaters outlet of Mill Pond, Gloucester to the confluence with the Annisquam River, Gloucester.

Length/area: 0.10 mi<sup>2</sup>

Classification: Class SA.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

### **DISCHARGES**

**NPDES (see Appendix E, Table E3)**

### **USE ASSESSMENT**

#### ***Aquatic Life Use***

##### Habitat and flow

DMF biologists evaluated the Mill River's suitability for smelt spawning habitat, however, minor freshwater inputs and daily intrusion of saltwater keeps outflow from Mill Pond saline which in turn provides little attraction for smelt seeking spawning habitat (Chase 2006a).

##### Biology

No evidence of smelt spawning was found near the tidegate in 1988 or at upstream freshwater reaches in 1988 (Chase 2006a).

##### Water Chemistry

Sampling was conducted by DWM staff in the Mill River downstream from Route 127 in Gloucester (W0891) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 7).

Good DO/saturation, pH, and temperatures (measurements taken during both pre-dawn and daytime) were documented in the river in July, August and September 2002.

Although no water quality problems were identified, the *Aquatic Life Use* is not assessed for the Mill River (only limited data are available –not enough spatial representativeness).

#### ***Shellfish Harvesting Use***

DMF shellfish status of July 2000 indicates that areas N9.3, N9.6, and N9.9, which comprise this segment area, are conditionally approved. No changes to this status have been made (Kennedy 2006a).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing areas are conditionally approved.




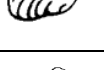


#### ***Primary and Secondary Contact Recreation and Aesthetics Uses***

Bacteria sampling was conducted by DWM staff in the Mill River downstream from Route 127 in Gloucester (W0891) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8). Fecal coliform bacteria counts ranged from <6 to 52 cfu/100 mls. These all met the standard of 200 cfu/100 mls for primary contact recreation.

Field observations were made by DWM personnel during the surveys conducted in the Mill River between May and September 2002. With the exception of isolated areas of trash/debris and on one occasion some turbidity, no other objectionable conditions (odors, oils) were noted during any of the surveys (Station MR01) (MassDEP 2002a).

Although the bacteria counts were very low at the sampling location they may not be representative enough for the entire segment area and, therefore, the *Primary Contact Recreational Use* is not assessed. The *Secondary Contact Recreational* and *Aesthetics* uses, however, are assessed as support for the Mill River based on the limited data, the conditionally approved status of the shellfishing area, and best professional judgment.

# MILL RIVER (SEGMENT MA93-28) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems
Primary Contact		NOT ASSESSED
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

## RECOMMENDATIONS

Support the following actions identified by DMF to study/protect/remediate smelt spawning habitat (Chase 2006a). *“The Mill River system may offer one of the few opportunities to establish a smelt run in the Cape Ann region. Alterations to the tidegate may improve the attraction flows for adult smelt and upstream freshwater flow management and habitat improvement could provide suitable spawning habitat. Increased flushing at the tidegate would benefit marine life in Mill Pond regardless of the outcome for smelt restoration. It is recommended that the ongoing cooperative effort to improve flushing in the Mill River tidegate is supported and smelt restoration is evaluated as a component of this effort.”*

Implement recommendations in the DMF shellfish management plan for areas N9.3, N9.6, and N9.9.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

## **ANNISQUAM RIVER (SEGMENT MA93-12)**

Location: The waters from the Gloucester Harbor side of the Route 127 bridge, Gloucester to Ipswich Bay at an imaginary line drawn from Bald Rocks to Wigwam Point, Gloucester.

Length/area: 0.82 mi<sup>2</sup>

Classification: Class SA.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

### **DISCHARGES**

**NPDES (see Appendix E, Table E3)**

### **USE ASSESSMENT**

#### ***Aquatic Life Use***

##### Eelgrass Bed Habitat

MassDEP's Wetlands Conservancy Program (WCP) identified the presence of eelgrass in the Annisquam River from historic 1951 black and white aerial photography (Costello 2003). In 1998 MassDEP WCP performed field verification of 1995 aerial photography and mapped the extent of eelgrass bed habitat in the Annisquam River. Total areal coverage of the Annisquam River from the 1995 survey was approximately 2% of the area. In 2001 MassDEP WCP performed field verification of 2001 aerial photography and mapped the extent of eelgrass bed habitat in the Annisquam River. There was almost no change (a very slight decrease) in the total coverage of eelgrass beds along the shoreline north of Babson Point between 1995 and 2001.

##### Toxicity

##### *Ambient*

The Gloucester Water Pollution Control Facility (WPCF) sub-contracts personnel to collect water from the Annisquam River at the Cape Ann Marina Dock located outside of Gloucester Harbor for use as dilution water in the facility's whole effluent toxicity tests (Millhouse 2006). Between December 2001 and December 2005, survival of *M. bahia* exposed (48 hours) to the river water ranged from 98 to 100% (n=17) and survival of *M. beryllina* during the same time period and length of exposure to the river water ranged from 90 to 100% (n=17)(TOXTD database).

Although survival of test organisms exposed to the Annisquam River water has been excellent in all of the tests conducted, and there has been almost no change in eelgrass bed habitat in the Annisquam River between 1995 and 2001, not enough data are available to assess the *Aquatic Life Use*.

#### ***Shellfish Harvesting Use***

DMF shellfish status of July 2000 indicates that areas N9.5, N9.6, N9.7, N9.9, and N9.16 are conditionally approved while areas N9.13, N9.14, N9.17, and N9.1 are prohibited. No changes to their status have been made (Kennedy 2006a).

It should also be noted that Cape Ann Marina on the Annisquam River has a pump-out boat and shoreside facility that was funded by the Clean Vessel Act to provide free pump-outs (MA DFG 2006c).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing areas are either conditionally approved or prohibited.







#### ***Primary and Secondary Contact Recreation and Aesthetics Uses***

Although weekly *Enterococci* bacteria testing was conducted, there were no postings of Wingearsheek Beach in Gloucester during the 2002, 2003, and 2004 bathing beach seasons (MA DPH 2003, MA DPH 2004, and MA DPH 2005b).

According to DMF biologists, the Annisquam River is well flushed and does not typically have any objectionable conditions (Chase 2006b).

The *Primary* and *Secondary Contact Recreational* and *Aesthetics* uses are assessed as support for Essex Bay. This assessment is based on the lack of any beach postings at Wingearsheek Beach and the conditionally approved status of the shellfishing area in Essex Bay and observations from DMF biologists.

ANNISQUAM RIVER (SEGMENT MA93-12) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems
Primary Contact		SUPPORT
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

## RECOMMENDATIONS

Implement recommendations in the DMF shellfish management plan for areas N9.1, N9.5, N9.6, N9.7, N9.9, N9.13, N9.14, N9.16, and N9.17.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

## OUTER CAPE ANN

The Outer Cape Ann area encompasses portions of Gloucester and Manchester as well as the entire community of Rockport. Segments in the Outer Cape Ann area are shown in Figure 11. Information on one NPDES discharge (MA0027391) Shore Cliff-Deaconess Retirement Home can be found in Appendix E, Table E2.

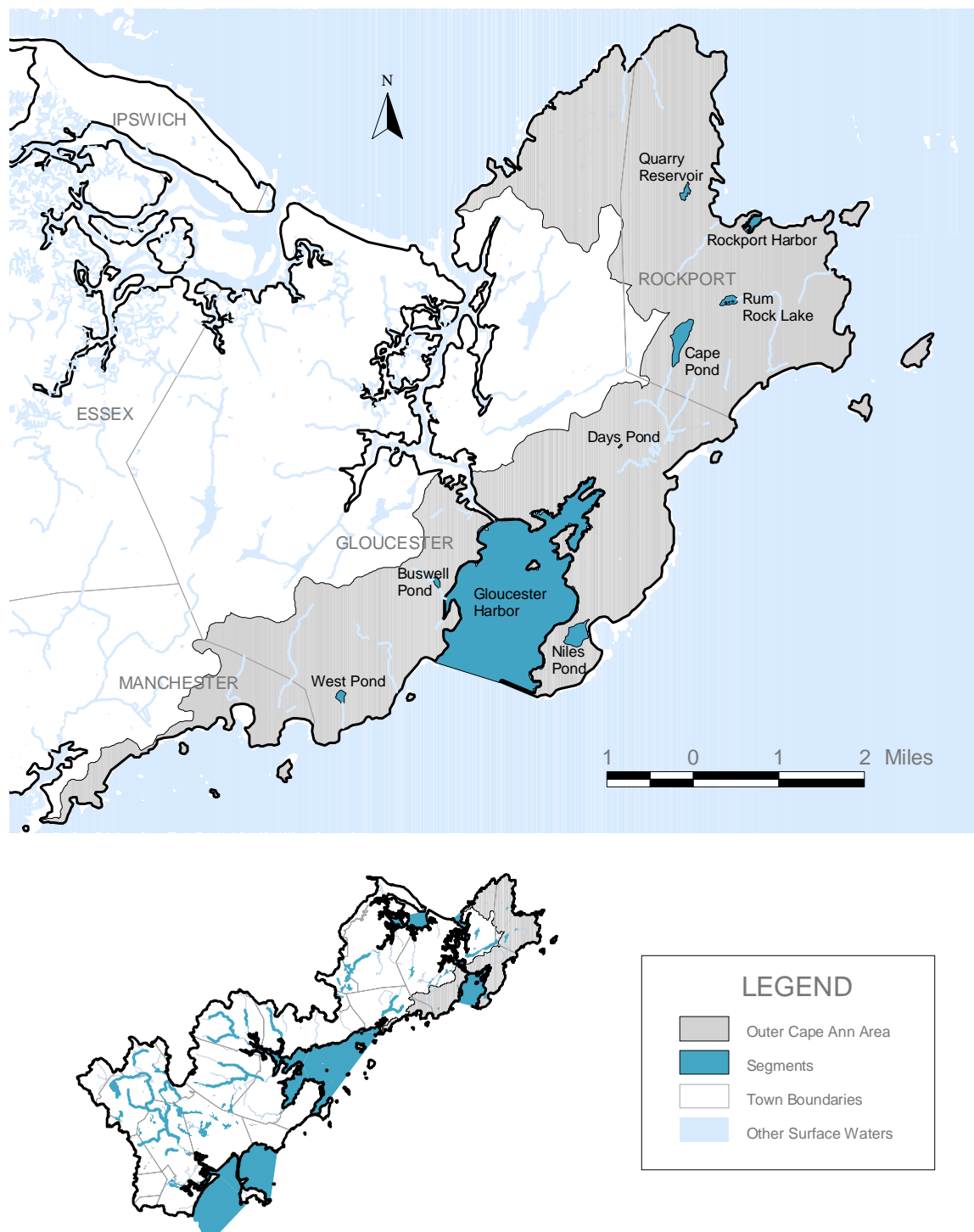


Figure 11. Locations of segments in the Outer Cape Ann drainage area.

## QUARRY RESERVOIR (SEGMENT MA93053)

Location: Rockport.

Length/area: 7 acres

Classification: Class A/PWS/ORW.

This segment is on the 2004 Integrated List of Waters in Category 2 - Attaining Some Uses (*Secondary Contact Recreation* and *Aesthetics*); Others Not Assessed (MassDEP 2005).

### WITHDRAWALS AND DISCHARGES

#### WMA (Appendix E, Table E1)







Rockport Water Department registration/permit (31825201/9P31825201). The Rockport Water Department has a Water Loss Prevention Grant Project (2005-10/WLP) in an effort to identify and reduce unaccounted-for water loss from the water works and distribution system to 10% or less.

#### NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Quarry Reservoir. All designated uses are not assessed.

QUARRY RESERVOIR (SEGMENT MA93053) Use Summary

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

\* The MassDEP Drinking Water Program maintains current drinking water supply data.

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

## ROCKPORT HARBOR (SEGMENT MA93-17)

Location: The waters landward of an imaginary line connecting the seawalls in the northeastern end of the harbor, Rockport.

Length/area: 0.02 mi<sup>2</sup>

Classification: Class SB.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

Outside of the Rockport Harbor, the Rockport WPCF staff collected water from Sandy Bay on the south side of Granite Pier for use as dilution water in the facility's whole effluent toxicity tests (Wonson 2006). This location is less than a half- mile north of Bearskin Neck from where the outfall pipe extends into "Sandy Bay"). Between January 2000 and March 2006, survival of *M. beryllina* exposed (48 hours) to the bay water ranged from 88 to 100% (n=13)(TOXTD database).

### DISCHARGES

#### NPDES (Appendix E, Tables E2 and E3)

MA0100145--The Rockport WWTP to Sandy Bay (outside of Rockport Harbor proper but may tidally affect the harbor).

MA0090654—Cape Ann Lighthouse (discharge to Atlantic Ocean).

### USE ASSESSMENT

#### *Aquatic Life Use*

##### Toxicity

##### Effluent

With the exception of one test event, no acute whole effluent toxicity to *M. beryllina* was detected in the Rockport WWTP effluent during the tests conducted between January 2000 and March 2005 (n=13) (TOXTD database). In the July 2003 test, the effluent was slightly toxic (LC<sub>50</sub> = 91% effluent).

Only limited data are available so the *Aquatic Life Use* is not assessed for Rockport Harbor.

#### *Shellfish Harvesting Use*




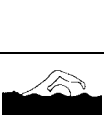


DMF shellfish status of July 2000 indicates that Area N11.1 which comprises this segment area, is prohibited. No changes to their status have been made (Kennedy 2006a).

It should also be noted that Rockport Harbor has a pump-out boat funded by the Clean Vessel Act to provide free pump-outs (MA DFG 2006c).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing areas are either conditionally approved or prohibited.



# ROCKPORT HARBOR (SEGMENT MA93-17) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, marinas/boating pumpout releases, marinas/boating sanitary on-vessel discharges
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

## RECOMMENDATIONS

Implement recommendations in the DMF shellfish management plan for Area N11.1.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Encourage use of boat pump-out facility through a public information and outreach program.

## RUM ROCK LAKE (SEGMENT MA93064)

Location: Rockport.

Length/area: 10 acres

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 2 - Attaining Some Uses (*Secondary Contact Recreation* and *Aesthetics*); Others Not Assessed (MassDEP 2005).






### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Rum Rock Lake. All designated uses are not assessed.

RUM ROCK LAKE (SEGMENT MA93064) Use Summary

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

## CAPE POND (SEGMENT MA93011)

Location: Rockport.

Length/area: 42 acres

Classification: Class A/PWS/ORW.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of turbidity (MassDEP 2005).

### WITHDRAWALS AND DISCHARGES

#### WMA (Appendix E, Table E1)

Rockport Water Department registration/permit (31825201/9P31825201). The Rockport Water Department has a Water Loss Prevention Grant Project (2005-10/WLP) in an effort to identify and reduce unaccounted-for water loss from the water works and distribution system to 10% or less.







#### NPDES (Appendix E, Tables E2 and E3)

Rockport Water Treatment Plant (MAG640021)

### USE ASSESSMENT

No quality-assured data are available for Cape Pond. All designated uses are not assessed.

CAPE POND (SEGMENT MA93011) Use Summary

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

\* The MassDEP Drinking Water Program maintains current drinking water supply data.

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Conduct a site visit to evaluate any visual potential impacts associated with the Rockport Water Treatment Facility discharge and determine need for monitoring.

## DAYS POND (SEGMENT MA93092)

Location: Gloucester.

Length/area: 1 acres (actual size less than one acre)

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant due to the presence of exotic (non-native) species (MassDEP 2005).

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT






#### *Aquatic Life Use*

##### Biology

Days Pond is infested with a non-native aquatic plant (*Egeria densa*) (DeCesare *et al.* 2000 and Fugro 1995).

The *Aquatic Life Use* for Days Pond is assessed as impaired because of the infestation of a non-native aquatic macrophyte.

DAYS POND (SEGMENT MA93092) Use Summary

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non native aquatic macrophyte Source: Unknown
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Document the effectiveness of management options recommended by Fugro (1995) once they have been implemented.

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

## NILES POND (SEGMENT MA93052)

Location: Gloucester.

Length/area: 34 acres

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2005).






### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Niles Pond. All designated uses are not assessed.

NILES POND (SEGMENT MA93052) Use Summary

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

## BUSWELL POND (SEGMENT MA93009)

Location: Gloucester.

Length/area: 4 acres

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2005).






There is no fishway at the Buswell Pond Dam and since there are four obstructions which block passage to the pond, any anadromous fish development would be costly and unlikely due to the small potential resource return for the investment (Reback *et al.* 2005).

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Buswell Pond. All designated uses are not assessed.

BUSWELL POND (SEGMENT MA93009) Use Summary				
Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

## **GLOUCESTER HARBOR (SEGMENT MA93-18)**

Location: The waters landward of an imaginary line drawn between Mussel Point and the tip of the Dog Bar Breakwater, Gloucester; excluding the Annisquam River.

Length/area: 2.32 mi<sup>2</sup>

Classification: Class SB/CSO.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

Gloucester Harbor is designated as Essential Fish Habitat (EFH) providing EFH for at least one life stage for 25 of the 30 managed species listed by the New England Fisheries Management Council (NEFMC) (MGI 2001).

A detailed characterization of environmental history, human influences, and status of marine resources in Gloucester Harbor has recently been published by the Massachusetts Office of Coastal Zone Management (CZM) (Wilbur 2004a). A summary of information related to the geography, history, resources, and water quality of Gloucester Harbor was also compiled by the North Coastal Watershed Alliance (NCWA 2000).

### **DISCHARGES**

#### **NPDES (Appendix E, Tables E2 and E3)**

MA0090492 – United States Coast Guard Outfall #001.

MA0100625—The City of Gloucester primary wastewater treatment facility (discharges under a 301(h) waiver outside of Gloucester Harbor proper). Five CSO discharges and a pump station bypass outfalls also discharge directly into Gloucester Harbor. Information about the Gloucester Water Pollution Control Facility (historical and current operations) is also available (Wilbur 2004a and NCWA 2000).

Whole effluent toxicity tests were conducted on the Gloucester WPCF effluent between December 2001 and March 2006. The effluent exhibited acute toxicity to both species. The LC<sub>50</sub>s using *M. bahia* ranged from 16 to 100% effluent (only 2 of 17 tests met the permit limit LC<sub>50</sub>>100%, one test was not valid). Using *M. beryllina*, the LC<sub>50</sub>s ranged from 8.8 to 60.5% effluent (all 18 tests failed to meet the LC<sub>50</sub> limit) (TOXTD database). *M. beryllina* were almost always the more sensitive test organism.

### **USE ASSESSMENT**

#### ***Aquatic Life Use***

##### **Eelgrass Bed Habitat**

MassDEP's Wetlands Conservancy Program (WCP) identified the presence of eelgrass in Gloucester Harbor from historic 1951 black and white aerial photography (Costello 2003). In 1998 MassDEP WCP performed field verification of 1995 aerial photography and mapped the extent of eelgrass bed habitat in Gloucester Harbor. Total areal coverage of Gloucester Harbor from the 1998 survey was approximately 3% of the harbor. In 2001 MassDEP WCP performed field verification of 2001 aerial photography and mapped the extent of eelgrass bed habitat in Gloucester Harbor. There was almost no change (a very slight decrease) in the total coverage of eelgrass beds between 1995 and 2001.

In 1951 there were two small areas of eelgrass bed habitat identified in the western harbor area just north of Stage Head along the shoreline and just west of Fort Point along Pavillion Beach. The largest area of eelgrass bed habitat was along the shoreline of the southeast harbor area between Niles Beach and Black Bess Rocks and along the shoreline of Lighthouse Cove. These same areas were identified as having beds in 2001 although the bed along Pavillion Beach was larger while the beds along Niles Beach and Lighthouse Cove had changed shape slightly but were both larger areas.

Sediment profile imaging (SPI), a multibeam seafloor mapping system (generating a highly detailed map of seafloor topography and substrate type), and diving observations were conducted in Gloucester Harbor between 1998 and 2001 (Wilbur 2004b). The study concluded that five coastal habitats, several eelgrass beds and four seafloor habitats with variable features were found within the Harbor. According to the report, "human-induced disturbance was apparent along a gradient from degraded seafloor conditions in the Inner Harbor to non-degraded, higher seafloor quality in the Outer Harbor" (Wilbur 2004b). Whereas

the inner harbor seafloor habitat was comprised primarily of soft mud, shallow Redox potential discontinuity (RPD) depth, and sedentary organisms living on the seafloor surface, the navigational channel adjacent to the Paint Factory was a soft mud/fine sand mix and was more similar to outer harbor in terms of RPD depth and stations sampled around Tenpound Island had unconsolidated soft mud, relatively deep RPD, and evidence of infauna feeding at depth (Wilbur 2004b). The report further states: "Aggregates of polychaetes and no apparent Redox potential discontinuity (RPD) depth (i.e., anoxic conditions), at the seafloor are indicative of stressed benthos (e.g., organically enriched and/or recently disturbed)...these features were found in the inner harbor and suggest a high inventory and/or continued input of organic matter...Benthic habitat in the outer portion of the inner harbor, areas adjacent to Tenpound Island, and outer harbor exhibited higher habitat quality and were characterized by well-oxidized seafloor sediments and evidence of infauna (e.g., presence of mollusks or feeding voids)" (Wilbur 2004b). Reduced tidal flushing, increased anthropogenic inputs, and physical disturbance apparently influenced seafloor habitat quality of the Inner Harbor (Wilbur 2004b).

The Gloucester Harbor shoreline is characterized by small, intermittent, embayments/coves separated by rocky headlands. Numerous submerged/partially submerged rocks, reefs, and ledges lie within and around the perimeter of the Harbor. Depth of the Harbor ranges up to 50 feet with a mean tidal range of 8.7 feet (MGI 2001).

#### Biology

Monthly sampling at eight locations (four otter trawl and four seine stations) was conducted in Gloucester Harbor between June 1998 and May 1999 (Wilbur 2004c). These surveys documented the presence of 29 fish species in the Harbor with skates, winter flounder, and Atlantic cod dominating the fish community. "Resident and transient species exhibited seasonal variation in both presence and relative abundance with the highest relative abundance (total fish catch per unit effort or CPUE) in the spring and fall. Juvenile fishes dominated the catches...demonstrating the use of the Harbor as nursery habitat" (Wilbur 2004c).

While aggregates of polychaetes were found in the inner harbor, the outer harbor sediments exhibited evidence of infauna (e.g., presence of mollusks or feeding voids) (Wilbur 2004b).

The *Aquatic Life Use* is assessed as impaired in the inner portion of Gloucester Harbor because of the degraded habitat quality conditions (i.e., anoxic sediments) and the evidence of a stressed benthic community. These conditions are evidence of organic enrichment and physical disturbance from the anthropogenic sources including CSO and stormwater discharges, restricted tidal flushing, and navigational channel maintenance (dredging).

The *Aquatic Life Use* is assessed as support in the outer Gloucester Harbor area based on the higher habitat quality characterized by well-oxidized seafloor sediments with evidence of infauna (e.g., presence of mollusks or feeding voids), the general stability and presence of eelgrass bed habitat, and the use of the harbor as nursery habitat for fish.

#### **Shellfish Harvesting Use**

DMF shellfish status of July 2000 indicates that areas N9.0 and N9.15, which comprise this segment area, are prohibited. No changes to their status have been made (Kennedy 2006a).

It should also be noted that Gloucester Harbor has a pump-out boat funded by the Clean Vessel Act (CVA) to provide free pump-outs (MA DFG 2006c).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing areas are prohibited.

#### **Primary and Secondary Contact Recreation and Aesthetics Uses**

There are four public beaches in outer Gloucester Harbor: Cressy's, Half Moon, Pavillion, and Niles beaches. Weekly *Enterococci* bacteria testing was conducted and there were no postings in 2002 or 2003. The beaches were all posted at least once in 2004 (Half Moon was posted three times in 2004) (MA DPH 2003, MA DPH 2004, and MA DPH 2005b). In 2004 Cressy's, Pavillion and Niles beaches were all posted for six days each while Half Moon Beach was posted for 20 days.









According to the Final Combined Sewer Overflow Revised Long-Term Control Plan submitted by Metcalf and Eddy on behalf of the City of Gloucester, the baseline CSO activations and volumes for a year with typical rainfall are as follows (Brander 2006c):

Discharge Point	Description	Annual Discharge Volume (MG)	Activations (Events/Year)
002	Mansfield Street Drain Western Ave CSO	13.04	33
004	Rogers Street CSO	0.66	9
005	Main Street CSO	10.96	53
006	East Main Street CSO	0.33	10
006A	East Main Street CSO	0.44	8
009	Hartz Street Pump station Bypass	*	
003	Fort Square Bypass	Eliminated	
007	State Fish Pier "tide gate"		
008	Beacon Marine Bypass		

\* Note: during larger wet weather events this overflow occurs in an area with a separate sewer system and is considered a sanitary sewer overflow, which is not permitted. The City is proceeding with construction work in the Hartz St. area to upgrade a number of pump stations and perform inflow and infiltration (I/I) abatement work, which is intended to mitigate the frequency and duration of sanitary sewer overflow (SSO) discharges at this location (Brander 2006c).

The inner area of Gloucester Harbor is not assessed for the *Recreational* and *Aesthetics* uses. The outer Gloucester Harbor area is assessed as support for the *Primary Contact Recreational Use* since the four beaches were open for the majority of the three bathing seasons between 2002 and 2004. However, this use is identified with an Alert Status since one of the four beaches was posted for 20 days in 2004. This lengthy beach closure, combined with the presence of CSO and stormwater discharges into the harbor, are of concern.

#### GLOUCESTER HARBOR (SEGMENT MA93-18) Use Summary

Designated Uses		Status
Aquatic Life		IMPAIRED 0.25 mi <sup>2</sup> Inner Harbor Causes: Degraded biota/habitat conditions, anoxic sediments (low DO) Sources: Changes in ordinary stratification and bottom water hypoxia/anoxia, changes in tidal circulation/flushing, combined sewer overflows, discharges from municipal separate storm sewer systems (MS4), and dredging for navigational channels  SUPPORT 2.07 mi <sup>2</sup> Outer Harbor
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Combined sewer overflows, discharges from municipal separate storm sewer systems (MS4)
Primary Contact		NOT ASSESSED 0.25 mi <sup>2</sup> Inner Harbor* SUPPORT 2.07 mi <sup>2</sup> Outer Harbor*
Secondary Contact		NOT ASSESSED 0.25 mi <sup>2</sup> Inner Harbor* SUPPORT 2.07 mi <sup>2</sup> Outer Harbor
Aesthetics		NOT ASSESSED 0.25 mi <sup>2</sup> Inner Harbor* SUPPORT 2.07 mi <sup>2</sup> Outer Harbor

\*Alert Status issues identified, see details in use assessment section

## RECOMMENDATIONS

The whole effluent toxicity testing requirements for the City of Gloucester WPCF permit MA0100625 should be reduced to *M. beryllina* only, since they were almost always the more sensitive test organism. The facility should also be required to conduct a Toxicity Identification/Toxicity Reduction Evaluation (TIE/TRE) and implement appropriate treatment/actions to eliminate the acute toxicity in the effluent.

Continue to monitor water quality (particularly DO/saturation profiles) and seafloor habitat quality conditions in both the inner and outer Gloucester Harbor areas to evaluate trends over time associated with pollution abatement projects (i.e., implementation of CSO long-term control project and Phase II NPDES permit requirements).

Encourage use of boat pump-out facility through a public outreach and education program.

Implement recommendations in the DMF shellfish management plan for areas N9.0 and N9.15.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

## WEST POND (SEGMENT MA93089)

Location: Gloucester.

Length/area: 7 acres

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of nutrients and the presence of noxious aquatic plants (MassDEP 2005).

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### ***Aquatic Life Use***

##### Water Chemistry

Sampling was conducted by DWM staff at one location (W0967) in the pond as part of the 2002 Baseline Lake TMDL Project (Appendix C, Tables C1 and C2).

West Pond is an algal dominated waterbody. Chlorophyll *a* concentrations were low in early July but increased to high concentrations by September. Although total phosphorus concentrations were low, Secchi disk measurements exceeded the bathing beach guidance in West Pond on two of the three sampling dates.






The *Aquatic Life Use* is assessed as impaired in West Pond because of elevated concentrations of chlorophyll *a* and poor Secchi disk transparency.

#### ***Primary and Secondary Contact Recreation and Aesthetics Uses***

Sampling was conducted by DWM staff at one location (W0967) in the pond as part of the 2002 Baseline Lake TMDL Project (Appendix C, Tables C1 and C2). With the exception of poor Secchi disk transparency measurements, no other objectionable conditions (e.g., odors, oils, deposits) were recorded (MassDEP 2002a).

The *Primary and Secondary Contact Recreational and Aesthetics* uses are assessed as impaired for West Pond based on the Secchi disk measurements that did not meet the bathing beach guidance.

WEST POND (SEGMENT MA93089) Use Summary

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Elevated chlorophyll <i>a</i> , poor Secchi disk transparency Source: Unknown
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Cause: Poor Secchi disk transparency Source: Unknown
Secondary Contact		IMPAIRED Cause: Poor Secchi disk transparency Source: Unknown
Aesthetics		IMPAIRED Cause: Poor Secchi disk transparency Source: Unknown

### RECOMMENDATIONS

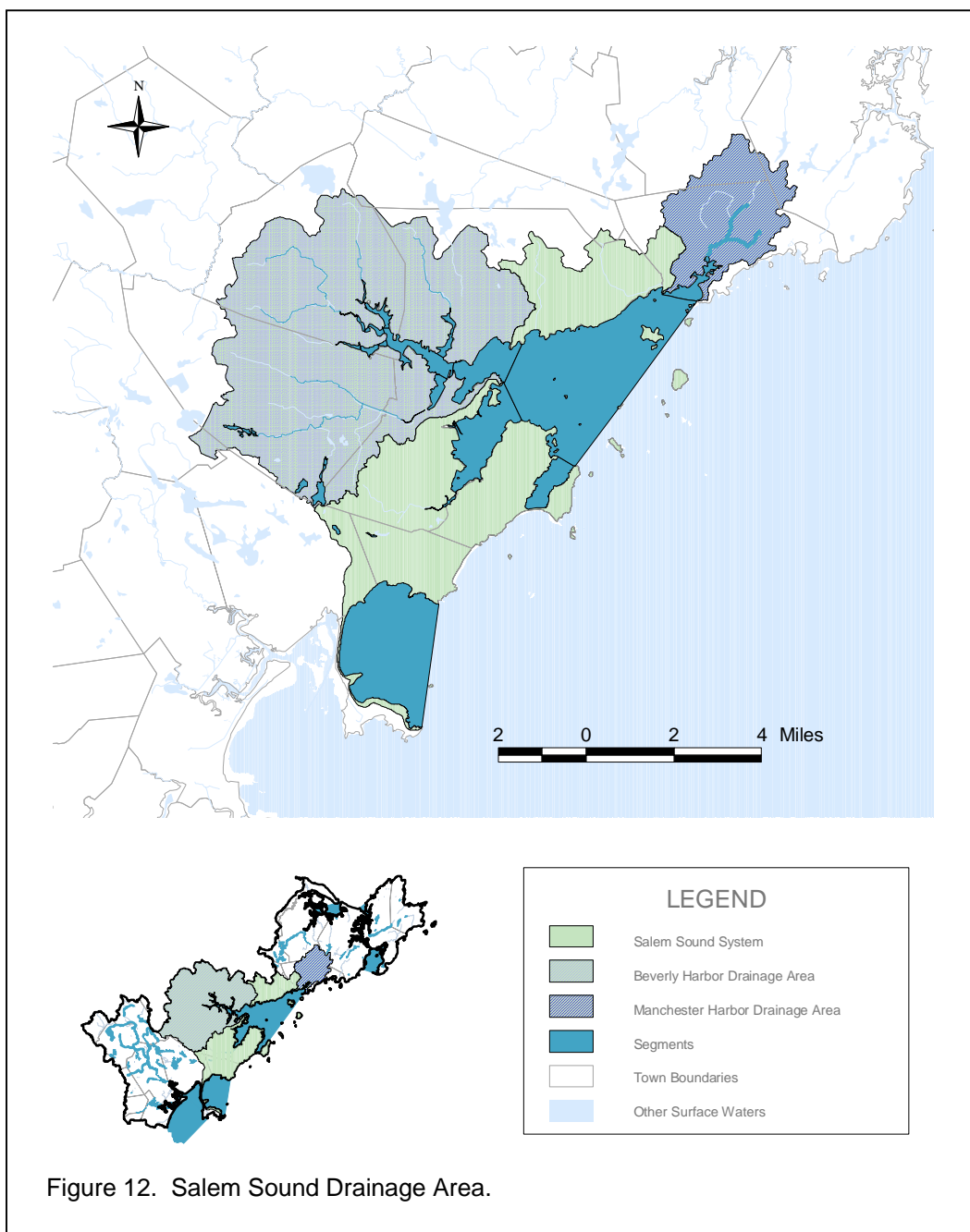
Determine source(s) contributing to elevated chlorophyll *a* and poor Secchi disk transparency in West Pond. Develop and implement remediation actions necessary to restore good transparency in the pond.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

## SALEM SOUND SYSTEM

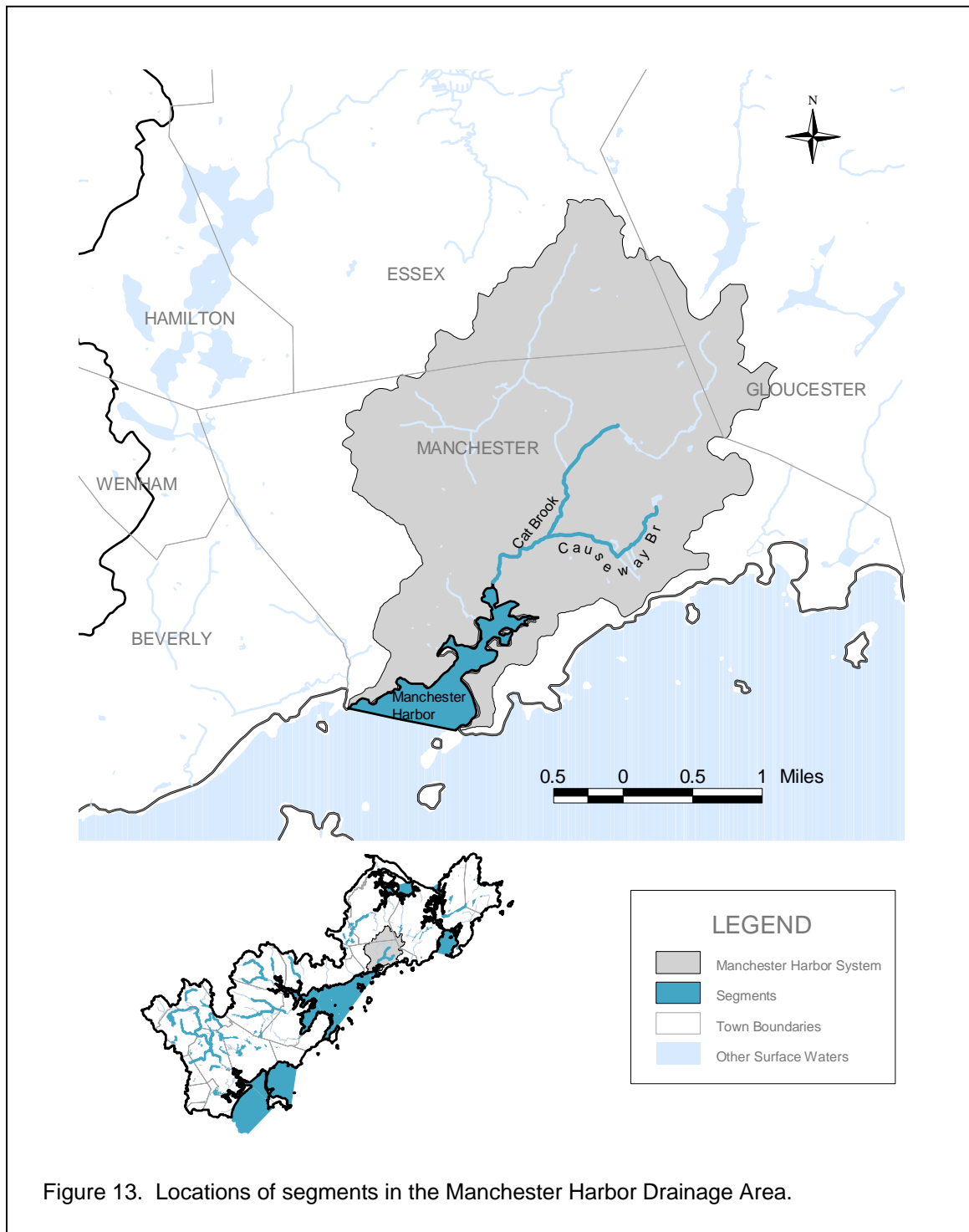
The Salem Sound area is comprised primarily of three major systems (Figure 12). These include the drainage areas to Manchester, Beverly, as well as Salem and Marblehead harbors. Excluding these drainage systems, Salem Sound is broadly defined as the waters inside of an imaginary line drawn from Marblehead Light northeast to the southwestern point on Bakers Island, Beverly, and from the northwestern point on Bakers Island to Gales Point, Manchester. Nahant Bay is also open to the Sound at the southern tip of the Salem Sound drainage area.

A 1997 DMF study of Salem Sound surveyed intertidal and subtidal stations throughout Salem Sound catching 45 species of fish and 22 crustaceans (Chase *et al.* 2002). Species richness and diversity had not apparently changed from previous investigations and was typical for a shallow embayment in the Gulf of Maine. Growing concerns related to watershed contributions of non-point sources of nutrient, sediment and bacterial pollution and increasing presence of aquatic invasive species were noted (Chase 2006c).



## MANCHESTER HARBOR SYSTEM

Two named tributaries, Wolf Trap Brook and Cat Brook flow directly into Manchester Harbor. Tributaries to Cat Brook include Causeway and Sawmill brooks. DMF biologists report that smelt fishing in Manchester Harbor has declined in the last 15-20 years (Chase 2006a). Two streams, "Bennet Brook" and Cat Brook were found to contain suitable spawning habitat and were monitored for smelt by DMF biologists over a two-year period. The locations of the three segments in the Manchester Harbor system in this report are illustrated in Figure 13.



## **CAT BROOK (SEGMENT MA93-29)**

Location: Headwaters east of Route 128, Manchester to confluence with Manchester Harbor (Route 127), Manchester.

Length/area: 1.7 miles.

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pH, siltation, and pathogens (MassDEP 2005).

### **WITHDRAWALS AND DISCHARGES**

#### **WMA (Appendix E, Table E1)**

Essex Country Club Registration 31816602.

Manchester Water Department registration/permit (31816601/ 9P31816601).

#### **NPDES (see Appendix E, Table E3)**

### **USE ASSESSMENT**

#### ***Aquatic Life Use***

##### Habitat and Flow

Streamflow and smelt passage in Cat Brook are influenced by the dam and tidegate at the Route 127 bridge, Manchester. Average tides were prevented from entering the brook when the tidegate was closed. However, since 1999 the Manchester DPW has adopted a tidegate opening schedule to give smelt an opportunity to pass through the tidegate at the bottom of the dam during lower tides (Chase 2006a). Habitat in Cat Brook in the vicinity of School Street is reported to be favorable for rainbow smelt spawning (i.e., substrate comprised largely of clean cobble and gravel, excellent flow conditions, adequate water depths over riffles, and a fair amount of attached vegetation) and is the largest of the spawning areas available in the Manchester Harbor System (Chase 2006a).

Streamflow conditions in Cat Brook were noted to be very low during the summer months of 2002 (MassDEP 2002a) coincident with drought conditions (advisories and watches were in effect in Massachusetts -- see Appendix B).

##### Biology

Smelt eggs were first found in Cat Brook in the vicinity of School Street in 1989 and 1990 by DMF biologists (Chase 2006a). Egg deposition monitoring by DMF biologists was also conducted in Cat Brook between 1999 and 2001 to evaluate improved passage opportunities for smelt and channel wall stabilization near the spawning habitat (restoration project partners Salem Sound 2000 and Manchester DPW). Low densities of smelt eggs were found in those years.

##### Water Chemistry

Sampling was conducted by DWM staff in Cat Brook near Lincoln Street in Manchester (W0889) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 7).

In-stream DO concentrations ranged from 4.0 to 10.1 mg/L representing both day-time and pre-dawn (worst case) conditions. While all the measurements taken between May and July met standards, none of the measurements taken in August and September were >5.0 mg/L. Drought conditions were present during that time (i.e., at or <7Q10 flows). The pH measurements were all low (ranging from 5.9 to 6.5 SU).

The *Aquatic Life Use* is not assessed for Cat Brook (too little water quality data). This use is identified with an Alert Status because of low DO/saturation; but these conditions reflected the very low flow conditions encountered. Smelt spawning was documented in the brook and despite suitable habitat and improvements in passage and channel stabilization, the density of egg deposition has been low in recent years. The very low pH measurements (i.e., 5.9 SU) are of concern although low pH in general (>6.0 to 6.5 SU) is likely naturally-occurring (best professional judgment). The impact, if any, of water withdrawals in this subwatershed area is unknown at this time.






### **Primary and Secondary Contact Recreation and Aesthetics uses**

Bacteria sampling was conducted by DWM staff in Cat Brook near Lincoln Street in Manchester (W0889) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8). Fecal coliform bacteria counts ranged from 20 to 6,800 cfu/100 mls with a geometric mean of 379 cfu/100 mls. This exceeded the standard of 200 cfu/100 mls for primary contact recreation. The highest fecal coliform bacteria count likely represented the influence of a local storm event.

Field observations were made by DWM personnel during the surveys conducted in Cat Brook between May and September 2002. With the exception of isolated areas of trash/debris, no objectionable conditions (odors, oils, turbidity) were noted during any of the surveys (Station SM03) (MassDEP 2002a).

The *Primary Contact Recreational Use* is assessed as impaired because of elevated fecal coliform bacteria counts. The highest count likely represented the influence of a local storm event. The *Secondary Contact Recreational* and *Aesthetics* uses are assessed as support. The *Secondary Contact Recreational Use* is also identified with an Alert Status because of the high bacteria count.

CAT BROOK (SEGMENT MA93-29) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

\*Alert Status issues identified, see details in use assessment section

### **RECOMMENDATIONS**

Chase (2006a) recommends that at a minimum the openings of the tidegate to allow smelt passage to spawning habitat in Cat Brook should be continued by the Manchester Department of Public Works. Additionally, a more permanent modification to the dam and tidegate at Route 127 in Manchester to allow free passage for smelt without scheduled openings should be considered.

Chase (2006a) also recommends that stabilization of the channel wall in the vicinity of School Street bridge be implemented to protect the smelt spawning habitat from sedimentation as well as tree planting to increase shading.

More comprehensive water quality monitoring should be conducted along this brook to better characterize water quality conditions (i.e., DO/% saturation, pH, nutrients, biological monitoring) and to evaluate the *Aquatic Life Use*.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Bacteria source tracking should be conducted, if needed, to help identify undocumented sources.



## CAUSEWAY BROOK (SEGMENT MA93-47)

Location: Headwaters, outlet Dexter Pond, Manchester to confluence with Cat Brook, Manchester.

Length/area: 1.1 miles.

Classification: Class B.

This is a new segment so it does not appear on the 2004 Integrated List of Waters.

### WITHDRAWALS AND DISCHARGES

#### WMA (Appendix E, Table E1)

Manchester Water Department registration/permit (31816601/ 9P31816601).

#### NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### *Aquatic Life Use*

##### Habitat and Flow

Streamflow conditions in Causeway Brook were noted to be very low during the summer months of 2002 (MassDEP 2002a) coincident with drought conditions (advisories and watches were in effect in Massachusetts -- see Appendix B). Visible surface velocity was described as "none" or "low" on all of the field survey sheets at this sampling station between June and September 2002 (MassDEP 2002a).

##### Water Chemistry

Sampling was conducted by DWM staff in Causeway Brook near Lincoln Street in Manchester (W0888) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 7).

In-stream DO concentrations ranged from 1.0 to 10.2 mg/L, representing both day-time and pre-dawn (worst case) conditions. Only the measurements taken in May met standards (none of the measurements taken between June and September were >5.0 mg/L and/or 60% saturation). These measurements reflected the extremely low flow conditions encountered during the surveys. The pH measurements were all low (ranging from 6.0 to 6.3 SU).

Given the very small size of the Causeway Brook drainage area and the extremely low flow conditions encountered during the 2002 survey season, the *Aquatic Life Use* is not assessed for Causeway Brook. This use is identified with an Alert Status because of the very low DO/saturations measured. However these conditions represent drought conditions. Low pH is also of concern though it is likely naturally-occurring. Streamflow manipulations (outlet control practices at Dexter Pond and the impounded/channelized area in Sweney Park/Danas Beach area) may also be contributing to extremely low flow conditions in Causeway Brook.

#### ***Primary and Secondary Contact Recreation and Aesthetics uses***






Bacteria sampling was conducted by DWM staff in Causeway Brook near Lincoln Street in Manchester (W0888) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8).

Fecal coliform bacteria counts ranged from 20 to 10,000 cfu/100 mls with a geometric mean of 299 cfu/100 mls. This exceeded the standard of 200 cfu/100 mls for primary contact recreation. The highest fecal coliform bacteria count likely represented the influence of a local storm event.

Field observations were made by DWM personnel during the surveys conducted in Causeway Brook between May and September 2002. The water column was occasionally described as being highly cloudy and on one occasion a thick oil sheen was noted (Station CB01) (MassDEP 2002a).

The *Primary Contact Recreational Use* is assessed as impaired because of elevated fecal coliform bacteria counts. The highest counts likely represented the influence of local storm events. The *Secondary Contact Recreational* and *Aesthetics* uses are assessed as support but are identified with an Alert Status because of the occasional aesthetic quality issues and the high bacteria count.

### CAUSEWAY BROOK (SEGMENT MA93-47) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT*

\*Alert Status issues identified, see details in use assessment section

### RECOMMENDATIONS

Conduct additional bacteria sampling along Causeway Brook bracketing potential sources, conducting bacteria source tracking if needed, and to evaluate Phase II NPDES stormwater permit requirements implementation effectiveness. Evaluate the status of the *Primary* and *Secondary Contact Recreational* uses.

More comprehensive water quality monitoring should be conducted along this brook to better characterize water quality conditions (i.e., DO/% saturation, pH, habitat quality) and to evaluate the *Aquatic Life Use*.

Further investigate streamflow conditions in Causeway Brook. Evaluate potential manipulations including the outlet control practices at Dexter Pond and the impounded/channelized area in Sweney Park/Danas Beach area.

## **MANCHESTER HARBOR (SEGMENT MA93-19)**

Location: The waters landward of an imaginary line drawn between Gales Point and Chubb Point, Manchester excluding Cat Brook.

Length/area: 0.33 mi<sup>2</sup>

Classification: Class SB.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

With the support of the Massachusetts Office of Coastal Zone Management, Manchester Marine will install a recycling boat bottom washing system (SECTION 319 NPS PROJECT 04-12/319). They will then conduct an extensive education and outreach program aimed at demonstrating this BMP to other boatyards to make them aware of it and encourage its adoption in other boatyards. Total project cost is \$195,596, funded by the US EPA and Manchester Marine. The project duration is 2005 – 2008.

### **DISCHARGES**

**NPDES (see Appendix E, Table E3)**

### **USE ASSESSMENT**

#### ***Aquatic Life Use***

##### Eelgrass Bed Habitat

MassDEP's Wetlands Conservancy Program (WCP) identified the presence of eelgrass in Manchester Harbor from historic 1951 black and white aerial photography (Costello 2003). In 1998 MassDEP WCP performed field verification of 1995 aerial photography and mapped the extent of eelgrass bed habitat in Manchester Harbor. Total areal coverage of Manchester Harbor from the 1995 survey was approximately 43% of the harbor. In 2001 MassDEP WCP performed field verification of 2001 aerial photography and mapped the extent of eelgrass bed habitat in Manchester Harbor. There was some loss (estimated 5%) in the total coverage of eelgrass beds between 1995 and 2001.

In 1951 there was a large area of eelgrass bed habitat in the Harbor from Nortons Point seaward. The beds in 2001 were in the outer harbor area seaward of Proctor Point and exhibited some loss.

The *Aquatic Life Use* is assessed as support for outer Manchester Harbor area based on the presence of eelgrass bed habitat. The inner harbor area is not assessed for this use (landward/north of Nortons Point).

#### ***Shellfish Harvesting Use***

DMF shellfish status of July 2000 indicates that Area N15.1, which comprises this segment area, is prohibited. No changes to this status have been made (Kennedy 2006a).

It should also be noted that Manchester Marine has a pump-out boat and shoreside facility funded by the Clean Vessel Act to provide free pump-outs (MA DFG 2006c).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing areas are prohibited.

#### ***Primary and Secondary Contact Recreation and Aesthetics uses***

There are two beaches along the outer western shoreline of Manchester Harbor: West Manchester and Tuck's Point beaches. Weekly *Enterococci* bacteria testing no postings in 2002 or 2003 and West Manchester Beach was posted twice in 2004 for a total of 12 days (MA DPH 2003, MA DPH 2004, MA DPH 2005b, and Salem Sound Coastwatch 2004).







A survey was conducted along the Salem Sound shoreline in April 2004 from which an inventory of observable stormwater outfall pipes 12" or greater in diameter was created (Horsley Witten Group 2005). In an attempt to identify discharges contributing significant bacteria loads to Salem Sound under dry weather conditions (i.e., screening for illicit discharge connections), two rounds of bacteria sampling (5 October and 4 November 2004) were conducted at targeted stormwater discharge pipes. Three pipes were sampled in the Manchester Harbor area. One of the three pipes sampled was near West

Manchester Beach and was found to have high fecal coliform bacteria counts (Horsley Witten Group 2005).

The outer area of Manchester Harbor is assessed as support for the *Primary Contact Recreational Use* since both beaches were open for the majority of the three bathing seasons between 2002 and 2004. However, this use is identified with an Alert Status since one beach was posted for 12 days in 2004. This, combined with the presence of large stormwater discharges into the harbor, are of concern. The *Secondary Contact Recreational* and *Aesthetics* uses are also assessed as support for the outer area of Manchester Harbor based primarily on best professional judgment (beaches open for majority of bathing seasons and the extensive area of eelgrass bed habitat indicative of good water clarity).

The *Primary* and *Secondary Contact Recreational* and *Aesthetics* uses are not assessed for the inner Manchester Harbor area (landward/north of Nortons Point) because no data are available for this area.

MANCHESTER HARBOR (SEGMENT MA93-19) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED: Inner Manchester Harbor area (0.07mi <sup>2</sup> ) SUPPORT: Outer Manchester Harbor area (0.26 mi <sup>2</sup> )
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Discharges from municipal separate storm sewer systems (MS4)
Primary Contact		NOT ASSESSED: Inner Manchester Harbor area (0.07mi <sup>2</sup> ) SUPPORT: Outer Manchester Harbor area (0.26 mi <sup>2</sup> )
Secondary Contact		NOT ASSESSED: Inner Manchester Harbor area (0.07mi <sup>2</sup> ) SUPPORT: Outer Manchester Harbor area (0.26 mi <sup>2</sup> )
Aesthetics		NOT ASSESSED: Inner Manchester Harbor area (0.07mi <sup>2</sup> ) SUPPORT: Outer Manchester Harbor area (0.26 mi <sup>2</sup> )

## RECOMMENDATIONS

Continue to monitor eelgrass bed habitat in Manchester Harbor.

Implement recommendations in the DMF shellfish management plan for Area N15.1.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

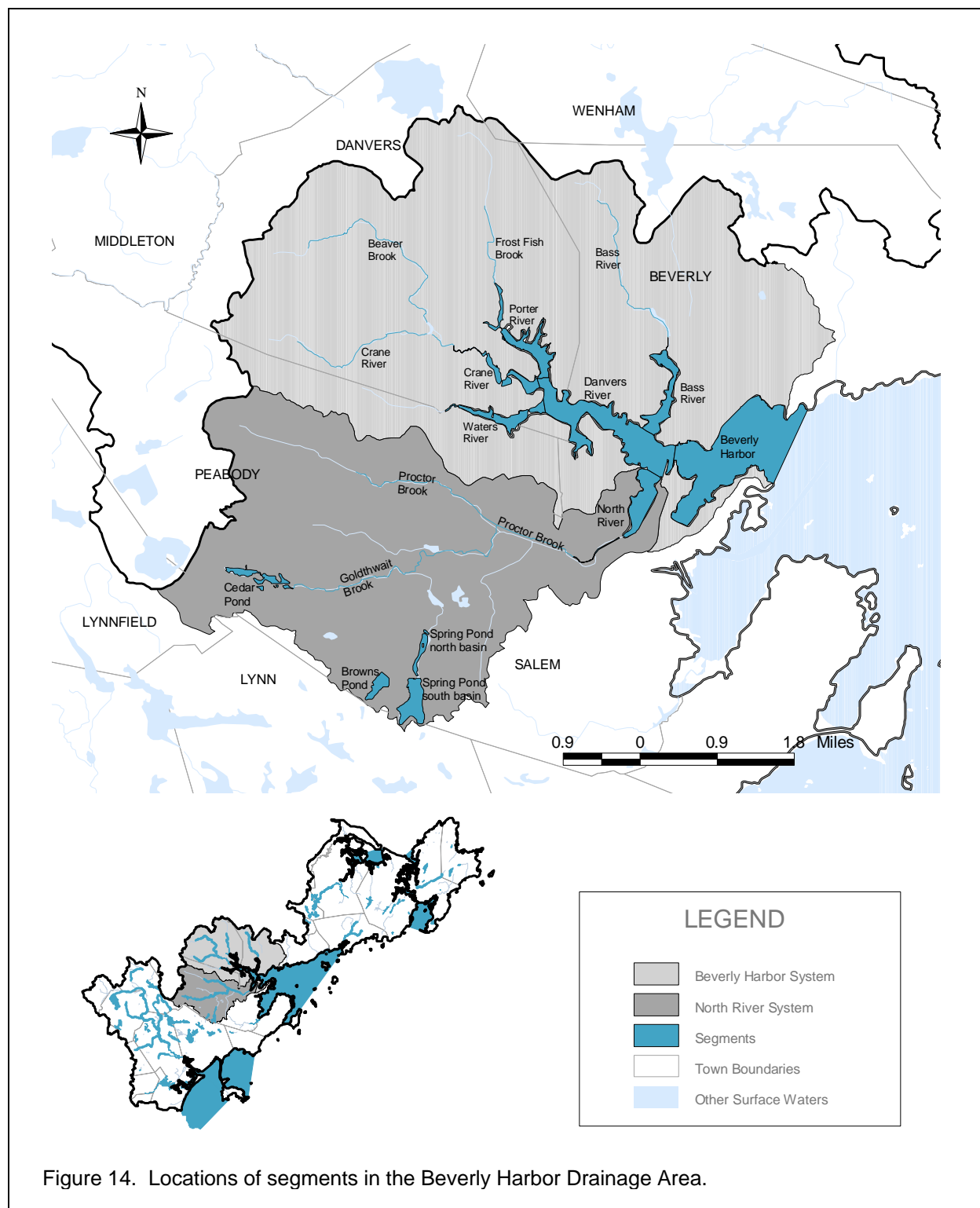
Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Continue to monitor stormwater discharges into Manchester Harbor and remediate illicit connections and other problems as identified.

Encourage use of boat pump-out facilities through an outreach and education program.

## BEVERLY HARBOR SYSTEM

Beverly Harbor is bordered by the cities of Beverly to the north and Salem to the south. Beverly Harbor is approximately 0.78 mi<sup>2</sup> in area and similar in depth to Salem Harbor but receives a proportionately larger freshwater input from the combined flows of the Bass, Porter, Crane, Waters, and North rivers. All of these rivers flow into the Danvers River, which is tidal for its entire length, and discharges into Beverly Harbor. This river system drains highly urbanized sections of Salem, Peabody, Danvers and Beverly. The locations of segments in the Beverly Harbor system are depicted in Figure 14.



## BASS RIVER (SEGMENT MA93-07)

Location: Headwaters west of Wenham Lake, Beverly to the outlet of "Lower Shoe Pond" north of Route 62, Beverly.

Length/area: 2.1 miles.

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2005).

[Note: This segment encompasses Shoe Pond (formerly reported as Segment MA93068), which is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of turbidity (MassDEP 2005). The annual retention time of Shoe Pond was estimated at 11 days based on the annual historical mean discharge from two stream gages on the Ipswich River (01102000 and 01101500) and the normal storage volume of the pond reported by MA DCR in their Massachusetts Dam Safety Program Database (Socolow *et al.* 2004 and MA DCR 2002).]

### WITHDRAWALS AND DISCHARGES

#### WMA (Appendix E, Table E1)

Beverly Commerce Park, Inc. registration (31803001) (previously Emhart Industries).

#### NPDES (Appendix E, Tables E2 and E3)

MAG250520- CPI, Inc. Beverly Microwave Division – Beverly

### USE ASSESSMENT

#### *Aquatic Life Use*

##### Habitat and Flow

There are over 15 acres of potential river herring habitat in the two impoundments on the Bass River, but herring currently have no way to access this habitat. Neither the culvert at Elliot Street, the dam above the Elliot Street Parking area, nor Shoe Pond Dam are equipped with structures to allow anadromous fish passage (Reback *et al.* 2005). No smelt spawning habitat was available due to the presence of the dams and the lack of any freshwater riffles.






##### Toxicity

##### Effluent

One modified acute and chronic whole effluent toxicity test was conducted on the CPI, Inc. discharge (MAG250520) Outfall #001 in November 2000. No acute or chronic toxicity was detected by *C. dubia* in the effluent ( $LC_{50} > 100$  and  $CNOEC = 100\%$  effluent).

The *Aquatic Life Use* is assessed as impaired because of the barriers to anadromous fish migration.

BASS RIVER (SEGMENT MA93-07) Use Summary

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Fish barriers Source: Hydrostructure impacts on fish passage
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

## RECOMMENDATIONS

MAG250520- CPI, Inc. Beverly Microwave Division – Beverly permit should be reissued with water quality based limits for Total Residual Chlorine (TRC). This facility is supplied by municipal water. Because the municipal water supply is chlorinated there is no control over TRC concentrations in the discharge.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Although difficulty of providing fish passage at the obstructions give it a low priority for development (Reback *et al.* 2005), passage and habitat should be made available for anadromous fish.

## **BASS RIVER (SEGMENT MA93-08)**

Location: Outlet of "Lower Shoe Pond" north of Route 62, Beverly, to confluence with Danvers River, Beverly.

Length/area: 0.12 mi<sup>2</sup>

Classification: Class SA.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

### **DISCHARGES**

**NPDES (see Appendix E, Table E3)**

### **USE ASSESSMENT**

#### ***Shellfish Harvesting Use***

DMF shellfish status of July 2000 indicates that Area N17.0, which comprises this segment area, is prohibited. No changes to this status have been made (Kennedy 2006a).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing areas are prohibited.

#### ***Primary and Secondary Contact Recreation and Aesthetics uses***




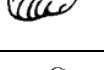


There is one beach along the shoreline of this segment of the Bass River, Goat Hill Beach, near the confluence with the Danvers River. This beach was tested weekly for bacteria during the summers of 2002, 2003, and 2004. There was one posting because of elevated *Enterococci* bacteria counts in 2003 (totaling two days) and one posting (totaling seven days) in 2004. There were no postings reported in 2002 (MA DPH 2003, MA DPH 2004, and MA DPH 2005b).

A survey was conducted along the Salem Sound shoreline in April 2004 from which an inventory of observable stormwater outfall pipes 12" or greater in diameter was created (Horsley Witten Group 2005). In an attempt to identify discharges contributing significant bacteria loads to Salem Sound under dry weather conditions (i.e., screening for illicit discharge connections), two rounds of bacteria sampling (5 October and 4 November 2004) were conducted at targeted stormwater discharge pipes. Seven pipes were sampled in the Bass River area. Four of the pipes sampled were found to have elevated bacteria counts (Horsley Witten Group 2005).

Since Goat Hill Beach is near the confluence with the Danvers River, the MA DPH beach closing information is not considered representative/sufficient to assess the entire segment for the *Primary Contact Recreational Use*. No other data are currently available so the *Primary* and *Secondary Contact Recreational* and *Aesthetics* uses are not assessed for this segment of the Bass River. The *Primary Contact Recreational Use* is identified with an Alert Status because of the evidence of bacteria loading and the beach posting information.



### BASS RIVER (SEGMENT MA93-08) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Discharges from municipal separate storm sewer systems (MS4)
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

\*Alert Status issues identified, see details in use assessment section

### RECOMMENDATIONS

Implement recommendations in the DMF shellfish management plan for Area N17.0.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Continue to monitor stormwater discharges into the Bass River and locate and remediate illicit connections and other problems as identified.

## **FROST FISH BROOK (SEGMENT MA93-36)**

Location: Cabot Road, Danvers to confluence Porter River at Route 62, Danvers.

Length/area: 1.0 miles.

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

### **DISCHARGES**

#### **NPDES (Appendix E, Tables E2 and E3)**

MA0034819 – Thermadyne Wingersheek Building, Danvers

### **USE ASSESSMENT**

#### ***Aquatic Life Use***

##### Habitat and Flow

DWM conducted a habitat assessment of Frost Fish Brook upstream from Route 62, Danvers (Station FF01) on 30 July 2002. In-stream habitat was somewhat limited (total habitat score of 131 out of 200) (MassDEP 2002b). The sampling reach had marginal in-stream cover for fish and was observed to have silt deposition in a long slow stretch. The riparian zone width on the right bank was poor and velocity/depth combinations were also only marginal. Habitat in Frost Fish Brook upstream from Route 62 is reported to be favorable for rainbow smelt spawning (i.e., substrate comprised of cobble and gravel, shallow riffles present) (Chase 2006a). There are no obstructions to flow or fish passage (*Reback et al. 2005*).

##### Biology

Suitable rainbow smelt spawning habitat is available in Frost Fish Brook in the riffles upstream from Route 62. Smelt egg deposition was readily found by DMF biologists in a 350 m<sup>2</sup> area, however an additional 400 m<sup>2</sup> area of suitable upstream habitat was not utilized (Chase 2006a). Egg deposition was highest in 1989 but since then very low densities have been observed (Chase 2006a).

##### Water Chemistry

Sampling was conducted by DWM staff in Frost Fish Brook downstream from Route 62 in Danvers (W0881) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 7). This sampling station is tidally influenced (see conductivities) and so is not considered to be representative of fresh water quality conditions in Frost Fish Brook.

The *Aquatic Life Use* is not assessed for Frost Fish Brook. This use is identified with an Alert Status because of sedimentation/siltation issues identified by DWM and DMF biologists and the poor utilization of smelt spawning habitat.






#### ***Primary and Secondary Contact Recreation and Aesthetics uses***

DWM biologists did not note any objectionable odors, oils, turbidity, or other objectionable conditions in Frost Fish Brook upstream from Route 62, Danvers (Station FF01) on 30 July 2002 (MassDEP 2002b).

Bacteria sampling was conducted by DWM staff in Frost Fish Brook downstream from Route 62 in Danvers (W0881) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 7). This sampling station is tidally influenced (see conductivities) and so is not considered to be representative of fresh water quality conditions in Frost Fish Brook. Field observations were also made by DWM personnel during the surveys conducted in the brook downstream from Route 62 between May and September 2002. With the exception of isolated areas of trash/debris and on one occasion septic odor, no other objectionable conditions (oils, turbidity) were noted during any of the surveys (Station CR03) (MassDEP 2002a).

The *Primary and Secondary Contact Recreational* uses are not assessed for Frost Fish Brook due to a lack of bacteria data. The *Aesthetics Use* for Frost Fish Brook is assessed as support based on field observations made by DWM biologist and sampling crews.

### FROST FISH BROOK (SEGMENT MA93-36) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

\*Alert Status issues identified, see details in use assessment

### RECOMMENDATIONS

Chase (2006a) recommends the following.

Spawning habitat at Frost Fish Brook may benefit from physical improvements to repair the damage done to riffles above Route 62. An evaluation should be made on the value and approach for such a project.

Sediment loading at the junction of Route 62 and Frost Fish Brook/Porter River degrades spawning and upper estuarine habitat. This location should be considered a candidate for enhanced stormwater treatment and sediment controls when opportunities arise. Existing catch basins should be annually cleaned at in the vicinity of this junction.

Restoration of a vegetative canopy that would provide shading in the vicinity of the smelt spawning habitat.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking if needed.

Additional field reconnaissance is necessary to evaluate sediment inputs into Frost Fish Brook. Remediate problem areas.

## PORTER RIVER (SEGMENT MA93-04)

Location: Confluence with Frost Fish Brook (Route 62), Danvers to confluence with Danvers River, Danvers.

Length/area: 0.13 mi<sup>2</sup>

Classification: Class SA.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of siltation, noxious aquatic plants, turbidity, and pathogens (MassDEP 2005).

### DISCHARGES

#### NPDES (Appendix E, Tables E2 and E3)

MA0100501 South Essex Sewage District Outfall #002; eliminated December 1987.

### USE ASSESSMENT

#### ***Aquatic Life Use***

##### Water Chemistry

Sampling was conducted by DWM staff in the Porter River as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Tables 7 and 8). This sampling location was clearly tidally influenced and so it is considered to be representative of the Porter River, although the technical memorandum in Appendix B identifies the sampling station as Frost Fish Brook downstream from Route 62 in Danvers (W0881).

With the exception of the September 18 and 19 survey data when DO and % saturations were slightly low, all of the *in-situ* measurements met water quality standards. These data represented both day-time and pre-dawn (worst case) conditions. Total suspended solids concentrations were also low (all measurements < 5.2 mg/L).

Too limited water quality data are available so the *Aquatic Life Use* is not assessed for the Porter River.

#### ***Shellfish Harvesting Use***

DMF shellfish status of July 2000 indicates that Area N17.0, which comprises this segment area, is prohibited. No changes to this status have been made (Kennedy 2006a).

Danversport Yacht Club in Danvers has a shoreside facility along the Porter River to provide pump-outs (MA DFG 2006c).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing areas are prohibited.

#### ***Primary and Secondary Contact Recreation and Aesthetics uses***

Bacteria sampling was conducted by DWM staff in the Porter River downstream from Route 62 in Danvers (W0881) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8). This sampling location was clearly tidally influenced so it is considered to be representative of the Porter River, although the technical memorandum in Appendix B identifies the sampling station as Frost Fish Brook downstream from Route 62 in Danvers (W0881).

Fecal coliform bacteria counts ranged from 20 to 14,000 cfu/100 mls with a geometric mean of 2,479 cfu/100 mls. This geometric mean exceeded the standard of 200 and 1,000 cfu/100 mls for primary and secondary recreational uses, respectively.

Weekly testing for *Enterococci* bacteria during the swimming season was conducted at Sandy Beach, Danvers during the summers of 2002, 2003, and 2004. There was one posting reported because of elevated *Enterococci* bacteria counts in 2003 (totaling 13 days) and one posting reported in 2004 (totaling five days). There were no postings reported in 2002.







Field observations were also made by DWM personnel during the surveys conducted in the river downstream from Route 62, Danvers, between May and September 2002. With the exception of isolated

areas of trash/debris and on one occasion septic odor, no other objectionable conditions (oils, turbidity) were noted during any of the surveys (Station CR03) (MassDEP 2002a).

A survey was conducted along the Salem Sound shoreline in April 2004 from which an inventory of observable stormwater outfall pipes 12" or greater in diameter was created (Horsley Witten Group 2005). In an attempt to identify discharges contributing significant bacteria loads to Salem Sound under dry weather conditions (i.e., screening for illicit discharge connections), two rounds of bacteria sampling (5 October and 4 November 2004) were conducted at targeted stormwater discharge pipes. Six pipes were sampled in the Porter River area. Four of the pipes monitored were found to have very elevated bacteria counts (Horsley Witten Group 2005).

The *Primary* and *Secondary Contact Recreational* uses are assessed as impaired for the Porter River because of high bacteria counts and the prolonged beach closure at Sandy Beach. Sources of bacteria include stormwater from municipal separate storm sewer systems. Other suspected sources include illicit connections/hookups to storm sewers and discharges from marinas/boating pumpout releases and sanitary on-vessel discharges. The *Aesthetics Use* is assessed as support but is identified with an Alert Status because of the septic odor and best professional judgment.

PORTER RIVER (SEGMENT MA93-04) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Discharges from municipal separate storm sewer systems (MS4), Suspected sources: Illicit connections/hookups to storm sewers, marinas/boating pumpout releases, marinas/boating sanitary on-vessel discharges
Primary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Discharges from municipal separate storm sewer systems (MS4) Suspected sources: Illicit connections/hookups to storm sewers, marinas/boating pumpout releases, marinas/boating sanitary on-vessel discharges
Secondary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Discharges from municipal separate storm sewer systems (MS4) Suspected sources: Illicit connections/hookups to storm sewers, marinas/boating pumpout releases, marinas/boating sanitary on-vessel discharges
Aesthetics		SUPPORT*

\*Alert Status issues identified, see details in use assessment section

## RECOMMENDATIONS

More comprehensive (better spatial coverage) water quality monitoring should be conducted to characterize water quality conditions in the Porter River estuary. Nutrient samples should be collected and analyzed with appropriate analytical methods.

Implement recommendations in the DMF shellfish management plan for Area N17.0.  
Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking when necessary.

Encourage use of boat pump-out facilities through a public outreach and education program.

Continue to monitor stormwater discharges into the Porter River and locate and remediate illicit connections and other problems as identified.

## CRANE RIVER SYSTEM

The Crane River System (shown on Figure 14) is comprised of two freshwater streams that flow into Mill Pond in Danvers; Beaver Brook and Crane Brook. The Crane River flows from the outlet of Mill Pond to its confluence with the Danvers River. Assessments follow for all segments in the Crane River subwatershed.

### BEAVER BROOK (SEGMENT MA93-37)

Location: Headwaters west of Route 95, Danvers to inlet Mill Pond, Danvers.

Length/area: 2.7 miles.

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of organic enrichment/low DO and pathogens (MassDEP 2005).

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### *Aquatic Life Use*

##### Water Chemistry

Sampling was conducted by DWM staff in Beaver Brook just downstream from the small dam near Holten Street in Danvers (W0450) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 7).

In-stream DO concentrations ranged from 2.0 to 7.1 mg/L representing both day-time and pre-dawn (worst case) conditions. Although the highest measurements were found in May and early June, few of the measurements met standards (>5.0 mg/L and/or 60% saturation). These measurements reflected the extremely low flow conditions encountered during the surveys. It should also be noted that there is an impounded area not far upstream from the sampling station location identified as "The Meadow" on the USGS topographic map. It may naturally contribute to low DO/% saturation conditions in Beaver Brook near Holten Street. With the exception of the somewhat elevated conductivity measurements for a freshwater system all of the other variables monitored met standards.

Given the very small size of the Beaver Brook drainage area and the extremely low flow conditions encountered during the 2002 survey season, the *Aquatic Life Use* is not assessed for Beaver Brook. This use is identified with an Alert Status because of the very low DO/saturations measured. These conditions represent drought and/or natural conditions. Conductivity was somewhat elevated for a freshwater system and is also of concern.

#### ***Primary and Secondary Contact Recreation and Aesthetics uses***






Bacteria sampling was conducted by DWM staff in Beaver Brook just downstream from the small dam near Holten Street in Danvers (W0450) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8).

Fecal coliform bacteria counts ranged from <20 to 580 cfu/100 mls with a geometric mean of 93 cfu/100 mls and only one sample was >400 cfu/100 mls. This met the standard of 200 cfu/100 mls for primary contact recreation. The highest fecal coliform bacteria count likely represented the influence of a local storm event.

Field observations were made by DWM personnel during the surveys conducted in Beaver Brook between May and September 2002. With the exception of isolated areas of trash/debris and by August some moderate amount of duckweed, no objectionable conditions (odors, oils, turbidity) were noted during any of the surveys (Station CR03) (MassDEP 2002a).

The *Primary and Secondary Contact Recreational and Aesthetics* uses area assessed as support based primarily on the bacteria data and observations of field sampling crews.

### BEAVER BROOK (SEGMENT MA93-37) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

\*Alert Status issues identified, see details in use assessment section

### RECOMMENDATIONS

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Additional *in-situ* monitoring should be conducted along Beaver Brook to better evaluate DO/%saturation conditions and to evaluate whether or not these conditions are naturally-occurring (e.g., influence of wetlands and The Meadow).



## CRANE BROOK (SEGMENT MA93-02)

Location: Headwaters east of Route 95, Danvers to inlet Mill Pond, Danvers.

Length/area: 1.8 miles.

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of unionized ammonia, organic enrichment/low DO, suspended solids, turbidity, and pathogens as well as other habitat alterations\* (MassDEP 2005).

### DISCHARGES

#### NPDES (Appendix E, Tables E2 and E3)

MA0003859 OSRAM/Sylvania, Inc., Danvers

### USE ASSESSMENT

#### *Aquatic Life Use*

##### Water Chemistry

Sampling was conducted by DWM staff in Crane Brook near Pine Street in Danvers (W0451) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 7).

In-stream DO concentrations ranged from 5.0 to 9.6 mg/L representing both day-time and pre-dawn (worst case) conditions. While all of the DO measurements met standards, % saturations were <60% on four sampling events. Although low flow conditions were encountered during the surveys, this brook was usually described as having low water levels but higher visual surface velocities than most freshwater sampling stations. With the exception of the four slightly low % saturation measurements all of the other variables monitored met standards. Slightly elevated conductivity measurements were also noted.

The *Aquatic Life Use* is assessed as support for Crane Brook based primarily on the generally good water quality conditions documented during the 2002 sampling and best professional judgment.

#### *Primary and Secondary Contact Recreation and Aesthetics uses*






Bacteria sampling was conducted by DWM staff in Crane Brook near Pine Street in Danvers (W0451) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8).

Fecal coliform bacteria counts ranged from <20 to 17,000 cfu/100 mls with a geometric mean of 434 cfu/100 mls. This geometric mean exceeded the standard of 200 cfu/100 mls for primary contact recreation.

Field observations were made by DWM personnel during the surveys conducted in Crane Brook between May and September 2002. With the exception of trash/debris, no objectionable conditions (odors, oils, aquatic plant growths, turbidity) were noted during any of the surveys (Station CR02) (MassDEP 2002a).

The *Primary Contact Recreational Use* is assessed as impaired because of elevated fecal coliform bacteria counts. The highest counts likely represented the influence of local storm events. The *Secondary Contact Recreational and Aesthetics uses* are assessed as support based on the bacteria data, field observations, and best professional judgment. The *Secondary Contact Recreational Use* is identified with an Alert Status because of the very high bacteria count.

### CRANE BROOK (SEGMENT MA93-02) Use Summary

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

\*Alert Status issues identified, see details in use assessment section

### RECOMMENDATIONS

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as needed to help document sources.

## CRANE RIVER (SEGMENT MA93-38)

Location: Headwaters outlet Mill Pond, Danvers to outlet of the pump house sluiceway, Purchase Street, Danvers.

Length/area: 0.3 miles.

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens and turbidity (MassDEP 2005).

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### *Aquatic Life Use*

##### Habitat and Flow

Currently the Mill Pond Dam in Danvers has no fishway structure and serves as a barrier to anadromous fish passage into the pond (Reback *et al.* 2005).

DWM conducted a habitat assessment of the Crane River upstream from Ash Street/Purchase Street, Danvers (Station CR01) on 30 July 2002. In-stream habitat was limited (total habitat score of 126 out of 200) (MassDEP 2002b). Extremely poor bank stability, marginal bank vegetative protection and limited riparian zone width, poor in-stream fish cover and marginal velocity/depth combinations were noted.

With nearly 2,000 m<sup>2</sup> of suitable smelt spawning substrate upstream from the Purchase Street sluiceway, it was selected as a priority location in Massachusetts Bay for smelt population enhancement and habitat restoration. The Purchase Street sluiceway impeded smelt passage and was eliminated during the 1995 to 1997 restoration project (Chase 2006a). Sedimentation, excessive periphyton growth, and stormwater flows were identified as substantial negative influences on the suitability of smelt spawning habitat (Chase 2006a).

##### Biology

In the early 1990's, DMF biologists identified the Crane River as a potential site for smelt population and spawning habitat restoration. During 1995-1997 restoration project, smelt eggs were transferred from donor rivers to the Crane River. Monitoring to determine the success of the introduction took place during 1997-2001 and smelt eggs were found during each year except 1999. The project appears to have successfully introduced smelt to the Crane River, and resulted in the designation of the Crane River as a smelt run (Chase 2006a).

##### Water Chemistry

Sampling was conducted by DWM staff in Crane River near Ash Street/Purchase Street in Danvers (W0452) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Tables 7 and 8).

In-stream DO concentrations ranged from 4.6 to 10.9 mg/L representing both day-time and pre-dawn (worst case) conditions. While all but one of the DO measurements met standards, % saturations were <60% on two sampling events. Although low flow conditions were encountered during the surveys, this brook was usually described as having low water levels but higher visual surface velocities than most freshwater sampling stations. With the exception of the slightly low DO and % saturation measurements, and moderate concentrations of total phosphorus (0.031 to 0.12 mg/L with the highest concentration representative of a local storm event), all of the other variables monitored met standards. Slightly elevated conductivity measurements were also noted.

The *Aquatic Life Use* is assessed as support for this segment of the Crane River based primarily on the generally good water quality conditions documented during the 2002 sampling, smelt spawning habitat restoration, and best professional judgment. This use is identified with an Alert Status because of the habitat quality issues (e.g., extremely poor bank stability, the marginal bank vegetative protective cover

and limited riparian zone, excessive periphyton growth on substrates, obvious impacts from stormwater pipes/flows and sedimentation) noted by DWM and/or DMF biologists.

### **Primary and Secondary Contact Recreation and Aesthetics uses**






Sampling was conducted by DWM staff in Crane River near Ash Street/Purchase Street in Danvers (W0452) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8).

Fecal coliform bacteria counts ranged from 10 to 680 cfu/100 mls with a geometric mean of 109 cfu/100 mls and only one sample was >400 cfu/100 mls. This geometric mean met the standard of 200 cfu/100 mls for primary contact recreation. The highest fecal coliform bacteria count likely represented the influence of a local storm event.

DWM biologists did note that the Crane River upstream from Ash Street, Danvers (Station CR01), was turbid on 30 July 2002, but no other objectionable conditions were noted (e.g., oils, odors, other deposits) (MassDEP 2002b). Field observations were also made by DWM personnel during the surveys conducted between May and September 2002. With the exception of isolated areas of trash/debris and on one occasion a fishy odor, no other objectionable conditions (oils, turbidity) were noted during any of the surveys (MassDEP 2002a).

The *Primary and Secondary Contact Recreational and Aesthetics* uses are assessed as support based primarily on the bacteria data and observations of field sampling crews. The *Primary Contact Recreational Use* is identified with an Alert Status because of elevated bacteria during a storm event.

CRANE RIVER (SEGMENT MA93-38) Use Summary

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

\*Alert Status issues identified, see details in use assessment section

### **RECOMMENDATIONS**

Chase (2006a) recommends the following.

Spawning activity continues to be scant relative to the available habitat in the Crane River. The smelt run in the Crane River should be monitored for spawning activity and recommendations should be developed for improving water quality in the Crane River.

The next practical step following the Crane River smelt egg transfer project is to enhance smelt populations using hatchery methods to improve egg survival. This may provide benefits if a quantitative approach is taken in concert with water and habitat quality improvements. If hatchery enhancement is attempted in Massachusetts Bay, the Crane River should be considered a candidate to receive contributions of larvae.

The clearing of river bank vegetation along the Crane River should be avoided. A vegetation canopy provides the benefits of reducing warming and algal growth. Conservation Commissions should develop by-laws to protect shading along river habitats.

A large stormwater culvert drains the parking areas of a large retail complex to a location on Crane River just downstream from the lower limit of observed smelt egg deposition. An evaluation should be conducted on the efficiency of this stormwater system for removing pollutants and excessive sediments.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as needed to help document sources.

Streambanks along this segment of the Crane River should be stabilized (e.g., improve bank vegetative protective cover and increase riparian zone where possible) to improve habitat quality in the river.

A reconnaissance survey should be conducted along the Crane River to evaluate areas contributing sediment loading to the river. These areas should be targeted for remediation including the development and implementation of best management practices.

Conduct additional water quality monitoring (*in-situ* and nutrient sampling) to better evaluate the *Aquatic Life Use* and determine the need for identify source(s) contributing elevated nutrients.

Passage for anadromous fish should be considered at the Mill Pond Dam.

## CRANE RIVER (SEGMENT MA93-41)

Location: Outlet pump house sluiceway, Purchase Street, Danvers to confluence with Danvers River, Danvers.

Length/area: 0.07 mi<sup>2</sup>

Classification: Class SA.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

### DISCHARGES

#### NPDES (Appendix E, Tables E2 and E3)

MA0030091 Crane River West Condominiums, Danvers.

### OTHER

The former Creese & Cook Co. property (an abandoned tannery since 1984) is adjacent to the south bank along this segment of the Crane River. The tannery discharged its wastewater to the river until the flow was connected to the municipal sewer system in 1975. Remediation of the site has been ongoing (EPA 2006b). High levels of arsenic detected in the soil samples from the former lagoon areas at the former Creese & Cook Co. property represent a possible threat to the Crane River (EPA 2006b).







### USE ASSESSMENT

#### *Shellfish Harvesting Use*

DMF shellfish status of July 2000 indicates that Area N17.0, which comprises this segment area, is prohibited. No changes to this status have been made (Kennedy 2006a).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing areas are prohibited.

CRANE RIVER (SEGMENT MA93-41) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, marinas/boating pumpout releases, marinas/boating sanitary on-vessel discharges
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

### RECOMMENDATIONS

Implement recommendations in the DMF shellfish management plan for Area N17.0.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as needed.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Encourage use of boat pump-out facilities through a public outreach and education program.

## **WATERS RIVER (SEGMENT MA93-01)**

Location: Headwaters west of Route 128, Peabody/Danvers to confluence with Danvers River, Danvers.

Length/area: 0.09 mi<sup>2</sup>

Classification: Class SA.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens and other habitat alterations\* (MassDEP 2005).

### **DISCHARGES**

#### **NPDES (Appendix E, Tables E2 and E3)**

MA00024732 Northeast Petroleum Corporation –Pocahantas Fuel Company, Inc. Outfall #001.

### **USE ASSESSMENT**

#### ***Aquatic Life Use***

##### Water Chemistry

Sampling was conducted by DWM staff in Waters River near Water Street in Danvers (W0884) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Tables 7 and 8).

In-stream DO concentrations ranged from 5.6 to 9.1 mg/L representing both day-time and pre-dawn (worst case) conditions. While all but one of the DO measurements met standards, % saturations were all >75%. Total suspended solids concentrations were also low (all measurements < 11 mg/L).

The *Aquatic Life Use* is not assessed (too limited data available).

#### ***Shellfish Harvesting Use***

DMF shellfish status of July 2000 indicates that Area N17.0, which comprises this segment area, is prohibited. No changes to this status have been made (Kennedy 2006a).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing areas are prohibited.

#### ***Primary and Secondary Contact Recreation and Aesthetics uses***

Bacteria sampling was conducted by DWM staff in Waters River near Water Street in Danvers (W0884) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Tables 7 and 8).




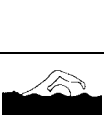


Fecal coliform bacteria counts ranged from 6 to 140 cfu/100 mls with a geometric mean of 34 cfu/100 mls. This geometric mean met the standard of 200 cfu/100 mls for primary contact recreation.

Field observations were made by DWM personnel during the surveys conducted in the Waters River between May and September 2002. With the exception of occasional fishy odor and one day when the water was described as highly cloudy, no other objectionable conditions (deposits, oils, turbidity) were noted during any of the surveys (Station WA00) (MassDEP 2002a).

The *Primary and Secondary Contact Recreational and Aesthetics* uses are assessed as support for the Waters River based primarily on the bacteria data and visual observations of field sampling crews.



# WATERS RIVER (SEGMENT MA93-01) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, marinas/boating pumpout releases, marinas/boating sanitary on-vessel discharges
Primary Contact		SUPPORT
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

## RECOMMENDATIONS

Implement recommendations in the DMF shellfish management plan for Area N17.0.

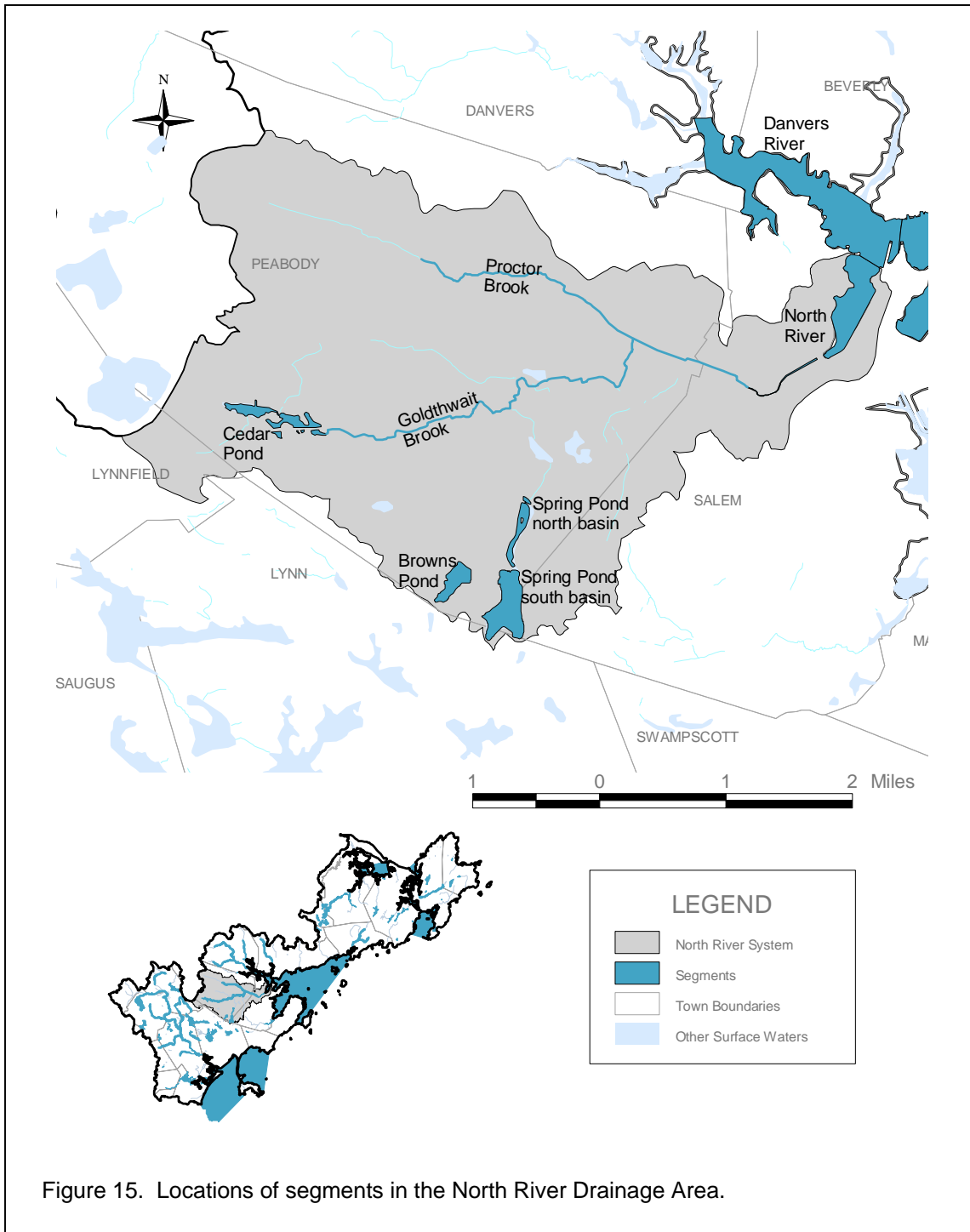
Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as needed to help document sources.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Encourage use of boat pump-out facilities through a public outreach and education program.

## NORTH RIVER SYSTEM

The North River receives flow from one freshwater tributary named Proctor Brook. Proctor Brook is fed by two named streams, Goldthwait and Strongwater brooks. Goldthwait Brook receives flow from one named tributary, Tapley Brook. Review of historical water quality data from the North River system (Goldthwait and Proctor Brooks and the North River revealed that pathogens impaired the *Primary* and *Secondary Contact Recreational* uses while low levels of dissolved oxygen and high concentrations of ammonia-nitrogen impaired the *Aquatic Life Use*. Ammonia-nitrogen concentrations on 18 and 19 August 1987 at four stations (two each on Goldthwait and Proctor Brooks) ranged between 0.99 and 3.2 mg/L) and averaged 2.4 mg/L (Duerring 1989). Other pollution problems (sediment contamination) were also problematic. The location of segments in the North River System are illustrated in Figure 15.



## CEDAR POND (SEGMENT MA93013)

Location: Peabody.

Length/area: 34 acres

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant due to the presence of exotic (non-native) species (MassDEP 2005).

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT






#### ***Aquatic Life Use***

##### Biology

There is no record of a non-native aquatic macrophyte in Cedar Pond. There is an infestation of the non-native wetland plant, *Phragmites australis* (DeCesare *et al.* 2000). This infestation has encroached on about half of the pond reducing open water habitat.

No quality-assured data are available for Cedar Pond. All designated uses are not assessed but the *Aquatic Life Use* is identified with an Alert Status because of the *P. australis* infestation.

CEDAR POND (SEGMENT MA93013) Use Summary

Aquatic Life*	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

\*Alert Status issues identified, see details in use assessment section

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

A survey should be conducted to document the current extent of *Phragmites australis*.

## **GOLDTHWAIT BROOK (SEGMENT MA93-05)**

Location: Outlet Cedar Pond, Peabody to confluence with Proctor Brook, Peabody.

Length/area: 3.3 miles.

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of unknown causes, unknown toxicity, unionized ammonia, nutrients, organic enrichment/low DO, noxious aquatic plants, and pathogens as well as flow alteration\* and other habitat alterations\* (MassDEP 2005).

[\*Note: this impairment is not a pollutant requiring the development of a TMDL.]

### **WITHDRAWALS AND DISCHARGES**

#### **WMA (Appendix E, Table E1)**

Eastman Gelatine Corporation registration/permit (31822902/9P31822902)

[Note: Peabody Water Department registration (31822903) from Spring Pond is in this subwatershed area].

#### **NPDES (Appendix E, Tables E2 and E3)**

MA0003956 Eastman Gelatine Corporation Outfall #001 and stormwater runoff from 18 other outfalls.

MA0028584 Stahl Finishing, Peabody

MA0028215 Permuthane Inc, Peabody

MA0035467 Stahl USA, Peabody

### **USE ASSESSMENT**

#### **Aquatic Life Use**

##### **Habitat and Flow**

Streamflow conditions in Goldthwait Brook were noted to be very low during the summer months of 2002 (MassDEP 2002a) coincident with drought conditions (advisories and watches were in effect in Massachusetts -- see Appendix B).

##### **Toxicity**

###### **Ambient**

Water from Goldthwait Brook was collected upstream from the Eastman Gelatine Corporation's outfalls just upstream from Allens Lane for use as dilution water in the facility's whole effluent toxicity tests as well as for ambient testing. Water was also collected from Goldthwait Brook downstream from the company's outfalls (400-500 yards downstream from where the brook crosses under and then parallels the railroad tracks), which was also screened for acute toxicity. Between May 1999 and May 2006 (n=30), survival of *Ceriodaphnia dubia* exposed (48 hours) to the water upstream from the discharges were all 100% except for two test events when survival was 0% (January 2002 and September 2002). Survival of *C. dubia* exposed (48 hours) to the water downstream from the discharges were all >95%, except for the September 2002 test when survival was 0%. These test results indicated an improvement in water quality of the brook since the last evaluation reported in DeCesare *et al.* (2000).

###### **Effluent**

A total of 16 acute whole effluent toxicity tests were conducted on the Eastman Gelatine Corporation's Outfall #001. With the exception of two test events, no acute toxicity has been detected by *C. dubia* in the effluent (LC<sub>50</sub>>100% effluent) in the 16 tests conducted between May 1999 and May 2006. The two tests that did exhibit acute toxicity were in May and September 2002 (LC<sub>50</sub>'s reported as 72 and <6.25%, respectively). It should be noted that the toxicity in the September 2002 test event was thought to be associated with the toxicity in the river water that commingles with the effluent in the discharge pipe (Carter 2002). Overall there has been a definite improvement in effluent quality (expressed as acute whole effluent toxicity) over those tests done between April 1995 and November 1998 (see DeCesare *et al.* 2000).

##### **Water Chemistry**

Sampling was conducted by DWM staff in Goldthwait Brook near Foster Street in Peabody (W0454) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Tables 7 and 8).

In-stream DO concentrations ranged from 2.5 to 9.7 mg/L, representing both day-time and pre-dawn (worst-case) conditions. While all the measurements taken between May and July met standards, none of the measurements taken in August and September were >5.0 mg/L. However, drought conditions were present during that time (i.e., at or <7Q10 flows). Although moderate to high concentrations of total phosphorus were documented (0.027 to 0.21 mg/L), all of the other variables monitored were indicative of good water quality conditions. Slightly elevated conductivity measurements were also noted.

The *Aquatic Life Use* is assessed as support for Goldthwait Brook based on the typically high survival of test organisms exposed to river water collected both upstream and downstream from the Eastman Gelatine discharges (>93% of the 30 test results had survival of test organisms exposed to river water exceeding 90%) and the limited water quality data. This use is identified with an Alert Status because of in-stream toxicity detected in two test events (January and September 2002) and the low DO/saturation and elevated total phosphorus concentrations documented in August and September 2002. The low DO/saturation conditions, however, likely reflected the very low flow conditions encountered.

#### ***Primary and Secondary Contact Recreation and Aesthetics uses***




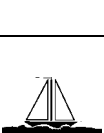

Bacteria sampling was conducted by DWM staff in Goldthwait Brook near Foster Street in Peabody (W0454) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8).

Fecal coliform bacteria counts ranged from 78 to 8,000 cfu/100 mls with a geometric mean of 450 cfu/100 mls. This exceeded the standard of 200 cfu/100 mls for primary contact recreation. The highest fecal coliform bacteria count likely represented the influence of a local storm event.

Field observations were made by DWM personnel during the surveys conducted in Goldthwait Brook between May and September 2002. Trash/debris in the stream and along the banks and oil sheens (July, August, and September) were noted (Station GB01) (MassDEP 2002a). Poor management practices associated with a construction site were also noted. The water column was described as murky during both the August and September surveys. Potential sources of pollution included highway/road and parking lot runoff.

The *Primary and Secondary Contact Recreational and Aesthetics* uses for Goldthwaite Brook are assessed as impaired because of the aesthetic quality degradation observed by field sampling crews. Elevated bacteria are also a problem for the *Primary Contact Recreational Use*.

### GOLDTHWAIT BROOK (SEGMENT MA93-05) Use Summary

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria, trash/debris, oil sheens Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, highway/road runoff
Secondary Contact		IMPAIRED Causes: Trash/debris, oil sheens Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, highway/road runoff
Aesthetics		IMPAIRED Causes: Trash/debris, oil sheens Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, highway/road runoff

\* Alert Status issues identified, see details in use assessment section

### RECOMMENDATIONS

There have been several NPDES permittees (Stahl/Permethane) that no longer discharge to the brook (tied into the South Essex Sewerage District sewer system or closed-looped) since the 2002 survey. During the 2007 monitoring season, field reconnaissance should be conducted along Goldthwaite Brook to determine the need for sampling as well as to document any potential sources contributing to the aesthetic quality degradation (e.g., oil sheens) observed in the brook near Foster Street during the 2002 DWM surveys.

Eastman Gelatine Company (MA0003956) should continue to utilize water collected from Goldthwait Brook near Allen Street for use as dilution water in their whole effluent acute toxicity tests.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as needed to identify undocumented sources.

Organize and conduct a stream cleanup.

## BROWNS POND (SEGMENT MA93008)

Location: Peabody.

Length/area: 24 acres

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2005).






### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Browns Pond. All designated uses are not assessed.

BROWNS POND (SEGMENT MA93008) Use Summary

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

## SPRING POND [SOUTH BASIN](SEGMENT MA93073)

Location: Lynn/Peabody/Salem.

Length/area: 66 acres

Classification: Class A/PWS/ORW

This segment is on the 2004 Integrated List of Waters in Category 2 - Attaining Some Uses (*Secondary Contact Recreation* and *Aesthetics*); Others Not Assessed (MassDEP 2005).

### WITHDRAWALS AND DISCHARGES

#### WMA (Appendix E, Table E1)

Peabody Department of Public Services registration (31822903).

#### NPDES (see Appendix E, Table E3)

### USE ASSESSMENT







#### *Aquatic Life Use*

##### Biology

Spring Pond [South Basin] was once infested with a non-native aquatic plant (*Eichornia crassipes*) (DeCesare *et al.* 2000). This non-native species does not overwinter in this climate and so is not considered an impairment.

No quality-assured data are available for Spring Pond [South Basin]. All designated uses are not assessed.

SPRING POND [SOUTH BASIN] (SEGMENT MA93073) Use Summary

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

\* The MassDEP Drinking Water Program maintains current drinking water supply data.

### RECOMMENDATIONS

Implement recommendations of the Source Water Assessment and Protection Plan for Peabody Water Department (MassDEP 2003a).

Conduct water quality monitoring to evaluate designated uses.



## SPRING POND [NORTH BASIN](SEGMENT MA93074)

Location: Peabody.

Length/area: 17 acres

Classification: Class A/PWS/ORW.

This segment is on the 2004 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2005).

### WITHDRAWALS AND DISCHARGES

#### WMA (Appendix E, Table E1)

Peabody Water Department registration (31822903). Water is usually withdrawn from Spring Pond South Basin. Since the water supply system was upgraded, however, water can be pumped from Spring Pond North Basin using the "Spring Pond Recycle Pump Station" and the Town can also take water directly from the North Basin (Zessoules 2006).

#### NPDES (Appendix E, Tables E2 and E3)

MAG640006 Coolidge Avenue Water Treatment Facility.

### USE ASSESSMENT



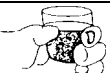



#### *Aquatic Life Use*

##### Habitat and Flow

There is a problem with sediment buildup in Spring Pond, which results from the Coolidge Avenue Water Treatment Facility discharge. The delta encompasses an area (slightly less than half acre) less than 3% of the total pond area.

The *Aquatic Life Use* is not assessed, but this use is identified with an Alert Status because of the area that is affected by sedimentation from the Coolidge Avenue Water Treatment Facility discharge.

SPRING POND (SEGMENT MA93074) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Drinking Water		The MassDEP Drinking Water Program maintains current drinking water supply data.
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

\*Alert Status issues identified, see details in use assessment section

### RECOMMENDATIONS

The sedimentation problem in Spring Pond [North Basin] resulting from the discharge from the Coolidge Avenue Water Treatment Facility needs to be remediated. Either the City needs to address the problem or MassDEP needs to take compliance and/or enforcement actions.

Implement recommendations of the Source Water Assessment and Protection Plan for Peabody Water Department (MassDEP 2003a).

Conduct water quality monitoring to evaluate designated uses.

## PROCTOR BROOK (SEGMENT MA93-39)

Location: Outlet small pond in wetland north of Downing Road, Peabody to Grove/Goodhue Street Bridge, Salem.

Length/area: 2.9 miles.

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of unknown causes, nutrients, siltation, and pathogens as well as other habitat alterations\* (MassDEP 2005). [\*Note: this impairment is not a pollutant requiring the development of a TMDL.]

## WITHDRAWALS AND DISCHARGES

### WMA (Appendix E, Table E1)

The Salem Country Club registration (31822901)

### NPDES (Appendix E, Tables E2 and E3)

MA0023132 Peabody Municipal Light Plant Outfall #001.

MA0025372 Salem Oil & Grease Company, Outfall #001.

MA0033723 Federal Express.

## USE ASSESSMENT

### Aquatic Life Use

#### Habitat and Flow

There are no obstructions to anadromous fish passage (Reback *et al.* 2005). Several thousand square meters of suitable smelt habitat (shallow riffles with gravel substrate) are present between Goodhue Street and Howley Street and a similar amount of available smelt spawning habitat is also present upstream from Howley Street (Chase 2006a). Decades of pollution discharges and habitat degradation (sedimentation and excessive periphyton growth) were identified as problems in this area (Chase 2006a).

Streamflow conditions in Proctor Brook were noted to be very low during the summer months of 2002 (MassDEP 2002a) coincident with drought conditions (advisories and watches were in effect in Massachusetts -- see Appendix B).

### Biology

DMF biologists have recently documented smelt spawning in Proctor Brook, whereas no evidence of smelt spawning was found during surveys conducted prior to 2001. In 2001 approximately 50 smelt eggs were documented in the shallow riffles downstream from Howley Street. In 2002 a smelt restoration project was implemented to improve spawning substrate (Chase 2006a). The return of smelt to this brook is encouraging, however, very low numbers of smelt are utilizing the available habitat. Additional evidence of a small smelt run was found in 2005 when five adult smelt were caught during 22 fyke net sets in this segment following no smelt caught during 18 sets in 2004 (Chase *et al.* 2006). American eel were commonly caught in the fyke nets at low relative abundance during both seasons.

### Water Chemistry

Sampling was conducted by DWM staff in Proctor Brook at Grove Street/Goodhue Street in Salem (W0887) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Tables 7 and 8).

In-stream DO concentrations ranged from 2.1 to 11.3 mg/L, but only three of the 10 measurements were >6.0 mg/L, while saturations ranged from 26 to 132%. This sampling station was tidally influenced with conductivities ranging from 808 to 45,510  $\mu\text{S}/\text{cm}$ . All other *in-situ* measurements (i.e., pH, temperature) met water quality standards. Total suspended solids concentrations were also low (all measurements < 4.7 mg/L).

### Sediment Chemistry

In June 2003, grab samples of deposited sediment (top 2 to 4 inches) were collected by USGS personnel from two locations in this segment (Station PCY-001 at Caller Street and Station PCY-002 at Howley Street) and analyzed for elements, polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides, and polychlorinated biphenyls (PCB) (Breault *et al.* 2004). It should be noted that the 'grab samples'

consisted of a homogenized composite of at least three samples at each location to characterize conditions at each site. The concentration of chromium exceeded the S-EL by factors of 8.5 and 2.8 at PCY-001 and PCY-002, respectively. None of the other metals exceeded their S-ELs. Concentrations of PAH, organochlorine pesticides, and PCB could not be compared to S-ELs (lack of total organic carbon data necessary to evaluate data) (Breault *et al.* 2004).

Only limited data representing freshwater conditions are available so the *Aquatic Life Use* is not assessed. This use is identified with an Alert Status because of historical pollution problems (DeCesare *et al.* 2000) and high chromium sediment concentrations compared to its S-EL, although some evidence of recovery is present (establishment of a small smelt spawning run).

#### **Primary and Secondary Contact Recreation and Aesthetics uses**






Bacteria sampling was conducted by DWM staff in Proctor Brook at Grove Street/Goodhue Street in Salem (W0887) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8).

Fecal coliform bacteria counts ranged from 330 to 3,000 cfu/100 mls with a geometric mean of 1,045 cfu/100 mls. This exceeded the standard of 200 cfu/100 mls and 1,000 cfu/100 mls for primary and secondary contact recreation, respectively.

Field observations were made by DWM personnel during the surveys conducted in Proctor Brook between May and September 2002. Trash/debris, evidence of oil sheens, occasional turbidity, and odors (sulfide, fishy, septic) were all noted (Station PB03) (MassDEP 2002a).

Because of the elevated fecal coliform bacteria counts, the *Primary* and *Secondary Contact Recreational* uses are assessed as impaired for this segment of Proctor Brook. These uses and the *Aesthetics Use* are also assessed as impaired due to objectionable conditions (trash/debris etc.) recorded by DWM field crews.

PROCTOR BROOK (SEGMENT MA93-39) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria, (trash/debris, oil sheens, odor) Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, highway/road runoff
Secondary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria, (trash/debris, oil sheens, odor) Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, highway/road runoff
Aesthetics		IMPAIRED Causes: Trash/debris, oil sheens, odor Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, highway/road runoff

\*Alert Status issues identified, see details in use assessment section

#### **RECOMMENDATIONS**

Chase (2006a) recommends the following.

Efforts should be made to improve water and substrate quality in Proctor Brook.

Enhance recent restoration project with additional structural improvements to smelt spawning habitat.

Reduce sedimentation inputs to Proctor Brook resulting from storm water discharges near downtown Peabody.

The clearing of riverbank vegetation along Proctor Brook should be avoided. A vegetation canopy provides the benefits of reducing warming and algal growth. Conservation Commissions should develop by-laws to protect shading along river habitats.

Continue to evaluate smelt spawning in Proctor Brook.

Conduct water quality sampling (i.e., biological and water chemistry monitoring including *in-situ* measurements and nutrient sampling) in Proctor Brook upstream from tidal influence to better evaluate water quality conditions and to assess the *Aquatic Life Use*.

Sediment toxicity testing is recommended given the historical use of the area by the tanning industry and the results of the sediment-screening project by USGS and to better evaluate the *Aquatic Life Use*.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking, if needed, to help identify undocumented sources.

Additional field reconnaissance is necessary to evaluate sediment inputs into Proctor Brook. Remediate problem areas identified by DMF (Chase 2006a).

## PROCTOR BROOK (SEGMENT MA93-40)

Location: Grove/Goodhue Street Bridge, Salem, to Route 114 culvert, Salem.

Length/area: <0.01 mi<sup>2</sup>

Classification: Class SA.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

### WITHDRAWALS AND DISCHARGES

#### WMA (Appendix E, Table E1)

Salem Suede, Inc. registration (31825802).

#### NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### ***Aquatic Life Use***

##### Habitat and Flow

Streamflow conditions in Proctor Brook were noted to be very low during the summer months of 2002 (MassDEP 2002a) coincident with drought conditions (advisories and watches were in effect in Massachusetts -- see Appendix B).

There was evidence of an iron tide gate at the Route 114 culvert, although this no longer impedes flow or fish passage (Chase 2006a). Decades of pollution discharges and habitat degradation were identified as problems in this area (Chase 2006a).

##### Water Chemistry

Sampling was conducted by DWM staff in Proctor Brook at Grove Street/Goodhue Street in Salem (W0887) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Tables 7 and 8).

In-stream DO concentrations ranged from 2.1 to 11.3 mg/L, but only three of the 10 measurements were >6.0 mg/L, while saturations ranged from 26 to 132%. This sampling station was tidally influenced with conductivities ranging from 808 to 45,510  $\mu$ S/cm. All other *in-situ* measurements (e.g., pH, temperature) met water quality standards. Total suspended solids concentrations were also low (all measurements < 4.7 mg/L).

##### Sediment Chemistry

In June 2003 grab samples of deposited sediment (top 2 to 4 inches) were collected by USGS personnel from one location in this segment (Station SAY-001, North River at Commercial Street) and analyzed for elements, polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides, and polychlorinated biphenyls (PCB) (Breault *et al.* 2004). It should be noted that the 'grab sample' consisted of a homogenized composite of at least three samples at each location to characterize conditions at the site. The concentrations of arsenic and chromium exceeded the S-ELs by factors of 1.2 and 3.2, respectively. None of the other metals exceeded their S-ELs. Concentrations of PAH, organochlorine pesticides, and PCB could not be compared to S-ELs (lack of total organic carbon data necessary to evaluate data) (Breault *et al.* 2004).

Only limited data are available so the *Aquatic Life Use* is not assessed for this segment of Proctor Brook. This use is identified with an Alert Status, however, because of low DO/saturations, evidence of high productivity, historical pollution problems (DeCesare *et al.* 2000), as well as the elevated concentrations of chromium and arsenic compared to their S-ELs in the sediment. There is some evidence of recovery in the establishment of a small smelt spawning run despite the poor utilization of smelt spawning habitat upstream from this segment.

#### ***Shellfish Harvesting Use***

No shellfish growing area is identified/classified by DMF so this use is not assessed.

### **Primary and Secondary Contact Recreation and Aesthetics uses**







Bacteria sampling was conducted by DWM staff in Proctor Brook near Grove Street/Goodhue Street in Salem (W0887) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8).

Fecal coliform bacteria counts ranged from 330 to 3,000 cfu/100 mls with a geometric mean of 1,045 cfu/100 mls. This exceeded the standard of 200 cfu/100 mls and 1,000 cfu/100 mls for primary and secondary contact recreation, respectively.

Field observations were made by DWM personnel during the surveys conducted in Proctor Brook between May and September 2002. Trash/debris, evidence of oil sheens, occasional turbidity, and odors (sulfide, fishy, septic) were all noted (Station PB03) (MassDEP 2002a).

Because of the elevated fecal coliform bacteria counts, the *Primary* and *Secondary Contact Recreational* uses are assessed as impaired for this segment of Proctor Brook. These uses and the *Aesthetics Use* are also assessed as impaired due to objectionable conditions (trash/debris etc.) recorded by DWM field crews.

PROCTOR BROOK (SEGMENT MA93-40) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		NOT ASSESSED
Primary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria, (trash/debris, oil sheens, odor) Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, highway/road runoff
Secondary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria, (trash/debris, oil sheens, odor) Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, highway/road runoff
Aesthetics		IMPAIRED Causes: Trash/debris, oil sheens, odor Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, highway/road runoff

\* Alert Status issues identified, see details in use assessment

### **RECOMMENDATIONS**

Continue to conduct water quality sampling in Proctor Brook to better evaluate water quality conditions and to assess the *Aquatic Life Use*.

Sediment toxicity testing is recommended given the historical use of the area by the tanning industry and the results of the sediment-screening project by USGS and to better evaluate the *Aquatic Life Use*.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking if needed.

Additional field reconnaissance is necessary to evaluate sediment inputs into Proctor Brook. Remediate problem areas as identified by DMF.

## **NORTH RIVER (SEGMENT MA93-42)**

Location: Downstream of Route 114 bridge (Proctor Brook becomes North River at this bridge), Salem to confluence with Danvers River, Salem.

Length/area: 0.15 mi<sup>2</sup>

Classification: Class SA.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of unionized ammonia, organic enrichment/low DO, and pathogens (MassDEP 2005).

A summary of information related to the geography, history, resources, and water quality of the North River was compiled by the North Coastal Watershed Alliance (NCWA 2000).

### **DISCHARGES**

**NPDES (see Appendix E, Table E3)**

### **USE ASSESSMENT**

#### ***Aquatic Life Use***

##### Sediment Chemistry

In June 2003 grab samples of deposited sediment (top 2 to 4 inches) were collected by USGS personnel from one location in this segment (Station SAY-002, North River near the conduit) and analyzed for elements, polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides, and polychlorinated biphenyls (PCB) (Breault *et al.* 2004). It should be noted that the 'grab sample' consisted of a homogenized composite of at least three samples at each location to characterize conditions at the site. The concentrations of chromium, copper, and lead exceeded the S-ELs by factors of 8.7, 1.2, and 1.4, respectively. None of the other metals exceeded their S-ELs. Concentrations of PAH, organochlorine pesticides, and PCB could not be compared to S-ELs (lack of total organic carbon data necessary to evaluate data) (Breault *et al.* 2004).

Only limited data are available so the *Aquatic Life Use* is not assessed for the North River. This use is identified with an Alert Status, however, because of high chromium, arsenic and lead sediment concentrations compared to their S-ELs as well as the known historic pollution problems.

#### ***Shellfish Harvesting Use***

DMF shellfish status of July 2000 indicates that Area N17.0, which comprises this segment area, is prohibited. No changes to the status have been made (Kennedy 2006a).







The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing area is prohibited.

#### ***Primary and Secondary Contact Recreation and Aesthetics uses***

A survey was conducted along the Salem Sound shoreline in April 2004 from which an inventory of observable stormwater outfall pipes 12" or greater in diameter was created (Horsley Witten Group 2005). In an attempt to identify discharges contributing significant bacteria loads to Salem Sound under dry weather conditions (i.e., screening for illicit discharge connections), two rounds of bacteria sampling (5 October and 4 November 2004) was conducted at targeted stormwater discharge pipes. Three pipes were sampled in the North River area. One of the pipes monitored was found to have elevated bacteria counts (Horsley Witten Group 2005).

No recent quality-assured bacteria data are available for North River. The *Primary* and *Secondary Recreational* and *Aesthetics* uses are not assessed.

# NORTH RIVER (SEGMENT MA93-42) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Discharges from separate storm sewer systems Suspected sources: Marinas/boating pumpout releases, marinas/boating sanitary on-vessel discharges
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

\*Alert Status issues identified, see details in use assessment section

## RECOMMENDATIONS

Sediment toxicity testing is recommended given the historical use of the area by the tanning industry and the results of the sediment screening project by USGS and to better evaluate the *Aquatic Life Use*.

Conduct water quality sampling (i.e., biological and water chemistry monitoring including *in-situ* measurements and nutrient sampling) in North River to better evaluate water quality conditions and to assess the *Aquatic Life Use*.

Implement recommendations in the DMF shellfish management plan for Area N17.0.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Continue to monitor stormwater discharges into the North River and remediate illicit connections and other problems as identified.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking, if needed, to help identify undocumented sources.

Encourage use of boat pump-out facilities available in Danvers River (segment MA93-09) through a public outreach and education program.



## DANVERS RIVER (SEGMENT MA93-09)

Location: Confluence of Porter, Crane, and Waters rivers, Danvers to mouth at Beverly Harbor, Beverly/Salem.

Length/area: 0.53 mi<sup>2</sup>

Classification: Class SA.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

### WITHDRAWALS AND DISCHARGES

#### WMA (Appendix E, Table E1)

Kernwood Country Club registration/permit (31825801/ 9P231825801)

#### NPDES (Appendix E, Tables E2 and E3)

MA0026794 Bayoil Co., Inc.

### USE ASSESSMENT

#### *Aquatic Life Use*

##### Biology

A DMF survey of Salem Sound conducted trawl sampling in this segment catching 16 species of fish during 18 sampling trips in 1997 (Chase *et al.* 2002). The relative abundance and diversity of fish was the lowest in the Danvers River among five trawl stations in Salem Sound; however the benthic habitat in this segment was the only station with common occurrences of sponges and tunicates and supported large aggregations of young-of-the-year winter flounder in November and December (Chase 2006c).

##### Water Chemistry

Sampling was conducted by DWM staff in the Danvers River at Kernwood Street in Beverly/ Salem (W0886) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Tables 7 and 8).

In-stream DO concentrations all met standards and ranged from 6.2 to 9.6 mg/L. Percent saturation all met standards and ranged from 79% to 105%. This sampling station was tidally influenced with conductivities ranging from 47,710 to 49,750  $\mu$ S/cm. Total suspended solids ranged from 5.5 to 88 mg/L. All other *in-situ* measurements (e.g., pH, temperature) met water quality standards.

Although no water quality problems were identified, the *Aquatic Life Use* is not assessed due to too limited data (poor spatial coverage).

#### *Shellfish Harvesting Use*

DMF shellfish status of July 2000 indicates that Area N17.0, which comprises this segment area, is prohibited. No changes to the status have been made (Kennedy 2006a).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing area is prohibited.

#### *Primary and Secondary Contact Recreation and Aesthetics uses*

Bacteria sampling was conducted by DWM staff in the Danvers River at Kernwood Street in Beverly/ Salem (W0886) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8).







Fecal coliform bacteria counts ranged from 6 to 73 cfu/100 mls with a geometric mean of 25 cfu/100 mls. None of the samples analyzed exceeded water quality standards for primary or secondary contact recreation.

Field observations were made by DWM personnel during the surveys conducted in the Danvers River between May and September 2002. With the exception of occasional fishy odor and on one occasion the water was described as murky, no other objectionable conditions (deposits, oils, turbidity) were noted during any of the surveys (Station DR01) (MassDEP 2002a).

A survey was conducted along the Salem Sound shoreline in April 2004 from which an inventory of observable stormwater outfall pipes 12" or greater in diameter was created (Horsley Witten Group 2005). In an attempt to identify discharges contributing significant bacteria loads to Salem Sound under dry weather conditions (i.e., screening for illicit discharge connections), two rounds of bacteria sampling (5 October and 4 November 2004) were conducted at targeted stormwater discharge pipes. One pipe was sampled in the Danvers River area. This pipe was found to have low bacteria counts (Horsley Witten Group 2005).

The *Primary* and *Secondary Contact* and *Aesthetics* uses are assessed as support based on the low fecal coliform bacteria counts and the lack of objectionable conditions.

DANVERS RIVER (SEGMENT MA93-09) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, marinas/boating pumpout releases, marinas/boating sanitary on-vessel discharges
Primary Contact		SUPPORT
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

## RECOMMENDATIONS

More comprehensive (better spatial coverage) water quality monitoring should be conducted to characterize water quality conditions in the Danvers estuary. Nutrient samples should be collected and analyzed with appropriate analytical methods.

Implement recommendations in the DMF shellfish management plan for Area N17.0.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking when necessary to help identify undocumented sources. Remediate illicit connections and other problems as identified.

Encourage use of boat pump-out facilities through a public outreach and education program.

## BEVERLY HARBOR (SEGMENT MA93-20)

Location: From the mouth of the Danvers River, Salem/Beverly to Salem Harbor at an imaginary line drawn from Juniper Point, Salem to Hospital Point, Beverly.

Length/area: 1.02 mi<sup>2</sup>

Classification: Class SB.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

### DISCHARGES

#### NPDES (Appendix E, Tables E2 and E3)

MA0100501 South Essex Sewage District has one CSO outfall #003 closed December 1996.

### USE ASSESSMENT

#### *Aquatic Life Use*

##### Eelgrass Bed Habitat

MassDEP's Wetlands Conservancy Program (WCP) identified the presence of eelgrass in Beverly Harbor from historic 1951 black and white aerial photography (Costello 2003). In 1998 MassDEP WCP performed field verification of 1995 aerial photography and mapped the extent of eelgrass bed habitat in Beverly Harbor. Total areal coverage in Beverly Harbor from the 1995 survey was approximately 11% of the harbor. In 2001 MassDEP WCP performed field verification of 2001 aerial photography and mapped the extent of eelgrass bed habitat in Beverly Harbor. There was almost no change in the total coverage of eelgrass beds between 1995 and 2001.

In 1951 there were two areas of eelgrass bed habitat in Beverly Harbor. One area was just south of Lobster Rocks and the second area was continuous along the northern shore of the harbor north of Tuck Point and out into Salem Sound. In 2001 the large continuous bed was relatively unchanged, but the bed near Lobster Rocks was gone. Two additional areas were identified. A DMF survey of Salem Sound conducted trawl sampling at an eelgrass station in Beverly Cove catching 17 species of fish during 18 sampling trips in 1997 (Chase *et al.* 2002). The eelgrass station had the highest fish diversity, decapod diversity, and decapod relative abundance among trawl stations. The eelgrass habitat supported high concentrations of juvenile lobster and rock crab during August and September (Chase 2006c).

##### Biology

Impingement and ichthyoplankton studies have recently been conducted for the Salem Harbor Power Station. Sampling at one location near Tucks Point in Beverly Harbor was conducted as part of that study (MRI and TRC 2004a). Fish egg and larval populations in Beverly Harbor were sampled weekly commencing mid-June 2002 through late September 2002 and in July 2003 (MRI and TRC 2004a). Although the report states that densities of eggs and larvae in inner Salem Harbor and Beverly Harbor were similar, no tables reporting results of Beverly Harbor sampling were included in the report.

The *Aquatic Life Use* is assessed as support based on the general stability of the eelgrass bed habitat.

#### *Shellfish Harvesting Use*

DMF shellfish status of July 2000 indicates that Area N17.0, which comprises this segment area, is prohibited. No changes to the status have been made (Kennedy 2006a).

It should also be noted that Beverly Ferryway Public Landing has a pump-out boat and shoreside facility funded by the Clean Vessel Act to provide free pump-outs (MA DFG 2006c).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing area is prohibited.

#### *Primary and Secondary Contact Recreation and Aesthetics uses*

Weekly testing for *Enterococci* bacteria during the swimming season has been conducted at ten beaches along the shoreline of this segment. These beaches (from north to south) include:

Rice Beach, Beverly - this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported because of elevated *Enterococci* bacteria counts in 2003 (totaling two days).

Lynch Beach, Beverly - this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported because of elevated *Enterococci* bacteria counts in 2004 (totaling seven days).

Woodbury Beach, Beverly - this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported because of elevated *Enterococci* bacteria counts in 2003 (totaling two days) and one posting (totaling one day) in 2004. There were no postings reported in 2002.

Dane Street Beach, Beverly - this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported in 2002, although no follow-up testing was done after September 5th. There were two postings reported because of elevated *Enterococci* bacteria counts in 2003 (totaling ten days). There were no postings reported in 2004.

Independence Park Beach, Beverly - this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported in 2002, although no follow-up testing was done after September 5th. There were two postings reported because of elevated *Enterococci* bacteria counts in 2004 (totaling nine days). There were no postings reported in 2003.

Sandy Point Beach, Beverly - this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported in 2002, although no follow-up testing was done after September 5th. There was one posting reported because of elevated *Enterococci* bacteria counts in 2003 (totaling two days) and one posting (totaling one day) in 2004.

Collins Cove Beach, Salem - this beach was tested weekly during the summers of 2002, 2003, and 2004. There were no postings reported for any of these years.

Dead Horse Beach, Salem - this beach was tested weekly during the summers of 2002, 2003, and 2004. There were no postings reported for any of these years.

Willows Pier Beach, Salem - this beach was tested weekly during the summers of 2002, 2003, and 2004. There were no postings reported for any of these years. This beach was selected as a flagship beach project. It was reported that the "number of samples that exceeded the standard has also been greatly reduced. This improvement can be attributed to the use of best management practices by the city of Salem" (EPA 2006c).







Juniper Point Beach, Salem - this beach was tested weekly during the summers of 2002, 2003, and 2004. There were no postings reported for any of these years.

Postings of beaches along Beverly Harbor have been neither frequent nor prolonged. Of the beaches with postings, Dane Street and Independence Park beaches had the highest number of days posted.

A survey was conducted along the Salem Sound shoreline in April 2004 from which an inventory of observable stormwater outfall pipes 12" or greater in diameter was created (Horsley Witten Group 2005). In an attempt to identify discharges contributing significant bacteria loads to Salem Sound under dry weather conditions (i.e., screening for illicit discharge connections), two rounds of bacteria sampling (5 October and 4 November 2004) were conducted at targeted stormwater discharge pipes. Five pipes were sampled in the Beverly Harbor area. All of the pipes were found to have elevated bacteria counts (Horsley Witten Group 2005).

Beverly Harbor is assessed as support for the *Primary Contact Recreational Use* since the beaches were open for the majority of the three bathing seasons between 2002 and 2004. The *Secondary Contact Recreational* and *Aesthetics* uses are also assessed as support Beverly Harbor based primarily on best professional judgment (beaches open for majority of bathing seasons and the stability of the eelgrass bed habitat which is indicative of good water clarity).

# BEVERLY HARBOR (SEGMENT MA93-20) Use Summary

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Discharges from separate storm sewer systems Suspected sources: Marinas/boating pumpout releases, marinas/boating sanitary on-vessel discharges
Primary Contact		SUPPORT
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

## RECOMMENDATIONS

Implement recommendations in the DMF shellfish management plan for Area N17.0.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking when necessary to help identify undocumented sources. Remediate illicit connections and other problems as identified.

Encourage use of boat pump-out facilities through a public outreach and education program.

Continue to monitor eelgrass bed habitat.

## OUTER SALEM SOUND

The area defined as Outer Salem Sound in this report is illustrated in Figure 16. Segment locations are also depicted.

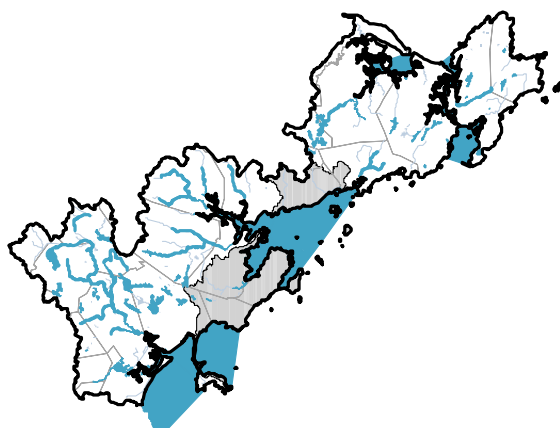
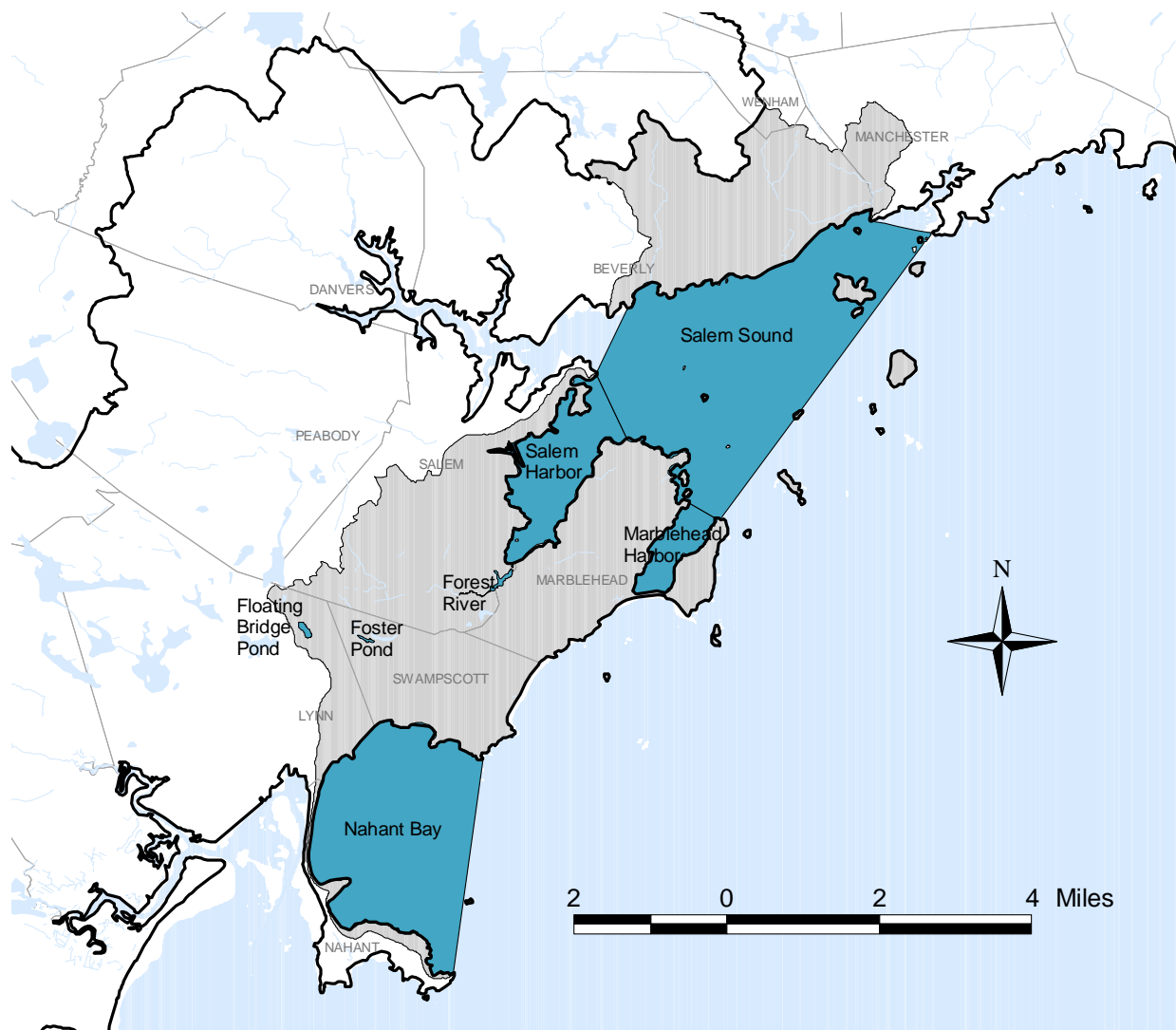


Figure 16. Locations of segments in the Outer Salem Sound Drainage Area.

## FOSTER POND (SEGMENT MA93026)

Location: Swampscott.

Length/area: 5 acres

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pesticides (MassDEP 2005).

### DISCHARGES

#### NPDES (Appendix E, Tables E2 and E3)

MA0001830 Bardon Trimount, Inc. – Swampscott






### USE ASSESSMENT

#### *Fish Consumption Use*

Fish contaminant monitoring was conducted by MassDEP in Foster Pond in October 2002. Edible fillets of two, three-fish composite samples (yellow perch - *Perca flavescens* and American eel - *Anguilla rostrata*) were analyzed for the presence of heavy metals, PCB, and organochlorine pesticides (Appendix D, Table D1). Mercury concentrations were well below the MA DPH trigger level of 0.5 mg/kg in the two samples analyzed, but a predatory species was not collected (worst case condition for mercury was not represented) (Maietta *et al.* 2004). Trace concentrations of PCB Congeners (BZ#s118, 114, 105, 156, 157, 180, and 170), Arochlor 1260, and DDT (and its metabolites DDE - dichlorodiphenyldichloroethylene and DDD - dichlorodiphenyldichloroethane) were detected in fish from Foster Pond, although four of twelve results were qualified as "Estimated value-concentration < reporting detection limit (RDL) or certain criteria not met." It should be noted that due to the very high levels of lipids (16%) in the American eel sample these data can be considered worst-case for PCB and organochlorine pesticides (Maietta *et al.* 2004). Concentrations do not appear to be indicative of an ongoing source of these contaminants, but it is feasible that these contaminants may have resulted from historic household use of pesticides in proximity to the pond or other potential pollution sources identified in the request for sampling (Maietta *et al.* 2004). The original request for the fish toxics monitoring lists a number of potential sources of contamination including: the NPDES discharger (the quarry), a junkyard, and several superfund sites. It is unclear whether any of these sites are a source of PCB or organochlorine pesticides. MA DPH reviewed these data and issued the following site-specific fish consumption advisory: "Children under 12, pregnant women, nursing mothers, and women of childbearing age who may become pregnant should refrain from consuming any American eel from Foster Pond to prevent exposure of developing fetuses, nursing infants and young children to DDT" and "the general public should not consume any American eel caught from Foster Pond" (MA DPH 2005a).

The *Fish Consumption Use* is assessed as impaired because of the site-specific fish consumption advisory to prevent exposure to DDT.

FOSTER POND (SEGMENT MA93026) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		IMPAIRED Cause: DDT Source: Unknown
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

**RECOMMENDATIONS**

Since the fish toxics monitoring represented what is considered by DWM biologists as worst-case scenario and only trace levels of organochlorine pesticides were detected, no additional fish toxics monitoring is deemed necessary.

The NPDES permit MA0001830 for Bardon Trimount, Inc. in Swampscott will need to be reissued. Review their Best Management Practices Plan and determine the need for any additional monitoring/permitting requirements.



## FOREST RIVER (SEGMENT MA93-10)

Location: Approximately 0.4 miles upstream from Loring Avenue, Salem to Salem Harbor, Salem.

Length/area: 0.03 mi<sup>2</sup>

Classification: Class SA.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of organic enrichment/low DO and pathogens as well as flow alteration\* and other habitat alteration\* (MassDEP 2005). [\*Note: this impairment is not a pollutant requiring the development of a TMDL.]

### WITHDRAWALS AND DISCHARGES

#### WMA (Appendix E, Table E1)

Tedesco Country Club registration (31816801).

#### NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### *Aquatic Life Use*

##### Habitat and flow

There are tide gates at the mouth of the Forest River near Route 114 in Salem that have been in operation for over 70 years and have restricted tidal flushing in the river. DMF biologists visited the Forest River several times during the spring of 1994 to look for smelt egg deposition and in 1997 to sample water of Salem Sound tributaries. In comparison to surveys conducted in 1990, the range and densities of *Phragmites* sp. near the tidal interface had increased markedly so that by 1997 no passage of adult smelt was possible through the dense reeds. The *Phragmites* sp. roots in this stretch were trapping sediment and detritus, resulting in reduced water velocity. This stretch of habitat had clearly degraded from 1990 to 1997, further reducing the likelihood of supporting a smelt run. The encroachment of reeds in the stream channel and related reduction of freshwater flow velocity offered little attraction for spawning smelt and may also have prevented upstream passage (Chase 2006a). In the late 1990s the City of Salem reportedly reduced the closures of the tidegates in order to improve tidal flushing in the Forest River estuary. The effectiveness of this program is not known at this time but warrants further investigation.

##### Water Chemistry

Sampling was conducted by DWM staff in the Forest River at Loring Avenue in Salem (W0885) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Tables 7 and 8).

In-stream DO concentrations ranged from 4.3 to 8.7 mg/L, while saturations ranged from 55 to 95%. Over half of the measurements taken did not meet water quality standards (i.e., 6.0 mg/L DO and/or 75% saturation). All but one of these measurements represented pre-dawn (worst-case) conditions. This sampling station was tidally influenced with conductivities ranging from 3,540 to 48,680  $\mu$ S/cm. Evidence of diurnal fluctuations may be indicative of primary productivity; these data did not appear to correlate with a particular tidal cycle (i.e., low DO/% saturations were found during a variety of tidally conditions). All other *in-situ* measurements (e.g., pH, temperature) met water quality standards. Total suspended solids concentrations were low (all measurements < 17 mg/L).

The *Aquatic Life Use* is support based on the *in-situ* water quality data and best professional judgment. This use is identified with an Alert Status, however, because of low DO/%saturation although it is best professional judgment that these conditions are natural. Changes in habitat resulting from increased tidal flushing due to improved tidegate openings are also unknown at this time

#### *Shellfish Harvesting Use*

No shellfish growing area is identified/classified by DMF so this use is not assessed.

#### *Primary and Secondary Contact Recreation and Aesthetics uses*

Bacteria sampling was conducted by DWM staff in the Forest River at Loring Avenue in Salem (W0885) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8).

Fecal coliform bacteria counts ranged from 10 to 850 cfu/100 mls with a geometric mean of 62 cfu/100 mls. These met the standard of 200 cfu/100 mls and 1,000 cfu/100 mls for primary and secondary contact recreation, respectively.

Field observations were made by DWM personnel during the surveys conducted in the Forest River between May and September 2002. With the exception of occasional fishy odor and one day when the water was described as highly cloudy, no other objectionable conditions (deposits, oils, turbidity) were noted during any of the surveys (Station FR01A) (MassDEP 2002a).







Weekly testing for *Enterococci* bacteria during the swimming season has been conducted at two beaches along the shoreline of this segment. The beaches include:

Pickman Beach, Salem – this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported because of elevated *Enterococci* bacteria counts in 2002 (totaling 21 days) and two postings reported (totaling eight days) in 2004. There were no postings reported in 2003. This beach is located along the northern shore of a cove. It is best professional judgment that this area is not very well flushed nor is it necessarily representative of the Forest River.

Mackey Beach, Salem – this beach, located near the mouth of the Forest River, was tested weekly during the summers of 2002, 2003, and 2004. There were no postings reported.

The *Primary* and *Secondary Contact Recreational* and *Aesthetics* uses are assessed as support based on the low bacteria levels documented by DWM during the 2002 surveys and the lack of beach postings at Mackey Beach. Although not considered well-representative of the Forest River, the *Primary Contact Recreational Use* is identified with an Alert Status because of the prolonged historical beach postings at Pickman Beach.

FOREST RIVER (SEGMENT MA93-10) Use Summary

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

\*Alert Status issues identified, see details in use assessment section

## RECOMMENDATIONS

Chase (2006a) recommends that the tidegates near the mouth of Forest River should be operated to maximize tidal flushing in order to benefit the overall ecology of the Forest River.

Reconnaissance should be conducted to evaluate infestation of *Phragmites* sp. and whether or not changes in tidegate operations are improving tidal flushing and habitat.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as needed particularly in the vicinity of Pickman Beach to help identify undocumented sources.

Additional water quality monitoring should be conducted in the Forest River to better evaluate DO/%saturation and nutrient conditions (including chlorophyll *a*, nitrogen and phosphorus data analyzed with appropriate methods).

## SALEM HARBOR (SEGMENT MA93-21)

Location: The waters landward of an imaginary line between Cloutman Point, Marblehead and Juniper Point, Salem; excluding Forest River.

Length/area: 1.73 mi<sup>2</sup>

Classification: Class SB.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

### DISCHARGES

#### NPDES (Appendix E, Tables E2 and E3)

MA0005096 Dominion Energy Salem Harbor, LLC (formerly USGenNE and New England Power Salem Station) Outfalls #001, 006, 005 and 007, 014, and 015. This facility will be referred to as the Salem Harbor Power Station.

### OTHER

US Army Corps of Engineers Navigation Project SALEM HARBOR (6th CD) states the following (USACOE 2006): *"Maintenance dredging of the existing federal navigation project, including 32-foot main channel and the shallow draft channels at Derby Wharf and the entrance to the South River will require dredging of about 200,000 cy of shoal material. Testing has determined this material is suitable for unconfined open water disposal in Massachusetts Bay. All federal and state regulatory approvals including water quality certification (WQC) and MACZM consistency concurrence have been received. An environmental assessment and finding of no significant impact were signed in July 2003. A review of water and sewer line elevations indicates there are no problems with utility crossings beneath the channel. Plans and specifications for the work are complete. Work will be conducted when funds become available. Shoal materials from the upper reaches of the federal South River channel, and other nonfederal areas in Salem Harbor were shown to be unsuitable for unconfined open water disposal. These areas are not proposed for dredging at the present time. The MACZM had been preparing a draft DMMP for unsuitable dredged materials for Salem Harbor, including the South River channel and numerous municipal and private dredging projects. However, that study has been deferred by the state, pending resolution of harbor development issues and regional disposal considerations."*

### USE ASSESSMENT

#### Aquatic Life Use

##### Eelgrass Bed Habitat

MassDEP's Wetlands Conservancy Program (WCP) did not identify the presence of any eelgrass in Salem Harbor from historic 1951 black and white aerial photography (Costello 2003). In 1998 MassDEP WCP performed field verification of 1995 aerial photography and mapped the extent of eelgrass bed habitat in Salem Harbor. Total areal coverage of Salem Harbor from the 1995 survey was approximately 9% of the harbor. In 2001 MassDEP WCP performed field verification of 2001 aerial photography and mapped the extent of eelgrass bed habitat in Salem Harbor. There was loss (over 80%) in the total coverage of eelgrass beds between 1995 and 2001.

There is a continuous eelgrass bed in the harbor along the shoreline from Folger Point to Cloutman Point. Two additional small areas of eelgrass east of Long Point and the Derby Wharf Light were also identified.

##### Habitat and Flow

Water is withdrawn from Salem Harbor for use as cooling water at the Salem Harbor Power Station at an onshore intake. The intake for cooling water for the Salem Harbor Power Station is 18 feet below the surface and has no sill to prevent bottom-dwelling organisms from becoming impinged or entrained (Callaghan 2006). There are four units and each unit has two, single speed, circulating water system pumps individually fitted with a trash rack and a conventional 3/8-inch traveling water screen. The velocity across the intake screen is estimated to be 2.0 ft/sec (well above the 0.5 ft/sec required in EPA's Phase II Rule) (Callaghan 2006). It is unknown if this intake velocity is accurate during all tidal stages and sediment conditions at maximum operational flow.

The screens operate continuously if the pump is in service. Impinged organisms are washed from each pair of screens by a high-pressure wash to remove debris and impinged organisms. This is problematic

because impinged fish can be injured by high-pressure wash. High-pressure washes should be preceded by a low-pressure wash at pressures designed to gently rinse impinged fish and other organisms from the screens. There are currently two fish return systems (one serving Units 1 & 2, and one serving Units 3 & 4) (Faggert 2005). The fish return serving Units 1 & 2 currently discharge directly in front of the intake structure following a drop of 5 to 15 feet. This is not best available technology for a fish return system and potentially injures small or otherwise sensitive fish that have already been stressed from impingement. In addition, release of already-stressed fish at a point in front of the intake promotes their re-impingement. The fish return serving Units 3 & 4 is located into the warmest portion of the condenser cooling-water discharge (Faggert 2005). Sodium hypochlorite for biofouling control is also injected (up to 2 hours per day) in front of the traveling screens for Units 1, 2, & 3 and behind the traveling screen for Unit 4. The flow capacities for Units 1, 2, 3, & 4 are 129.3, 129.3, 145.4, and 229.4 MGD, respectively (NEPC 1974).

### Biology

A DMF survey of Salem Sound conducted trawl sampling in Salem Harbor catching 25 species of fish during 18 sampling trips in 1997 (Chase *et al.* 2002). Despite the homogenous structure of the muddy harbor bottom, this station had the highest fish species richness and relative abundance among trawl stations. Relatively high densities of young-of-the-year winter flounder recruited to this habitat in the fall and adult skate were common in the warmer months (Chase 2006c). The fish richness, diversity and relative abundance showed little change from work in the 1960s and 1970s, with the glaring difference that fewer adult winter flounder and a large increase in adult skate were recorded (Chase 2006c).

Impingement and ichthyoplankton studies have recently been conducted for the Salem Harbor Power Station. During this sampling period (mid-July 2000 to June 2003) the Salem Harbor Power Station was estimated to be operating at flows between 32 and 75% capacity (MRI and TRC 2004b).

### *Impingement*

Intensive impingement sampling (three times per week) commenced in mid-July 2000 and continued through June 2003 (MRI and TRC 2004a). The total number of fish collected during the intensive impingement sampling was 1,977 individual fish representing 40 species (MRI and TRC 2004a). From these data, an estimated total of 29,000 fish were impinged at the Salem Power Station between July 2000 and June 2003. Dominant fish species, which represented 76% of the total number of fish collected during impingement sampling, included Atlantic menhaden (*Brevoortia tyrannus*), grubby (*Myoxocephalus aeneus*), winter flounder (*Pseudopleuronectes americanus*), and little skate (*Leucoraja erinacea*).

A total of sixteen species of invertebrates was also impinged. While no actual counts were provided, an estimated total of 104,387 individual invertebrates were impinged at the Salem Power Station between July 2000 and June 2003. Dominant species collected during impingement sampling included the green crab - *Carcinus maenas* (an estimated 37,445 individuals), blue mussel - *Mytilus edulis* (25,362), seven-spine bay shrimp - *Crangon septemspinosa* (17,905), rock crab - *Cancer irroratus* (11,587), and American lobster - *Homarus americanus* (2,458). These represent 36, 24, 17, 11, and 2%, respectively, of the estimated total of all impinged invertebrates.

### *Entrainment*

Fish egg and larval populations were sampled at a total of six stations including the plant intake (Station A), inner Salem Harbor (Station 1), outer Salem Harbor (Station 2), Beverly Harbor (Beverly), and two stations in Salem Sound - north of Great Haste Island in Salem Channel (Station 9), and just north of Chappel Ledge (Station 10). Weekly sampling at these sites was conducted during the months of March through September commencing mid-July 2000, and at approximately 2-week intervals during October through February, continuing through July 2003 (MRI and TRC 2004a). Ichthyoplankton sampling was also conducted in the Salem Harbor Power Station discharge canal approximately 100m from the discharge headwall. Sampling in the discharge canal was conducted three times per week, once in the morning, once in the afternoon, and once at night every week during the months of March through September and twice per month October through February beginning in August 2000 and ending in July 2003. One day each week sampling (duplicate) in the discharge canal was conducted at the same time as the intake (Station A).

The numbers of fish eggs and larvae entrained at the Salem Harbor Power Station were estimated by integrating species-specific densities over time after multiplying densities by plant flow. Totals were determined using estimated monthly mean plant flow as well as the maximum flow capacity of the Salem Harbor Power Station (MRI and TRC2004b).

A total of 47 species of fish eggs and/or larvae was collected during the 2001-2003 entrainment study (MRI and TRC 2004a). Entrainment estimates for this three-year period indicate that for seven selected species over 10 billion eggs and 145 million larvae were entrained at Salem Power Station (Table 1) (Scherer 2006). Equivalent adult analyses were also conducted for seven key species including Atlantic menhaden, Atlantic herring, Atlantic cod, tautog, cunner, Atlantic mackerel, and winter flounder. Estimates of total numbers of eggs and larvae of some other fish species (sand lance, silver hake, red/white hake, windowpane, American plaice, and Yellowtail flounder) entrained at Salem Power Station were over 474 million eggs and 176 million larvae (Table 2).

Table 1. Estimated total numbers of eggs and larvae of seven key species of fish entrained during average plant flows (approx. 32 to 75% capacity) at Salem Harbor Power Station during the 2001 – 2003 entrainment study (Scherer 2006 and MRI and TRC 2004a).

Species	Eggs	Eggs (% of total)	Larvae	Larvae (% of total)*
<b>Atlantic menhaden</b> <b>(<i>Brevoortia tyrannus</i>)</b>	8,310,748	0.08%	822,542	0.11%
<b>Atlantic herring</b> <b>(<i>Clupea harengus</i>)</b>			16,248,962	2.08%
<b>Atlantic cod</b> <b>(<i>Gadus morhua</i>)</b>	38,272,517	0.36%	8,433,063	1.08%
<b>Labridae</b>	9,725,689,121	91.29%		
<b>Tautog</b> <b>(<i>Tautoga onitis</i>)</b>			823,426	0.11%
<b>Cunner</b> <b>(<i>Tautoglabrus adspersus</i>)</b>			99,586,913	12.75%
<b>Atlantic mackerel</b> <b>(<i>Scomber scombrus</i>)</b>	370,802,835	3.48%	341,373	0.04%
<b>Winter flounder</b> <b>(<i>Pseudopleuronectes americanus</i>)</b>	40,938,407	0.38%	19,489,945	2.49%
Seven selected species total	10,184,013,628	95.59%	145,746,224	18.65%
Total estimated entrainment (47 species represented)	10,653,544,977		781,327,887	

Table 2. Estimated total numbers of eggs and larvae of other species of fish entrained during average plant flows (approx. 32 to 75% capacity) at Salem Harbor Power Station during the 2001 – 2003 entrainment study (Scherer 2006).

Species	Eggs	Eggs (% of total)	Larvae	Larvae (% of total)*
Sand lance ( <i>Ammodytes</i> sp.)	0	0%	169,051,078	21.64%
Silver hake ( <i>Merluccius bilinearis</i> )	475,306	0.004%	290,829	0.04%
Red/White hake ( <i>Urophycis</i> sp.)	475,306	0.004%	290,829	0.04%
Windowpane ( <i>Scophthalmus aquosus</i> )	260,724,819	2.45%	4,911,998	0.63%
American plaice ( <i>Hippoglossoides platessoides</i> )	48,277,159	0.45%	1,374,414	0.18%
Yellowtail flounder ( <i>Limanda ferruginea</i> )	164,831,701	1.55%	670,147	0.09%
Additional species total	474,784,291	4.46%	176,589,295	22.60%

### Water Chemistry

Salem Harbor Power Station discharges result in surface warming of Salem Harbor waters typically in the range of 1-4 °C depending on location and tide stage (Chase *et al.* 2002). Little evidence was found of warming extending more than a few meters of depth in the water column (Chase 2006c).

The *Aquatic Life Use* is assessed as impaired for Salem Harbor based on the significant loss of eelgrass bed habitat that occurred during the 1995 to 2001 period. Impacts associated with the Salem Harbor Power Station are also of concern, although no definitive impact statement can be made at this point. These issues include: impingement and entrainment; the location of the intake on the bottom puts bottom-dwelling fish at risk (i.e., a significant number of winter flounder were impinged); fish return systems are poor; injection of sodium hypochlorite for biofouling control in front of Units 1, 2, & 3 contributes additional stress on organisms. Impingement and entrainment effects were evaluated during periods when plant flows were lower than the maximum allowed, so increased plant operations would exacerbate these effects. Other concerns expressed by DMF biologists for Salem Harbor include stormwater contributions from the South River (bacterial, sediment, and nutrients), high boat slip and mooring densities (boat related pollutants), and the surface water warming from the power plant. Chase (2006c) indicated that there were some data in the 1997 Salem Sound study that support these concerns, but not enough to define the problem.

### **Shellfish Harvesting Use**

DMF shellfish status of July 2000 indicates that areas N18.0, N18.1, and N19.0, which comprises this segment area, are prohibited. No changes to the status have been made (Kennedy 2006a).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing areas are prohibited.

### **Primary and Secondary Contact Recreation and Aesthetics uses**

Weekly testing for *Enterococci* bacteria during the swimming season has been conducted at ten beaches along the shoreline of this segment. These beaches (from northern most shore and around the harbor) include:

Steps Beach, Salem - this beach was tested weekly during the summers of 2002, 2003, and 2004.

There was one posting reported because of elevated *Enterococci* bacteria counts in 2002 (totaling one day).

Winter Island (Waikiki) Beach, Salem - this beach was tested weekly during the summers of 2002, 2003, and 2004 – there were no postings reported for any of these years.

Willow Avenue Beach, Salem - this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported because of elevated *Enterococci* bacteria counts in 2002 (totaling 29 days) and seven postings reported in 2004 (totaling 35 days). There were no postings reported in 2003.

Ocean Avenue Beach, Salem - this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported because of elevated *Enterococci* bacteria counts in 2004 (totaling seven days). There were no postings reported in 2002 and 2003.

Pioneer Beach, Salem - this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported because of elevated *Enterococci* bacteria counts in 2002 (totaling three days). There were no postings reported in 2003 and 2004.

Forest River Point Beach, Salem - this beach was tested weekly during the summers of 2002, 2003, and 2004. There were no postings reported for any of these years.

Osgood Beach, Salem - this beach was tested weekly during the summers of 2002, 2003, and 2004 – there were no postings reported for any of these years.

Village Street Beach, Marblehead - this beach was tested weekly during the summers of 2003 and 2004. There were no postings reported for these years.

Sunset Road Beach, Marblehead - this beach was tested weekly during the summers of 2002, 2003, and 2004. There were no postings reported for any of these years.







Stramski Beach, Marblehead - this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported because of elevated *Enterococci* bacteria counts in 2002 (totaling three days), two postings reported in 2003 (totaling three days), and six postings reported in 2004 (totaling 54 days).

With the exception of two beaches, Willow Avenue Beach in Salem and Stramski Beach in Marblehead, postings of other the eight beaches along Salem Harbor have been neither frequent nor prolonged. Postings were frequent and/or prolonged at both Willow Avenue and Stramski beaches.

A survey was conducted along the Salem Sound shoreline in April 2004 from which an inventory of observable stormwater outfall pipes 12" or greater in diameter was created (Horsley Witten Group 2005). In an attempt to identify discharges contributing significant bacteria loads to Salem Sound under dry weather conditions (i.e., screening for illicit discharge connections), two rounds of bacteria sampling (5 October and 4 November 2004) were conducted at targeted stormwater discharge pipes. Nine pipes were sampled in the Salem Harbor area. One of the pipes was found to have very high bacteria counts and three others also had elevated counts (Horsley Witten Group 2005). One of the pipes was near Stramski Beach.

The *Primary Contact Recreational Use* is assessed as impaired because two of the ten bathing beaches, Willow Avenue and Stramski, had frequent/prolonged beach closures in both 2002 and 2004. The other bathing beaches along the Salem Harbor shoreline were open for most of the 2002, 2003, and 2004 bathing beach seasons. The *Secondary Contact Recreational Use* is assessed as support based on the beach closure information and best professional judgment. The *Aesthetics Use* is not assessed.

SALEM HARBOR (SEGMENT MA93-21) Use Summary

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Loss of eelgrass bed habitat (an estuarine bioassessment) Source: Unknown Suspected sources: Discharges from separate storm sewer systems, surface water warming from the power plant
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Discharges from separate storm sewer systems Suspected sources: Marinas/boating pumpout releases, marinas/boating sanitary on-vessel discharges
Primary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Discharges from separate storm sewer systems
Secondary Contact		SUPPORT
Aesthetics		NOT ASSESSED

\*Alert Status issues identified, see details in use assessment section

## RECOMMENDATIONS

Dominion Energy's Salem Harbor Power Station discharges once-through cooling water to Salem Harbor. Aquatic resources (fish, shellfish, etc.) within receiving waters may be susceptible to the impacts of the cooling water intake and the discharge. Additional monitoring should be implemented and results provided to the regulatory agencies to identify possible impacts. During the next permit review, additional data collection/monitoring should be required of the power plant. [Note: There already is a proposal for entrainment sampling]. This facility is currently conducting environmental monitoring in accordance with the US EPA's Final Rule for Phase II Facilities – Cooling Water Intake Structures (Section 316(b) of the Clean Water Act. For example, Dominion recently (March 2006) proposed a plan to collect ichthyoplankton and entrainment data. Dominion felt that its existing impingement data was sufficient to meet the Phase II Rule requirements. Dominion proposed to sample for entrained larvae and eggs at the headwall to the discharge and at five locations in Salem Sound. CZM disagreed with the headwall



location, suggesting instead that a valve-actuated ball tap be used (similar to the one used at Mystic Station) to collect entrained organisms directly from the cooling water.

In general MassDEP DWM recommends that all once-through cooling water power plant operators in the Commonwealth be required to provide the following:

A “*Fact Sheet*” detailing the physical information of the facility should be available to the permitting authorities. This *Fact Sheet* should be updated when any changes are implemented at the facility and should include the following.

1. Cooling water use schematic including location of intake(s) and discharge(s).
2. Intake structure design information for each unit such as the presence of a sill to limit the intake of benthic species, a description of the sill maintenance program.
3. Pump information including number, types, estimated and measured velocities across screens under all (high, mid, and low) tidal or flow conditions.
4. Intake screen information including screen type, mesh size, screen rotation ability and rotation frequency used at the facility, screen wash mechanisms for removing debris and impinged organisms including pressures used in each.
5. Schematic of fish return system and operational description including horizontal angles of all nonlinear portions of the return pipe, vertical angle of return (i.e., where is return in relationship to the receiving waterbody). For a tidally influence facility does the fish return system empty beneath the water column at all tides? Provide fish return discharge locations for each unit.
6. Discharge structure design including estimated and/or measured velocities under all (high, mid, and low) tidal or flow conditions, and barrier net location(s) where applicable.
7. Description of any condensor biofouling program including the chemical, location of injection units relative to the intake screens, frequency of biofouling treatments, and sequencing [if any] of biofouling treatments in different electrogenerating units.

As part of either the NPDES permit or a 401 Water Quality Certification certain data collection/monitoring should be required to identify possible impacts of the facility on the waterbody. In general MassDEP recommends that all power plants that utilize once-through cooling water in the Commonwealth collect the following types of information on a continuing basis and have this information transcribed to a database or spreadsheets.

- Hourly cooling water flow at each intake.
- Hourly average intake and discharge temperatures.
- Weekly impingement monitoring (one 8 hour sample collected three times per week; each sample should be collected during a different 8-hour period such that over the course of one-week, each 8-hour period in the 24-hour diurnal cycle is sampled (i.e., 1200 to 0800 hrs, 0800 to 1600 hrs, and 1600-2400 hrs). Permittee should identify and report all fish species and resident important invertebrates [based on past 316a&b studies] impinged with annual estimates of impingement numbers at monthly average and permitted flows.
- Weekly entrainment monitoring (three times per week needed to track entrainment of eggs, larvae and early-stage juveniles of resident important species) and reporting with annual estimates of numbers of entrained eggs, larvae and juveniles of resident important species [based on past 316 a&b studies] at monthly average and permitted flows (all entrainment estimates should be based on samples collected from inside the intake structure and should be collected in a manner which is representative of the entire water column).
- Fish kill monitoring and reporting.
- Annual reports of all monitoring results should be submitted to the permitting authorities.

A technical advisory committee of scientists from the regulators agencies in conjunction with Dominion’s consulting scientists should review the results of the annual monitoring report, direct the analysis of all monitoring data (e.g., require Equivalent Adult Analyses or other modeling or assessment methods), determine whether or not any modifications need to be made to the sampling program, evaluate the need for requiring Best Available Technologies (BAT) at the facility to reduce impact(s) to the receiving waterbody, and to make any other recommendations necessary to protect against the creation of habitat, due to the plant’s operations (in combination with other pollutants and/or conditions of the waterbody), that is not healthful to aquatic life in the waterbody from which intake waters are drawn and/or into which heated water is discharged.

MassDEP has the following recommendations for Dominion Energy to mitigate unnecessary impacts from the Salem Harbor's cooling water intake structure and discharge:

- Redesign of the return sluices and screen systems to ensure that 1) species are returned to the surface or subsurface at all tides, 2) low pressure spray is used to remove impinged organisms, 3) no chlorination of screens when pumps are on, 4) the sluices have smooth interiors and no sharp angles that would injure fish, 5) the screens have Ristroph-type fish buckets.
- Installation of a sill on the bottom of the intake to prevent bottom-dwelling organisms from entering. Maintain the area in front of the intake to ensure that sediments have not decreased the open area of the intake.
- Injection location of sodium hypochlorite for biofouling control for Units 1, 2, & 3 should be moved to behind the traveling screens. Simultaneous biofouling controls for the units should not be allowed--units should be treated sequentially.
- Add sand lance to the list of key fish species for entrainment evaluations. Provide detailed catch rate and size data for all impinged diadromous species recommended by (Chase 2006).

Continue to monitor eelgrass bed habitat in Salem Harbor.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as needed particularly in the vicinity of Willow Avenue Beach in Salem and Stramski Beach in Marblehead.

Implement recommendations in the DMF shellfish management plan for areas N18.0, N18.1, and N19.0.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Encourage use of boat pump-out facilities through a public outreach and education program.

## MARBLEHEAD HARBOR (SEGMENT MA93-22)

Location: The waters landward of an imaginary line drawn northwesterly from the northern tip of Marblehead Neck to Fort Sewall, Marblehead.

Length/area: 0.56 mi<sup>2</sup>

Classification: Class SA.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### *Aquatic Life Use*

##### Eelgrass Bed Habitat

MassDEP's Wetlands Conservancy Program (WCP) identified the presence of eelgrass in Marblehead Harbor from historic 1951 black and white aerial photography (Costello 2003). In 1998 MassDEP WCP performed field verification of 1995 aerial photography and mapped the extent of eelgrass bed habitat in Marblehead Harbor. Total areal coverage of Marblehead Harbor from the 1995 survey was approximately 7% of the harbor. In 2001 MassDEP WCP performed field verification of 2001 aerial photography and mapped the extent of eelgrass bed habitat in Marblehead Harbor. There has been loss (over 50%) of the total coverage of eelgrass beds between 1995 and 2001.

In 1951 there was one eelgrass bed along the innermost area of the harbor near Ladys Cove. Although the eelgrass bed identified in 2001 in this same area had decreased in size somewhat, a second area of eelgrass bed habitat was identified along the shoreline as far out as Boden Point. A very small patch of eelgrass bed habitat was also identified just offshore north of Jack Point.

The *Aquatic Life Use* is not assessed for Marblehead Harbor. This use is identified with an Alert Status because of the loss of eelgrass bed habitat. However, it only represents a small portion of the segment area.

#### *Shellfish Harvesting Use*

DMF shellfish status of July 2000 indicates that Area N20.0, which comprises this segment area, is prohibited. No changes to the status have been made (Kennedy 2006a).

The Cliff Street Boatyard in Marblehead has a pump-out boat and a shoreside facility funded by the CVA to provide free pump-outs (MA DFG 2006c).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing area is prohibited.







#### *Primary and Secondary Contact Recreation and Aesthetics uses*

Weekly testing for *Enterococci* bacteria during the swimming season has been conducted at Crocker Park Beach along the shoreline of this segment. No postings have been reported in the 2002, 2003, or 2004 bathing seasons. There is one beach, Riverside Beach, in the southwestern corner of the Marblehead Harbor segment. Bacteria results from this beach are not being reported under the "Beaches Bill".

A survey was conducted along the Salem Sound shoreline in April 2004 from which an inventory of observable stormwater outfall pipes 12" or greater in diameter was created (Horsley Witten Group 2005). In an attempt to identify discharges contributing significant bacteria loads to Salem Sound under dry weather conditions (i.e., screening for illicit discharge connections), two rounds of bacteria sampling (5 October and 4 November 2004) were conducted at targeted stormwater discharge pipes. Three pipes were sampled in the Marblehead Harbor area. One pipe was found to have very high bacteria counts (Horsley Witten Group 2005). This pipe is near Riverside Beach.

Only limited data are available so the *Primary and Secondary Contact Recreational and Aesthetics* uses are not assessed.

### MARBLEHEAD HARBOR (SEGMENT MA93-22) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Discharges from separate storm sewer systems Suspected sources: marinas/boating pumpout releases, marinas/boating sanitary on-vessel discharges
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

\*Alert Status issues identified, see details in use assessment section

#### RECOMMENDATIONS

Implement recommendations in the DMF shellfish management plan for Area N20.0.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking when necessary to help identify unknown sources. Remediate illicit connections and other problems as identified (e.g., pipe near Riverside Beach).

Encourage use of boat pump-out facilities through a public outreach and education program.

Continue to monitor eelgrass bed habitat.

## **SALEM SOUND (SEGMENT MA93-25)**

Location: The waters landward of an imaginary line between Gales Point, Manchester and the Marblehead Lighthouse on Marblehead Neck, Marblehead; excluding Marblehead, Salem, Beverly, and Manchester harbors, and Chubb Creek.

Length/area: 8.03 mi<sup>2</sup>

Classification: Class SA.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

Smelt spawning in Chubb Creek (a direct tributary to Salem Sound along the Manchester/Beverly town lines just outside of Manchester Harbor) was limited to a small area just downstream from the Route 127 culvert. Chubb Creek was found to be one of the smaller active smelt runs in the area (Chase 2006a). Repairs were made to the Route 127 culvert that may have improved passage to riffle areas upstream from Route 127. However, no egg deposition was observed in the stone-lined pool habitat created during construction downstream from the culvert. Smelt spawning in Chubb Creek should continue to be monitored and modifications to restore habitat should be evaluated.

## **DISCHARGES**

### **NPDES (Appendix E, Tables E2 and E3)**

MA0100501-- South Essex Sewerage District WWTP (SESD) (Note: This facility was the recipient of the 2005 EPA New England Exemplary Performance Award).

MA0100871-- Manchester By-The-Sea WWTP (discharges to Manchester Bay in Salem Sound near Sauli Rock).

## **USE ASSESSMENT**

### ***Aquatic Life Use***

#### **Eelgrass Bed Habitat**

MassDEP's Wetlands Conservancy Program (WCP) identified the presence of eelgrass in Salem Sound from historic 1951 black and white aerial photography (Costello 2003). In 1998 MassDEP WCP performed field verification of 1995 aerial photography and mapped the extent of eelgrass bed habitat in Salem Sound. Total areal coverage of Salem Sound from the 1995 survey was approximately 8% of the sound. In 2001 MassDEP WCP performed field verification of 2001 aerial photography and mapped the extent of eelgrass bed habitat in Salem Sound. There was almost no change (<15%) in the total coverage of eelgrass beds between 1995 and 2001.

In 1951 there were three eelgrass beds along the northern shore of Salem Sound: one extended from Rices Beach to Smith Point, the second sizeable area was between West Beach and Great Misery Island, and the third area extended out from the mouth of Manchester Harbor. The eelgrass bed identified in 2001 near the mouth of Manchester Harbor had decreased in size somewhat. However, eelgrass bed habitat extended from between Rices Beach to West Beach/Great Misery Island and several additional areas along the northern Marblehead shoreline (near Fluen and Dolliber Points) and an area between Great and Little Misery Islands were also identified in 2001.

#### **Biology**

A DMF survey of Salem Sound conducted trawl sampling outside of Marblehead Harbor and in Haste Channel during 18 sampling trips in 1997 (Chase *et al.* 2002). The Marblehead Harbor station was the deepest station with coolest bottom water. Eighteen species of fish were caught at this station with the lowest relative abundance for fish and second highest diversity. The catch composition along the muddy bottom Haste Channel was similar to Salem Harbor. The relative abundance was second highest among trawl stations and was dominated by juvenile winter flounder and adult skate (Chase 2006c).

#### **Toxicity**

##### ***Ambient***

The Manchester WPCF staff collected water from Salem Sound near Sauli Rock in the vicinity of the outfall pipe for use as dilution water in the facility's whole effluent toxicity tests (Sibbalds 2006). Between March 2000 and September 2004, survival of *M. bahia* exposed (48 hours) to water from Salem Sound

ranged from 95 to 100% (n=10). Between March 2000 and September 2005 survival of *M. beryllina* exposed (48 hours) ranged from 93 to 100% (n=12)(TOXTD database).

#### *Effluent*

Acute whole effluent toxicity tests were conducted on the SEDS effluent. Acute toxicity was detected in four of 29 *M. bahia* test events conducted between February 1999 and April 2006. The LC<sub>50</sub>s ranged from 71.8 to 95.6% effluent in the four acutely toxic events – February 1999, February 2000, February 2004 and August 2004. Acute toxicity was detected in eight of 30 *M. beryllina* test events conducted between February 1999 and April 2006. The LC<sub>50</sub>s ranged from 51.8 to 99.9% effluent in the eight acutely toxic events – April 1999, August 1999, two tests in August 2002, February 2004, August 2004, August 2005, and April 2006. *M. beryllina* were always the more sensitive of the two test species when concurrent tests were run.

Acute whole effluent toxicity tests were conducted on the Manchester WWTP effluent. Acute toxicity was not detected by either *M. bahia* or *M. beryllina* in the tests conducted between March 2000 and September 2005 (n=10 and 12 tests, respectively). The LC<sub>50</sub>s were all reported as >100% and all met the LC<sub>50</sub>>50% permit limit (TOXTD database).

#### Water Chemistry

The DMF survey of Salem Sound measured surface and bottom water chemistry at six subtidal stations during 18 visits during 1997 (Chase *et al.* 2002). No violations of class SA criteria for dissolved oxygen were found. The outer Sound benefited from the flushing associated with shallow depth and high tidal amplitude. Evidence of degrading water quality was primarily associated with proximity to the SEDS outfall and wet-weather flows in Salem Sound tributaries (Chase 2006c).

The *Aquatic Life Use* is assessed as support for Salem Sound based primarily on the stability of the eelgrass bed habitat and the survival of test organisms exposed to water from Salem Sound. The presence of acute whole effluent toxicity in the SEDS effluent is of concern.

#### **Shellfish Harvesting Use**

DMF shellfish status of July 2000 indicates that areas N15.0, N16.0, and N19.0, which comprise this segment area, are prohibited. No changes to the status have been made (Kennedy 2006a).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing area is prohibited.

#### **Primary and Secondary Contact Recreation and Aesthetics uses**

Weekly testing for *Enterococci* bacteria during the swimming season has been conducted at five beaches within the Salem Sound segment (MA DPH 2003, MA DPH 2004, and MA DPH 2005b and Salem Sound Coastwatch 2004). These beaches include:

West Beach, Beverly – this beach was tested weekly during the summers of 2002, 2003, and 2004 – there were no postings reported.

Mingo Beach, Beverly - this beach was tested weekly during the summers of 2002, 2003, and 2004. There were three postings because of elevated *Enterococci* bacteria counts in 2002 (totaling 21 days) and one posting (totaling two days) in 2003. There were no postings reported in 2004.

Brackenbury Beach, Beverly - this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported because of elevated *Enterococci* bacteria counts in 2003 (totaling two days).

Grace Oliver Beach, Marblehead - this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported because of elevated *Enterococci* bacteria counts in 2004 (totaling two days).







Gas House Beach, Marblehead - this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported because of elevated *Enterococci* bacteria counts in 2004 (totaling 13 days).

A survey was conducted along the Salem Sound shoreline in April 2004 from which an inventory of observable stormwater outfall pipes 12" or greater in diameter was created (Horsley Witten Group 2005). In an attempt to identify discharges contributing significant bacteria loads to Salem Sound under dry

weather conditions (i.e., screening for illicit discharge connections), two rounds of bacteria sampling (5 October and 4 November 2004) were conducted at targeted stormwater discharge pipes. Six pipes were sampled within this segment. Three of the pipes had elevated bacteria counts (Horsley Witten Group 2005).

The *Primary Contact Recreational Use* is assessed as support since the majority of the bathing beaches along the Salem Sound segment shoreline were open for the majority of the three bathing seasons between 2002 and 2004. The *Secondary Contact Recreational* and *Aesthetics* uses are also assessed as support for Salem Sound based primarily on best professional judgment (beaches open for majority of bathing seasons and the extensive area of eelgrass bed habitat indicative of good water clarity).

SALEM SOUND (SEGMENT MA93-25) Use Summary

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Discharges from separate storm sewer systems Suspected sources: Marinas/boating pumpout releases, marinas/boating sanitary on-vessel discharges
Primary Contact		SUPPORT
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

## RECOMMENDATIONS

The whole effluent toxicity testing requirements for SESD should be reduced to one test species, *M. beryllina*, since they have been the more sensitive test species. The permittee should also be required to conduct a Toxicity Identification/Toxicity Reduction Evaluation (TIE/TRE) and implement appropriate treatment/actions to eliminate the acute toxicity in the effluent.

Implement recommendations in the DMF shellfish management plan for areas N15.0, N16.0, and N19.0.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking when necessary to help identify undocumented sources. Remediate illicit connections and other problems as identified.

Encourage use of boat pump-out facilities through a public outreach and education program.

Continue to monitor eelgrass bed habitat.

## FLOATING BRIDGE POND (SEGMENT MA93024)

Location: Lynn.

Length/area: 12 acres

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of nutrients, turbidity, and the presence of noxious aquatic plants (MassDEP 2005).






### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Floating Bridge Pond. All designated uses are not assessed.

FLOATING BRIDGE POND (SEGMENT MA93024) Use Summary

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Implement recommendations in Diagnostic/Feasibility Study for Floating Bridge Pond (CDM and IEP 1986).



## NAHANT BAY (SEGMENT MA93-24)

Location: The waters landward of an imaginary line drawn between Galloupes Point, Swampscott and East Point, Nahant.

Length/area: 5.12 mi<sup>2</sup>

Classification: Class SA/CSO.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

MassDEP managed loan projects that should be improving water quality conditions in this segment include:

SRF- Lynn Water and Sewer Commission CSO Abatement Projects

### DISCHARGES

#### NPDES (Appendix E, Tables E2 and E3)

MA0100552 - Lynn Water and Sewer Commission (LWSC) Outfall #006.

MAR041064 - Town of Swampscott and MA0101907. It should be noted that Outfall #004, identified in the Town's former NPDES permit MA0101907 (now terminated) that is currently chlorinated during the summer months, is not in compliance with Massachusetts Water Quality Standards without a duly issued NPDES permit.

### USE ASSESSMENT

#### *Aquatic Life Use*

##### Eelgrass Bed Habitat

MassDEP's Wetlands Conservancy Program (WCP) identified the presence of eelgrass in Nahant Bay from historic 1951 black and white aerial photography (Costello 2003). In 1998 MassDEP WCP performed field verification of 1995 aerial photography and mapped the extent of eelgrass bed habitat in Nahant Bay. Total areal coverage of Nahant Bay from the 1995 survey was approximately <1% of the bay. In 2001 MassDEP WCP performed field verification of 2001 aerial photography and mapped the extent of eelgrass bed habitat in Nahant Bay. There has been almost no change in the total coverage of eelgrass bed habitat between 1995 and 2001. The eelgrass bed habitat is in the cove area near Fishermans Beach.

The *Aquatic Life Use* is not assessed for Nahant Bay. Although the eelgrass bed habitat has been stable, it only represents a small portion of the segment area.

#### *Shellfish Harvesting Use*

DMF shellfish status of July 2000 indicates that their areas (N22.0, N22.1, N23.0 and N24.0), which comprise this segment area, are prohibited. No changes to the status for any of these areas have been made (Kennedy 2006a).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing area is prohibited.

#### *Primary and Secondary Contact Recreation and Aesthetics uses*

Nahant Bay experiences a locally abundant but globally very rare mutant algal species, *Pilayella littoralis*, which may at times cover large portions of the beach with a thick brown mat. The alga affects the entire bay and shoreline from Nahant all the way up to Swampscott (Borci 2006). Decomposition of the algae that washes up on the beach results in objectionable odors. Funding for removal of the algae to improve aesthetics was increased from \$35,000 to \$50,000 in 2006 to increase beach cleanups to every week and a half (Bradley 2006). Although studies have been conducted, no specific cause(s) have been identified. Wilce *et al.* (1987) concluded that nitrogen concentrations in Massachusetts Bay water were sufficient to support the Nahant Bay free-living *P. littoralis* population.

Weekly testing for *Enterococci* bacteria during the swimming season has been conducted at eight beaches within this segment. These beaches include:

Eisman's Beach, Swampscott - this beach was tested weekly during the summers of 2002, 2003, and 2004. There were no postings reported for any of these years.

Whales Beach, Swampscott - this beach was tested weekly during the summers of 2002, 2003, and 2004. There were no postings reported for any of these years

Fisherman's Beach, Swampscott - this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported because of elevated *Enterococci* bacteria counts in 2004 (totaling six days). There were no postings reported in 2002 and 2003.

King's North Beach, Swampscott - this beach was tested weekly during the summers of 2002, 2003, and 2004. There were no postings reported for any of these years.

King's DCR Beach, Lynn - this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported because of elevated *Enterococci* bacteria counts in 2003 (totaling six days) and two postings reported in 2004 (totaling two days). There were no postings reported in 2002.

Nahant Beach, Nahant - this beach was tested weekly during the summers of 2002, 2003, and 2004. There was one posting reported because of elevated *Enterococci* bacteria counts in 2002 (totaling one day) and one posting reported in 2003 (totaling one day). There were no postings reported in 2004.

Short Beach, Nahant - this beach was tested weekly during the summers of 2002, 2003, and 2004 – there were no postings reported for any of these years.




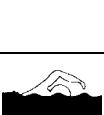


Canoe Beach, Nahant - this beach was tested weekly during the summers of 2002, 2003, and 2004 – there were no postings reported for any of these years.

MA0100552 - Lynn Water and Sewer Commission (LWSC) Outfall #006 (Sanderson Avenue) is a wet weather CSO that discharges into Stacey Brook. This culverted brook discharges to Kings Beach. The discharge is through a box culvert adjacent to, and just south of the box culvert from the town of Swampscott. Under the Second Modified Consent Decree (SMCD) entered in federal court (civil action no. 76-2184-RGS), the Lynn Water & Sewer Commission is proceeding with sewer separation work, which will result in elimination of outfall #006 as a CSO discharge point (Brander 2006b). Presently, the #006 CSO activates approximate 26 times each year, discharging on average a total of 61 million gallons of CSO each year. Following the sewer separation work, the Stacey Brook culvert will continue to discharge base flow and separated stormwater to the outfall on King's Beach (Brander 2006b).

The Town of Swampscott continues to operate a chlorination system during the summer months to disinfect flows from Outfall 004 the New Ocean Street Underdrain intermittent discharge to Stacey Brook to King's Beach during the swimming season (Brander 2006b). Historical and recent data indicate that the drainage system is still influenced by wastewater flows, through underdrain connections, direct connections, or both.

The *Primary* and *Secondary Contact Recreational* and *Aesthetics* uses are assessed as support but are identified with an Alert Status. Although most of the bathing beaches along the Nahant Bay shoreline were open for the majority of the three bathing seasons between 2002 and 2004, the discharges at Kings Beach are of concern. These uses are also identified with an Alert Status because of the nuisance growth/blooms of *Pilayella littoralis*. The cause(s) of this condition has not been identified and regular beach cleanups are conducted to alleviate objectionable aesthetic conditions.

# NAHANT BAY (SEGMENT MA93-24) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Combined sewer overflows, unpermitted discharge Suspected sources: Discharges from separate storm sewer systems, marinas/boating pumpout releases, marinas/boating sanitary on-vessel discharges
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT*

\*Alert Status issues identified, see details in use assessment section

## RECOMMENDATIONS

Lynn Water and Sewer Commission (LWSC) (MA0100552) should do the following.

- Continue implementation of the sewer separation program in the #006 area, along with work to identify and remove infiltration and inflow sources, so that CSO discharges to Stacey Brook are eliminated.
- Implement illegal connection identification and removal program in the Stacey Brook watershed, in Lynn and Swampscott, to identify and remove any wastewater connections to the stormdrain system.
- Assess the sewer and stormdrain system in Swampscott, to identify any connections between the sewer and drain systems, through underdrains or direct connections, and take actions to separate these systems.
- Implement stormwater management programs in Swampscott and Lynn, to address pollutant sources to King's Beach.

Conduct regular sampling of the Lynn and Swampscott Stacey Brook culverts, during wet and dry weather, to monitor the risk to beach users, and to track the progress of the CSO and stormwater pollution abatement work.

The Town of Swampscott needs to address the problems at "Stacey Brook".

- Illegal Connections: The Town will need to undertake a program to identify and remove any direct connections and proceed with any infrastructure improvements to keep the sewers from exfiltrating into the drain. They have already identified some of this work in a Project Evaluation Form (request for SRF funding but need to follow through on this).
- Chlorination Facility: They are operating without a permit, which constitutes a violation. MassDEP should approve an Operation & Maintenance plan (noting management by a certified operator), and interim residual chlorine limits and fecal coliform and/or *Enterococci* bacteria limits at the point of discharge. The Town should formally apply for an NPDES permit. The permit should have an expeditious schedule in the Administrative Consent Order (ACO) for all of these activities.

Continue to monitor eelgrass bed habitat in Nahant Bay.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as needed particularly in the vicinity of King's Beach Swampscott/Lynn.

Implement recommendations in the DMF shellfish management plan for areas N22.0, N22.1, N23.0 and N24.0.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Encourage use of boat pump-out facilities through a public outreach and education program.

Develop a monitoring plan to evaluate conditions contributing to the free-living *P. littoralis* population in Nahant Bay.

## LYNN HARBOR SYSTEM

There are two major tributaries to Lynn Harbor: the Saugus River and the Pines River. The Saugus River originates at the outlet of Lake Quannapowitt in Wakefield and eventually flows into the estuary downstream from the Saugus River Ironworks in Saugus. The river receives flow from four tributaries in its freshwater reach including Beaverdam Brook, Mill River, Hawkes Brook and Bennetts Pond Brook. Shutes Brook discharges into the tidal Saugus River. The Pines River is fed by an unnamed tributary locally known as "Town Line Brook". Together the Pines and Saugus rivers flow into Lynn Harbor, which eventually discharges into Broad Sound. The location of segments in the Lynn Harbor System are illustrated in Figure 17.

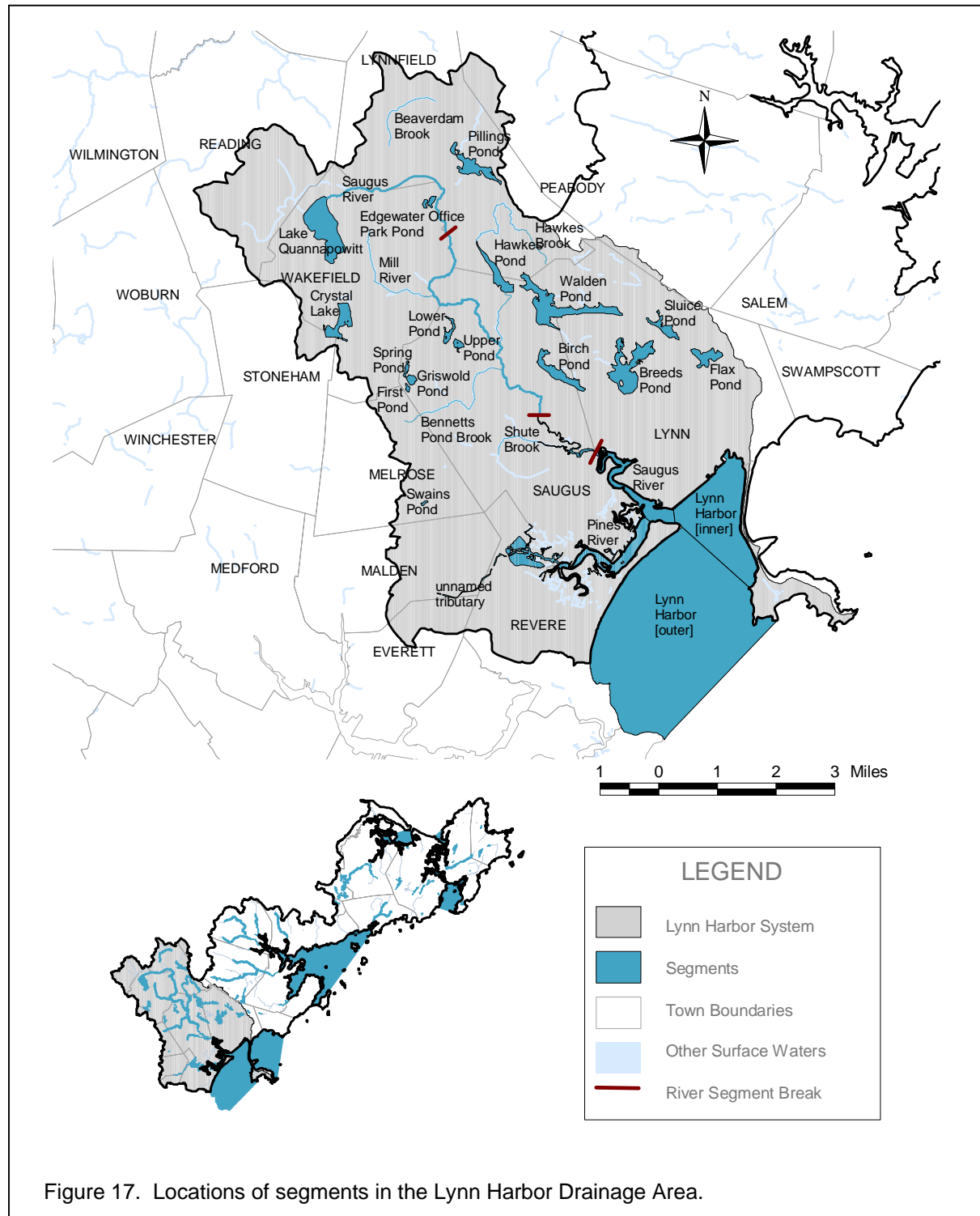


Figure 17. Locations of segments in the Lynn Harbor Drainage Area.

## LAKE QUANNAPOWITT (SEGMENT MA93060)

Location: Wakefield.

Length/area: 246 acres

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of turbidity and the presence of noxious aquatic plants as well as exotic species\* (MassDEP 2005).

[\*Note: this impairment is not a pollutant requiring the development of a TMDL.]

There is a concrete dam with wooden boards (Lake Quannapowitt Dam) that is listed as the second obstruction on the Saugus River. Neither this dam nor the Lynn waterways/Colonial Country Club Dam downstream have any type of fishway structures (Reback *et al.* 2005).

A data review for Lake Quannapowitt was prepared for the Town of Wakefield and the Friends of Lake Quannapowitt (ENSR 2000). This project was funded by the Massachusetts Department of Conservation and Recreation (MA DCR, formerly MA DEM) and provides a diagnostic summary of conditions as well as some monitoring recommendations. It should be noted, however, that quality assurance/quality control data for some of the sources of information used in this report were not provided and so cannot be utilized to make use assessment decisions.

There is a Tier 1C hazardous waste site (#3-0019079) for the Municipal Gas & Light Dept. Property on North Avenue in Wakefield, which is currently in Phase IV of cleanup. There is a cove area of the lake that reportedly had deposits of coal tar. The status of remediation at this site is unknown.

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### ***Aquatic Life Use***

##### Biology

Lake Quannapowitt was reported to have a non-native aquatic plant (*Potamogeton crispus*) (DeCesare *et al.* 2000 and MassDEP 1993). This lake has historically experienced severe blue-green blooms (MassDEP 1997). Although the non-native macrophyte could still be present in the lake, the severity of blue-green blooms could also have decimated the macrophyte populations. Without new information about the macrophyte populations the *Aquatic Life Use* is not assessed as impaired.

##### Sediment Chemistry

In June 2003, grab samples of deposited sediment (top 2 to 4 inches) were collected by USGS personnel from one location in Lake Quannapowitt (Station WAY-001) and analyzed for elements, polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides, and polychlorinated biphenyls (PCB) (Breault *et al.* 2004). It should be noted that the 'grab sample' consisted of a homogenized composite of at least three samples at each location to characterize conditions at the site. The concentrations of arsenic, chromium, copper, and lead exceeded the S-ELs by factors of 4.7, 1.5, 4.6, and 1.8, respectively while the concentration of mercury was at the S-EL. None of the other metals exceeded their S-ELs. Concentrations of PAH, organochlorine pesticides, and PCB could not be compared to S-ELs (lack of total organic carbon data necessary to evaluate data) (Breault *et al.* 2004).

Since too limited recent quality-assured data are available, the *Aquatic Life Use* is not assessed. But it is identified with an Alert Status because of the history of poor water quality (e.g., blue-green blooms, high nutrient loadings from stormwater inputs, low Secchi disk measurements). Somewhat elevated concentrations of arsenic, chromium, lead, and mercury in the sediment ( $\geq$  their respective S-ELs) are also of concern.

#### ***Fish Consumption Use***





Fish contaminant monitoring was conducted by MassDEP in Lake Quannapowitt in May 1998 (DeCesare *et al.* 2000). MA DPH reviewed these data and no fish consumption advisory was issued.

Since no site-specific fish consumption advisory was issued by MA DPH, the *Fish Consumption Use* is not assessed.

**Primary and Secondary Contact Recreation and Aesthetics uses**

Since too limited recent quality-assured data are available, the *Recreational* and *Aesthetics* uses are not assessed. But they are identified with an Alert Status because of the history of poor water quality (e.g., blue-green blooms, high nutrient loadings, low Secchi disk measurements).

LAKE QUANNAPOWITT (SEGMENT MA93060) Use Summary

Aquatic Life*	Fish Consumption	Primary Contact*	Secondary Contact*	Aesthetics*
				
NOT ASSESSED				

\*Alert Status issues identified, see details in use assessment section

**RECOMMENDATIONS**

Conduct water quality monitoring to evaluate designated uses. Monitoring should include macrophyte surveys, *in-situ* measurements for DO/% saturation, pH, and temperature, as well as chlorophyll *a*, and nutrient sampling.

Determine whether or not coal tar deposits have been remediated.

## PILLINGS POND (SEGMENT MA93056)

Location: Lynnfield.

Length/area: 90 acres

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of turbidity and the presence of noxious aquatic plants (MassDEP 2005).

Unpermitted dredging and filling activities took place in Pillings Pond between 1990 and 1996 (EPA 1997).

A grant project funded by MA DCR to develop a management plan for Pillings Pond was completed (Waterflow 1998). The Town of Lynnfield, in collaboration with the Lynnfield Conservation Commission and BSC Group, received state funding from MassDEP in 2005 to implement restoration work in the pond. No report of that work (project duration April 2005 to June 2006) has yet been made available to MassDEP.

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### ***Aquatic Life Use***

##### Biology

A small infestation of the non-native aquatic macrophyte *Trapa natans* (water chestnut) was found near the northwest inlet of the pond during the 2002 macrophyte survey of Pillings Pond (MassDEP 2002d).

##### Water Chemistry

Sampling was conducted by DWM staff at two locations (W0985 - deep hole and W0965 near the center) in the pond as part of the 2002 Baseline Lake TMDL Project (Appendix C, Tables C1 and C2).

Low DO/%saturation in the hypolimnion and supersaturation in the epilimnion was documented. Elevated chlorophyll *a* concentrations were measured, as were high concentrations of phosphorus in samples from the hypolimnion.

The *Aquatic Life Use* is assessed as impaired for Pillings Pond because of low DO; both high and low saturation; elevated chlorophyll *a* and total phosphorus concentrations; and excessive algal growth. There is evidence of internal loading of phosphorus from the sediments. Other nonpoint source contributions of nutrients include residential lawns adjacent to the shoreline.

#### ***Primary and Secondary Contact Recreation and Aesthetics Uses***






Sampling was conducted by DWM staff at two locations W0985 (deep hole) and W0965 (center) in the pond as part of the 2002 Baseline Lake TMDL Project (Appendix C, Table C1).

Although no bacteria data are available for Pillings Pond, Secchi disk measurements did not meet the bathing beach guidance. DWM field sampling crews noted excessive algal growth in Pillings Pond and objectionable scums including blue-greens (*Microcystis* sp. and *Oscillatoria* sp.) as well as blooms of the green filamentous alga *Rhizoclonium* sp. (MassDEP 2002a).

The *Primary and Secondary Contact Recreational and Aesthetics* uses are assessed as impaired for Pillings Pond because of the objectionable conditions including excess algal growths and scum and the poor Secchi disk transparency. These conditions are the result of internal loading of phosphorus from the sediments and are also likely exacerbated by nonpoint source pollution (fertilization of lawns adjacent to the pond).



# PILLINGS POND (SEGMENT MA93056) Use Summary

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Low DO/saturation, elevated chlorophyll <i>a</i> , excessive algal growth, elevated total phosphorus, non-native aquatic plant infestation Source: Internal nutrient recycling, unknown Suspected sources: Nonpoint source loading of nutrients from residential lawns
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Cause: Poor Secchi disk transparency, excessive algal growth Source: Internal nutrient recycling Suspected sources: Nonpoint source loading of nutrients from residential lawns
Secondary Contact		
Aesthetics		

## RECOMMENDATIONS

Vigilant efforts should be made to eradicate the limited infestation of the non-native aquatic macrophyte *Trapa natans*. Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Reduce external total phosphorus loading to the pond (suspected sources include both stormwater and lawn fertilizing). Once accomplished mitigate internal release of phosphorus from sediments.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Review lake restoration activities/data and evaluate need for additional monitoring.

## CRYSTAL LAKE (SEGMENT MA93018)

Location: Wakefield/Stoneham.

Length/area: 82 acres

Classification: Class A/PWS/ORW.

This segment is on the 2004 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2005).

### WITHDRAWALS AND DISCHARGES

#### WMA (Appendix E, Table E1)







Wakefield Water Department is registered (31830501). A Source Water Protection Project for Crystal Lake (99-07/SWT) was developed to characterize and manage stormwater inflow and sanitary sewer outflow entering the lake. While the majority of water for the town is supplied by the MWRA approximately 15% comes from Crystal Lake (MWRA 2003).

#### NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Crystal Lake. All designated uses are not assessed.

CRYSTAL LAKE (SEGMENT MA93018) Use Summary

Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

\* The MassDEP Drinking Water Program maintains current drinking water supply data.

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

## **SAUGUS RIVER (SEGMENT MA93-34)**

Location: Headwaters, outlet of Lake Quannapowitt, Wakefield (thru Reedy Meadow) to the Lynn Water & Sewer Commission diversion canal, Wakefield/Lynnfield (canal diverts to Hawkes Pond).

Length/area: 3.1 miles.

Classification: Class B, Treated Water Supply.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of nutrients, noxious aquatic plants, turbidity, and pathogens as well as flow alteration\* and other habitat alteration\* (MassDEP 2005). [\*Note: this impairment is not a pollutant requiring the development of a TMDL.]

A summary of information related to the geography, history, resources, and water quality of the Saugus River was compiled by the North Coastal Watershed Alliance (NCWA 2000).

## **WITHDRAWALS AND DISCHARGES**

### **WMA (Appendix E, Table E1)**

Lynn Water and Sewer Commission registration/permit (31816302/9P31816302).

Sheraton Colonial Country Club, Lynnfield permit (9P31816402).

### **NPDES (Appendix E, Tables E2 and E3)**

MA0026247 New England Detroit Diesel, Wakefield

## **USE ASSESSMENT**

### **Aquatic Life Use**

#### **Habitat and Flow**

Streamflow conditions in the Saugus River were noted to be very low during the summer months of 2002 (MassDEP 2002a) coincident with drought conditions (advisories and watches were in effect in Massachusetts -- see Appendix B).

Anadromous fish are unable to pass the Lynn Waterways concrete dam (lack of fishway) at the Colonial Golf and Country Club. Herring have been observed at the base of this dam since the Saugus Iron Works Dam was breached (Reback *et al.* 2005). A study to assess the feasibility of fish passage and spawning habitat upstream from the LWSC dam was conducted in 2005 (SRWC 2005). The study, prepared for the Saugus River Watershed Council and DMF and funded by Gulf of Maine Council/National Oceanic and Atmospheric Administration (NOAA) Restoration Center, found poor conditions during the dry summer of 2005 for restoring river herring in the Saugus River. River herring passage and potential spawning habitat upstream from the LWSC dam was very limited due to low flows, aquatic plant growth and low DO (Gomez and Sullivan 2006).

#### **Water Chemistry**

Sampling was conducted by DWM staff in the Saugus River at Vernon Street/Main Street in Wakefield/Lynnfield (W0882) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Tables 7 and 8).

In-stream DO concentrations ranged from 4.4 to 7.5 mg/L representing both day-time and pre-dawn (worst-case) conditions. While all the measurements taken in May, June and August met standards, most of the measurements taken in July and September were <5.0 mg/L and/or <60% saturation. However, these conditions are likely associated with the low flow/drought conditions present during that time (i.e., at or <7Q10 flows). Moderate to high concentrations of total phosphorus were documented (0.063 to 0.16 mg/L), but all of the other variables monitored met standards. Slightly elevated conductivity measurements were also noted.

#### **Sediment Chemistry**

In June 2003, grab samples of deposited sediment (top 2 to 4 inches) were collected by USGS personnel from three locations in this segment (Station WAY-002 at Vernon Street, Station L6Y-001 in Central Reedy Meadow, and Station WAY-003 at Reedy Meadow Pond) and analyzed for elements, polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides, and polychlorinated biphenyls (PCB) (Breault *et al.* 2004). It should be noted that the 'grab samples' consisted of a homogenized composite of at least

three samples at each location to characterize conditions at each site. The concentration of arsenic, chromium, and lead exceeded the S-EL by factors of 1.5, 1.6 and 2.8 at WAY-002. The concentrations of chromium and nickel at Station L6Y-001 exceeded the S-ELs by factors of 2.8 and 2.1, respectively. The concentration of arsenic was at the S-EL at Station WAY-003. None of the other metals exceeded their S-ELs. Concentrations of PAH, organochlorine pesticides, and PCB could not be compared to S-ELs (lack of total organic carbon data necessary to evaluate data) (Breault *et al.* 2004).

The *Aquatic Life Use* is not assessed for this segment of the Saugus River (too limited water quality data). This segment is identified with Alert Status because of moderate to high concentrations of total phosphorus and the sediment concentrations of arsenic, chromium, lead and nickel which slightly exceeded their S-ELs. The slightly low DO/saturation conditions, however, likely reflected the very low flow conditions encountered. The current lack of fish passage is also of concern.

#### ***Fish Consumption Use***

Fish contaminant monitoring was conducted by MassDEP in Reedy Meadow (along this segment of the Saugus River) in April 2002. Edible fillets of two, three-fish composite samples (yellow perch - *Perca flavescens* and brown bullhead - *Ameiurus nebulosus*) were analyzed for the presence of heavy metals, PCB, and organochlorine pesticides (Appendix D, Table D1). Mercury concentrations were below the MA DPH trigger level of 0.5 mg/kg in the two samples analyzed. It should be noted that predatory fish, which tend to be worst-case with regard to mercury concentrations, were not collected or analyzed. In light of the mercury concentrations found in small yellow perch (0.35 mg/Kg) and brown bullhead (0.30 mg/Kg) larger, older, predators such as largemouth bass may contain mercury concentrations approaching the MA DPH trigger level (Maietta *et al.* 2004). MA DPH reviewed these data and no site-specific fish consumption advisory was issued.

Since no site-specific fish consumption advisory was issued by MA DPH the *Fish Consumption Use* is not assessed.

#### ***Primary and Secondary Contact Recreation and Aesthetics uses***




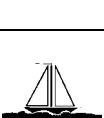

Bacteria sampling was conducted by DWM staff in the Saugus River at Vernon Street/Main Street in Wakefield/Lynnfield (W0882) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8).

Fecal coliform bacteria counts ranged from 39 to 20,000 cfu/100 mls with a geometric mean of 617 cfu/100 mls. This exceeded the standard of 200 cfu/100 mls for primary contact recreation. The highest fecal coliform bacteria count likely represented the influence of a local storm event.

Field observations were made by DWM personnel during the surveys conducted in this segment of the Saugus River between May and September 2002. The water was almost always described as being very murky and trash/debris were also noted at the sampling location. Other objectionable conditions (odors, oils) were not noted during any of the surveys (Station SR04A) (MassDEP 2002a).

The *Primary Contact Recreational Use* is assessed as impaired because of elevated fecal coliform bacteria counts. The highest counts likely represented the influence of local storm events. Aesthetic quality degradation (water was almost always murky/highly turbid) was also a problem so the *Secondary Contact Recreational* and *Aesthetics* uses are assessed as impaired.

### SAUGUS RIVER (SEGMENT MA93-34) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria, turbidity Sources: Unknown Suspected sources: Discharges from separate storm sewer systems
Secondary Contact		IMPAIRED Causes: Turbidity Sources: Unknown Suspected sources: Discharges from separate storm sewer systems
Aesthetics		IMPAIRED Causes: Turbidity Sources: Unknown Suspected sources: Discharges from separate storm sewer systems

\*Alert Status issues identified, see details in use assessment section

### RECOMMENDATIONS

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as necessary and remediate problems identified.

Conduct additional water quality sampling to better evaluate the status of the *Aquatic Life Use* for this segment of the Saugus River and to identify source(s) contributing to in-stream turbidity.

Implement recommendations in the Comprehensive Surface Water Supply Protection Plan for the City of Lynn.

Improvements to upstream river hydrology to re-establish main stem river channel should be a priority for the Saugus River Watershed and consideration should be given to installing an eel ramp at the LWSC dam to facilitate eel passage to upstream habitat (Gomez and Sullivan 2006).

## BEAVERDAM BROOK (SEGMENT MA93-30)

Location: Headwaters west of Main Street, Lynnfield to confluence with Saugus River (Reedy Meadow), Lynnfield.

Length/area: 1.5 miles.

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of organic enrichment/low DO and pathogens (MassDEP 2005).

### WITHDRAWALS AND DISCHARGES

#### WMA (Appendix E, Table E1)

Lynnfield Center Water District registration (31816401). The Lynnfield Center Water has a Water Loss Prevention Grant Project (04-10/WLP) in an attempt to identify and reduce unaccounted-for water loss from the water works and distribution system to 10% or less.






#### NPDES (Appendix E, Tables E2 and E3)

MAG640017 Lynnfield Center Water District.

### USE ASSESSMENT

No quality-assured data are available for Beaverdam Brook. All designated uses are not assessed.

BEAVERDAM BROOK (SEGMENT MA93-30) Use Summary

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

### RECOMMENDATIONS

Field reconnaissance should be conducted along Beaverdam Brook to determine the need, if any, to conduct monitoring (e.g., habitat quality, biological monitoring, etc.) up and downstream from the Lynnfield Center Water District discharge (MAG640017).

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

## EDGEWATER OFFICE PARK POND (SEGMENT MA93094)

Location: Wakefield.

Length/area: 15 acres

Classification: Class B

This is a new segment so it does not appear on the 2004 Integrated List of Waters.

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT






#### *Aquatic Life Use*

##### Biology

This waterbody is reported to be infested with the non-native aquatic macrophyte *Cabomba caroliniana* (MassDEP 2004).

The *Aquatic Life Use* for Edgewater Office Park Pond is assessed as impaired because of the infestation of non-native aquatic macrophyte.

EDGEWATER OFFICE PARK POND (SEGMENT MA93094) Use Summary

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non native aquatic macrophyte Source: Unknown
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

## **SAUGUS RIVER (SEGMENT MA93-35)**

Location: From the Lynn Water & Sewer Commission diversion canal, Wakefield/Lynnfield to the Saugus Iron Works, Bridge Street, Saugus.

Length/area: 5.4 miles.

Classification: Class B

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of organic enrichment/low DO and pathogens as well as flow alteration\* and other habitat alterations\* (MassDEP 2005). [\*Note: this impairment is not a pollutant requiring the development of a TMDL.]

A summary of information related to the geography, history, resources, and water quality of the Saugus River was compiled by the North Coastal Watershed Alliance (NCWA 2000).

### **WITHDRAWALS AND DISCHARGES**

#### **WMA (Appendix E, Table E1)**

[Note: Lynn Water and Sewer Commission (LWSC) registration/permit (31816302/9P31816302) withdrawals upstream from this segment.]

#### **NPDES (see Appendix E, Table E3)**

### **USE ASSESSMENT**

#### ***Aquatic Life Use***

##### Habitat and Flow

Through funding from the Massachusetts Environmental Trust, the Saugus River Watershed Council (SRWC) launched a Saugus River Flow Restoration Project. The project, conducted in 2003/2004, encouraged a reduction of water withdrawals, increased public awareness/water conservation, volunteer monitoring of flow, fish monitoring and establishment of a Saugus River Flow Task Force (SRWC 2005). Gomez and Sullivan (2002) estimated natural or virgin flow conditions and compared these flows at the USGS gage near the Saugus Ironworks to determine the effects of regulated withdrawals. They found that the Saugus River is most affected during low flow summer months and in the fall when LWSC attempts to refill storage reservoirs (Gomez and Sullivan 2002). Two reaches of the river were evaluated for habitat/flow requirements – just downstream from the diversion dam and the reach near Route 1. Based on these analyses, recommended flows were developed (Gomez and Sullivan 2002). In 2003 MassDEP established “recommended” interim streamflow diversion thresholds to be maintained downstream from the LWSC diversion dam in the LWSC WMA permit (permit is currently under appeal). The recommended flows are as follows:

June through September – 3 cfs,  
October through February – 6 cfs,  
March through April - 12 cfs, and  
May – 10 cfs.

In addition to studying hydrology, Gomez and Sullivan (2002) conducted an analysis of habitat from the LWSC Diversion Dam in Lynnfield, MA to the Saugus River USGS gage near the Saugus Ironworks. The habitat was inventoried as follows: 5.7% riffles, 93.0 % runs and 1.3 % pools (Gomez and Sullivan 2002).

Stage height and streamflow data for the Saugus River (approximately 10 meters downstream from the Lynn Water & Sewer Commission (LWSC) diversion to Hawkes Pond) are available as part of the Massachusetts Riverways Programs pilot River In-stream Flow Stewards (RIFLS) project (MA DFG 2006b). This gage has been monitored by LWSC almost daily July 2004 (Kearns 2006b). The LWSC has also been following a voluntary program to limit withdrawals from the Saugus River during critical fish spawning and low-flow periods (Kearns 2006a and SRWC 2005).

In the summer of 2005, water levels in the wetland/impoundment upstream from the diversion dam dropped very rapidly. No flow was released to the river downstream for an extended period (mid-July to early-October) because of concerns about completely desiccating upstream wetland habitats (Kearns 2006a and MA DFG 2006b).



DWM conducted a habitat assessment of the Saugus River downstream from Elm Street, Saugus (Station SR01), on 31 July 2002. Although no buffer was available along the factory property just upstream from the sampling reach, in-stream habitat was optimal (total habitat score of 180 out of 200) (MassDEP 2002b).

Suitable rainbow smelt spawning habitat is available in the Saugus River near the Iron Works. Smelt egg deposition was readily found by DMF biologists in a 1,215 m<sup>2</sup> area, but an additional area of suitable habitat upstream is currently not accessible because of elevation rise and turbulent flow from the rubble of the former dam upstream from the Iron Works property (Chase 2006a). Other negative influences on the spawning habitat quality were stormwater, sedimentation, excessive periphyton growth, and streamflow (Chase 2006a).

USGS maintains one gage just downstream from this segment of the Saugus River on left bank 20' upstream from Bridge Street in Saugus (gage 01102345). The drainage area at the gage is 20.8 mi<sup>2</sup>. The average annual discharge at the gage is 30.4 cfs (period of record March 1994 to current; Socolow *et al.* 2005). The USGS remarks indicate that there is evidence of seasonal regulation by ponds upstream. Occasional high tides will submerge the pool where the water temperature and specific conductance probes are located and may cause high specific conductance values (Socolow *et al.* 2005).

#### Biology

Rainbow smelt egg deposition was reported to be highest in 1989 but since then very low densities have been observed (Chase 2006a).

Chlorophyll *a* concentrations in the Saugus River just upstream from Bridge Street (USGS gage 01102345) from June 2001 to September 2001 (n=5) were low ranging from 1.1 to 1.7 µg/L (USGS 2006).

#### Water Chemistry

Sampling was conducted by DWM staff in the Saugus River at Elm Street in Saugus (W0883) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Tables 7 and 8).

##### *Dissolved oxygen*

In-stream DO concentrations in the river near Elm Street ranged from 6.5 to 10.3 mg/L while saturations ranged from 71 to 95% representing both day-time and pre-dawn (worst-case) conditions (Appendix B, Table 7). Monthly DO measurements reported by USGS for the Saugus River just upstream from Bridge Street (USGS gage 01102345) ranged from 6.6 to 13.5 mg/L (n= 51)(USGS 2006). None of these measurements represented pre-dawn (worst-case) conditions.

##### *Temperature*

Monthly water temperature data are available for the Saugus River just upstream from Bridge Street (USGS gage 01102345) from September 1998 to September 2004 (n=51)(USGS 2006). The maximum temperature was 22.1°C.

##### *pH and alkalinity*

The pH of the Saugus River just upstream from Bridge Street (USGS gage 01102345) from September 1998 to September 2004 (n=38) ranged from 6.9 to 7.8 SU (USGS 2006). Alkalinity measurements taken between September 1998 and September 2001 (n=42) ranged from 19 to 70 mg/L as CaCO<sub>3</sub>.

##### *Specific conductance*

Monthly specific conductance data are available for the Saugus River just upstream from Bridge Street (USGS gage 01102345) from September 1998 to September 2004 (n=51) (USGS 2006). Specific conductance ranged from 160 to 830 µS/cm at 25°C.

##### *Chloride*

Monthly chloride data are available for the Saugus River just upstream from Bridge Street (USGS gage 01102345) from October 1998 to September 2001 (n=44) (USGS 2006). Chloride concentrations ranged

from 32.4 to 197 mg/L - all below the recommended chronic fresh water quality criterion of 230 mg/L (EPA 1988).

#### *Total nitrogen*

Monthly ammonia + organic nitrogen as nitrogen data (unfiltered samples) and nitrite+nitrate nitrogen as nitrogen (filtered samples) are available for the Saugus River just upstream from Bridge Street (USGS gage 01102345) from September 1998 to September 2004 (n=48)(USGS 2006). The average total nitrogen concentration of these data was 1.09 mg/L and the median concentration was 1.05 mg/L nitrogen.

#### *Ammonia-nitrogen*

Monthly ammonia + organic nitrogen as nitrogen data are available for the Saugus River just upstream from Bridge Street (USGS gage 01102345) from September 1998 to September 2004 (n=49)(USGS 2006). The concentrations ranged from <0.10 mg/L to 1.2 mg/L with an average and median concentration of 0.53 mg/L.

#### *Total phosphorus*

Moderate concentrations of total phosphorus were documented by DWM (0.034 to 0.085 mg/L) (Appendix B, Table 8). Monthly total phosphorus data are available for the Saugus River just upstream from Bridge Street (USGS gage 01102345) from September 1998 to September 2004 (n=49)(USGS 2006). With the exception of one extremely low concentration (<0.004 mg/L which appears to be an outlier), the concentration of total phosphorus in the river ranged from 0.018 to 0.084 mg/L with average and median concentrations of 0.047 and 0.046 mg/L, respectively.

#### *Mercury*

The concentrations of total and methyl mercury samples from the water column of the Saugus River reported by USGS (samples collected on 22 September 1998, 26 April and 22 August 2000 ranged between 2.46 and 6.20 and 0.110 to 0.281 ng/L, respectively (USGS 2003b).

#### Sediment Chemistry

In June 2003, grab samples of deposited sediment (top 2 to 4 inches) were collected by USGS personnel from three locations in this segment (Station WAY-004 at Sunset Drive, Station SEY-001 at Route 1, and Station SEY-002 at Saugus Iron Works) and analyzed for elements, polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides, and polychlorinated biphenyls (PCB) (Breault *et al.* 2004). It should be noted that the 'grab samples' consisted of a homogenized composite of at least three samples at each location to characterize conditions at each site. The concentration of chromium exceeded the S-EL by factors of 1.7, 2.8 and 2.3 at Stations WAY-004, SEY-001, and SEY-002, respectively. None of the other metals exceeded their S-ELs. Concentrations of PAH, organochlorine pesticides, and PCB could not be compared to S-ELs (lack of total organic carbon data necessary to evaluate data) (Breault *et al.* 2004).

USGS also collected sediment from the Saugus River near the USGS gaging station in Saugus (near the Saugus Iron Works) in September 1998 as part of the National Water-Quality Assessment Program (NAWQA) program. The sediment was analyzed for trace elements and organic compounds. Arsenic, cadmium, copper, lead, mercury, and zinc concentrations all exceeded the L-EL guidelines while chromium, iron, manganese, and nickel exceeded the S-EL guidelines (Chalmers 2002 and Persaud *et al.* 1993).

#### Tissue Chemistry

The USGS collected white suckers from this segment of the Saugus River in September 1998 (Chalmers 2002). A total of seven to eight white suckers were collected near the USGS gage in Saugus (near the Saugus Iron Works) in September 1998. The total PCB concentration in the "whole fish" composite sample was 140 ppb wet weight (Chalmers 2002). Total PCB in this "whole fish" sample did not exceed the NAS/NAE guideline for total PCB (in Coles 1998) of 500 ppb wet weight for the protection of fish-eating wildlife.

The USGS, also collected four pumpkinseed from this segment of the Saugus River (near Saugus Iron Works) on September 22, 1998 (USGS 2003b). These fish had an average weight of 19 grams and these

specimens were chopped and processed whole (Brumbaugh *et al.* 2001). The total mercury concentration in this “whole fish” composite sample was 107 ppb wet weight (USGS 2003b). According to Brumbaugh *et al.* (2001), “*Sunfish do not bioaccumulate Hg as rapidly as larger predatory fish species*” such as largemouth and small mouth bass. If present in this river these larger predatory fish may have higher mercury concentrations than found in the pumpkinseed.

The *Aquatic Life Use* is assessed as support for this segment of the Saugus River based primarily on the water quality data. This use is identified with an Alert Status because of low flow issues (unexplained problem documented in the summer of 2005) and sediment concentrations of chromium, arsenic, iron, manganese and nickel, which slightly exceeded their S-ELs. DMF biologists also identified a few additional factors exerting a negative influence on the suitability of smelt spawning habitat including rubble from a former dam, stormwater runoff, sedimentation, and excessive periphyton growth (Chase 2006a).

#### **Primary and Secondary Contact Recreation and Aesthetics uses**

Bacteria sampling was conducted by DWM staff in the Saugus River at Elm Street in Saugus (W0883) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8).




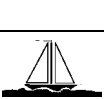

Fecal coliform bacteria counts ranged from 220 to 17,000 cfu/100 mls with a geometric mean of 615 cfu/100 mls (excluding duplicate sample results). This exceeded the standard of 200 cfu/100 mls for primary contact recreation. The highest fecal coliform bacteria count likely represented the influence of a local storm event.

There is a beach at Camp Nihan (at Pecham Pond) in Saugus. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No objectionable conditions (e.g., oils, odors, turbidity, other deposits) were noted by DWM field sampling crews (Station SR01B) during the water quality surveys conducted between May and September 2002 (MassDEP 2002a). DWM biologists did note that the river downstream from Elm Street (Station SR01) was turbid on 31 July 2002 (MassDEP 2002b).

The *Primary Contact Recreational Use* is assessed as impaired because of elevated fecal coliform bacteria counts. The highest counts likely represented the influence of local storm events. The *Secondary Contact Recreational* and *Aesthetics* uses are assessed as support based on the bacteria data and the generally good aesthetic conditions noted by field sampling crews. The *Secondary Contact Recreational Use* is identified with an Alert Status because of the high bacteria count.

SAUGUS RIVER (SEGMENT MA93-35) Use Summary

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

\*Alert Status issues identified, see details in use assessment section

## RECOMMENDATIONS

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as necessary and remediate problems identified.

Chase (2006a) recommends the following.

Smelt are currently limited to spawning below the rubble of the former dam upstream from the Iron Works property. The elevation rise and turbulent flow prevents smelt from passing upstream to suitable habitat. It is recommended that an evaluation is made of making modest structural changes to this section of the river bed to improve smelt passage and greatly increase the amount of potential spawning habitat.

All concerned EOE agencies should work with the Lynn Water and Sewer Commission and Saugus River Watershed Council to evaluate existing river flows and habitat requirements and develop minimum flow requirements for anadromous fish in the Saugus River.

Local authorities should routinely maintain stormwater retention basins in the vicinity of the Iron Works spawning habitat. When possible, resources should be devoted to the installing the best treatment technologies for drains next to this valuable habitat.

Biological monitoring (habitat quality, benthic macroinvertebrate RBPIII) should be conducted to better evaluate the status of the *Aquatic Life Use*.

Review the Gomez and Sullivan (2002) study and evaluate streamflow conditions in this segment of the Saugus River.

## MILL RIVER (SEGMENT MA93-31)

Location: From headwaters in wetland north of Salem Street, Wakefield to confluence with Saugus River, Wakefield.

Length/area: 2.0 miles.

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of organic enrichment/low DO, suspended solids, turbidity, and pathogens (MassDEP 2005).

### DISCHARGES

#### NPDES (Appendix E, Tables E2 and E3)

MA0103004 Town of Wakefield (New Broadway Water Treatment Plant)

MAG250965 the Wakefield Corporation (to a tributary of Mill River called "Wakefield Brook").

MA0034452 Spir-it, Inc.

### USE ASSESSMENT

#### *Aquatic Life Use*

##### Toxicity

##### Effluent






One modified acute and chronic whole effluent toxicity test was conducted on the Wakefield Corporation's non-contact cooling water discharge in June 1999. No acute toxicity to *C. dubia* was detected, while the chronic test result was CNOEC = 50% effluent.

##### Sediment Chemistry

In June 2003 grab samples of deposited sediment (top 2 to 4 inches) were collected by USGS personnel from one location in this segment (Station WAY-005, Mill River at Farm Street) and analyzed for elements, polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides, and polychlorinated biphenyls (PCB) (Breault *et al.* 2004). It should be noted that the 'grab sample' consisted of a homogenized composite of at least three samples at each location to characterize conditions at the site. The concentrations of chromium, copper, and lead exceeded the S-ELs by factors of 2.5, 1.3, and 1.6, respectively. None of the other metals exceeded their S-ELs. Concentrations of PAH, organochlorine pesticides, and PCB could not be compared to S-ELs (lack of total organic carbon data necessary to evaluate data) (Breault *et al.* 2004).

Too limited data area available to assess the *Aquatic Life Use*. This use is identified with an Alert Status because sediment concentrations of chromium, copper and lead slightly exceeded their respective S-ELs.

MILL RIVER (SEGMENT MA93-31) Use Summary

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED*				

\*Alert Status issues identified, see details in use assessment section

### RECOMMENDATIONS

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as necessary and remediate problems identified.

Field reconnaissance should be conducted along Mill River to evaluate whether or not turbidity continues to be problematic since many of discharges have been removed and stormwater management practices may have been improved. Develop sampling strategy to evaluate current conditions and to assess the *Aquatic Life Use*.

Wakefield Corporation (MAG250965) should conduct an additional modified acute and chronic whole effluent toxicity test as part of their permit renewal process.

## UPPER POND (SEGMENT MA93083)

Location: Saugus.

Length/area: 13 acres

Classification: Class B

This segment is on the 2004 Integrated List of Waters in Category 2 - Attaining Some Uses (*Secondary Contact Recreation* and *Aesthetics*); Others Not Assessed (MassDEP 2005).






### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Upper Pond. All designated uses are not assessed.

UPPER POND (SEGMENT MA93083) Use Summary

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

## LOWER POND (SEGMENT MA93044)

Location: Saugus.

Length/area: 21 acres

Classification: Class B

This segment is on the 2004 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant due to the presence of exotic (non-native) species (MassDEP 2005).

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### ***Aquatic life Use***

##### Biology

Lower Pond (also known as Pearce Lake) was reported to have a non-native aquatic plant (*Cabomba caroliniana*) (DeCesare *et al.* 2000). There was no record of *C. caroliniana* on the field survey sheet (MassDEP 1997), so the infestation and subsequent listing of this waterbody in Category 4c is incorrect.






The *Aquatic Life Use* is not assessed for Lower Pond.

#### ***Primary and Secondary Contact Recreation and Aesthetics uses***

There is one beach along the shores of Lower Pond (Pearce Lake) at Breakheart. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

The *Primary and Secondary Contact Recreational and Aesthetics* uses are not assessed due to the lack of any recent quality assured data.

LOWER POND (SEGMENT MA93044) Use Summary

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

### RECOMMENDATIONS

A macrophyte survey of Lower Pond needs to be conducted.

Conduct water quality monitoring to evaluate designated uses.

## HAWKES BROOK (SEGMENT MA93-32)

Location: Headwaters near the Lynn/Lynnfield border to the inlet of Hawkes Pond, Lynnfield.

Length/area: 2.6 miles

Classification: Class A, Public Water Supply, ORW.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

### WITHDRAWALS AND DISCHARGES







#### WMA (Appendix E, Table E1)

Lynn Water and Sewer Commission (LWSC) registration/permit (31816302/9P31816302).

#### NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Hawkes Brook. All designated uses are not assessed.

HAWKES BROOK (SEGMENT MA93-32) Use Summary					
Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

\* The MassDEP Drinking Water Program maintains current drinking water supply data.

### RECOMMENDATIONS

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as necessary and remediate problems identified.

To the extent possible, the LWSC should try to keep streamflow patterns in Hawkes Brook as close to natural as possible. Conduct water quality monitoring to evaluate the *Aquatic Life Use*.

Implement recommendations in the Comprehensive Surface Water Supply Protection Plan for the City of Lynn.



## HAWKES POND (SEGMENT MA93032)

Location: Lynnfield/Saugus.

Length/area: 65 acres

Classification: Class A/PWS/ORW.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of turbidity (MassDEP 2005).

### WITHDRAWALS AND DISCHARGES







#### WMA (Appendix E, Table E1)

Lynn Water and Sewer Commission (LWSC) registration/permit (31816302/9P31816302).

#### NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Hawkes Pond. All designated uses are not assessed.

HAWKES POND (SEGMENT MA93032) Use Summary					
Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

\* The MassDEP Drinking Water Program maintains current drinking water supply data.

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Implement recommendations in the Comprehensive Surface Water Supply Protection Plan for the City of Lynn.

## WALDEN POND (SEGMENT MA93084)

Location: Lynn/Saugus/Lynnfield.

Length/area: 223 acres

Classification: Class A/PWS/ORW.

This segment is on the 2004 Integrated List of Waters in Category 2 - Attaining Some Uses (*Secondary Contact Recreation* and *Aesthetics*); Others Not Assessed (MassDEP 2005).

### WITHDRAWALS AND DISCHARGES







#### WMA (Appendix E, Table E1)

Lynn Water and Sewer Commission (LWSC) registration/permit (31816302/9P31816302).

#### NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Walden Pond. All designated uses are not assessed.

WALDEN POND (SEGMENT MA93084) Use Summary					
Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

\* The MassDEP Drinking Water Program maintains current drinking water supply data.

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Implement recommendations in the Comprehensive Surface Water Supply Protection Plan for the City of Lynn.

## HAWKES BROOK (SEGMENT MA93-33)

Location: Outlet of Hawkes Pond, Saugus to confluence with Saugus River, Saugus.

Length/area: 1.1 miles.

Classification: Class B.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

### WITHDRAWALS AND DISCHARGES

#### WMA (Appendix E, Table E1)






[Note: Lynn Water and Sewer Commission (LWSC) registration/permit (31816302/9P31816302) withdrawals upstream from this brook.]

#### NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for this segment of Hawkes Brook. All designated uses are not assessed.

HAWKES BROOK (SEGMENT MA93-33) Use Summary

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

### RECOMMENDATIONS

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as necessary and remediate problems identified.

To the extent possible, the LWSC should try to keep streamflow patterns in Hawkes Brook as close to natural as possible. Conduct water quality monitoring to evaluate the *Aquatic Life Use*.

## **BENNETTS POND BROOK (SEGMENT MA93-48)**

Location: Headwaters east of Lynn Fells Parkway (in Bellevue Golf Course), Melrose to confluence with Saugus River, Saugus.

Size: 2.4 miles

Classification: Class B

This is a new segment so this waterbody does not appear in the 2004 Integrated List of Waters. This stream is most recently labeled as Crystal Pond Brook on the USGS topographic map.

### **DISCHARGES**

**NPDES (see Appendix E, Table E3)**

### **USE ASSESSMENT**

#### ***Aquatic Life Use***

##### Water Chemistry

Sampling was conducted by DWM staff in Bennetts Pond Brook near the mall entrance east of Forest Street in Saugus (W0878) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Tables 7 and 8).

Despite low streamflow conditions prevalent during the summer months of 2002 coincident with drought conditions (advisories and watches were in effect in Massachusetts), in-stream DO concentrations ranged from 6.0 to 11.8 mg/L in Bennetts Pond Brook representing both day-time and pre-dawn (worst case) conditions. All *in-situ* measurements met standards. Moderate to high concentrations of total phosphorus were documented (0.023 to 0.19 mg/L) and slightly elevated conductivity measurements were also noted.

The *Aquatic Life Use* is assessed as support based on the *in-situ* water quality data. This use is identified with an Alert Status, however, because of the elevated concentrations of total phosphorus.

#### ***Primary and Secondary Contact Recreation and Aesthetics uses***




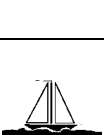

Sampling was conducted by DWM staff in Bennetts Pond Brook near the mall entrance east of Forest Street in Saugus (W0878) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8).

Fecal coliform bacteria counts ranged from 220 to 9,400 cfu/100 mls with a geometric mean of 1,858 cfu/100 mls. This exceeded the standard of 200 cfu/100 mls and 1,000 cfu/100 mls for primary and secondary contact recreation, respectively. The highest count was representative of a local storm event.

Field observations were made by DWM personnel during the surveys conducted in Bennetts Pond Brook between May and September 2002. Although dense beds of water cress - *Rorippa* sp. and some duckweed - *Lemna* sp. were observed and there was an isolated area of trash/debris near the stream, no objectionable conditions (odors, oils, turbidity) were noted during any of the surveys (Station BP03) (MassDEP 2002a).

Because of the elevated fecal coliform bacteria counts, the *Primary* and *Secondary Contact Recreational* uses are assessed as impaired for Bennetts Pond Brook. The *Aesthetics Use* is assessed as support since no objectionable conditions (e.g., odor, oils, turbidity, deposits) were recorded by DWM field crews.

# BENNETTS POND BROOK (SEGMENT MA93-48) Use Summary

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, highway/road runoff
Secondary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, highway/road runoff
Aesthetics		SUPPORT

\*Alert Status issues identified, see details in use assessment section

## RECOMMENDATIONS

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as necessary and remediate problems identified.

Conduct additional water quality sampling for to identify potential source(s) contributing total phosphorus to the brook. Once source(s) are identified, implement best management practices to reduce nutrient loading.

## SPRING POND (SEGMENT MA93072)

Location: Saugus.

Length/area: 8 acres

Classification: Class B, ORW

This segment is located with the Golden Hills ACEC.

This segment is on the 2004 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant due to the presence of exotic (non-native) species (MassDEP 2005).

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT






#### ***Aquatic Life Use***

##### Biology

Spring Pond is infested with a non-native aquatic plant (*Cabomba caroliniana*, and potentially *Myriophyllum heterophyllum*, but this species needs confirmation when flowering heads are present) (DeCesare *et al.* 2000). The pond has been treated with herbicides from 2001 to 2003 (MassDEP 2001, 2002c, and 2003b).

The *Aquatic Life Use* for Spring Pond is assessed as impaired because of the infestation of at least one non-native aquatic macrophyte. All other designated uses are not assessed.

SPRING POND (SEGMENT MA93072) Use Summary

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non native aquatic macrophyte Source: Unknown
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

### RECOMMENDATIONS

Water quality monitoring (*in-situ* measurements for DO, temperature, and other water quality parameters as well as bacteria sampling) should be conducted to better evaluate water quality conditions in Spring Pond and to assess the status of the designated uses.

Confirm species of *Myriophyllum*.

Continue to monitor for the presence of invasive non-native aquatic vegetation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and responsibility of spreading these species.

## GRISWOLD POND (SEGMENT MA93029)

Location: Saugus.

Length/area: 13 acres

Classification: Class B, ORW

This segment is located with the Golden Hills ACEC.

This segment is on the 2004 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant due to the presence of exotic (non-native) species (MassDEP 2005).

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT






#### ***Aquatic Life Use***

##### Biology

Griswold Pond is infested with a non-native aquatic plant (*Cabomba caroliniana* and *Myriophyllum heterophyllum*) (DeCesare *et al.* 2000). The Final Environmental Impact Report for Griswold Pond confirmed the presence of these species (Lyman 2001). The pond has been treated with herbicides each year from 2000 to 2003 (MassDEP 2000, 2001, 2002c, and 2003b).

The *Aquatic Life Use* for Griswold Pond is assessed as impaired because of the infestation of non-native aquatic macrophytes. All other designated uses are not assessed.

GRISWOLD POND (SEGMENT MA93029) Use Summary

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non native aquatic macrophyte Source: Unknown
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

### RECOMMENDATIONS

Water quality monitoring (*in-situ* measurements for DO, temperature, and other water quality parameters as well as bacteria sampling) should be conducted to better evaluate water quality conditions in Griswold Pond and to assess the status of the designated uses.

Continue to monitor for the presence of invasive non-native aquatic vegetation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and responsibility of spreading these species.

## FIRST POND (SEGMENT MA93081)

Location: Saugus (also known as Upper Griswold Pond).

Length/area: 4 acres

Classification: Class B, ORW

This segment is located with the Golden Hills ACEC.

This is a new segment so it does not appear on the 2004 Integrated List of Waters.

## DISCHARGES

NPDES (see Appendix E, Table E3)

## USE ASSESSMENT






### *Aquatic Life Use*

#### Biology

This waterbody is infested with the non-native aquatic macrophyte *Cabomba caroliniana* (and potentially *Myriophyllum heterophyllum*, but this species needs confirmation when flowering heads are present) (MassDEP 2002c). The pond has been treated with herbicides from 2001 to 2003 (MassDEP 2001, 2002c, and 2003b).

The *Aquatic Life Use* for First Pond is assessed as impaired because of the infestation of at least one non-native aquatic macrophyte. All other designated uses are not assessed.

FIRST POND (SEGMENT MA93081) Use Summary

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non native aquatic macrophyte Source: Unknown
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

## RECOMMENDATIONS

Water quality monitoring (*in-situ* measurements for DO, temperature, and other water quality parameters as well as bacteria sampling) should be conducted to better evaluate water quality conditions in First Pond and to assess the status of the designated uses.

Confirm species of *Myriophyllum*.

Continue to monitor for the presence of invasive non-native aquatic vegetation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and responsibility of spreading these species.



## BIRCH POND (SEGMENT MA93004)

Location: Saugus/Lynn.

Length/area: 80 acres

Classification: Class A/PWS/ORW

This segment is on the 2004 Integrated List of Waters in Category 2 - Attaining Some Uses (*Secondary Contact Recreation* and *Aesthetics*); Others Not Assessed (MassDEP 2005).

### WITHDRAWALS AND DISCHARGES







#### WMA (Appendix E, Table E1)

Lynn Water and Sewer Commission (LWSC) registration/permit (31816302/9P31816302).

#### NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Birch Pond. All designated uses are not assessed.

BIRCH POND (SEGMENT MA93004) Use Summary					
Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

\* The MassDEP Drinking Water Program maintains current drinking water supply data.

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Implement recommendations in the Comprehensive Surface Water Supply Protection Plan for the City of Lynn.

## BREEDS POND (SEGMENT MA93006)

Location: Lynn.

Length/area: 195 acres

Classification: Class A/PWS/ORW

This segment is on the 2004 Integrated List of Waters in Category 2 - Attaining Some Uses (*Secondary Contact Recreation* and *Aesthetics*); Others Not Assessed (MassDEP 2005).

### WITHDRAWALS AND DISCHARGES







#### WMA (Appendix E, Table E1)

Lynn Water and Sewer Commission (LWSC) registration/permit (31816302/9P31816302).

#### NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

No quality-assured data are available for Breeds Pond. All designated uses are not assessed.

BREEDS POND (SEGMENT MA93006) Use Summary					
Aquatic Life	Fish Consumption	Drinking Water*	Primary Contact	Secondary Contact	Aesthetics
					
NOT ASSESSED					

\* The MassDEP Drinking Water Program maintains current drinking water supply data.

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Implement recommendations in the Comprehensive Surface Water Supply Protection Plan for the City of Lynn.

## SLUICE POND (SEGMENT MA93071)

Location: Lynn.

Length/area: 42 acres

Classification: Class B

This segment is on the 2004 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2005).

This pond was sampled by DWM in August 2005 as part of the Nutrient Criteria Development Project however these data are not yet available.

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### ***Aquatic Life Use***

##### Biology

Sluice Pond is infested with a non-native aquatic plant (*Myriophyllum spicatum*) (MA DCR 2005).






The *Aquatic Life Use* for Sluice Pond is assessed as impaired because of the infestation of a non-native aquatic macrophyte.

#### ***Primary and Secondary Contact Recreation and Aesthetics uses***

There are two beaches along the shores of Sluice Pond: Briarcliff Lodge Beach and Four Winds Beach. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no Primary Contact Recreational Use assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

The *Primary and Secondary Contact Recreational and Aesthetics* uses are not assessed due to the lack of any recent quality assured data.

SLUICE POND (SEGMENT MA93071) Use Summary

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte Source: Unknown
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Control the infestation of *Myriophyllum spicatum*. Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program

should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Support improvement of freshwater Beaches Bill data quality and reporting.

## FLAX POND (SEGMENT MA93023)

Location: Lynn.

Length/area: 55 acres

Classification: Class B

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL due to the presence of noxious aquatic plants, turbidity, and pesticides as well as exotic species\* (MassDEP 2005).

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### ***Aquatic Life Use***

##### Biology

Flax Pond is infested with a non-native aquatic plant (*Potamogeton crispus*) (MassDEP 1997 and DeCesare *et al.* 2000).

The *Aquatic Life Use* for Flax Pond is assessed as impaired because of the infestation of a non-native aquatic macrophyte.

#### ***Fish Consumption Use***

Fish contaminant monitoring was conducted by MassDEP in Flax Pond in May 2002. Edible fillets of four, three-fish composite samples (largemouth bass - *Micropterus salmoides*, white perch - *Morone americana*, yellow perch - *Perca flavescens*, and American eel - *Anguilla rostrata*) were analyzed for the presence of heavy metals, PCB, and organochlorine pesticides (Appendix D, Table D1). Mercury concentrations were below the MA DPH trigger level of 0.5 mg/kg in all four samples analyzed. PCB Aroclors and Congeners were below method detection limits (MDLs) in all but the sample of American eel. Chlordane and/or DDT (and its metabolites DDE - dichlorodiphenyldichloroethylene and DDD - dichlorodiphenyldichloroethane) were detected in all samples analyzed (although a number of these data points were qualified as "Estimated value-concentration <reporting detection limit (RDL) or certain criteria not met"). It should be noted that due to the very high levels of lipids (13%) in the American eel sample, these data can be considered worst-case for PCB and organochlorine pesticides (Maietta *et al.* 2004). Concentrations do not appear to be indicative of an ongoing source of these contaminants, however it is feasible that these contaminants may have resulted from historic household use of pesticides (Maietta *et al.* 2004).

MA DPH reviewed these data and issued the following site-specific fish consumption advisory: "Children under 12, pregnant women, nursing mothers, and women of childbearing age who may become pregnant should refrain from consuming any American eel or white perch from Flax Pond to prevent exposure of developing fetuses, nursing infants and young children to chlordane and DDT" and "the general public should not consume any American eel caught from Flax Pond" (MA DPH 2005a).






Because of the site-specific fish consumption advisory due to chlordane and DDT contamination, the *Fish Consumption Use* is assessed as impaired for Flax Pond.

#### ***Primary and Secondary Contact Recreation and Aesthetics uses***

There are two beaches along the shores of Flax Pond: Railing Beach and Rocks Beach. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

The *Primary and Secondary Contact Recreational and Aesthetics* uses are not assessed due to the lack of any recent quality assured data.

### FLAX POND (SEGMENT MA93023) Use Summary

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non native aquatic macrophyte Source: Unknown
Fish Consumption		IMPAIRED Cause: Elevated concentrations of Chlordane, DDT Source: Unknown
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

### RECOMMENDATIONS

Conduct water quality monitoring to evaluate designated uses.

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Support improvement of freshwater Beaches Bill data quality and reporting.

## SAUGUS RIVER (SEGMENT MA93-43)

Location: Saugus Iron Works, Bridge Street, Saugus to Lincoln Avenue/Boston Street, Saugus/Lynn (formerly part of segment MA93-14).

Length/area: 0.04 mi<sup>2</sup>

Classification: Class SB.

This segment (formerly part of MA93-14) is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of thermal modifications, oil & grease, and pathogens as well as flow alteration\* (MassDEP 2005). [\*Note: this impairment is not a pollutant requiring the development of a TMDL.]

A summary of information related to the geography, history, resources, and water quality of the Saugus River was compiled by the North Coastal Watershed Alliance (NCWA 2000).

The Town of Saugus has a wastewater pumping station near to the Saugus River on Lincoln Avenue. There are chronic sewer system overflows (SSO) at this location during significant wet weather events (Brander 2006a).

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### ***Aquatic Life Use***

##### Habitat and Flow

USGS maintains one gage in this segment of the Saugus River on left bank 20' upstream from Bridge Street in Saugus (gage 01102345). The drainage area at the gage is 20.8 mi<sup>2</sup>. The average annual discharge at the gage is 30.4 cfs (period of record March 1994 to current; Socolow *et al.* 2005). The USGS remarks indicate that there is evidence of seasonal regulation by ponds upstream. Occasional high tides will submerge the pool where the water temperature and specific conductance probes are located and may cause high specific conductance values (Socolow *et al.* 2005).

##### Biology

A smelt fyke station was established by DMF at the NPS Iron Works property in 2005 for annual monitoring of smelt populations. Smelt were routinely caught during the spring spawning run in 2005 and the presence of white perch - *Morone americana*, alewife - *Alosa* sp., and American eel - *Anguilla rostrata* was also documented (Chase *et al.* 2006). This station and an upstream glass eel trap will be maintained annually with the assistance of the Saugus River Watershed Association and the National Park Service.

##### Sediment Chemistry

In June 2003, grab samples of deposited sediment (top 2 to 4 inches) were collected by USGS personnel from one location in this segment (Station L5Y-001, Saugus River at Boston Street) and analyzed for elements, polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides, and polychlorinated biphenyls (PCB) (Breault *et al.* 2004). It should be noted that the 'grab sample' consisted of a homogenized composite of at least three samples at each location to characterize conditions at the site. The concentration of chromium exceeded the S-EL by a factor of 2.4. None of the other metals exceeded their S-ELs. Concentrations of PAH, organochlorine pesticides, and PCB could not be compared to S-ELs (lack of total organic carbon data necessary to evaluate data) (Breault *et al.* 2004).

Only limited data are available so the *Aquatic Life Use* is not assessed. This use is identified with an Alert Status because the concentration of chromium in the sediment slightly exceeded its S-EL.

#### ***Shellfish Harvesting Use***







DMF shellfish status of July 2000 indicates that Area N26.0, which comprises this segment area, is prohibited. No changes to their status have been made (Kennedy 2006a).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing areas are either conditionally approved or prohibited.

**Primary and Secondary Contact Recreation and Aesthetics uses**

The *Primary and Secondary Contact Recreational* and *Aesthetics* uses are not assessed but are identified with an Alert Status because of the Town of Saugus's SSO discharge to the river during significant wet weather events.

SAUGUS RIVER (SEGMENT MA93-43) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Sanitary sewer overflows Suspected sources: Discharges from separate storm sewer systems
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED*
Aesthetics		NOT ASSESSED*

\*Alert Status issues identified, see details in use assessment section

**RECOMMENDATIONS**

Implement stormwater inflow and infiltration (I/I) best management practices and storm water bank as per Consent Order issued by Mass DEP for the town of Saugus (Brander 2006a).

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary and Secondary Contact Recreational* uses. Conduct bacteria source tracking as necessary and remediate problems identified.

Conduct water quality monitoring to evaluate designated uses.

Review the results of the project that was recently funded through the Coastal Wetlands Restoration Partnership to conduct a comprehensive fish monitoring project in the spring of 2005 in conjunction with DMF and the Saugus Iron Works National Historic Site (SRWC 2005).



## SHUTE BROOK (SEGMENT MA93-50)

Location: From the confluence of Fiske Brook, Saugus to approximately 350 feet downstream from Central Street, Saugus.

Length/area: 0.9 miles

Classification: Class B.

This is a new segment so it does not appear on the 2004 Integrated List of Waters.

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### ***Aquatic Life Use***

##### Habitat and Flow

Suitable rainbow smelt spawning habitat is available in this segment of Shute Brook near Central Street. Smelt egg deposition was found by DMF biologists in an 810m<sup>2</sup> area; the upper limit of smelt spawning was the culvert under the street but it did not prevent passage (Chase 2006a). The smelt-spawning habitat was described as being susceptible to stormwater runoff in terms of both physical alteration (sedimentation) and excessive periphyton growth (Chase 2006a).

##### Biology

Smelt egg deposition in Shute Brook was documented during all three years of monitoring (1989 – 1991)(Chase 2006a).

##### Water Chemistry

Sampling was conducted by DWM staff in Shute Brook upstream from Central Street in Saugus (W0877) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 7).

In-stream DO concentrations all met standards and ranged from 6.6 to 10.6 mg/L. Percent saturation all met standards and ranged from 73% to 98. Total suspended solids ranged from less than one to 7 mg/L. All other *in-situ* measurements (e.g., pH, temperature) met water quality standards. Ammonia-nitrogen concentrations were low ranging from <0.02 to 0.11 mg/L. Phosphorus levels were low to moderate and were highest during the wet weather survey (0.098 mg/L).

The *Aquatic Life Use* is assessed as support for Shute Brook. This use is identified with an Alert Status, however, because of sedimentation, somewhat high concentrations of total phosphorus, and excessive periphyton growth. DMF biologists noted stormwater runoff as a concern.

#### ***Primary and Secondary Contact Recreation and Aesthetics uses***




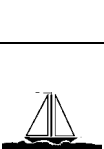

Bacteria sampling was conducted by DWM staff in Shute Brook upstream from Central Street in Saugus (W0877) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8).

Fecal coliform bacteria counts ranged from 440 to 28,000 cfu/100 mls with a geometric mean of 2,039 cfu/100 mls. This geometric mean exceeded the standard of 200 and 1,000 cfu/100 mls for primary and secondary recreational uses, respectively. The highest fecal coliform bacteria count likely represented the influence of a local storm event.

Field observations were made by DWM personnel during the surveys conducted in Shute Brook between May and September 2002. With the exception of isolated areas of trash/debris, no objectionable conditions (i.e., odors, oils, turbidity) were noted during any of the surveys (Station SB01) (MassDEP 2002a).

The *Primary and Secondary Contact Recreational* uses are assessed as impaired due to the high bacteria counts. The highest count was associated with wet weather conditions. Other sources are unknown. The *Aesthetics Use* is assessed as support based on the lack of objectionable conditions.

### SHUTE BROOK (SEGMENT MA93-50) Use Summary

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, highway/road runoff, illicit sewer connections
Secondary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, highway/road runoff, illicit sewer connections
Aesthetics		SUPPORT

\*Alert Status issues identified, see details in use assessment section

### RECOMMENDATIONS

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as necessary and remediate problems identified.

Field reconnaissance should be conducted along Shute Brook to identify any areas contributing sediment to Shute Brook. Biological monitoring (benthic macroinvertebrate and habitat quality evaluations) should again be conducted to better evaluate the *Aquatic Life Use*.

Support the following actions identified by DMF to study/protect/remediate smelt spawning habitat (Chase 2006a):

Enhance the quality of smelt spawning habitat with modest substrate improvements at the culvert opening accompanied by routine maintenance. Shute Brook should also be considered a potential smelt spawning habitat restoration project. Remediation of chronic sedimentation and trash accumulation resulting from stormwater runoff is also needed.

Local authorities should routinely maintain stormwater retention basins in the vicinity of the Shute Brook spawning habitat. Installation of best treatment technologies for storm drains in the vicinity of the smelt spawning habitat should be considered as a high priority.

## **SHUTE BROOK (SEGMENT MA93-49)**

Location: Approximately 350 feet downstream from Central Street, Saugus to the confluence with the Saugus River, Saugus.

Length/area: 0.01mi<sup>2</sup>

Classification: Class SA.

This is a new segment so it does not appear on the 2004 Integrated List of Waters.

### **DISCHARGES**

**NPDES (see Appendix E, Table E3)**

### **USE ASSESSMENT**

#### ***Aquatic Life Use***

##### Sediment Chemistry

In June 2003 grab samples of deposited sediment (top 2 to 4 inches) were collected by USGS personnel from one location in Shute Brook (Station SEY-003 near cemetery) and analyzed for elements, polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides, and polychlorinated biphenyls (PCB) (Breault *et al.* 2004). It should be noted that the 'grab sample' consisted of a homogenized composite of at least three samples at each location to characterize conditions at the site. The concentration of chromium exceeded the S-EL by a factor of 2.4. None of the other metals exceeded their S-ELs. Concentrations of PAH, organochlorine pesticides, and PCB could not be compared to S-ELs (lack of total organic carbon data necessary to evaluate data) (Breault *et al.* 2004).

Only limited data are available so the *Aquatic Life Use* is not assessed. This use is identified with an Alert Status because the concentration of chromium in the sediment slightly exceeded its S-EL.

#### ***Shellfish Harvesting Use***

DMF shellfish status of July 2000 indicates that Area N26.0, which comprises a portion of this segment area, is prohibited. No changes to this status have been made (Kennedy 2006a).





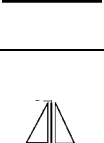

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing area is prohibited.

#### ***Primary and Secondary Contact Recreation and Aesthetics uses***

Bacteria sampling was conducted by DWM staff upstream from this segment of Shute Brook near Central Street in Saugus (W0877) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 8). The fecal coliform bacteria counts were high at this sampling location (ranging from 440 to 28,000 cfu/100 mls with a geometric mean of 2,039 cfu/100 mls). This geometric mean exceeded the standard of 200 and 1,000 cfu/100 mls for primary and secondary recreational uses, respectively. The highest fecal coliform bacteria count represented the influence of a local storm event.

The *Primary and Secondary Contact Recreational* uses are assessed as impaired because of high bacteria counts documented just upstream from this segment of Shute Brook and best professional judgment. The highest count was associated with wet weather conditions. Other sources are unknown. The *Aesthetics Use* is not assessed.

### SHUTE BROOK (SEGMENT MA93-49) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, highway/road runoff, illicit sewer connections
Primary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, highway/road runoff, illicit sewer connections
Secondary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Unknown Suspected sources: Discharges from separate storm sewer systems, highway/road runoff, illicit sewer connections
Aesthetics		NOT ASSESSED

\*Alert Status issues identified, see details in use assessment section

### RECOMMENDATIONS

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as needed.

Implement recommendations in the DMF shellfish management plan for Area N26.0

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

## **SAUGUS RIVER (SEGMENT MA93-44)**

Location: Lincoln Avenue/Boston Street, Saugus/Lynn to mouth (east of Route 1A) at Lynn Harbor, Lynn/Revere (formerly part of segment MA93-14)

Length/area: 0.36 mi<sup>2</sup>

Classification: Class SB, CSO, ORW

This segment is almost entirely within Rumney Marshes ACEC. This segment (formerly part of MA93-14) is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of thermal modifications, oil & grease, and pathogens as well as flow alteration\* (MassDEP 2005). [\*Note: this impairment is not a pollutant requiring the development of a TMDL.]

A summary of information related to the geography, history, resources, and water quality of the Saugus River was compiled by the North Coastal Watershed Alliance (NCWA 2000).

MassDEP managed loan projects that should be improving water quality conditions in this segment include:

SRF- Lynn Water and Sewer Commission Summer Street and Cottage Street Sewer Separation Project

SRF- Lynn Water and Sewer Commission I/I Flow Reduction and Sewer System Rehabilitation Project (Western Interceptor)

## **WITHDRAWALS AND DISCHARGES**

### **WMA (Appendix E, Table E1)**

Carr Leather Company, Lynn registration (31816301) rescinded as of 6/30/1997. [Note: factory no longer in operation and there was a short term cleanup (removal) at Carr Leather started on 10/1/98 and completed on 2/27/99 (EPA 2006a)].

### **NPDES (Appendix E, Tables E2 and E3)**

MA0100552 for the Lynn Water and Sewer Commission (LWSC) Outfall #003 Summer St. wet weather CSO which discharges to the "Little River" Street portion (also referred to as Strawberry Brook) of the Saugus River located upstream from the Route 107 Bridge. Lynn is under a court order (Civil Action No. 76-2184-RGS) to mitigate their CSOs, including CSO discharges from #003. Dry weather discharges are prohibited (Brander 2006b).

MA0028193 Wheelabrator Saugus JV (formerly Refuse Energy Systems Company [RESCO]).

MA0003905 General Electric Company, Lynn (GE Lynn) 15 discharge outfalls.

MA0004634 Eastern Tool and Stamping Co., Inc. to a tidal channel tributary of the Saugus River.

## **USE ASSESSMENT**

### ***Aquatic Life Use***

#### ***Habitat and Flow***

There are several potential salt marsh restoration projects in the Rumney Marshes ACEC along this segment of the Saugus River (e.g., widening of the Lincoln Avenue/Boston Street Bridge, routine maintenance of ditches, etc.). Details on each project site can be found in the ACEC Salt Marsh Restoration Plan (EOEA and MDEM 2002).

There are four "intakes" of water along this segment of the Saugus River. The Saugus River near the GE Lynn facility is approximately 19.5 feet deep at mean low tide and there is a 9.5-foot water level differential between mean low and high tides (Tetra Tech 2006a). On the opposite (southern) shore the Saugus River is shallower, with an average depth of approximately 10', and largely consists of salt marsh habitat (Tetra Tech 2006a and b). No biocides or other chemicals are used for the cooling water intake systems.

GE Lynn has three intakes along the northern shoreline between Route 107 (Salem Turnpike/Western Avenue) and the train tracks. These intakes include:

1. one to supply the Test Facility associated with Outfall #014 (which is only used sporadically and because of sediment build up can only be used at high tide - Callaghan 2006),
2. one to supply cooling water to the Power House and discharging to Outfall #018, and
3. one to supply the Gear Plant, which discharges to Outfall #029 (currently inactive).

The Test Facility intake consists of a single shoreline intake canal (approximately 90') the same depth as the Saugus River. However, because of the infrequency of use (one to two times per month, approximately 8% utilization rate), aquatic organisms that may take refuge in the canal could be subject to higher impingement during intake operation (Tetra Tech 2006a). The traveling screens rotate constantly when in use and are cleaned by a high pressure (50 psi) spray wash and any organisms and debris are deposited into an open wooden trough that discharges into the main body of the river just upstream from the intake canal. The return trough was noted to be in very poor condition (abrasion, de-scaling and other contact injuries considered to be highly likely). The return trough location was also noted to be poor (essentially returning organisms to the mouth of the canal where they would be subject to re-impingement). There are no impingement and entrainment data specific to the Test Facility intake. The through-screen intake velocity was estimated as 1.28 feet per second (fps) (Tetra Tech 2006a). It is unknown if this intake velocity is accurate during all tidal stages and sediment conditions. The Test Facility intake is reported to operate only at high tides due to sedimentation in front of the intake (Tetra Tech 2006a).

The Power House intake consists of a shoreline intake structure with multiple intake bays. The reported utilization rate is over 99% (Tetra Tech 2006a). The structure withdraws down to a depth of 16 feet (just above the bottom of the river). Variable speed pumps were reportedly installed in 1998 (Becker 2006). The traveling screens, which rotate constantly, are cleaned by a high pressure (60 –100 psi) spray wash and any organisms and debris are deposited into an enclosed return pipe that discharges into an underwater location approximately 100-150' from the pumphouse (Tetra Tech 2006a). This return pipe (an upgrade to the prior fish return system for the Power House) was installed in 2002/2003 (Becker 2006). The through-screen intake velocity was estimated as 0.43 fps for the current permitted discharge volume of 35.9 MGD (Tetra Tech 2006a). It is unknown if this intake velocity is accurate during all tidal stages and sediment conditions.

The Gear Plant intake, which has not been used for the last 10 years, is located at the end of a long pier just west of Route 1A (Tetra Tech 2006a). The river is approximately 14' deep and the intake structure extends to the river bottom. Shallower, salt marsh habitat is also prevalent near the intake area. The single intake structure is at the end of the pier, which is approximately 700' in length (Tetra Tech 2006a). There is a series of fixed screens with progressively smaller mesh openings. Debris and organisms must be removed manually with a trash rake. There is no mechanism in place to protect against impingement or entrainment (Tetra Tech 2006a).

The Wheelabrator intake is located southeast of the Route 107 (Salem Turnpike) in East Saugus along the southern shore of Saugus River almost opposite from the Test Facility GE intake. A dredged channel 16' deep is maintained in front of the cooling water intake out to the navigation channel that is maintained in the river (Tetra Tech 2006b). The submerged shoreline intake structure has two intake bays. Each bay has a single speed pump with a variable frequency drive (upgraded to this system in 2003). In 2001 single entry-single exit Ristroph traveling screens were installed with 0.25 inch by 0.5-inch coarse wedgewire mesh screens. The screens are rotated and washed at least every two hours. The screens are first washed with a low-pressure (7 psi) spray wash that removes impinged organisms. The impinged organism are returned to the center of the Saugus River east of the intake area via this submerged fish return pipe. (A constant flow is maintained in the fish return pipe even when the screens are not rotating). A second spray (15 psi) deposits debris into a second return trough however no information was provided for this system. In July 2003, Wheelabrator replaced its circulating water pumps with variable speed pumps. However, there has been no decrease in intake flow realized with the use of the variable speed pumps. Wheelabrator also upgraded its fish return system (Callaghan 2006).

#### Biology

##### *Impingement - GE*

Test Facility Intake - No impingement data are available.

Power House Intake - Between November 1994 and October 1996, impingement and entrainment studies were conducted for the GE Power House intake (MRI 1997). During the two-year study (39 sampling events) 2,283 fish of 25 species were collected. Sampling effort varied between months and among years so there are no percent composition data comparing the relative abundance of individual species.

Dominant fish species collected during impingement sampling included grubby (*Myoxocephalus aeneus*), threespine stickleback (*Gasterosteus aculeatus*), winter flounder (*Pseudopleuronectes americanus*), and cunner (*Tautoglabrus adspersus*). Annual impingement rates per 24-hour period varied from 45 to 321 (1994-95 and 1995-96, respectively). Monthly 24-hour impingement rates varied from 5 to 200 fish during the first year of the study and 4 to 2,555 for the second (MRI 1997). These variations illustrate the potential for large impingement events to affect annual impingement estimates. [Note: These events should not be trimmed from the data set as outliers because they can and do occur. Also, reporting impingement (or entrainment) rates per 24-hour period is potentially not as accurate as reporting rates per unit flow. For example, flow can vary between days and samples (due to outages or use of variable speed drives) thereby affecting the total number of fish collected. It is unknown whether or not the data presented were adjusted for flow.] Neither annual impingement estimates nor peak impingement periods were provided for collected fish species.

Gear Facility Intake - No impingement data are available for the GE Gear Facility intake. This facility has not been operated in the last 10 years and therefore impingement is assumed to be zero. There are no technologies in place to effectively reduce impingement should the facility be reactivated.

#### Entrainment - GE

Test Facility Intake - No entrainment data are available though, based on a projected utilization rate of only 8%, yearly entrainment at this intake is likely limited.

Power House Intake - Entrainment samples were collected at the GE Power House Intake from November 1994 through October 1996 (MRI 1997). Samples were collected from the discharge canal, a factor that may have decreased the total number of organisms collected (i.e., eggs and larvae may be damaged or destroyed while passing through the station thereby making it impossible to assess total numbers). While 40 species were identified from the collections, annual entrainment rates were presented for only three species of interest -- winter flounder, Atlantic herring, and Atlantic mackerel (see summary below). Peak entrainment periods for these species were April through mid-May (winter flounder), November through early-May (Atlantic herring), mid-May through June (Atlantic mackerel eggs), and March through July (Atlantic mackerel larvae). Estimates of entrainment and reported equivalent adults are summarized for these three species in Table 3.

Table 3. Entrainment estimates and reported equivalent adults for the GE Power House Intake from November 1994 through October 1996 as reported in MRI (MRI 1997).

Species	Lifestage	Estimated # of fish entrained 1994 -1995 Season	Estimated # of fish entrained 1995 -1996 Season	Reported Equivalent # of Adults (94-95 and 95-96)
winter flounder ( <i>Pseudopleuronectes americanus</i> )	larvae	141,388	80,580	86 and 117 (age 3 adults)*
Atlantic herring ( <i>Clupea harengus</i> )	larvae	14,946	60,261	1,977 and 7,971 (age 4 adults)
Atlantic mackerel ( <i>Scomber scombrus</i> )	eggs	1,168,772	2,809,133	84 and 10 (age 3 fish)
	larvae	1,543,701	104,810	

\*Staged survival estimation values (MRI 1997)

Gear Facility Intake - No entrainment data are available for the GE Gear Facility intake. This facility has not been operated in the last 10 years, so entrainment is assumed to be zero. If the facility is reactivated, there are no technologies in place to effectively reduce entrainment.

#### Impingement - Wheelabrator

A total of 23 fish species were collected during impingement sampling at the Wheelabrator facility from September 1986 through May 1988. In total the five most abundant species (winter flounder – *P. americanus*, northern pipefish - *Syngnathus fuscus*, mummichog - *Fundulus heteroclitus*, grubby - *Myoxocephalus aeneus*, and windowpane - *Scophthalmus aquosus*) accounted for 86% of all fish collected. Winter flounder accounted for 36% of all individuals while pipefish, mummichogs, grubby, and

windowpane accounted for 21.8%, 14.2%, 7.9%, and 6.8%, respectively, of the total catch (Tetrtech 2006b). [Note: Specifics on sampling effort are described in MRI (1988), however it should be noted that sampling effort varied between months.] The impingement rates for all species measured ranged between 1.8 and 20.4 fish per 24-hours (approximately 3,100 fish per year) (Tetrtech 2006b). An estimate of total impingement by species was not provided in the report. Impingement survival rates (48-hour) for these dominant species were 77.5% for winter flounder (n=307), 77.5% for northern pipefish (n=209), 79.6% for mummichogs (n=114), 78.5% for grubby (n=60), and 31.4% for windowpane (n=51) (MRI 1988). It is likely that impingement survival has increased since the 2001 installation of Ristroph traveling water screens with wedgewire mesh.

#### *Entrainment - Wheelabrator*

Two entrainment studies have been conducted at the Wheelabrator facility. These studies occurred during the 1980s and early 1990s. However, since 2001, the intake screens have been upgraded, variable speed pumps have been installed, and the fish return system has been renovated. Each of these changes, coupled with changes in the waterbody since 1991, makes it impossible to draw conclusions on the current rate of impingement and entrainment at the facility. Therefore, impingement and entrainment data (presented below) may serve only to identify those species in the waterbody and species potentially impacted by the Wheelabrator plant operation.

Two entrainment studies were conducted at Wheelabrator since it was first constructed. During both studies there was concurrent ichthyoplankton sampling of the Saugus River. The first, a two-year study completed in 1988, found that the most abundant larvae were sculpin species (Cottidae), rainbow smelt (*Osmerus mordax*), Atlantic silverside (*Menidia menidia*), Atlantic tomcod (*Microgadus tomcod*), winter flounder (*P. americanus*) and rock gunnel (*Pholis gunnellus*). Most entrained eggs were from two groups labrid and windowpane (Tetrtech 2006b). The primary entrainment period for most species collected extended from March through May. Results of the initial study indicated that fish densities within the intake were, for six common species, higher than those found at river sampling sites. For example, rainbow smelt densities were 45 times higher at the intake compared to the river. Ratios for other species were 8:1 for winter flounder, 5.5:1 for rock gunnel, 2:1 for northern pipefish, 35:1 for sculpin, and 27:1 for silverside species. MRI (1991) stated of the 1988 data that “*These data suggest that entrainment at Wheelabrator (formerly RESCO) may affect a high percentage of larvae found in the Saugus River adjacent to the plant, a particular concern because of potential impacts to the local smelt and winter flounder populations.*” DMF raised concerns over potentially high entrainment mortality for several species due to intake operations (Chase 2006c). A second study, conducted during April and May of 1991, was initiated to better define entrainment rates for specific species of concern including winter flounder and rainbow smelt. Reported results from the 1991 study indicate that the mean entrainment rate for winter flounder was 26.1 larvae per 100 m<sup>3</sup> of intake water (when larvae were present), a rate 2.2 times that of the river (MRI 1991, Tetrtech 2006b). That larval winter flounder were more abundant in bottom water samples and the plant’s intake is located on the bottom appeared to explain the high abundance of larvae in the intake. When adjusted to account for the extent of the larval period and potential extrusion from the sampling net, MRI estimated that 3,506,694 winter flounder were entrained. MRI (1988) reported that the mean entrainment density for larval rainbow smelt was reported to be 13.3 fish per 100 m<sup>3</sup> though no annual entrainment estimates were provided. Not enough rainbow smelt were collected in 1991 to allow MRI to analyze densities or project yearly entrainment numbers (MRI 1991). Other species entrained in substantial quantities were sand lance (*Ammodytes* sp.), windowpane (*Scophthalmus aquosus*), fourbeard rockling (*Enchelyopus cimbrius*), radiated shanny (*Ulvaria subbifurcata*), Atlantic silverside (*M. menidia*), and cunner (Callaghan 2006).

#### Water Chemistry

Sampling was conducted by DWM staff in this segment of the Saugus River approximately 800 feet upstream from Route 107 in Saugus (W0892) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 7).

All but one DO concentration met standards (measurements ranged from 4.8 to 8.4 mg/L) while percent saturations were all >60% (ranging from 62 to 103%). All other *in-situ* measurements (e.g., pH, temperature) met water quality standards.



*Note: GE Lynn is currently participating in a study of the combined effects of both the GE Lynn and Wheelabrator thermal plumes (Callaghan 2006). In a December 15, 2005 letter to David Webster of EPA, Wheelabrator (owners of RESCO) presented the results of eight modeling scenarios requested by EPA (McIver 2005 and Swanson et al. 2004). The results included presentations of hypothetical three-dimensional thermal plumes under two Wheelabrator heat loads at four different times of year (March, June, August, and October). In all scenarios, the heat load from GE outfalls 014 and 018 were kept constant at their potential maximum. The two Wheelabrator heat loads were chosen to represent Wheelabrator operating its intake pumps 1) at 100% capacity (60 MGD) with a delta T of 18° F and 2) at 70% capacity (42 MGD) with a delta T of 22° F and no 90° F absolute effluent temperature limit, respectively. Overall the results showed that the thermal plume under the reduced intake flow scenario appeared to be within background in terms of its extent and magnitude, but the persistence of high temperatures within the plume increased over background (Callaghan 2006).*

#### Sediment Chemistry

In June 2003, grab samples of deposited sediment (top 2 to 4 inches) were collected by USGS personnel from three locations in this segment of the Saugus River (Station L5Y-002 near Strawberry Brook, Station SEY-004 at Route 107, and Station L5Y-003 at Route 1A) and analyzed for elements, polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides, and polychlorinated biphenyls (PCB) (Breault *et al.* 2004). It should be noted that the 'grab samples' consisted of a homogenized composite of at least three samples at each location to characterize conditions at each site. The concentration of chromium exceeded the S-EL by factors of 2.3, 2.4, and 1.4 at L5Y-002, SEY-004, and L5Y-003, respectively. None of the other metals exceeded their S-ELs. Concentrations of PAH, organochlorine pesticides, and PCB could not be compared to S-ELs (lack of total organic carbon data necessary to evaluate data) (Breault *et al.* 2004).

Although the limited water quality data for this segment of the Saugus River indicated generally good water quality conditions, the *Aquatic Life Use* is not assessed because of the lack of current data associated with the GE Lynn and Wheelabrator power plants. Since these facilities have made changes to their intakes (i.e., intake screens have been upgraded, variable speed pumps have been installed, and/or the fish return systems have been upgraded/renovated), no data currently exist to estimate impingement and entrainment under the current operating conditions. Impingement and entrainment at these facilities, which are located on opposite shores of the river, are of concern and so the *Aquatic Life Use* is identified with an Alert Status. This use is also identified with an Alert Status because the concentrations of chromium in the sediment slightly exceeded its S-EL.

#### **Shellfish Harvesting Use**

DMF shellfish status of July 2000 indicates that Area N26.0, which comprises this segment area, is prohibited. No changes to this status have been made (Kennedy 2006a).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing area prohibited.

#### **Primary and Secondary Contact Recreation and Aesthetics uses**

The Town of Saugus has a wastewater pumping station right next to the Saugus River on Lincoln Avenue (behind Spuds Restaurant) (Brander 2006a). MassDEP Northeast Regional Office has them under an Administrative Consent Order (ACO) due to chronic sewer system overflows at this location. The entire Saugus sewer system conveys flows to this point, and during significant wet weather events, the flows reaching the station have been beyond the capacity of the pumping facilities, which are limited under an Inter-municipal Agreement (IMA) with the LWSC, who receives and treats the waste. MassDEP's ACO requires the town to aggressively identify and remove infiltration and inflow from the sewer system, and establish a "sewer bank" to ensure that any new connections to the system do not exacerbate the overflow problem (Brander 2006a).

The LWSC proceeded with sewer separation work in the Outfall #003 sub-area subject to the federal court order, and is now assessing the need for further CSO abatement work. The #003 outfall on average is active 27 events each year, discharging approximately 8 million gallons of CSO flow (Brander 2006b). In October 2004, LWSC submitted a Supplemental CSO Facilities Plan (SFP) to MassDEP and EPA. The recommendations in the SFP include additional CSO abatement actions at the WWTP and in

the collection system, which will eliminate CSO discharges at Outfall #003 during a “typical” year, with average precipitation. MassDEP and EPA are reviewing the plan to determine if this represents the highest feasible level of CSO control, as required by the Clean Water Act, and MA Water Quality Standards (Brander 2006b).







Sampling was conducted by DWM staff in this segment of the Saugus River approximately 800 feet upstream from Route 107 in Saugus (W0892) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 7).

The fecal coliform bacteria counts were low at this sampling location ranging from <20 to 330 cfu/100 mls with a geometric mean of 101 cfu/100 mls). This geometric mean was 101 cfu/100 mls which met the standards of 200 and 1,000 cfu/100 mls for primary and secondary contact recreation, respectively.

Field observations were made by DWM personnel during the surveys conducted in this segment of the Saugus River (Station SR00) between May and September 2002. Although there was often a fishy odor and on one occasion an oil sheen was noted, no other objectionable conditions (turbidity, deposits) were noted (MassDEP 2002a).

Only limited data are available and so the *Primary* and *Secondary Contact Recreational* and *Aesthetic* uses are not assessed. Given the issues related to SSO and CSO discharges, these uses are identified with an Alert Status.

SAUGUS RIVER (SEGMENT MA93-44) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Sanitary sewer overflows, combined sewer overflows, discharges from municipal separate storm sewer systems (MS4)
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED*
Aesthetics		NOT ASSESSED*

\*Alert Status issues identified, see details in use assessment section

## RECOMMENDATIONS

LWSC (Brander 2006b)

- The LWSC should institute a sampling program to determine and eliminate the sources of bacterial contamination emanating from the Summer Street Outfall (#003).
- The LWSC NPDES permit specifically states that dry weather discharges from the CSO outfalls are prohibited. LWSC should provide notification to MassDEP, EPA, and other resource managers when wastewater flows are being discharges at #003.
- Upon approval by the regulatory agencies, LWSC should proceed with further CSO abatement actions to eliminate discharges at Outfall #003.

## Power Companies

Two power companies (Wheelabrator and GE Lynn) discharge to this segment of the Saugus River. Wheelabrator discharges once-through, non-contact cooling water. GE Lynn operates both closed loop and non-contact cooling water systems. Aquatic resources (fish, shellfish, etc.) within receiving waters

may be susceptible to the impacts of the cooling water intakes and the discharges. Additional monitoring should be implemented and results provided to the regulatory agencies to identify possible impacts. During the next permit reviews, additional data collection/monitoring should be required of the power plants. In general MassDEP DWM recommends that all once-through cooling water power plant operators in the Commonwealth be required to provide the following.

A “*Fact Sheet*” detailing the physical information of the facility should be available to the permitting authorities. This *Fact Sheet* should be updated when any changes are implemented at the facility and should include the following.

1. Cooling water use schematic including location of intake(s) and discharge(s).
2. Intake structure design information for each unit such as the presence of a sill to limit the intake of benthic species, a description of the sill maintenance program.
3. Pump information including number, types, estimated and measured velocities across screens under all (high, mid, and low) tidal or flow conditions.
4. Intake screen information including screen type, mesh size, screen rotation ability and rotation frequency used at the facility, screen wash mechanisms for removing debris and impinged organisms including pressures used in each.
5. Schematic of fish return system and operational description including horizontal angles of all nonlinear portions of the return pipe, vertical angle of return (i.e., where is return in relationship to the receiving waterbody). For a tidally influence facility does the fish return system empty beneath the water column at all tides? Provide fish return discharge locations for each unit.
6. Discharge structure design including estimated and/or measured velocities under all (high, mid, and low) tidal or flow conditions, and barrier net location(s) where applicable.
7. Description of any condensor biofouling program including the chemical, location of injection units relative to the intake screens, frequency of biofouling treatments, and sequencing [if any] of biofouling treatments in different electrogenerating units.

As part of either the NPDES permit or a 401 Water Quality Certification certain data collection/monitoring should be required to identify possible impacts of the facility on the waterbody. In general MassDEP recommends that all power plants that utilize once-through cooling water in the Commonwealth collect the following types of information on a continuing basis and have this information transcribed to a database or spreadsheets.

- Hourly cooling water flow at each intake.
- Hourly average intake and discharge temperatures.
- Weekly impingement monitoring (one 8 hour sample collected three times per week; each sample should be collected during a different 8-hour period such that over the course of one-week, each 8-hour period in the 24-hour diurnal cycle is sampled (i.e., 1200 to 0800 hrs, 0800 to 1600 hrs, and 1600-2400 hrs). Permittee should identify and report all fish species and resident important invertebrates [based on past 316a&b studies] impinged with annual estimates of impingement numbers at monthly average and permitted flows.
- Weekly entrainment monitoring (three times per week over time periods needed to track entrainment of eggs, larvae and early-stage juveniles of resident important species) and reporting with annual estimates of numbers of entrained eggs, larvae and juveniles of resident important species [based on past 316 a&b studies] at monthly average and permitted flows (all entrainment estimates should be based on samples collected from inside the intake structure and should be collected in a manner which is representative of the entire water column).
- Fish kill monitoring and reporting.
- Annual reports of all monitoring results should be submitted to the permitting authorities.

A technical advisory committee of scientists from the regulators agencies in conjunction with Dominion’s consulting scientists should review the results of the annual monitoring report, direct the analysis of all monitoring data (e.g., require Equivalent Adult Analyses or other modeling or assessment methods), determine whether or not any modifications need to be made to the sampling program, evaluate the need for requiring Best Available Technologies (BAT) at the facility to reduce impact(s) to the receiving waterbody, and to make any other recommendations necessary to protect against the creation of habitat, due to the plant’s operations (in combination with other pollutants and/or conditions of the waterbody),

that is not healthful to aquatic life in the waterbody from which intake waters are drawn and/or into which heated water is discharged.

Require detailed catch rate and size data for valuable indicator species such as diadromous fish (Chase 2006).

MassDEP has the following recommendations for GE to implement to better evaluate and/or mitigate unnecessary impacts from the facility:

Annual impingement and entrainment (rates and total numbers) for all species based on flow, entrainment sampling should be conducted at the intake rather than the discharge, and survival estimates based on latent impingement mortality (i.e., 96 hour survival).

The Test Facility intake fish return system should be upgraded to minimize potential damage to fish and invertebrates passing through the system (see recommended design characteristics in ASCE 1982). The return system should be located away from the intake structure to prevent re-impingement of organisms and debris (i.e., similar location to the Power Plant CWIS return).

The Power House intake fish return system should be upgraded (including a low pressure spray wash, upgrading screens) to minimize potential damage to fish and invertebrates passing through the system (see recommended design characteristics in ASCE 1982).

The Gear Plant intake currently has no mechanisms in place to protect against impingement or entrainment. This intake should not be utilized until BAT retrofitting has been implemented or the intake should be removed.

MassDEP has the following recommendations for Wheelabrator to implement to better evaluate and/or mitigate unnecessary impacts from the facility:

Updated impingement and entrainment data for screens installed in 2003, data should include annual impingement and entrainment (rates and total numbers) for all species based on flow, entrainment sampling should be conducted at the intake rather than the discharge, and survival estimates based on latent impingement mortality (i.e., 96 hour survival).

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as needed.

Bacterial contamination from the Saugus River on a flood tide should be remediated to improve conditions in the Pines River.

Implement recommendations in the DMF shellfish management plan for Area N26.0.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Support the Salt Marsh Restoration Plan for the Rumney Marshes Area of Critical Environmental Concern (EOEA and MDEM 2002).

## SWAINS POND (SEGMENT MA93095)

Location: Melrose.

Length/area: 3 acres

Classification: Class B.

This is a new segment so it does not appear on the 2004 Integrated List of Waters.

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT






#### *Aquatic Life Use*

##### Biology

This waterbody is infested with the non-native aquatic macrophyte *Cabomba caroliniana* (MassDEP 2002c).

The *Aquatic Life Use* for Swains Pond is assessed as impaired because of the infestation of non-native aquatic macrophytes. No other data are available so all other uses are not assessed.

SWAINS POND (SEGMENT MA93095) Use Summary

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non native aquatic macrophyte Source: Unknown
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

### RECOMMENDATIONS

Control the infestation of *Cabomba caroliniana*. Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Conduct water quality monitoring to evaluate designated uses.

## UNNAMED TRIBUTARY (“TOWN LINE BROOK”) (SEGMENT MA93-51)

Location: Unnamed tributary locally known as 'Town Line Brook', from Route 99, Malden to the confluence with the Pines River, Revere.

Length/area: 0.02 mi<sup>2</sup>

Classification: Class SA

This is a new segment so it does not appear on the 2004 Integrated List of Waters.

The Town Line Brook subwatershed area drains significant portions of Revere, Malden, Everett, and Melrose and encompasses approximately 2,500 acres of highly urbanized area. One of two tributaries to the brook, locally known as Linden Brook, was almost completely enclosed in a system of culverts (Quigley *et al.* 2002). The second tributary, locally known as Trifone Brook, drains a portion of Revere. The Massachusetts Environmental Trust (MET) funded a study to provide recommendations for improvements to the existing drainage infrastructure and management of the watershed to address public safety (chronic flooding problems) and to reduce pollution entering the Pines River and surrounding shellfish beds (Quigley *et al.* 2002, SRWC and GeoSyntec Consultants 2003).

### DISCHARGES

NPDES (see Appendix E, Table E3)

### USE ASSESSMENT

#### ***Aquatic Life Use***

##### Habitat and Flow

As part of a flood mitigation project in the 1950s, this segment of Town Line Brook was excavated and concrete lined and tide gates were placed at the culvert near Route 1 to limit tidal flows into the brook and its drainage system (Quigley *et al.* 2002). Other portions of the flood protection project (e.g., a large detention facility and pump station) were never completed. The tide gates have leaked substantially for at least 20 years restoring some of the previously drained salt marshes upstream from the tide gates (EOEA and MDEM 2002). In 2001 the Massachusetts Highway Department (MHD) funded replacement of the leaking tide gates with eight new ones including three new self-regulating tide gates and repair of the stop logs (EOEA and MDEM 2002). The rehabilitated tidegate system was constructed for upstream salt marsh restoration (approximately 5 acres of degraded salt marsh adjacent to the Showcase Cinemas parking lot) as well as improve flood protection. Additional areas of restorable salt marsh (in planning/design phase) will require naturalization of the stream channel (EOEA and MDEM 2002).

The concrete flood control channel has altered the flow regime and streambank and resulted in a loss of habitat for aquatic life.

##### Water Chemistry

Sampling was conducted by DWM staff in the unnamed tributary to the Pines River “Town Line Brook” near the northern end of Beth Israel Cemetery in Malden (W0880) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Tables 7 and 8). Because of the complex hydrology (varying tidal conditions encountered during surveys) and the censoring of some of the *in-situ* data, no conclusions can be drawn.

The *Aquatic Life Use* is assessed as impaired because of habitat alteration/channelization. The concrete channels and poorly functioning tide gates have altered the flow regime and streambank and degraded the in-stream habitat quality of the brook.

#### ***Shellfish Harvesting Use***

No shellfish growing area is identified/classified by DMF so this use is not assessed.

#### ***Primary and Secondary Contact Recreation and Aesthetics uses***

Bacteria sampling was conducted by DWM staff in the unnamed tributary to the Pines River “Town Line Brook” near the northern end of Beth Israel Cemetery in Malden (W0880) as part of the 2002 North Coastal Drainage Area water quality surveys (Appendix B, Table 7).

Fecal coliform bacteria counts ranged from 78 to 8,400 cfu/100 mls with a geometric mean of 1,008 cfu/100 mls. This exceeded the standard of 200 cfu/100 mls and 1,000 cfu/100 mls for primary and secondary contact recreation, respectively.

In 2001 an estimated total of 14 tons of trash/debris were removed from Town Line Brook during two cleanup days organized by the Saugus River Watershed Council (SRWC 2001a). In the 2002 field-sampling season, DWM personnel noted objectionable amounts of trash/debris in this brook between May and September 2002 (MassDEP 2002a). The water column ranged from slightly turbid to murky. Septic odors were noted on one occasion.







There have been two CZM/Coastal Pollution Remediation (CPR) grant projects in the Town Line Brook subwatershed since 2000 that should help to improve/restore water quality conditions:

In the fall of 2000, the City of Revere was awarded \$30,000 to investigate the sources of stormwater pollution to Trifone Brook (SRWC 2000). This pollution has been responsible for shellfish closures in the estuary (Rumney Marsh ACEC). As part of this project, a preliminary engineering design was developed. The design was used to support a subsequent application to install a structure to reduce or eliminate this pollution, directly benefiting water quality, habitat, and economic potential of the area. In the fall of 2001, the City of Revere was awarded \$22,860 for the Trifone Brook Stormwater Design Project, and the City of Malden was awarded \$30,000 for the Linden Brook Stormwater Assessment and Conceptual Engineering Project (SRWC 2001b).

It should also be noted that the SRWC has been working with the cities of Revere, Malden, Everett, and Melrose to address water quality issues. Actions have included storm drain sampling projects, pet waste education, and stormwater management project implementation (SRWC 2005).

Because of the elevated fecal coliform bacteria counts and the poor aesthetic quality conditions in Town Line Brook, the *Primary* and *Secondary Contact Recreational* and *Aesthetics* uses are assessed as impaired. Sources of pollution include discharges from separate storm sewer systems, runoff from urbanized areas, and collection system failures.

UNNAMED TRIBUTARY ("TOWN LINE BROOK") (SEGMENT MA93-51) Use Summary

Designated Uses		Status
Aquatic Life		IMPAIRED Causes: Habitat alteration, anthropogenic substrate alterations, other flow regime alterations, alteration in stream -side/littoral vegetative covers Sources: Channelization, streambank modification <i>habitat degradation associated with the flood control channel</i>
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		NOT ASSESSED
Primary Contact		IMPAIRED Causes: Elevated fecal coliform bacteria, (trash/debris, odor Sources: Municipal urbanized high density area, discharges from separate storm sewer systems, sanitary sewer overflows, urban runoff/storm sewers Suspected sources: Illicit connections
Secondary Contact		
Aesthetics		IMPAIRED Causes: Trash/debris, odor Sources: Municipal urbanized high density area, discharges from separate storm sewer systems, sanitary sewer overflows, urban runoff/storm sewers Suspected sources: Illicit connections

## RECOMMENDATIONS

Support efforts to improve water quality and habitat conditions along Town Line Brook (e.g., constructed wetlands, optimize settings of the self regulating tide gates, ecological restoration projects) some of which are described in the Town Line Brook Action Plan (SRWC and GeoSyntec Consultants 2003).

Evaluate the concrete flood control structures for instituting modifications to improve aquatic habitat quality.

Cleanup of this brook, identified by DMF biologists as one of the major sources of bacterial contamination and trash/debris to the Pines River, should be undertaken.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other grant projects that have been implemented. Assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as needed.



## **PINES RIVER (SEGMENT MA93-15)**

Location: Headwaters east of Route 1, Revere/Saugus to confluence with the Saugus River, Saugus/Revere.

Length/area: 0.58 mi<sup>2</sup>

Classification: Class SB, ORW.

This segment is entirely within Rumney Marshes ACEC.

This segment is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

### **DISCHARGES**

#### **NPDES (Appendix E, Tables E2 and E3)**

MA0034045 The Refuse Energy Systems Company (RESCO) Saugus Landfill to an unnamed tributary of the Pines River.

MA0036897 GLEN-MOR Fuel Oil Co., Revere

MA0033103 Holiday Fitness Center, Revere

MA0032671 Sports Oil Co., Revere

### **USE ASSESSMENT**

#### ***Aquatic Life Use***

##### Habitat and Flow

Many salt marsh restoration projects are underway in the Rumney Marshes ACEC adjacent to the Pines River and in its watershed area (e.g., tide gate replacements, new culverts, excavation/removal of fill materials, etc.). Details on each project site can be found in the ACEC Salt Marsh Restoration Plan (EOEA and MDEM 2002). A few of the projects completed and/or underway that are directly adjacent to the Pines River include the following: MHD Central Artery Mitigation, Old Saugus Racetrack Open Marsh Water Management, Roughan's Point Mitigation, and Revere Beach Back Shore Ponding Area (EOEA and MDEM 2002).

The southern edge of the Dewey Dagget Landfill, located along the banks of the Pines River between Route 107 and the RESCO landfill, is eroding. This site, as well as other potential sites identified in the Salt Marsh Restoration Plan, has not yet been restored.

##### Sediment Chemistry

In June 2003, grab samples of deposited sediment (top 2 to 4 inches) were collected by USGS personnel from one location in the Pines River (Station RDY-001 near Gibson Field) and analyzed for elements, polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides, and polychlorinated biphenyls (PCB) (Breault *et al.* 2004). It should be noted that the 'grab sample' consisted of a homogenized composite of at least three samples at each location to characterize conditions at the site. The concentrations of chromium exceeded the S-EL by a factor of 2.1. None of the other metals exceeded their S-ELs. Concentrations of PAH, organochlorine pesticides, and PCB could not be compared to S-ELs (lack of total organic carbon data necessary to evaluate data) (Breault *et al.* 2004).

Although many salt marsh restoration projects are proposed/underway/implemented, too limited data are available so the *Aquatic Life Use* is not assessed for the Pines River. This use is identified with an Alert Status, however, because of the need for habitat/flow restoration projects and the concentration of chromium in the sediment slightly exceeded its S-EL.

#### ***Shellfish Harvesting Use***

DMF shellfish status of July 2000 indicates that areas N26.1, N26.3, N26.4, N26.5, and N26.6 which comprise this segment area, are prohibited. No changes to this status have been made however there may be upgrades in the classifications of one or more of these areas in the fall of 2006 (Kennedy 2006b).







The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing areas are prohibited.

### **Primary and Secondary Contact Recreation and Aesthetics uses**

According to DMF biologists, the Pines River is characterized by good aesthetics with the exception of two areas (Casey 2006). The eroding bank near the Dewey Dagget Landfill is one problem area. The debris near the headwaters from Town Line Brook (also known as Malden Canal) and some of its tributaries is also a problem.

No bacteria data are readily available so the *Primary* and *Secondary Contact Recreational* uses are not assessed. The *Aesthetics Use* is assessed as support but is identified with an Alert Status because of the trash/debris emanating from Town Line Brook and its tributaries and the eroding bank near the Dewey Dagget Landfill.

PINES RIVER (SEGMENT MA93-15) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Discharges from separate storm sewer systems, upstream sources, urban runoff/storm sewers Suspected sources: Illicit connections
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT*

\*Alert Status issues identified, see details in use assessment section

### **RECOMMENDATIONS**

Develop and conduct water quality monitoring (*in-situ* measurements of DO, % saturation, pH, temperature) to evaluate status of *Aquatic Life Use*.

Support the Salt Marsh Restoration Plan for the Rumney Marshes Area of Critical Environmental Concern (EOEA and MDEM 2002).

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as needed.

Implement recommendations in the DMF shellfish management plans for areas N26.1, N26.3, N26.4, N26.5, and N26.6.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

Cleanup of Town Line Brook, identified by DMF biologists as one of the major sources of bacterial contamination and trash/debris to the Pines River, should be undertaken. Remediation of bacterial contamination to the Pines River from the Saugus River on a flood tide should also be implemented.

## **LYNN HARBOR [INNER] (SEGMENT MA93-52)**

Location: The "Inner" portion of Lynn Harbor; waters landward of an imaginary line drawn from Black Rock Point, Nahant to the eastern edge of Point of Pines, Revere; excluding Saugus River.

Length/area: 1.62 mi<sup>2</sup>

Classification: Class SB/CSO.

Note: This segment was formerly part of Segment MA93-23. Segment MA93-23 is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

The power plant on Marine Boulevard in Lynn does not generate power. It is currently utilized by National Grid as a substation (Dunn 2006).

### **DISCHARGES**

#### **NPDES (Appendix E, Tables E2 and E3)**

MA0100552--The Lynn Water and Sewer Commission (LWSC) outfalls #002, #004, and #005.

### **USE ASSESSMENT**

#### ***Aquatic Life Use***

##### Eelgrass Bed Habitat

MassDEP's Wetlands Conservancy Program (WCP) identified the presence of eelgrass in Lynn Inner Harbor from historic 1951 black and white aerial photography (Costello 2003). In 1998 MassDEP WCP performed field verification of 1995 aerial photography and mapped the extent of eelgrass bed habitat in Lynn Inner Harbor. Total areal coverage of Lynn Inner Harbor from the 1995 survey was approximately 21% of the harbor. In 2001 MassDEP WCP performed field verification of 2001 aerial photography and mapped the extent of eelgrass bed habitat in Lynn Inner Harbor. There was almost no change in the total coverage of eelgrass beds between 1995 and 2001.

There were two large areas of eelgrass bed habitat identified in 1951 near the mouth of Lynn Inner Harbor. There has been some loss of eelgrass bed habitat based on the 2001 datalayer.

Although the eelgrass bed habitat along the outer portion of Lynn Inner Harbor appears to be fairly stable, given the presence of CSO and other stormwater discharges along the inner harbor area, too limited data are available, so the *Aquatic Life Use* is not assessed for Lynn Inner Harbor.

#### ***Shellfish Harvesting Use***

The DMF shellfish status for Area N26.0, which comprises this segment area, is prohibited. No changes to this status have been made (Kennedy 2006a).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing area prohibited.

The Seaport Landing Marina in Lynn provides free pump-outs and Revere has a pump-out boat funded by CVA- to provide free pump-outs (MA DFG 2006c).







#### ***Primary and Secondary Contact Recreation and Aesthetics uses***

LWSC has two wet weather CSO outfalls that discharge into Lynn Harbor, outfalls #004—Market Street Overflow and #005 Broad Street Overflow. Lynn is under a court order (Civil Action No. 76-2184-RGS) to mitigate their CSOs, including CSO discharges from outfalls #004 and #005 (Brander 2006b). Dry weather discharges are prohibited. The Outfall #004 on average is active 31 events each year, discharging approximately 77 million gallons of CSO flow, while Outfall #005 on average is active 15 events per year, discharging approximately 22 million gallons of CSO flow (Brander 2006b). In October 2004, LWSC submitted a Supplemental CSO Facilities Plan (SFP) to MassDEP and EPA. The recommendations in the SFP include additional CSO abatement actions at the WWTP and in the collection system that will reduce CSO discharges at outfalls #004 and #005 to 4 events during a "typical" year, with average precipitation. MassDEP and EPA are reviewing the plan to determine if this represents the highest feasible level of CSO control, as required by the Clean Water Act, and MA Water Quality Standards (Brander 2006b).

There is one beach, Black Rock Beach, along the shoreline of Lynn Inner Harbor in Nahant. Based on weekly *Enterococci* bacteria testing the beach was not posted in 2002, 2003, or 2004 (MA DPH 2003, MA DPH 2004, and MA DPH 2005b). This beach is not considered representative of the entire segment area.

Only limited data are available so the *Primary* and *Secondary Recreational* and *Aesthetics* uses are not assessed for Lynn Inner Harbor. These uses are identified with an Alert Status because of the frequency and volume of CSO discharges.

LYNN HARBOR [INNER] (SEGMENT MA93-52) Use Summary

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Sanitary sewer overflows, combined sewer overflows, discharges from municipal separate storm sewer systems (MS4)
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED*
Aesthetics		NOT ASSESSED*

\*Alert Status issues identified, see details in use assessment section

## RECOMMENDATIONS

Lynn WWTP

- The LWSC should institute a sampling program to find and eliminate the sources of bacterial contamination emanating from the Market and Broad Street outfalls and implement stormwater management programs.
- Upon approval by the regulatory agencies, LWSC should proceed with further CSO abatement work to mitigate or eliminate CSO discharges from outfalls #004 and #005.
- Track the status of the LWSC court order to abate CSO discharges.

Develop and conduct water quality monitoring (*in-situ* measurements of DO, % saturation, pH, temperature) to evaluate status of *Aquatic Life Use*.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as needed to help identify undocumented sources.

Implement recommendations in the DMF shellfish management plan for Area N26.0.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

## LYNN HARBOR [OUTER] (SEGMENT MA93-53)

Location: The "Outer" portion of Lynn Harbor; the waters landward of an imaginary line drawn from Bailey's Hill, Nahant to eastern point of Winthrop Highlands, Winthrop to the seaward edge of Lynn Inner Harbor (an imaginary line drawn from Black Rock Point, Nahant to the eastern edge of Point of Pines, Revere).

Length/area: 6.56 mi<sup>2</sup>

Classification: Class SB/CSO.

Note: This segment was formerly part of Segment MA93-23. Segment MA93-23 is on the 2004 Integrated List of Waters in Category 5 - Waters Requiring a TMDL because of pathogens (MassDEP 2005).

### DISCHARGES

#### NPDES (Appendix E, Tables E2 and E3)

MA0100552--The Lynn Water and Sewer Commission (LWSC) Outfall #001.

### USE ASSESSMENT

#### ***Aquatic Life Use***

##### Eelgrass Bed Habitat

MassDEP's Wetlands Conservancy Program (WCP) identified the presence of eelgrass in the outer portion of Lynn Harbor from historic 1951 black and white aerial photography (Costello 2003). In 1998 MassDEP WCP performed field verification of 1995 aerial photography and mapped the extent of eelgrass bed habitat in Lynn Harbor. Total areal coverage of Lynn Outer Harbor from the 1995 survey was approximately 15% of the harbor. In 2001 MassDEP WCP performed field verification of 2001 aerial photography and mapped the extent of eelgrass bed habitat in Lynn Harbor. There was a slight loss in the total coverage of eelgrass beds between 1995 and 2001.

##### Toxicity

##### Effluent

Both acute and chronic whole effluent toxicity tests have been conducted on the Lynn Water & Sewer Commission treated effluent. Between July 2000 and March 2006, 23 valid tests were conducted using *M. bahia*. The LC<sub>50</sub>s ranged from 74.6 to 100% effluent with only three tests (December 2001, September 2003, and September 2005) not meeting the permit limit LC<sub>50</sub>>100%. Acute toxicity was detected more frequently using *M. beryllina*; out of the 25 valid tests conducted between July 2000 and March 2006, ten tests exhibited acute toxicity (LC<sub>50</sub>s ranged from 53 to 91.4% effluent) the remaining tests reported LC<sub>50</sub>s of 100% effluent (TOXTD database). *M. beryllina* were always more sensitive to acute whole effluent toxicity in the discharge. Results of the *M. beryllina* chronic whole effluent toxicity tests ranged between 25 and 100% effluent; all of which (n=24 valid test events) met the CNOEC limit of 5.26% effluent (TOXTD database). Similar results were reported for the *A. punctulata* chronic test results. Neither *A. punctulata* nor *M. beryllina* were consistently more sensitive. It should be noted that slightly over half of the acute toxicity test failures were in September (when the facility goes in and out of nitrification and that sometime in September goes out of nitrification completely because of temperature changes – Ackerman 2006). Both pH and ammonia-nitrogen concentrations were fairly high in the tests that exhibited acute toxicity however both pH and ammonia-nitrogen concentrations were also fairly high in other tests that did not exhibit acute toxicity.

The *Aquatic Life Use* is assessed as support for the Lynn Outer Harbor area based primarily on the eelgrass bed habitat and best professional judgment. This use is identified with an Alert Status because of the acute toxicity detected in the LWSC effluent and the slight decline in the eelgrass bed habitat area since 1951.

#### ***Shellfish Harvesting Use***

The DMF shellfish status for areas N26.0 and N26.2, which comprise this segment area, are prohibited. No changes to the status have been made (Kennedy 2006a).

The *Shellfish Harvesting Use* is assessed as impaired because the shellfish growing areas are prohibited.

### **Primary and Secondary Contact Recreation and Aesthetics uses**

Weekly testing for *Enterococci* bacteria during the swimming season has been conducted at three beaches along the shoreline of Lynn Outer Harbor. These beaches include:







Revere Beach, Revere - this beach was tested weekly at several sampling locations during the summers of 2002, 2003, and 2004. There was one posting reported in both 2003 and 2004 for one day each because of elevated *Enterococci* bacteria counts (totaling two days).

Short Beach, Revere/Wintrop this beach was tested weekly during the summers of 2002, 2003, and 2004. The beach was posted twice in 2003 because of elevated *Enterococci* bacteria counts (totaling two days).

Halford Beach, Winthrop this beach was tested seven times during the summers of 2003 and 2004 – there were no postings reported for either of these years.

The *Primary Contact Recreational Use* is assessed as support since the bathing beaches along the Outer Lynn Harbor segment shoreline were open for the majority of the three bathing seasons between 2002 and 2004. The *Secondary Contact Recreational* and *Aesthetics* uses are also assessed as support for based primarily on best professional judgment (beaches open for majority of bathing seasons and the relatively stable area of eelgrass bed habitat indicative of good water clarity).

LYNN HARBOR [OUTER] (SEGMENT MA93-53) Use Summary

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Shellfish Harvesting		IMPAIRED Causes: Elevated fecal coliform bacteria Sources: Sanitary sewer overflows, combined sewer overflows, discharges from municipal separate storm sewer systems (MS4)
Primary Contact		SUPPORT
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

### **RECOMMENDATIONS**

#### **Lynn WWTP**

- Since *M. beryllina* were always more sensitive to acute whole effluent toxicity in the discharge, the toxicity testing requirements should be reduced to *M. beryllina* only. The facility should be required to conduct a Toxicity Identification/Toxicity Reduction Evaluation (TIE/TRE) and implement appropriate treatment/actions to eliminate the acute toxicity in the effluent. Chronic toxicity monitoring only is needed.

Develop and conduct water quality monitoring (*in-situ* measurements of DO, % saturation, pH, temperature) to evaluate the status of *Aquatic Life Use*.

Develop a monitoring plan and conduct bacteria sampling to evaluate the effectiveness of point (Phase II stormwater permits) and non-point source pollution control activities and other actions and to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Conduct bacteria source tracking as needed to help identify undocumented sources.

Implement recommendations in the DMF shellfish management plans for areas N26.0 and N26.2.

Support DMF efforts to improve availability/access (electronic or web site) to water quality and biological monitoring data collected from DMF shellfish sampling stations to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

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