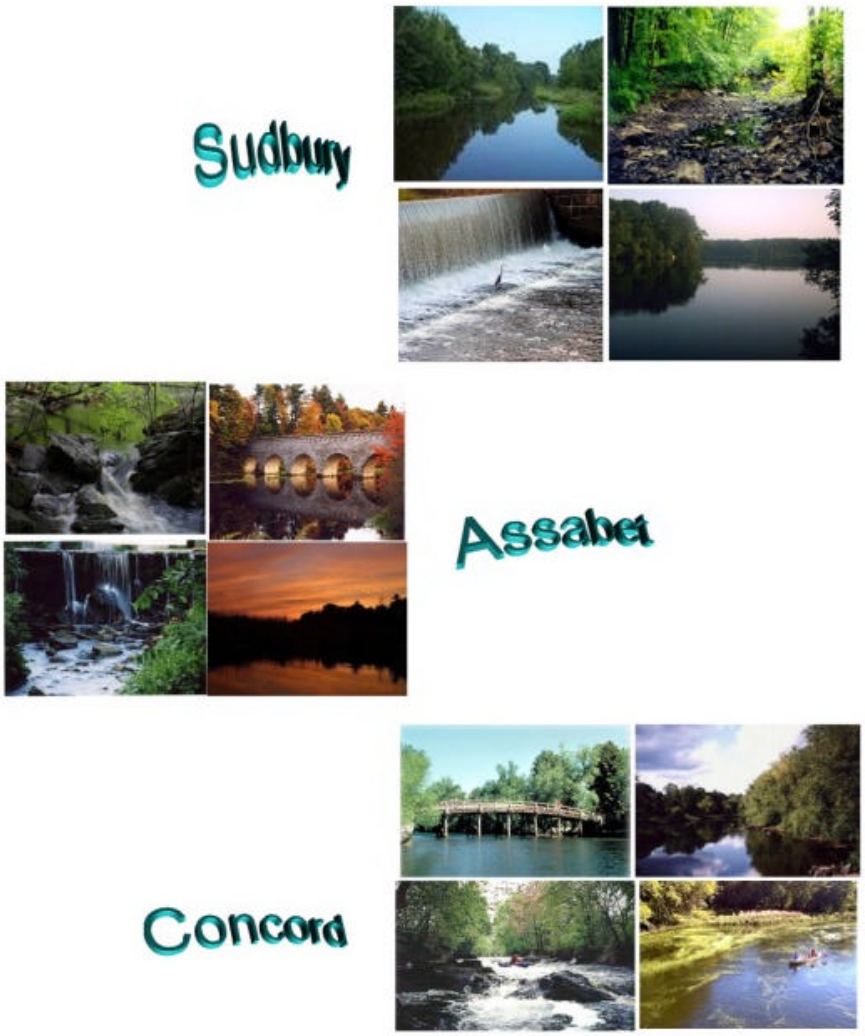
SuAsCo WATERSHED
2001 WATER QUALITY ASSESSMENT REPORT



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SuAsCo WATERSHED

2001 WATER QUALITY ASSESSMENT REPORT

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Division of Watershed Management

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State

- Massachusetts Department of Environmental Protection (MA DEP):
  - Bureau of Strategic Policy and Technology, Wall Experiment Station
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  - Bureau of Waste Site Cleanup (BWSC)
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- Department of Fish and Game (DFG)
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Regional

- ENSR International
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- Stream teams

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Cover photo credits:
Sudbury: Ashland Open Space Committee, www.ashlandopenspace.org/photos/html; MA DFG Riverways Program www.state.ma.us/dfwele/River/rivLow_flow_Inventory/physicalenv.html; Garrett Wollman, www.bostonradio.org/digicam/miscellany/100-01128-med.html; Ashland Open Space Committee

Assabet: Organization for the Assabet River, www.assabetriver.org/riverpics/scenics1/ Danforth Brook, Hudson by Dave Griffin; Assabet River, Northborough by Frank Boffolia; Mill Dam, Assabet River, Northborough by Jean Collins; Assabet River, Stow by Dave Griffin

Concord: National Wild and Scenic Rivers System Sudbury, Assabet and Concord Rivers Massachusetts, www.nps.gov/rivers/wsr-suasco.html; www.garytrinity.net/conin6.html; New Hampshire AMC Paddlers, www.nhamcpaddlers.org/mem_trips/concord_river.htm; Concord Magazine; www.concordma.com/magazine/sepoct01/concordfall.html

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

LIST OF ACRONYMS

7Q10	Seven day, ten year low flow
ACEC	Area of Critical Environmental Concern
ACOE	US Army Corps of Engineers
ADB	Assessment Database
aka	Also Known As
BMP	Best Management Practice
BOD	Biological Oxygen Demand
BOD_5	5- Day Biochemical Oxygen Demand
BPJ	Best professional judgment
BRP	Bureau of Resource Protection
BWSC	Bureau of Waste Site Cleanup
CCC	Chronic CriterionConcentration
CBOD	carbonaceous biochemical oxygen demand
CDM	Camp Dresser & McKee
CMR	Code of Massachusetts Regulations
C-NOEC	Chronic no observed effect concentration
CREST	Concord River Environmental Stream Team
CSO	Combined Sewer Overflow
CWA	Clean Water Act
CWF	Cold Water Fishery
CWMP	Comprehensive Wastewater Management Plan
DDT	Dichlordiphenyltrichloroethane
DFG	Department of Fish and Game
DMF	Division of Marine Fisheries
DMTF	Drought Management Task Force
DO	Dissolved oxygen
DPW	Department of Public Works
DWM	Division of Watershed Management
DWP	Drinking Water Program
EOEA	Executive Office of Environmental Affairs
EPA	United States Environmental Protection Agency
EPT	Ephmeroptera, Plecoptera, Trichoptera
ESS	Environmental Science Services
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
GIS	Geographic information system
HAZMAT	Hazardous Materials
HBI	Hilsenhoff Biotic Index
Hg	Mercury
HLP	Hudson Light and Power
I/I	Inflow/Infiltration
LC_{50}	Lethal concentration to 50% of the test organisms
L-EL	Lowest Effect Level
LRWWU	Lowell Regional Water and Wastewater Utilities
MA DCR	Massachusetts Department of Conservation and Recreation
MA DEP	Mass. Dept. of Environmental Protection
MA DEM	Mass. Dept. of Environmental Management
MassGIS	Mass. Geographic Information System
MDFW	Mass. Division of Fisheries and Wildlife
MCI	Mass. Correctional Institute
MCP	Mass. Contingency Plan
MDPH	Mass. Department of Public Health
MDL	Method Detection Limit
MPN	Most probable number
MS4	Medium and large municipal separate storm sewer systems
MWRA	Massachusetts Water Resource Authority
NAS/NAE	National Academy of Sciences/National Academy of Engineering
NAWQA	National Water Quality and Assessment Program
NCCW	Non-Contact Cooling Water
NECB	New England Coastal Basins
NMI	Nuclear Metals Inc.
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NWR	National Wildlife Refuge
OAR	Organization for the Assabet River
ORW	Outstanding Resource Water
PAB	Public Access Board
PAH	Polycyclic Aromatic Hydrocarbon
PALIS	Pond and Lake Information System
PCB	Polychlorinated biphenol
POTW	Publicly Owned Treatment Works
PWS	Public water supply
QAPP	Quality assurance project plan
QA/QC	Quality assurance/ quality control
RBP	Rapid bioassessment protocol
ROD	Record of Decision
SARIS	Stream and River Inventory System
SDWA	Safe Drinking Water Act
S-EL	Severe Effect Level
SMART	Strategic Monitoring and Assessment of River basin Teams
SuAsCo	Sudbury, Assabet, Concord
SVOC	Semi-Volatile Organic Compound
SWAMP	Sudbury Watershed Monitoring and Protection Group
SWAP	Source Water Assessment Program
SWQS	Surface Water Quality Standards
TCE	1,1,1-trichloroethylene
TIE/TRE	Toxicity identification and toxic reduction evaluation
TMDL	Total maximum daily loads
TNTC	Too Numerous To Count
TOC	Total organic carbon
TOXTD	MA DEP DWM Toxicity Testing Database
TRC	Total residual chlorine
TSS	Total Suspended Solids
UMass	University of Massachusetts
USAF	United States Air Force
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UV	Ultraviolet
VOC	Volatile Organic Compound
WBID	Waterbody Identification Code
WBS	Waterbody System Database
WES	Wall Experiment Station
WMA	Water Management Act
WPCF	Water Pollution Control Facility
WRC	Water Resource Commission
WTP	Water Treatment Plant
WWF	Warm Water Fishery
WWTP	Waste Water Treatment Plant

LIST OF UNITS

cfs	cubic feet per second
cfsm	cubic feet per second per square mile
cfu	colony forming units
cm	centimeter
ft^3	cubic feet
gpd	gallons per day
KW	Kilowatt
kg	kilogram
m	meter
M^2	square meter
m^3	cubic meter
Mg/L	milligram/liter
MGD	million gallons per day
mL	milliliter
L	liter
µg	microgram
µS/cm	Microsiemen per centimeter
ng	nanogram
NTU	nephelometric turbidity units
ppb	parts per billion
ppm	parts per million
SU	standard units (pH)
TEQ	toxic equivalents

TABLE OF FISH SCIENTIFIC NAMES

Common name	*Scientific name*	Common name	*Scientific name*
Alewife	*Alosa pseudoharengus*	Hybrid Redfin/Chain Pickerel	*Esox americanus americanus X Esox niger*
American eel	*Anguilla rostrata*	Largemouth bass	*Micropterus salmoides*
Banded sunfish	*Enneacanthus obesus*	Northern pike	*Esox lucius*
Black crappie	*Pomoxis nigromaculatus*	Pumpkinseed	*Lepomis gibbosus*
Blacknose dace	*Rhinichthys atratulus*	Rainbow trout	*Oncorhynchus mykiss*
Bluegill	*Lepomis macrochirus*	Redbreast sunfish	*Lepomis auritus*
Brook trout	*Salvelinus fontinalis*	Redfin pickerel	*Esox americanus americanus*
Brown bullhead	*Ameiurus nebulosus*	Rock bass	*Ambloplites rupestris*
Brown trout	*Salmo trutta*	Smallmouth bass	*Micropterus dolomieu*
Chain pickerel	*Esox niger*	Spottail shiner	*Notropis hudsonius*
Common carp	*Cyprinus carpio*	Tiger Trout	*Salvelinus fontinalis X Salmo trutta*
Creek chubsucker	*Erimyzon oblongus*	White perch	*Morone americana*
Fallfish	*Semotilus corporalis*	White sucker	*Catostomus commersoni*
Golden shiner	*Notemigonus crysoleucas*	Yellow bullhead	*Ameiurus natalis*
Green sunfish	*Lepomis cyanellus*	Yellow perch	*Perca flavescens*

EXECUTIVE SUMMARY
SuAsCo WATERSHED 2001
WATER QUALITY ASSESSMENT REPORT

The Massachusetts Surface Water Quality Standards (SWQS) designate the most sensitive uses for which surface waters in the Commonwealth shall be protected. This assessment report presents a summary of current water quality data and information used to assess the status of the designated uses as defined in the SWQS for the SuAsCo Watershed (SuAsCo is an abbreviation for Sudbury, Assabet, and Concord rivers). The designated uses, where applicable, include: *Aquatic Life, Fish Consumption, Drinking Water, Shellfish Harvesting, Primary* and *Secondary Contact Recreation* and *Aesthetics*. The assessment of current water quality conditions provides a determination of whether or not each designated use of a particular water body is ***supported*** or ***impaired***. Or, when too little current data/information exists or no quality-assured data are available, the use is ***not assessed***. However, if there is some indication of water quality impairment, which is not considered to be naturally occurring, the use is identified with an "Alert Status". It is important to note that not all waters are assessed. Many small and/or unnamed rivers and lakes are currently ***unassessed***. The status of the designated uses of these waters has never been reported to the EPA in the Commonwealth's Summary of Water Quality Report (305(b) Report) nor is information on these waters maintained by the Massachusetts Department of Environmental Protection in the Water Body System (WBS) or Assessment Database (ADB). This report provides basic information that can be used to focus resource protection and remediation activities later in the watershed management planning process.

There are a total of 38 named and six unnamed freshwater rivers, streams, or brooks (the term "rivers" will hereafter be used to include all) in the SuAsCo Watershed that are included in this report. These include the mainstem Sudbury, Assabet, and Concord rivers as well as numerous tributaries. These assessments represent 46% of the 82 named rivers and approximately 61% (163.5) of an estimated 266.1 named river miles in the watershed. The six unnamed tributaries total 7.7 river miles. The remaining rivers are small and are currently *unassessed* (not included in this report). This report also includes information on 62 of the 129 lakes, ponds, or impoundments (the term "lakes" will hereafter be used to include all) that have been assigned a Pond and Lake Identification System (PALIS) number in the SuAsCo Watershed. (In the SuAsCo Watershed many of the lakes are man-made impoundments, resulting from the damming of rivers for hydropower.) The 62 lakes included in this report represent 88% of the total lake acreage (6,584 of 7,464 acres) in the SuAsCo Watershed.

AQUATIC LIFE USE

The *Aquatic Life Use* is supported when suitable habitat (including water quality) is available for sustaining a native, naturally diverse, community of aquatic flora and fauna. Impairment of the *Aquatic Life Use* may result from anthropogenic stressors that include point and/or nonpoint source(s) of pollution and hydrologic modification. The status of the *Aquatic Life Use* in the SuAsCo Watershed is as follows.

Use Summary – Rivers (Figure 1)

Assabet River Watershed

As illustrated in Figure 1, twenty-eight percent (28%) of the river miles in the Assabet River Watershed included in this report are assessed as support for the *Aquatic Life Use;* five tributaries to the Assabet River, totaling 18.1 river miles (upstream to downstream- Hop, Cold Harbor, North, and Danforth brooks and an unnamed tributary) and the downstream-most segment (MA82B-07) of the mainstem Assabet River (6.4 miles). The *Aquatic Life Use* is impaired for 24.8 miles of the Assabet River (5 segments) as well as Nashoba Brook (9.4 miles). Causes of impairment along various portions of the mainstem Assabet include flow regime alterations, total phosphorus, excess algal growth, non-native aquatic plants, low

***Aquatic Life Use* Assessment-Rivers**
(Total length included in report – 171.2 miles)

Assabet River Watershed
- Support – 24.5 miles (28%)
- Impaired – 34.2 miles (39%)
- Not Assessed –28.1 miles (33%)

Sudbury River Watershed
- Support – 27.7 miles (51%)
- Impaired – 15.6 miles (28%)
- Not Assessed – 11.5 miles (21%)

Concord River Watershed
- Support – 0 miles
- Impaired – 15.5 miles (52%)
- Not Assessed – 14.1 miles (48%)

dissolved oxygen/saturation, and impacted benthic/fish communities. Chronic ambient toxicity is also a suspected cause of impairment. The major known sources of impairment are municipal point source discharges and impacts from hydrostructure/flow regulation/modifications. Suspected sources include stormwater from municipal separate storm sewers, internal nutrient recycling, golf courses, and yard maintenance. Nashoba Brook is impaired because of low flow alterations and an impacted fish community. Suspected impairment causes also include low dissolved oxygen and elevated levels of total phosphorus. While the source of impairment of Nashoba Brook is unknown, baseflow depletion from groundwater withdrawals and on-site septic systems are suspected. The remaining seven named rivers in the Assabet River Watershed are currently not assessed for the *Aquatic Life Use*.

Sudbury River Watershed
Fifty-one percent of the river miles in the Sudbury River Watershed are assessed as supporting the *Aquatic Life Use* (Figure 1)- three of the five mainstem Sudbury segments (MA82A-25, MA82A-03, and MA82A-04) and two tributaries (Indian Brook – MA82A-24 and Pine Brook- MA82A-14). Twenty-eight percent are assessed as impaired for the *Aquatic Life Use*. All rivers in the Hop Brook subwatershed (11.5 river miles) are impaired due to excess total phosphorus. Additional causes of impairment to various rivers in the Hop Brook subwatershed include total suspended solids (TSS), low dissolved oxygen saturation, pH, and low dissolved oxygen. The Marlborough Easterly Wastewater Treatment Plant discharge is the main source of nutrients to the system, although storm water from municipal separate storm sewers, landfills, urbanized high-density areas, and impoundments are also suspected. The Sudbury River from the outlet of Framingham Reservoir #1 to the inlet of Saxonville Pond in Framingham is impaired based on a moderately impacted benthic macroinvertebrate community. One unnamed tributary, locally known as Cochituate Brook, is also impaired based on a moderately impacted benthic community. Sources of impairment to both the Sudbury River (suspected) and the unnamed tributary locally known as Cochituate Brook (known) are upstream eutrophic impoundments. Additionally, storm water from municipal separate storm sewers and urbanized high-density areas are also suspected as contributing to the impairments in the unnamed tributary (Cochituate Brook). The remaining 11.5 river miles in the Sudbury River Watershed are currently not assessed for the *Aquatic Life Use* (Figure 1).

Concord River Watershed
None of the 29.6 river miles in the Concord River Watershed support the *Aquatic Life Use* (Figure 1). Fifteen and one half river miles (15.5) of the mainstem Concord River are assessed as impaired for the *Aquatic Life Use* because of non-native aquatic macrophyte infestations. Additionally, barriers to fish migration are also suspected of impacting the aquatic life in the Concord River from the Billerica Water Supply Intake in Billerica to Rogers Street bridge in Lowell. There are currently two dams along this portion of the river. One, the Centennial Island Dam, currently has fish passage facilities but does not always operate as required and the other, Talbot Mills/Billerica Dam, does not. The remaining 14.1 river miles in the Concord River Watershed are not assessed.

Aquatic Life Use Summary – Lakes (Figure 2)
Few lakes in the SuAsCo Watershed have been surveyed recently for variables used to assess the status of the *Aquatic Life Use* (i.e., DO, pH, nutrients, macrophytes and plankton/chlorophyll *a*). Only two of the lakes in the SuAsCo Watershed, Walden Pond in Concord (MA82109) and Willis Pond in Sudbury (MA82122), are assessed as supporting the *Aquatic Life Use* (130 acres). The *Aquatic Life Use* is assessed as impaired for 34 lakes or 58% of the total acreage (3,822 lake acres). Twenty-five lakes are assessed as impaired due to the presence of non-native aquatic macrophytes (Figure 2). The Assabet River Reservoir and Whitehall Reservoir are assessed as impaired due to the presence of non-native aquatic macrophytes, low dissolved oxygen, and low dissolved oxygen saturation. Carding Millpond, Stearns Millpond, Grist Mill Pond, and Hager Pond (a series of impoundments along Hop Brook) are assessed as impaired due to the presence of non-native macrophytes, low dissolved oxygen supersaturation, and high total phosphorus. The primary source of nutrient input is known to be the Marlborough Easterly Wastewater Treatment Plant. Additionally, storm water is also suspected to contribute nutrients to these impoundments. The remaining lake acreage (2,634 acres) in the SuAsCo Watershed (40%) is currently not assessed for the *Aquatic Life Use*.

Lakes
(Total area included in report – 6,586 acres)
- Support – 130 acres (2%)
- Impaired – 3,822 acres (58%)
- Not Assessed – 2,634 acres (40%)

Details of *Aquatic Life Use* impairments of river segments in the SuAsCo Watershed.

Segment	Causes	Sources
Assabet River (MA82B-01)	Flow regime alterations, combined biota/habitat bioassessment (Suspected: Nutrient enrichment)	Impacts from hydrostructure flow regulation/ modification
Assabet River (MA82B-02)	Total phosphorus, nutrient/ eutrophication biological indicators, combined biota/habitat bioassessments, Dissolved oxygen saturation (Suspected: Ambient bioassays- chronic)	Municipal point source discharge, impacts from hydrosturcture flow regulation/ modification (Suspected: Golf courses, yard maintenance, discharges from municipal separate storm sewer systems (MS4s), internal nutrient recycling)
Assabet River (MA82B-03)	Total phosphorus, excess algal growth, non-native aquatic plants (Suspected: Ambient bioassay -chronic aquatic toxicity)	Municipal point source discharge, unknown (Suspected: Discharges from municipal separate storm sewer systems (MS4s), internal nutrient recycling)
Assabet River (MA82B-04)	Combination benthic/fish bioassessment, total phosphorus, excess algal growth (Suspected: Ambient bioassay-chronic aquatic toxicity)	Municipal point source, discharge, impacts from hydrostructure flow regulation modification, unknown (Suspected: Internal nutrient recycling, discharges from municipal separate storm sewer systems (MS4s))
Assabet River (MA82B-05)	Total phosphorus, low dissolved oxygen, excess algal growth, noxious aquatic plants, non-native aquatic plants, nutrient/ eutrophication biological indicators (Suspected: Whole effluent toxicity)	Municipal point source discharge (Suspected: Impacts from hydrostructure/ flow regulation/ modification, internal nutrient recycling, discharges from municipal separate storm sewer systems (MS4s))
Assabet River (MA82B-06) Causes:	Total phosphorus, low dissolved oxygen, excess algal growth, noxious aquatic plants, non-native aquatic plants, nutrient/ eutrophication biological indicators, fish bioassessment (Suspected: Whole effluent toxicity)	Municipal point source discharge, unknown (Suspected: Impacts from hydrostructure /flow regulation/ modification, internal nutrient recycling, discharges from municipal separate storm sewer systems (MS4s))
Nashoba Brook (MA82B-14)	Low flow alterations, fish bioassessment (Suspected: Low dissolved oxygen, total phosphorus)	Unknown (Suspected: Baseflow depletion from groundwater withdrawals, on-site septic systems)
Sudbury River (MA82A-26)	Benthic macroinvertebrate assessment	(Suspected Sources: Upstream impoundment)
Unnamed Tributary (MA82A-22)	Organic enrichment biological indicators	Upstream impoundment (Suspected: Municipal urbanized high- density area, discharges from municipal separate storm sewers (MS4s))
Unnamed Tributary (MA82A-15)	Total phosphorus, total suspended solids	Municipal point source discharge (Suspected: Discharges from municipal storm sewers (MS4s), landfill, municipal urbanized high-density areas)
Unnamed Tributary (MA82A-16) Unnamed Tributary MA823A-17) Hop Brook (MA82A-05)	Total phosphorus, dissolved oxygen saturation, pH	Municipal point source discharge, upstream impoundments (Suspected: Discharges from municipal storm sewers (MS4s), landfill, municipal urbanized high-density areas)
Hop Brook (MA82A-06)	Total phosphorus, low dissolved oxygen dissolved oxygen saturation	Municipal point source discharge, upstream impoundments (Suspected: discharges from municipal storm sewers (MS4s), landfill, municipal urbanized high-density areas)
Concord River (MA82A-07)	Non-native aquatic plants	
Concord River (MA82A-08)	Non-native aquatic plants (Suspected: Fish barriers)	(Suspected Sources: Hydrostructure impacts on fish passage, impacts from hydrostructure flow regulation/ modification)

Figure 1. *Aquatic Life Use* Summary – Rivers

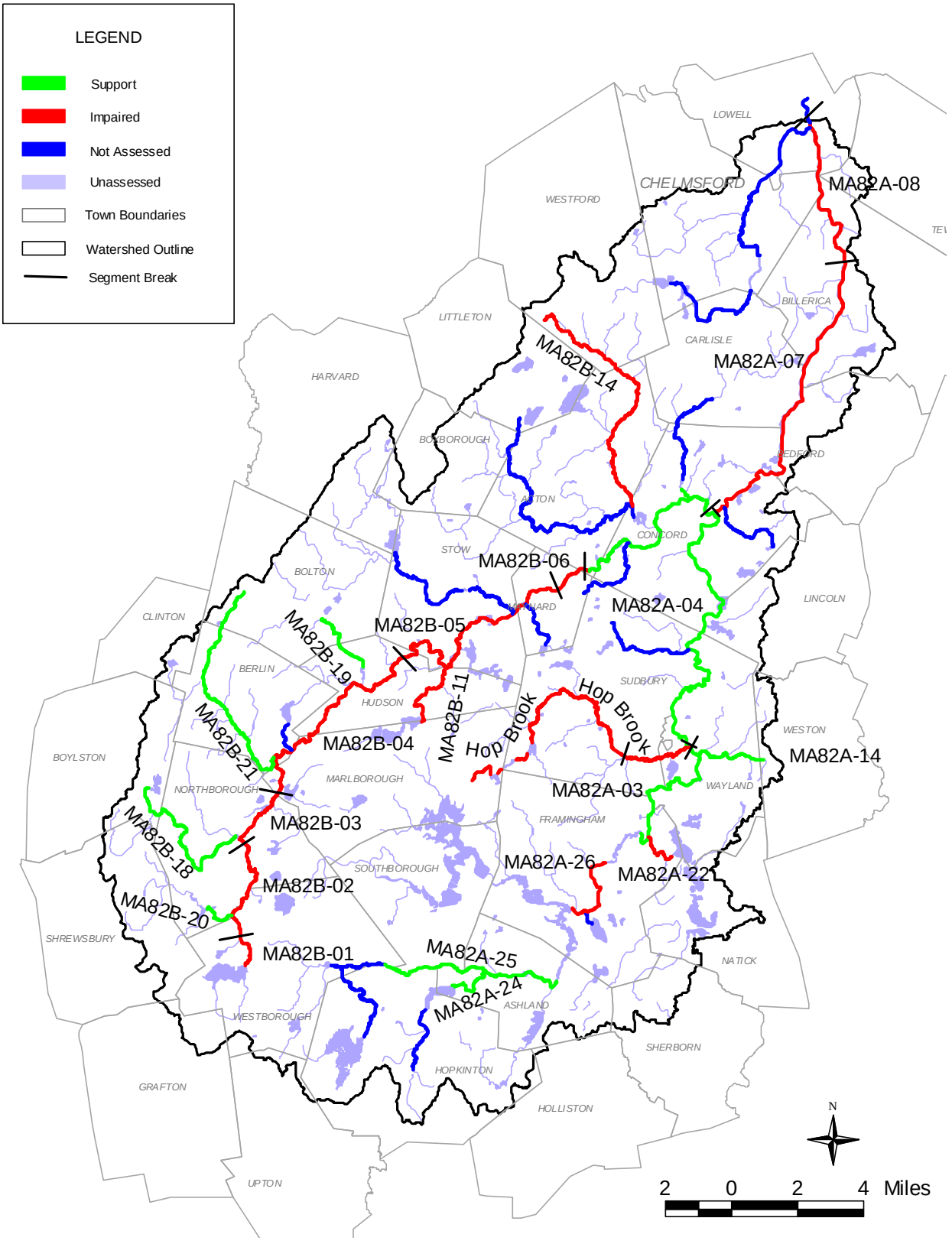
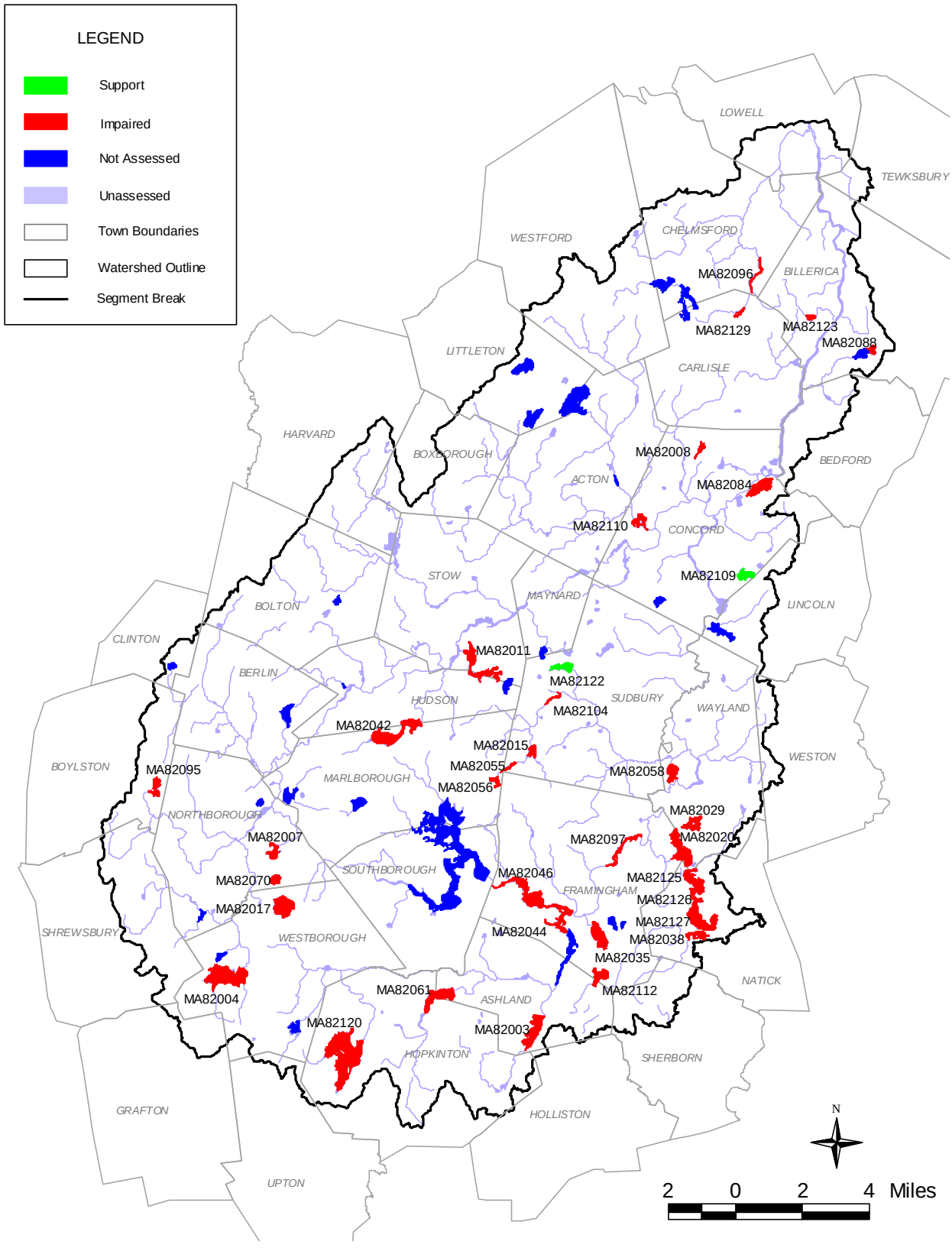


Figure 2. *Aquatic Life Use* Summary – Lakes



DRINKING WATER USE

The term *Drinking Water Use* has been used to indicate sources of public drinking water. While this use is not assessed in this report, the state provides general guidance on drinking water source protection of both surface water and groundwater sources (available at http://www.mass.gov/dep/brp/dws/dwshome.htm). These waters are subject to stringent regulation in accordance with the Massachusetts Drinking Water Regulations. MA DEP's Drinking Water Program (DWP) has primacy for implementing the provisions of the federal Safe Drinking Water Act. The DWP has also initiated work on its Source Water Assessment Program (SWAP), which requires that the Commonwealth delineate protection areas for all public ground and surface water sources, inventory land uses that may present potential threats to drinking water quality in these areas, determine the susceptibility of water supplies to contamination from these sources, and publicize the results.

Public water suppliers monitor their finished water (tap water) for major categories of both naturally-occurring and man-made contaminants such as: microbiological, inorganic, organic, pesticides, herbicides and radioactive contaminants. Specific information on community drinking water sources including SWAP activities and drinking water quality information are updated and distributed annually by the public water system to its customers in a "Consumer Confidence Report". These reports are available from the public water system.

FISH CONSUMPTION USE

The *Fish Consumption Use* is supported when there are no pollutants present that result in concentrations unacceptable for human consumption in edible portions (as opposed to whole fish - see *Aquatic Life Use*) of fish, other aquatic life or wildlife. The assessment of the *Fish Consumption Use* is made using the most recent list of Fish Consumption Advisories issued by the Massachusetts Executive Office of Health and Human Services, Department of Public Health (MDPH), Bureau of Environmental Health Assessment (MDPH 2004). The MDPH list identifies waterbodies where elevated levels of a specified contaminant in edible portions of freshwater species poses a health risk for human consumption; hence the *Fish Consumption Use* is assessed as impaired in these waters. In July 2001 MDPH issued new consumer advisories on fish consumption and mercury contamination (MDPH 2001). Because of these statewide advisories no waters can be assessed as support for the *Fish Consumption Use*; these waters default to "Not Assessed". The statewide advisories read as follows.

> The MDPH "is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish: shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MDPH 2001)." Additionally, MDPH "is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MDPH 2001)." MDPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially.

Use Summary - Rivers (Figure 3)

There are currently no site-specific MDPH-issued fish consumption advisories for any rivers in the Assabet River Watershed. The rivers in the subwatershed default to Not Assessed for the *Fish Consumption Use* because of the statewide advisory. MDPH issued a site-specific advisory for the Sudbury River for all towns from Ashland to Concord. Additionally, a site-specific advisory was issued for the Concord River in the towns of Concord, Carlisle, Bedford and Billerica. Therefore, the *Fish Consumption Use* for these rivers is assessed as impaired (see Figure 3). Elevated concentrations of mercury were detected in edible portions of fish collected along these waterbodies. The mercury contamination is associated with the Nyanza Superfund site. It is unclear why MDPH did not extend the advisory on the Concord River to the towns of Tewksbury, Chelmsford, and Lowell.

***Fish Consumption Use* Assessment-Rivers**
(total length included in report – 171.2 miles)

Assabet River Watershed
- Not Assessed –86.8 miles (100%)

Sudbury River Watershed
- Impaired – 24.5 miles (45%)
- Not Assessed – 30.3 miles (55%)

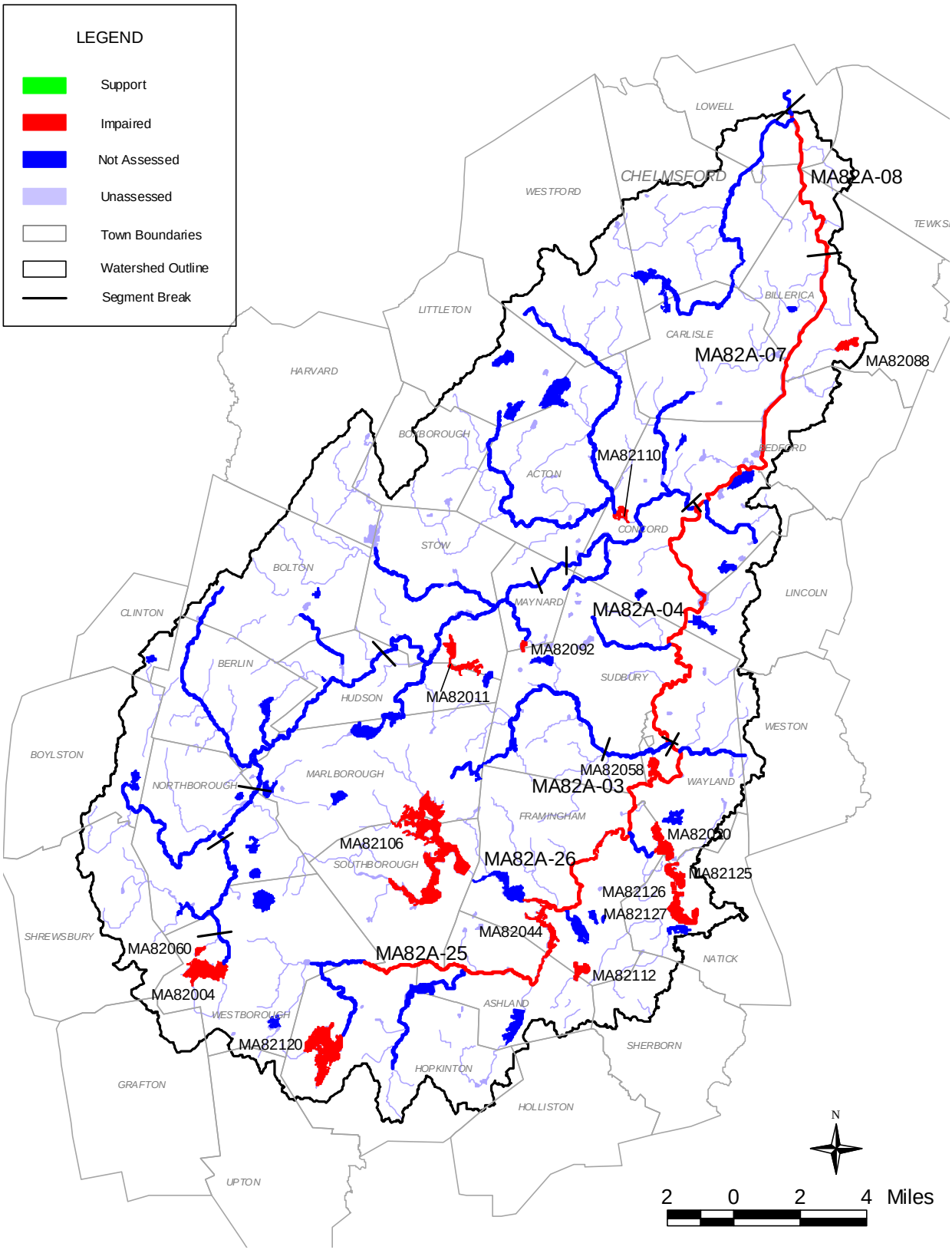
Concord River Watershed
- Impaired – 13.6 miles (46%)
- Not Assessed – 16.0 miles (54%)

Use Summary – Lakes (Figure 3)

Health concerns associated with exposure to mercury led MDPH to issue fish consumption advisories for 13 lakes in the SuAsCo watershed (Figure 3). Site-specific fish consumption advisories were also issued due to health concerns associated with exposure to poly-aromatic hydrocarbons or PAHs (Hocomonco Pond) and poly-chlorinated biphenyls or PCBs (Lake Cochituate). Known sources of contamination (Hg, PAHs, and PCBs) include Superfund sites. Atmospheric deposition is also a suspected source of mercury contamination. Therefore, the *Fish Consumption Use* is impaired for these lakes representing a total of 3459 acres (52% of the lake acreage included in this report). The remaining lakes in the watershed default to not assessed for the *Fish Consumption Use* because of the statewide advisory.

Lakes
(Total area included in report – 6586 acres)
- Impaired – 3459 acres (52%)
- Not Assessed – 3127 acres (48%)

Figure 3. *Fish Consumption Use* Summary – Rivers and Lakes



PRIMARY CONTACT RECREATION, SECONDARY CONTACT RECREATION AND AESTHETICS USES

The *Primary Contact Recreational Use* is supported when conditions are suitable (fecal coliform bacteria densities, turbidity, and aesthetics meet the SWQS) for any recreational or other water related activity during which there is prolonged and intimate contact with the water and there exists a significant risk of ingestion. Activities include, but are not limited to, wading, swimming, diving, surfing, and water skiing. The *Secondary Contact Recreational Use* is supported when conditions are suitable for any recreational or other water use during which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating, and limited contact related to shoreline activities. For lakes, macrophyte cover and/or transparency data (Secchi disk depth) are evaluated to assess the status of the recreational uses. The *Aesthetics Use* is supported when surface waters are free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance [growths of] species of aquatic life.

Use Summary – Rivers (Figure 4)

Due to the lack of current bacteria data none of the river miles in the SuAsCo Watershed are assessed as supporting the *Primary Contact Recreational* use.

In the Assabet River Watershed the *Primary*, *Secondary,* and *Aesthetics* uses are assessed as impaired for the mainstem Assabet River downstream from the Route 20 (Aluminum City) Dam in Northborough to the Powdermill Dam in Acton. Causes of impairment include excess algal growth, debris/floatables/trash, odors, and noxious aquatic plants. Sources include municipal point source discharges and sanitary sewer overflows. Suspected of also contributing to the impairments are highway/road/bridge runoff (non-construction), residential districts, municipal separate storm sewers, high-density areas, and internal sediment nutrient recycling. The Assabet River is also impaired for the *Primary Contact Recreational Use* downstream from the Powdermill Dam to the confluence with the Sudbury River because of elevated counts of fecal coliform bacteria. While the source of the bacterial contamination is unknown, storm water from municipal separate storm sewers is suspected. Thirty-six river miles support the *Aesthetics Use* in the Assabet River Watershed (Figure 4).

In the Sudbury River Watershed the *Primary and Secondary Contact Recreational* uses are assessed as impaired for Eames Brook and Pantry Brook. Eames Brook is impaired due to debris/floatables/trash, excess algal growth, and sediment odor. There are no known sources of impairment to Eames Brook, although municipal separate storm sewers, landfill, and high-density areas are suspected. Eames Brook is also impaired for the *Aesthetics Use* (same suspected causes and sources). Pantry Brook is impaired due to fecal coliform bacteria contamination. On-site treatment systems, waste from pets, and wildlife other than waterfowl are suspected contributors. The *Aesthetics Use* is supported for 14.6 river miles in the Sudbury River Watershed (Figure 4).

Debris/floatables/trash from urbanized high-density areas cause the impairment the *Primary, Secondary* and *Aesthetics* uses of River Meadow Brook (Figure 3). The Concord River from the Rogers Street Bridge to the confluence with the Merrimack River is impaired for the *Primary* and *Secondary Contact Recreational* uses because of fecal coliform bacteria, debris/floatables/trash, and excess algal growth. The *Aesthetic Use* is assessed as impaired due to debris/floatables/trash and excess algal growth. The Lowell Regional Water and Wastewater Utility combined sewer overflow at Warren Street is a known source of bacterial contamination while municipal separate storm sewers and urbanized high-density areas are also suspected sources. The *Aesthetics Use* is supported for 11.9 river miles in the Concord River Watershed.

Assabet River Watershed
Total miles included in report- 86.8 miles

Primary Contact Recreation
- Support –0 miles
- Impaired – 26.2 miles (30%)
- Not Assessed –60.6 miles (70%)

Secondary Contact Recreation
- Support – 6.4 miles (7%)
- Impaired – 19.8 miles (23%)
- Not Assessed –60.6 miles (30%)

Aesthetics
- Support – 36 miles (41%)
- Impaired – 19.8 miles (23%)
- Not Assessed –31 miles (36%)

Sudbury River Watershed
Total miles included in report- 54.8 miles

Primary Contact Recreation
- Support – 0 miles
- Impaired – 3.8 miles (7%)
- Not Assessed –51.0 miles (93%)

Secondary Contact Recreation
- Support – 0 miles
- Impaired – 3.8 miles (7%)
- Not Assessed –51.0 miles (93%)

Aesthetics
- Support – 14.6 miles (27%)
- Impaired – 0.6 miles (1%)
- Not Assessed –39.6 miles (72%)

Concord River Watershed
Total miles included in report- 29.6 miles

Primary Contact Recreation
- Support – 0 miles
- Impaired – 7.3 miles (25%)
- Not Assessed –22.3 miles (75%)

Secondary Contact Recreation
- Support – 0 miles
- Impaired – 7.3 miles (25%)
- Not Assessed –22.3 miles (75%)

Aesthetics
- Support – 11.9 miles (40%)
- Impaired – 7.3 miles (25%)
- Not Assessed –10.4 miles (35%)

Use Summary – Lakes (Figure 4)

Under the Massachusetts Beach Bill (MGL.C111.S5S), enacted in 2001, bacteria testing is required at public and semi-public beaches throughout the Commonwealth. In the SuAsCo Watershed the *Primary Contact Recreation Use* was assessed as support at eight bathing beaches (1,130 acres, 17% of the total assessed lake acreage) where information on beach closures was available from MDPH, Massachusetts Department of Conservation and Recreation (MA DCR, formerly MA DEM) or local boards of health. These include: Ashland Reservoir (MA82003), Chauncy Lake (MA82017), Lake Cochituate North Basin (MA82020), Fort Meadow Reservoir (MA82042), Hopkinton Reservoir (MA82061), Long Pond (MA82072), Walden Pond (MA82019), and West Pond (MA82115).

Eleven of the lakes in the SuAsCo Watershed, totaling 1512 acres (23%), are assessed as impaired for the *Primary Contact Recreational Use*. Eight of the eleven lakes (1253 acres, 19%) are also assessed as impaired for the *Secondary Contact Recreational* and *Aesthetics* uses. The middle basin of Lake Cochituate (MA82125), Heart Pond (MA82059) and the east basin of Nutting Lake (MA82088) were assessed as impaired for the *Primary Contact Recreational Use* based on the Beach Bill information. The Assabet River Reservoir (MA82004) and Whitehall Reservoir (MA82120) are impaired for the *Primary, Secondary,* and *Aesthetics* uses due to the high biovolume occupied by non-native aquatic macrophytes. Boons Pond (MA82011) is impaired for the *Primary, Secondary,* and *Aesthetics* uses due to the high biovolume occupied by non-native aquatic macrophytes and excess algal growth. Carding Millpond (MA820015), Grist Mill Pond (MA820055), Hager Pond (MA82056), and Stearns Millpond (MA82104) are impaired due to excess algal growth (*Primary, Secondary,* and *Aesthetics* uses). Secchi disk transparency and excess algal growth impair the *Primary, Secondary,* and *Aesthetics* uses of Heard Pond (MA82058).

Use Assessment- Lakes
(Total area included in report – 6586 acres)

Primary Contact Recreation
- Support –1130 acres (17%)
- Impaired – 1512 acres (23%)
- Not Assessed –3944 acres (60%)

Secondary Contact Recreation
- Support – 1130 acres (17%)
- Impaired – 1253 acres (19%)
- Not Assessed –4203 acres (64%)

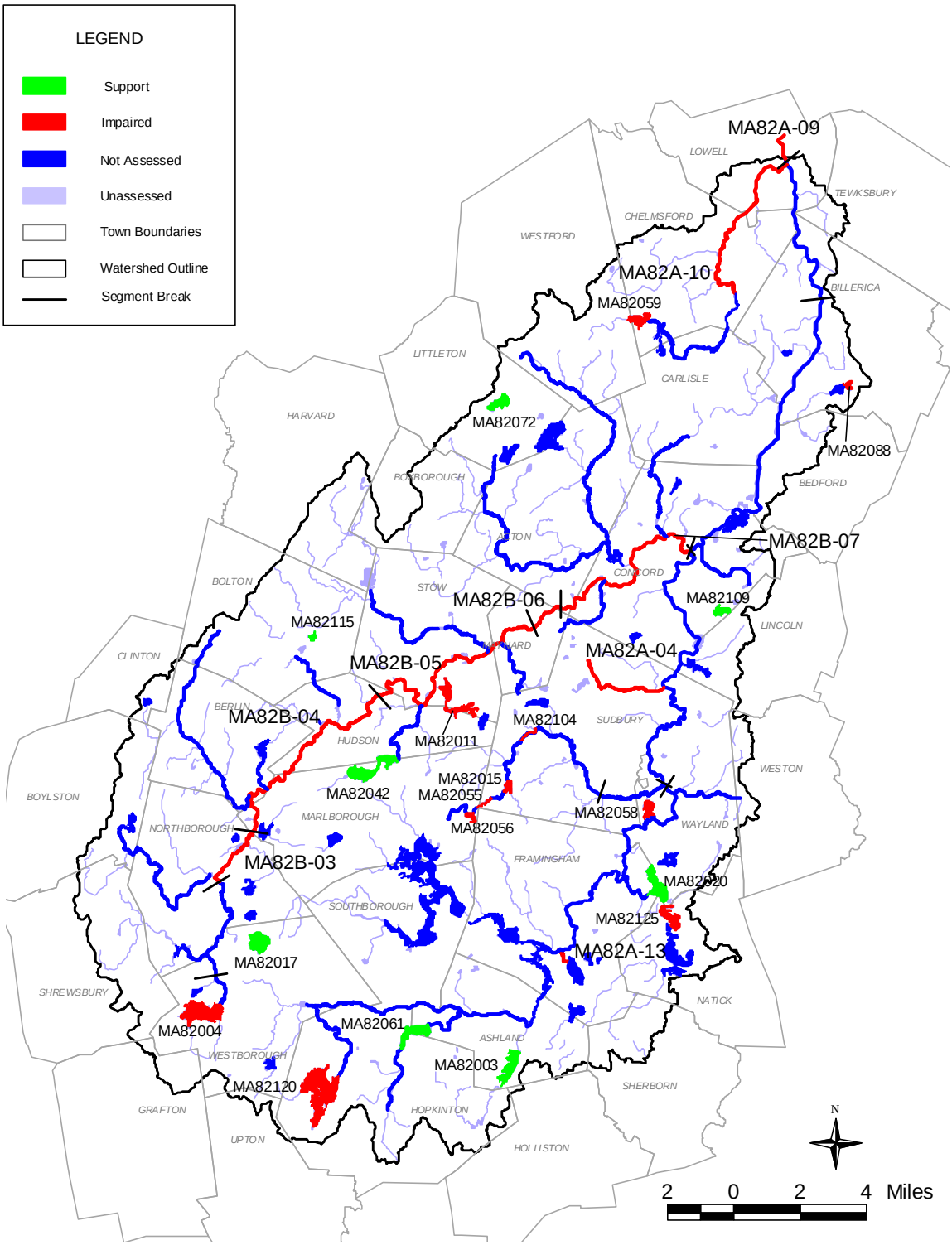
Aesthetics
- Support – 632 acres (10%)
- Impaired – 1253 acres (19%)
- Not Assessed –4699 acres (71%)

Details of impairment of the *Primary* and *Secondary Contact Recreational* uses and the *Aesthetics Use* for river segments in the SuAsCo Watershed.

NOTES: 1°= Primary Contact; 2°= Secondary Contact

Segment	Use Assessment	Causes	Sources
Assabet River (MA82B-03)	1°, 2°, Aesthetics- IMPAIRED	Debris/ floatables/trash, odor, excess algal growth	Municipal point source discharge (Suspected: Highway/ road/ bridge runoff (non -construction), residential districts, discharges from municipal separate storm sewer systems (MS4s), municipal urbanized high density areas, internal nutrient recucling)
Assabet River (MA82B-04)	1°, 2°, Aesthetics- IMPAIRED	Excess algal growth	Municipal point source discharge (Suspected: Highway/ road/ bridge runoff (non -construction), residential districts, discharges from municipal separate storm sewer systems (MS4s), municipal urbanized high density areas)
Assabet River (MA82B-05)	1°, 2°, Aesthetics- IMPAIRED	Excess algal growth noxious aquatic plants, debris/floatables/trash, odor	Municipal point source discharge (Suspected: Internal nutrient recycling, highway/ road/ bridge runoff (non -construction), residential districts, discharges from municipal separate storm sewer systems (MS4s), municipal urbanized high density areas)
Assabet River (MA82B-06)	1°, 2°, Aesthetics- IMPAIRED	Excess algal growth noxious aquatic plants, debris/floatables/trash, odor	Municipal point source discharge, sanitary sewer overflows (collection system failure) (Suspected: Impacts from hydrostructure/flow regulation/ modification, internal nutrient recycling, discharges from municipal separate storm sewer systems (MS4s))
Assabet River (MA82B-07)	1°- IMPAIRED 2°, Aesthetics- SUPPORT	Fecal coliform	Unknown (Suspected: Discharges from municipal separate storm sewer systems (MS4s))
Eames Brook MA82A-13)	1°, 2°, Aesthetics- IMPAIRED	Debris/floatables/trash, excess algal growth, sediment odor (1°, 2° Suspected - Fecal coliform bacteria)	(Suspected: Discharges from municipal separate storm sewers systems (MS4s), landfill, municipal urbanized high density areas)
Pantry Brook (MA82A-19)	1°, 2°, IMPAIRED Aesthetics- NOT ASSESSED	Fecal coliform bacteria	(Suspected: On-site treatment systems, waste from pets, wildlife other than waterfowl)
Concord River (MA82A-09)	1°, 2°, Aesthetics- IMPAIRED	1°, 2°- Fecal coliform bacteria, debris/floatables/ trash, excess algal growth Aesthetics: debris/floatables/ trash, excess algal growth	CSOs (Suspected: Municipal urbanized high density areas, discharges from municipal separate storm sewer systems (MS4s))
River Meadow Brook (MA82A-10)	1°, 2°, Aesthetics- IMPAIRED	Debris/floatables/trash	Municipal urbanized high density areas

Figure 4. *Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics* Use Summary – Rivers and Lakes



RECOMMENDATIONS

In addition to specific issues for the individual segments, the evaluation of current water quality conditions in the SuAsCo Watershed has revealed the need for the following.

- Monitoring of bacteria levels to document the effectiveness of bacteria source reduction activities associated with sewer collection improvements, Title V (septic system) improvements/upgrades, treatment of storm water discharges, sewering and/or Phase II community storm water management programs and to assess the status of the *Primary* and *Secondary Contact Recreation* uses.

- Coordination with MA DCR and/or other groups conducting lake surveys to generate quality-assured lakes data. More intensive surveys should be conducted to better determine the lake trophic and use support status and identify causes and sources of impairment. As sources are identified within lake watersheds they should be eliminated or at least minimized through the application of appropriate point or non-point source control techniques.

- Programs to prevent spreading on non-native, invasive aquatic macrophytes.

- Implementation of the recommendations from the Assabet River Nutrient TMDL.

- Monitoring for dissolved oxygen, nutrients, and plant biomass in the Assabet River Watershed to document the effectiveness of the Assabet TMDL.

- To the extent possible, flows released from impoundments throughout the watershed should mimic natural hydrographs. Minimum flows should be released, particularly during low flow periods, to protect aquatic life and enhance habitat quality.

- Continuation of water quality monitoring to better evaluate the status of the *Aquatic Life Use.* At a minimum continuous dissolved oxygen and temperature data and pH and total phosphorus data should be collected. Biological (benthic macroinvertebrate, habitat assessment, and fish population) sampling should also be conducted.

- Shoreline surveys to assess the *Aesthetics Use*.

- MDFW has recommended that a number of streams throughout the SuAsCo Watershed be protected as coldwater fishery habitat based on surveys they have conducted. Additional monitoring of the fish population, DO, and temperature is needed to evaluate MDFW's proposal to list these segments as cold water fisheries in the next revision of the Surface Water Quality Standards.

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INTRODUCTION

The Massachusetts Watershed Approach is a collaborative effort between state and federal environmental agencies, municipal agencies, citizens, non-profit groups, businesses and industries in the watershed. The mission is to improve water quality conditions and to provide a framework under which the restoration and/or protection of the watershed's natural resources can be achieved. Figure 5 illustrates the management structure to carry out the mission. This report presents the current assessment of water quality conditions in the SuAsCo Watershed. The assessment is based on information that has been researched and developed by the Massachusetts Department of Environmental Protection (MA DEP) through the first three years (information gathering, monitoring, and assessment) of the five-year cycle in partial fulfillment of MA DEP's federal mandate to report on the status of the Commonwealth's waters under the Federal Water Pollution Control Act (commonly known as the Clean Water Act [CWA]).

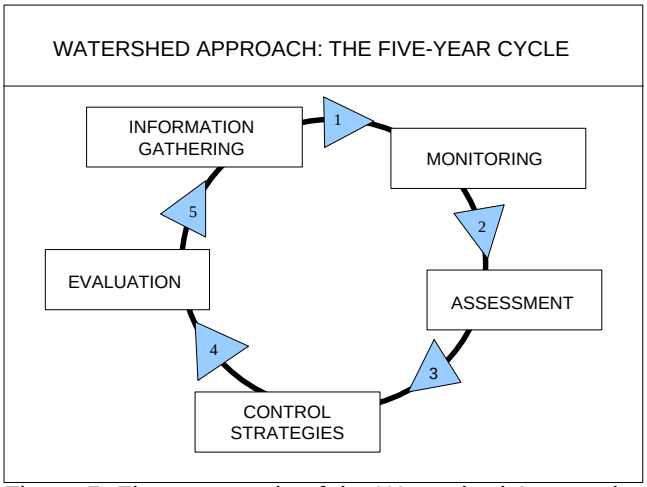

Figure 5. Five-year cycle of the Watershed Approach.

The goal of the 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 United States Environmental Protection Agency (EPA), the United States 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, every two years MA DEP must submit a statewide report (to the EPA) that describes the status of water quality in the Commonwealth. Up 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 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 Waters into one "Integrated List of Waters". This statewide list is based on the compilation of information for the Commonwealth's 27 watersheds. Massachusetts has opted to write individual watershed 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. Instream 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 below (Assessment Methodology). Once the use assessments have been completed the segments are categorized for the Integrated List.

ASSESSMENT METHODOLOGY

WATER QUALITY CLASSIFICATION

The Massachusetts Surface Water Quality Standards (SWQS) designate the most sensitive uses for which the surface waters of the Commonwealth shall be enhanced, maintained and protected; prescribe minimum water quality criteria required to sustain the designated uses; and include provisions for the prohibition of discharges (MA DEP 1996). These regulations should undergo public review every three years. The surface waters are segmented and each segment is assigned to one of the six classes described below. Each class is identified by the most sensitive and, therefore, governing water uses to be achieved and protected. Surface waters may be suitable for other beneficial uses, but shall be regulated by the Department of Environmental Protection to protect and enhance the designated uses.

Inland Water Classes

1. ***Class A*** *– These waters are designated as a source of public water supply. To the extent compatible with this use they shall be an excellent habitat for fish, other aquatic life* and *wildlife, and suitable for primary and secondary contact recreation. These waters shall have excellent aesthetic value. These waters are designated for protection as Outstanding Resource Waters (ORWs) under 314 Code of Massachusetts Regulations (CMR) 4.04(3).*
2. ***Class B*** *– These waters are designated as a habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation. Where designated they shall be suitable as a source of water supply with appropriate treatment. They shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value.*
3. ***Class C*** *– These waters are designated as a habitat for fish, other aquatic life and wildlife, and for secondary contact recreation. These waters shall be suitable for the irrigation of crops used for consumption after cooking and for compatible industrial cooling and process uses. These waters shall have good aesthetic value.*

Coastal and Marine Classes

4. ***Class SA*** *– These waters are designated as an excellent habitat for fish, other aquatic life and wildlife and for primary and secondary recreation. In approved areas they shall be suitable for shellfish harvesting without depuration (Open Shellfishing Areas). These waters shall have excellent aesthetic value.*
5. ***Class SB*** *– These waters are designated as a habitat for fish, other aquatic life and wildlife and for primary and secondary contact recreation. In approved areas they shall be suitable for shellfish harvesting with depuration (Restricted Shellfishing Areas). These waters shall have consistently good aesthetic value.*
6. ***Class SC*** *– These waters are designated as a habitat for fish, other aquatic life, and wildlife and for secondary contact recreation. They shall also be suitable for certain industrial cooling and process uses. These waters shall have good aesthetic value.*

The CWA Section 305(b) water quality reporting process is an essential aspect of the Nation's water pollution control effort. It is the principal means by which EPA, Congress, and the public evaluate existing water quality, assess progress made in maintaining and restoring water quality, and determine the extent of remaining problems. In so doing, the states report on waterbodies within the context of meeting their designated uses (described above in each class). Each class is identified by the most sensitive and, therefore, governing water uses to be achieved and protected. These uses include: *Aquatic Life, Fish Consumption, Drinking Water, Primary Contact Recreation, Secondary Contact Recreation, Shellfish Harvesting* and *Aesthetics*. Two subclasses of Aquatic Life are also designated in the standards: Cold Water Fishery (capable of sustaining a year-round population of cold water aquatic life, such as trout), and Warm Water Fishery (waters that are not capable of sustaining a year-round population of cold water aquatic life).

The SWQS, summarized in Table 1, prescribes minimum water quality criteria to sustain the designated uses. Furthermore, these standards describe the hydrological conditions at which water quality criteria must be applied (MA DEP 1996). In rivers, the lowest flow conditions at and above which aquatic life

criteria must be applied are the lowest mean flow for seven consecutive days to be expected once in ten years (7Q10). In artificially regulated waters the lowest flow conditions at which aquatic life criteria must be applied are the flow equal or exceeded 99% of the time on a yearly basis or another equivalent flow that has been agreed upon. In coastal and marine waters and for lakes the most severe hydrological condition for which the aquatic life criteria must be applied shall be determined by MA DEP on a case-by-case basis.

The availability of appropriate and reliable scientific data and technical information is fundamental to the 305(b) reporting process. It is EPA policy (EPA Order 5360.1 CHG 1) that any organization performing work for or on behalf of EPA establish a quality system to support the development, review, approval, implementation, and assessment of data collection operations. To this end, MA DEP describes its Quality System in an EPA-approved Quality Management Plan to ensure that environmental data collected or compiled by the Agency are of known and documented quality and are suitable for their intended use. For external sources of information, MA DEP requires the following: 1) an appropriate *Quality Assurance Project Plan* (QAPP) including a laboratory Quality Assurance /Quality Control (QA/QC) plan, 2) use of a state certified lab (or as otherwise approved by MA DEP for a particular analysis), and 3) sample data, QA/QC and other pertinent sample handling information are documented in a citable report. This information will be reviewed by MA DEP to determine its validity and usability to assess wateruse support. Data use could be modified or rejected due to poor or undocumented QAPP implementation, lack of project documentation, incomplete reporting of data or information, and/or project monitoring objectives unsuitable for MA DEP assessment purposes.

EPA provides guidelines to the States for making their use support determinations (EPA 1997 and 2002, Grubbs and Wayland III 2000 and Wayland III 2001). The determination of whether or not a waterbody supports each of its designated uses is a function of the type(s), quality and quantity of available current information. Although data/information older than five years are usually considered “historical” and used for descriptive purposes they can be utilized in the use support determination provided they are known to reflect the current conditions. While the water quality standards (Table 1) prescribe minimum water quality criteria to sustain the designated uses, numerical criteria are not available for every indicator of pollution. Best available guidance in the literature may be applied in lieu of actual numerical criteria (e.g., freshwater sediment data may be compared to *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*, Persaud, *et al*, 1993). Excursions from criteria due to solely “naturally occurring” conditions (e.g., low pH in some areas) do not constitute violations of the standards.

Each designated use within a given segment is individually assessed as ***support*** or ***impaired***. When too little current data/information exists or no reliable data are available the use is ***not assessed***. In this report, however, if there is some indication that water quality impairment may exist, which is not “naturally occurring”, the use is identified with an “Alert Status”. Detailed guidance for assessing the status of each use follows in the Designated Uses Section of this report. It is important to note that not all waters are assessed. Many small and/or unnamed ponds, rivers, and estuaries are currently ***unassessed***; the status of their designated uses has never been reported to EPA in the Commonwealth’s 305(b) Report or the Integrated List of Waters nor is information on these waters maintained in the waterbody system database (WBS) or the new assessment database (ADB).

Table 1. Summary of Massachusetts Surface Water Quality Standards (MA DEP 1996 and MDPH 2002a).

Dissolved Oxygen	Class A, Class B Cold Water Fishery (BCWF), and Class SA: ≥6.0 mg/L and ≥75% saturation unless background conditions are lower Class B Warm Water Fishery (BWWF) and Class SB: ≥5.0 mg/L and ≥60% saturation unless background conditions are lower Class C: Not ≤5.0 mg/L for more than 16 of any 24-hour period and not ≤3.0 mg/L anytime unless background conditions are lower; levels cannot be lowered below 50% saturation due to a discharge Class SC: Not ≤5.0 mg/L for more than 16 of any 24-hour period and not ≤4.0 mg/L anytime unless background conditions are lower; and 50% saturation; levels cannot be lowered below 50% saturation due to a discharge
Temperature	Class A: ≤68°F (20°C) and Δ1.5°F (0.8°C) for Cold Water and ≤83°F (28.3°C) and Δ1.5°F (0.8°C) for Warm Water. Class BCWF: ≤68°F (20°C) and Δ3°F (1.7°C) due to a discharge Class BWWF: ≤83°F (28.3°C) and Δ3°F (1.7°C) in lakes, Δ5°F (2.8°C) in rivers Class C and Class SC: ≤85°F (29.4°C) nor Δ5°F (2.8°C) due to a discharge Class SA: ≤85°F (29.4°C) nor a maximum daily mean of 80°F (26.7°C) and Δ1.5°F (0.8°C) Class SB: ≤85°F (29.4°C) nor a maximum daily mean of 80°F (26.7°C) and Δ1.5°F (0.8°C) between July through September and Δ4.0°F (2.2°C) between October through June
pH	Class A, Class BCWF and Class BWWF: 6.5 - 8.3 SU and Δ0.5 outside the background range. Class C: 6.5 - 9.0 SU and Δ1.0 outside the naturally occurring range. Class SA and Class SB: 6.5 - 8.5 SU and Δ0.2 outside the normally occurring range. Class SC: 6.5 - 9.0 SU and Δ0.5 outside the naturally occurring range.
Solids	All Classes: *These waters shall be free from floating, suspended, and settleable solids in concentrations or combinations that would impair any use assigned to each class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.*
Color and Turbidity	All Classes: *These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use.*
Oil and Grease	Class A and Class SA: *Waters shall be free from oil and grease, petrochemicals and other volatile or synthetic organic pollutants.* Class SA: *Waters shall be free from oil and grease and petrochemicals.* Class B, Class C, Class SB and Class SC: *Waters shall be free from oil* and *grease, petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course or are deleterious or become toxic to aquatic life.*
Taste and Odor	Class A and Class SA: *None other than of natural origin.* Class B, Class C, Class SB and Class SC: *None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to each class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.*
Aesthetics	All Classes: *All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.*
Toxic Pollutants	All Classes: *All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife… The division shall use the recommended limit published by EPA pursuant to 33 USC 1251, 304(a) as the allowable receiving water concentrations for the affected waters unless a site-specific limit is established*.
Nutrients	*Shall not exceed the site-specific limits necessary to control accelerated or cultural eutrophication.*

Note: *Italics are direct quotations.*

Δ criterion (referring to a change from natural background conditions) is applied to the effects of a permitted discharge.

Table 1 (Continued). Summary of Massachusetts Surface Water Quality Standards (MA DEP 1996 and MDPH 2002a).

Bacteria (MA DEP 1996 and MDPH 2002a) Class A criteria apply to the *Drinking Water Use*. Class B and SB criteria apply to *Primary Contact Recreation Use* while Class C and SC criteria apply to *Secondary Contact Recreation Use*.	Class A: • Fecal coliform bacteria: An arithmetic mean of <20 cfu/100mL in any representative set of samples and <10% of the samples >100 cfu/100mL. Class B: • At public bathing beaches, as defined by MDPH, where *E. coli* is the chosen indicator: No single *E. coli* sample shall exceed 235 *E. coli* /100 mL and the geometric mean of the most recent five *E. coli* samples within the same bathing season shall not exceed 126 *E. coli* / 100 mL. • At public bathing beaches, as defined by MDPH, where *Enterococci* are the chosen indicator: No single *Enterococci* sample shall exceed 61 *Enterococci* /100mL and the geometric mean of the most recent five *Enterococci* samples within same bathing season shall not exceed 33 *Enterococci* /100mL**.** • Current standards for other waters (not designated as bathing beaches), where fecal coliform bacteria are the chosen indicator: Waters shall not exceed a geometric mean of 200 cfu/100mL in any representative set of samples, nor shall more than 10% of the samples exceed 400 cfu/100mL. (This criterion may be applied on a seasonal basis at the discretion of the MA DEP.) Class C: • Fecal coliform bacteria: Shall not exceed a geometric mean of 1000 cfu/100ml, nor shall 10% of the samples exceed 2000 cfu/100 mL. Class SA: • Fecal coliform bacteria: Waters approved for open shellfishing shall not exceed a geometric mean (most probable number (MPN) method) of 14 MPN/100 mL, nor shall more than 10% of the samples exceed 43 MPN/100mL. • At public bathing beaches, as defined by MDPH, where *Enterococci* are the chosen indicator: No single *Enterococci* sample shall exceed 104 *Enterococci* /100mL and the geometric mean of the five most recent *Enterococci* levels within the same bathing season shall not exceed 35 *Enterococci* /100mL. • Current standards for other waters (not designated as shellfishing areas or public bathing beaches), where fecal coliform bacteria are the chosen indicator: Waters shall not exceed a geometric mean of 200 cfu/100mL in any representative set of samples, nor shall more than 10% of the samples exceed 400 cfu/100mL. (This criterion may be applied on a seasonal basis at the discretion of the MA DEP.) Class SB: • Fecal coliform bacteria: In waters approved for restricted shellfish, a fecal coliform median or geometric mean (MPN method) of <88 MPN/100mL and <10% of the samples >260 MPN/100mL. • At public bathing beaches, as defined by MDPH, where *Enterococci* are the chosen indicator: No single *Enterococci* sample shall exceed 104 *Enterococci* /100mL and the geometric mean of the most recent five *Enterococci* levels within the same bathing season shall not exceed 35 *Enterococci* /100mL. • Current standards for other waters (not designated as shellfishing areas or public bathing beaches), where fecal coliform bacteria are the chosen indicator: Waters shall not exceed a geometric mean of 200 cfu/100mL in any representative set of samples, nor shall more than 10% of the samples exceed 400 cfu/100mL. (This criterion may be applied on a seasonal basis at the discretion of the MA DEP.) Class SC: • Fecal coliform bacteria: Shall not exceed a geometric mean of 1000 cfu/100mL, nor shall 10% of the samples exceed 2000 cfu/100mL.

DESIGNATED USES

The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which the surface waters of the Commonwealth shall be enhanced, maintained and protected. Each of these uses is briefly described below (MA DEP 1996).

- *AQUATIC LIFE* - suitable habitat for sustaining a native, naturally diverse, community of aquatic flora and fauna. Two subclasses of aquatic life are also designated in the standards for freshwater bodies: *Cold Water Fishery* - capable of sustaining a year-round population of cold water aquatic life, such as trout; *Warm Water Fishery* - waters that are not capable of sustaining a year-round population of cold water aquatic life.
- *FISH CONSUMPTION* - pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or for the recreational use of fish, other aquatic life or wildlife for human consumption.
- *DRINKING WATER* - used to denote those waters used as a source of public drinking water. They may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). These waters are designated for protection as Outstanding Resource Waters under 314 CMR 4.04(3).
- *SHELLFISH HARVESTING* (in SA and SB segments) – Class SA waters in approved areas (Open Shellfish Areas) shellfish harvested without depuration shall be suitable for consumption; Class SB waters in approved areas (Restricted Shellfish Areas) shellfish harvested with depuration shall be suitable for consumption.
- *PRIMARY CONTACT RECREATION* - suitable for any recreation or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water. These include, but are not limited to, wading, swimming, diving, surfing and water skiing.
- *SECONDARY CONTACT RECREATION* - suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities.
- *AESTHETICS* - all surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.
- *AGRICULTURAL AND INDUSTRIAL* - suitable for irrigation or other agricultural process water and for compatible industrial cooling and process water.

The guidance used to assess the *Aquatic Life, Fish Consumption, Drinking Water, Shellfish Harvesting, Primary* and *Secondary Contact Recreation* and *Aesthetics* uses follows.

AQUATIC LIFE USE

This use is suitable for sustaining a native, naturally diverse, community of aquatic flora and fauna. The results of biological (and habitat), toxicological, and chemical data are integrated to assess this use. The nature, frequency, and precision of the MA DEP's data collection techniques dictate that a weight of evidence be used to make the assessment, with biosurvey results used as the final arbiter of borderline cases. The following chart provides an overview of the guidance used to assess the status (support or impaired) of the *Aquatic Life Use*:

Variable	***Support*** - Data available clearly indicates support or minor modification of the biological community. Excursions from chemical criteria (Table 1) not frequent or prolonged and may be tolerated if the biosurvey results demonstrate support.	***Impaired*** There are frequent or severe violations of chemical criteria, presence of acute toxicity, or a moderate or severe modification of the biological community.
BIOLOGY		
Rapid Bioassessment Protocol (RBP) III*	Non/Slightly impacted	Moderately or Severely Impacted
Fish Community	Best Professional Judgment (BPJ)	BPJ
Habitat and Flow	BPJ	Dewatered streambed due to artificial regulation or channel alteration, BPJ
Eelgrass Bed Habitat (Costello 2003)	Stable (No/minimal loss), BPJ	Loss/decline, BPJ
Macrophytes	BPJ	Exotic species present, BPJ
Plankton/Periphyton	No/infrequent algal blooms	Frequent and/or prolonged algal blooms
TOXICITY TESTS**		
Water Column/Ambient	≥75% survival either 48 hr or 7-day exposure	<75% survival either 48 hr or 7-day exposure
Sediment	≥75% survival	<75% survival
CHEMISTRY-WATER**		
Dissolved oxygen (DO)/percent saturation (MA DEP 1996, EPA 1997)	Infrequent excursion from criteria (Table 1), BPJ (minimum of three samples representing critical period)	Frequent and/or prolonged excursion from criteria [river and shallow lakes: exceedances >10% of measurements; deep lakes (with hypolimnion): exceedances in the hypolimnetic area >10% of the surface area].
pH (MA DEP 1996, EPA 19 November 1999)	Infrequent excursion from criteria (Table 1)	Criteria exceeded >10% of measurements.
Temperature **(**MA DEP 1996, EPA 1997)	Infrequent excursion from criteria (Table 1) [1]	Criteria exceeded >10% of measurements.
Toxic Pollutants (MA DEP 1996, EPA 19 November 1999) Ammonia-N (MA DEP 1996, EPA 19 November 1999, EPA 1999) Chlorine (MA DEP 1996, EPA 19 November 1999)	Infrequent excursion from criteria (Table 1) Ammonia is pH and temperature dependent[2] 0.011 mg/L (freshwater) or 0.0075 mg/L (saltwater) total residual chlorine (TRC) [3]	Frequent and/or prolonged excursion from criteria (exceeded >10% of measurements).
CHEMISTRY-SEDIMENT**		
Toxic Pollutants (Persaud *et al.* 1993)	Concentrations ≤ Low Effect Level (L-EL), BPJ	Concentrations ≥ Severe Effect Level (S-EL) [4], BPJ
CHEMISTRY-TISSUE		
PCB – whole fish (Coles 1998)	≤500 µg/kg wet weight	BPJ
DDT (Environment Canada 1999)	≤14.0 µg/kg wet weight	BPJ
PCB in aquatic tissue (Environment Canada 1999)	≤0.79 ng TEQ/kg wet weight	BPJ

*RBP II analysis may be considered for assessment decision on a case-by-case basis, **For identification of impairment, one or more of the following variables may be used to identify possible causes/sources of impairment: NPDES facility compliance with whole effluent toxicity test and other limits, turbidity and suspended solids data, nutrient (nitrogen and phosphorus) data for water column/sediments. [1]Maximum daily mean T in a month (minimum six measurements evenly distributed over 24-hours) less than criterion. [2] Saltwater is temperature dependent only. [3] The minimum quantification level for TRC is 0.05 mg/L. [4]For the purpose of this report, the S-EL for total polychlorinated biphenyl compounds (PCBs) in sediment (which varies with Total Organic Carbon (TOC) content) with 1% TOC is 5.3 ppm while a sediment sample with 10% TOC is 53 ppm.

Note: National Academy of Sciences/National Academy of Engineering (NAS/NAE) guideline for maximum organochlorine concentrations (i.e., total PCB) in fish tissue for the protection of fish-eating wildlife is 500µg/kg wet weight (ppb, not lipid-normalized). PCB data (tissue) in this report are presented in µg/kg wet weight (ppb) and are not lipid-normalized to allow for direct comparison to the NAS/NAE guideline.

FISH CONSUMPTION USE

Pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or for the recreational use of fish, other aquatic life or wildlife for human consumption. The assessment of this use is made using the most recent list of Fish Consumption Advisories issued by the Massachusetts Executive Office of Health and Human Services, Department of Public Health (MDPH), Bureau of Environmental Health Assessment (MDPH 2004). The MDPH list identifies waterbodies where elevated levels of a specified contaminant in edible portions of freshwater species pose a health risk for human consumption. Hence, the Fish Consumption Use is assessed as non-support in these waters.

In July 2001 MDPH issued new consumer advisories on fish consumption and mercury contamination (MDPH 2001).

1. The MDPH "…is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MDPH 2001)."
2. Additionally, MDPH "…is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MDPH 2001)."

Other statewide advisories that MDPH has previously issued and are still in effect are as follows (MDPH 2001).

1. Due to concerns about chemical contamination, primarily from polychlorinated biphenyl compounds (PCBs) and other contaminants, no individual should consume lobster tomalley from any source. Lobster tomalley is the soft green substance found in the tail and body section of the lobster.
2. Pregnant and breastfeeding women and those who are considering becoming pregnant should not eat bluefish due to concerns about PCB contamination in this species.

The following is an overview of EPA's guidance used to assess the status (support or impaired) of the *Fish Consumption Use*. Because of the statewide advisory no waters can be assessed as support for the *Fish Consumption Use*. Therefore, if no site-specific advisory is in place, the *Fish Consumption Use* is not assessed.

Variable	***Support*** No restrictions or bans in effect	***Impaired*** There is a "no consumption" advisory or ban in effect for the general population or a sub-population for one or more fish species or there is a commercial fishing ban in effect
MDPH Fish Consumption Advisory List (MDPH 2001, MDPH 2004)	Not applicable, precluded by statewide advisory (Hg)	Waterbody on MDPH Fish Consumption Advisory List

Note: MDPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially.

DRINKING WATER USE

The term *Drinking Water Use* denotes those waters used as a source of public drinking water. These waters may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). They are designated for protection as Outstanding Resource Waters in 314 CMR 4.04(3). MA DEP's Drinking Water Program (DWP) has primacy for implementing the provisions of the federal Safe Drinking Water Act (SDWA). Except for suppliers with surface water sources for which a waiver from filtration has been granted (these systems also monitor surface water quality) all public drinking water supplies are monitored as finished water (tap water). Monitoring includes the major categories of contaminants established in the SDWA: bacteria, volatile and synthetic organic compounds, inorganic compounds and radionuclides. The DWP maintains current drinking supply monitoring data. The status of the supplies is currently reported to MA DEP and EPA by the suppliers on an annual basis in the form of a consumer confidence report (http://yosemite.epa.gov/ogwdw/ccr.nsf/Massachusetts). Below is EPA's guidance to assess the status (support or impaired) of the drinking water use.

Variable	***Support*** No closures or advisories (no contaminants with confirmed exceedances of maximum contaminant levels, conventional treatment is adequate to maintain the supply).	***Impaired*** Has one or more advisories or more than conventional treatment is required or has a contamination-based closure of the water supply.
Drinking Water Program (DWP) Evaluation	See note below	See note below

Note: While this use is not assessed in this report, information on drinking water source protection and finish water quality is available at http://www.mass.gov/dep/brp/dws/dwshome.htm and from the SuAsCo Watershed's public water suppliers.

SHELLFISH HARVESTING USE

This use is assessed using information from the Department of Fisheries, Wildlife and Environmental Law Enforcement's Division of Marine Fisheries (DMF). A designated shellfish growing area is an area of potential shellfish habitat. Growing areas are managed with respect to shellfish harvest for direct human consumption, and comprise at least one or more classification areas. The classification areas are the management units, and range from being approved to prohibited (described below) with respect to shellfish harvest. Shellfish areas under management closures are *not assessed.* Not enough testing has been done in these areas to determine whether or not they are fit for shellfish harvest, therefore, they are closed for the harvest of shellfish.

Variable	***Support*** SA Waters: Approved[1] SB Waters: Approved[1], Conditionally Approved[2] or Restricted[3]	***Impaired*** SA Waters: Conditionally Approved[2], Restricted[3], Conditionally Restricted[4], or Prohibited[5] SB Waters: Conditionally Restricted[4] or Prohibited[5]
DMF Shellfish Project Classification Area Information (DFWELE 2000)	Reported by DMF	Reported by DMF

NOTE: Designated shellfish growing areas may be viewed using the MassGIS datalayer available from MassGIS at http://www.mass.gov/mgis/dsga.htm. This coverage currently reflects classification areas as of July 1, 2000.

[1] **Approved** - "...open for harvest of shellfish for direct human consumption subject to local rules and regulations..." An approved area is open all the time and closes only due to hurricanes or other major coastwide events.

[2] **Conditionally Approved** - "...subject to intermittent microbiological pollution..." During the time the area is open, it is "...for harvest of shellfish for direct human consumption subject to local rules and regulations…" A conditionally approved area is closed some of the time due to runoff from rainfall or seasonally poor water quality. When open, shellfish harvested are treated as from an approved area.

[3] **Restricted** - area contains a "limited degree of pollution." It is open for "harvest of shellfish with depuration subject to local rules and state regulations" or for the relay of shellfish. A restricted area is used by DMF for the relay of shellfish to a less contaminated area.

[4] **Conditionally Restricted** - "...subject to intermittent microbiological pollution..." During the time area is restricted, it is only open for "the harvest of shellfish with depuration subject to local rules and state regulations." A conditionally restricted area is closed some of the time due to runoff from rainfall or seasonally poor water quality. When open, only soft-shell clams may be harvested by specially licensed diggers (Master/Subordinate Diggers) and transported to the DMF Shellfish Purification Plant for depuration (purification).

[5] **Prohibited -** Closed for harvest of shellfish.

PRIMARY CONTACT RECREATION USE

This use is suitable for any recreational or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water during the primary contact recreation season (1 April to 15 October). These include, but are not limited to, wading, swimming, diving, surfing and water skiing. The chart below provides an overview of the guidance used to assess the status (support or impaired) of the *Primary Contact Recreation Use*. Excursions from criteria due to natural conditions are not considered impairment of use.

Variable	***Support*** Criteria are met, no aesthetic conditions that preclude the use	***Impaired*** Frequent or prolonged violations of criteria and/or formal bathing area closures, or severe aesthetic conditions that preclude the use
Bacteria (105 CMR 445.000) Minimum Standards for Bathing Beaches State Sanitary Code) (MA DEP 1996)	At "public bathing beach" areas: Formal beach postings/advisories neither frequent nor prolonged during the swimming season (the number of days posted or closed cannot exceed 10% during the locally operated swimming season). Other waters: Samples* collected during the primary contact season must meet criteria (Table 1). Shellfish Growing Area classified as "Approved" by DMF.	At "public bathing beach" areas: Formal beach closures/postings >10% of time during swimming season (the number of days posted or closed exceeds 10% during the locally operated swimming season). Other waters: Samples* collected during the primary contact season do not meet the criteria (Table 1).
Aesthetics (MA DEP 1996) - *All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance* [growth or amount] *species of aquatic life*		
Odor, oil and grease, color and turbidity, floating matter	Narrative "free from" criteria met or excursions neither frequent nor prolonged, BPJ.	Narrative "free from" criteria not met - objectionable conditions either frequent and/or prolonged, BPJ.
Transparency (MDPH 1969)	Public bathing beach and lakes – Secchi disk depth ≥1.2 meters (≥ 4') (minimum of three samples representing critical period).	Public bathing beach and lakes - Secchi disk depth <1.2 meters (< 4') (minimum of three samples representing critical period).
Nuisance organisms	No overabundant growths (i.e., blooms) that render the water aesthetically objectionable or unusable, BPJ.	Overabundant growths (i.e., blooms and/or non-native macrophyte growth dominating the biovolume) rendering the water aesthetically objectionable and/or unusable, BPJ.

* Data sets to be evaluated for assessment purposes must be representative of a sampling location (minimum of five samples per station recommended) over the course of the primary contact season. Samples collected on one date from multiple stations on a river are not considered adequate to assess this designated use. An impairment decision will not be based on a single sample (i.e., the geometric mean of five samples is <200 cfu/100mL but one of the five samples exceeds 400 cfu/100mL). The method detection limit (MDL) will be used in the calculation of the geometric mean when data are reported as less than the MDL (e.g. use 20 cfu/100mL if the result is reported as <20 cfu/100mL). Those data reported as too numerous to count (TNTC) will not be used in the geometric mean calculation; however frequency of TNTC sample results should be presented.

SECONDARY CONTACT RECREATION USE

This use is suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities. Following is an overview of the guidance used to assess the status (support or impaired) of the *Secondary Contact Use*. Excursions from criteria due to natural conditions are not considered impairment of use.

Variable	***Support*** Criteria are met, no aesthetic conditions that preclude the use	***Impaired*** Frequent or prolonged violations of criteria, or severe aesthetic conditions that preclude the use
Fecal Coliform Bacteria (MA DEP 1996)	Other waters: Samples* collected must meet the Class C or SC criteria (see Table 1).	Other waters: Samples* collected do not meet the Class C or SC criteria (see Table 1).
Aesthetics (MA DEP 1996) - *All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance* [growth or amount] *species of aquatic life*		
Odor, oil and grease, color and turbidity, floating matter Transparency (MA DPH 1969) Nuisance organisms	Narrative "free from" criteria met or excursions neither frequent nor prolonged*, BPJ. Public bathing beach and lakes – Secchi disk depth ≥1.2 meters (≥ 4') (minimum of three samples representing critical period). No overabundant growths (i.e., blooms) that render the water aesthetically objectionable or unusable, BPJ.	Narrative "free from" criteria not met - objectionable conditions either frequent and/or prolonged*, BPJ. Public bathing beach and lakes - Secchi disk depth <1.2 meters (< 4') (minimum of three samples representing critical period). Overabundant growths (i.e., blooms and/or non-native macrophyte growth dominating the biovolume) rendering the water aesthetically objectionable and/or unusable, BPJ.

*Data sets to be evaluated for assessment purposes must be representative of a sampling location (minimum of five samples per station recommended) over time. Samples collected on one date from multiple stations on a river are not considered adequate to assess this designated use.

AESTHETICS USE

All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life. The aesthetic use is closely tied to the public health aspects of the recreational uses (swimming and boating). Below is an overview of the guidance used to assess the status (support or impaired) of the *Aesthetics Use*.

Variable	***Support*** Narrative "free from" criteria met	***Impaired*** Objectionable conditions frequent and/or prolonged
Odor, oil and grease, color and turbidity, floating matter Transparency (MA DPH 1969) Nuisance organisms	Narrative "free from" criteria met or excursions neither frequent nor prolonged, BPJ. Public bathing beach and lakes – Secchi disk depth ≥1.2 meters (≥ 4') (minimum of three samples representing critical period). No overabundant growths (i.e., blooms) that render the water aesthetically objectionable or unusable, BPJ.	Narrative "free from" criteria not met - objectionable conditions either frequent and/or prolonged, BPJ. Public bathing beach and lakes - Secchi disk depth <1.2 meters (< 4') (minimum of three samples representing critical period). Overabundant growths (i.e., blooms and/or non-native macrophyte growth dominating the biovolume) rendering the water aesthetically objectionable and/or unusable, BPJ.

SUASCO WATERSHED DESCRIPTION

The following description of the Sudbury-Assabet-Concord (SuAsCo) Watershed was excerpted from the Executive Office of Environmental Affairs website (EOEA 2003a): http://www.mass.gov/envir/water/suasco/suasco.htm.

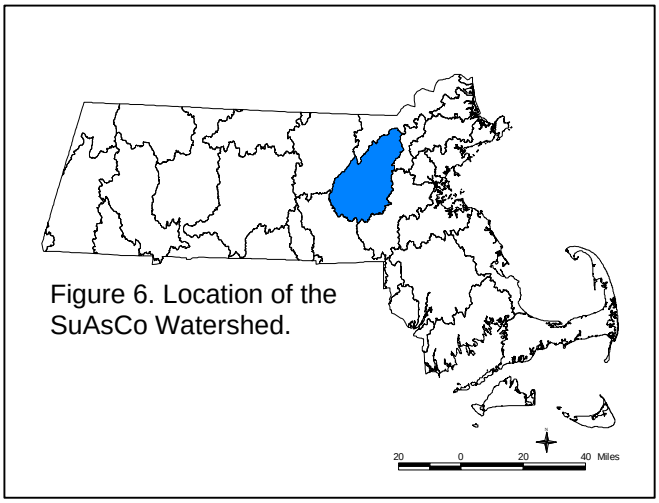

Figure 6. Location of the SuAsCo Watershed.

The SuAsCo Watershed, located in the metro-west area of the state, encompasses a large network of tributaries that ultimately flow into the Merrimack River (Figure 6)*. The watershed has a total drainage area of approximately 377 square miles. The Assabet River flows north about 30 miles from its headwaters in Westborough, through the now densely developed urban centers of Northborough, Hudson, and Maynard, to its confluence with the Sudbury River at historic Egg Rock in Concord, where the Concord River begins. The Sudbury River also has its beginnings in Westborough, flowing eastward from the Great Cedar Swamp toward Framingham. It then proceeds north through the towns of Sudbury, Wayland, and Lincoln, then into the Town of Concord. The Concord River flows through the towns of Bedford, Carlisle, Billerica, Chelmsford, and Tewksbury, before confluencing with the Merrimack River in the City of Lowell. The SuAsCo encompasses all or part of 36 municipalities and supports a population of 365,000 people*

Twenty-nine free-flowing miles of the three major rivers in the SuAsCo Watershed were designated under the Wild & Scenic Rivers Act on April 9, 1999:16.6 miles of the Sudbury River -Framingham (below Danforth Street Bridge), Wayland, Sudbury, Lincoln and Concord; 4.4 miles of the Assabet River – Concord (1000 feet below the Damon Mill Dam in West Concord to confluence with the Sudbury and Concord Rivers); 8 miles of the Concord River -Concord, Bedford and Billerica (Upstream of the Route 3 Bridge). The rivers were recognized for their outstanding ecological, historical, scenic, and recreational values, as well as their lasting place in American literature. Also located within the SuAsCo Watershed are two National Wildlife Refuges (NWRs) - the Great Meadows NWR, located primarily in Sudbury, and the Assabet NWR, located primarily in Stow- and the Commonwealth's first designated Area of Critical Environmental Concern - the Great Cedar Swamp located in Westborough. The Great Meadows NWR and the Great Cedar Swamp represent the two of the largest wetlands in Central Massachusetts (EOEA 2003a).

CLASSIFICATION

Consistent with the National Goal Uses of "fishable and swimmable waters", the waters in the SuAsCo Watershed are classified in accordance with the SWQS in the following manner (MA DEP 1996).

"Class A – These waters are designated as a source of public water supply. To the extent compatible with its use they shall be an excellent habitat for fish, other aquatic life and wildlife, and suitable for primary and secondary contact recreation. These waters shall have excellent aesthetic value. These waters are designated for protection as Outstanding Resource Waters (ORW) under 314 CMR 4.04(3)" (Rojko *et al*. 1995).

Class A Waters		
Assabet River Watershed	Sudbury River Watershed	Concord River Watershed
Nagog Pond, Source to outlet in Acton and those tributaries thereto (Public Water Supply-PWS) Gates Pond, Source to outlet in Berlin and those tributaries thereto (PWS) White Pond, Source to outlet in Hudson and those tributaries thereto (PWS) Millham Reservoir, Source to outlet in Marlborough and those tributaries thereto (PWS) Williams Lake, Source to outlet in Marlborough and those tributaries thereto (PWS) Wachusett Aqueduct (MWRA Open Canal), Entire length and those tributaries thereto (PWS)	Westborough Reservoir (Sandra Pond), Source to outlet in Westborough and those tributaries thereto (PWS) Sudbury Reservoir, In Westborough, Marlborough, Southborough, Farmington, and those tributaries thereto (PWS) Reservoir No. 3, Reservoir to outlet in Framingham and those tributaries thereto (PWS)	{None}

"Class B – These waters are designated as habitat for fish, other aquatic life and wildlife, and for primary and secondary contact recreation. Where designated they shall be suitable as a source of water supply with appropriate treatment. They shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value."

Class B Waters		
Assabet River Watershed	Sudbury River Watershed	Concord River Watershed
Assabet River, Source to Westborough STP (Warm Water Fishery- WWF) Assabet River, Westborough STP to outlet of Boones Pond (WWF) Assabet River, Outlet of Boones Pond to confluence with Sudbury River (WWF)	Sudbury River, Source to Fruit Street Bridge in Hopkinton (WWF, ORW) Sudbury River, Fruit Street Bridge to Outlet of Saxonville Pond (WWF) Sudbury River, Outlet of Saxonville Pond to Wash Brook confluence (Aquatic Life*) Sudbury River, Wash Brook confluence to Assabet River confluence (Aquatic Life*) Denny Brook (ORW) Jackstraw Brook (ORW) Picadilly Brook (ORW) Rutters Brook (ORW) Whitehall Brook (ORW) Hop Brook, Source to Sudbury River confluence (WWF)	Concord River, Confluence of Assabet and Sudbury to Billerica Water Supply Intake (WWF, Treated Water Supply) Concord River, Billerica Water Supply Intake to Rogers Street (WWF) Concord River, Rogers Street to confluence {with Merrimack River}

*The Aquatic Life designation was made only where background conditions prevent the attainment of a "higher use" designation. In these waters, Class C dissolved oxygen and temperature criteria apply.

Outstanding Resource Waters (ORW) designation applies to those waters with exceptional socio-economic, recreational, ecological and/or aesthetic values. ORWs have more stringent requirements than other waters because the existing use is so exceptional or the perceived risk of harm is such that no lowering of water quality is permissible. ORWs include certified vernal pools; all designated Class A Public Water Supplies; and may include surface waters found in National Parks, State Forests and Parks, Areas of Critical Environmental Concern (ACECs) and those protected by special legislation (MA DEM 1993). Wetlands that border ORWs are designated as ORWs to the boundary of the defined area.

Westborough Cedar Swamp was the first Area of Critical Environmental Concern designated in Massachusetts (3 July 1975). The approximately 1650 acres are primarily vegetated wetlands, providing critical floodwater storage capacity for the Sudbury River basin. The area is the headwaters of the Sudbury River and overlays the medium- and high-yield aquifers that supply two public wells for Westborough, as well as public drinking water reservoirs downstream in Framingham, which are maintained by the MA DCR Division of Water Supply Protection {formerly Metropolitan District Commission}. Cedar Swamp provides a large and important wildlife habitat in an increasingly urbanized area. This uncommon Atlantic White Cedar swamp, for which the area is named, provides habitat for

several state-listed rare species. Located between the urban centers of Framingham and Worcester, the Cedar Swamp is also an important public recreational resource. Sudbury Valley Trustees and the Metropolitan District Commission [now MA DCR] own lands that are used for hiking, canoeing, and nature study. Farther downstream, past the Metropolitan District Commission reservoirs, the Sudbury River forms the core of the Great Meadows National Wildlife Refuge. Since the designation was made in 1975, extensive archaeological studies have been conducted in the area. Much of the ACEC is now listed as an historic district on the State Register of Historic Places (MA DCR 2003). Cedar Swamp Pond in the Westborough Cedar Swamp ACEC is designated as an ORW (Rojko *et al* 1995).

Unlisted waters in the SuAsCo Watershed not otherwise designated in the SWQS are designated *Class B, High Quality Waters* for inland waters. According to the SWQS, where fisheries designations are necessary, they shall be made on a case-by-case basis.

"Vernal pools are small, shallow ponds characterized by lack of fish and by periods of dryness. Vernal pool habitat is extremely important to a variety of wildlife species including some amphibians that breed exclusively in vernal pools, and other organisms such as fairy shrimp which spend their entire life cycles confined to vernal pool habitat. Many additional wildlife species utilize vernal pools for breeding, feeding and other important functions. Certified vernal pools are protected if they fall under the jurisdiction of the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00). Certified vernal pools are also afforded protection under the state Water Quality Certification regulations (401 Program), the state Title 5 regulations, and the Forest Cutting Practices Act regulations. However, the certification of a pool only establishes that it functions biologically as a vernal pool. Certification does not determine that the pool is within a resource area protected by the Wetlands Protection Act (NHESP 1999)." Currently 269 vernal pools (Harding 2003) have received full certification. These are located in the towns of Westford, Chelmsford, Billerica, Bolton, Natick, Southborough, Westborough, Littleton, Carlisle, Harvard, Acton, Shrewsbury, Ashland, Bedford, Boxborough, Concord, Framingham, Hopkinton, Stow, Lincoln, Maynard, Sudbury, Clinton, Northborough, Wayland, Hudson, Weston, Boylston, and Marlborough. Species of special concern observed in these pools include the Mystic Valley Amphipod (*Crangonyx aberrans*). Other obligate vernal pool species observed include the spotted salamander (*Ambystoma maculatum*), marble salamanders, unidentified mole salamanders, fairy shrimp (Order Anostraca) and the wood frog (*Rana sylvatica*). Numerous facultative species of frogs, newts (a form or lifestage of a salamander), turtles, and a variety of benthic macroinvertebrates were also documented in vernal pools in the SuAsCo Watershed (NHESP 2002). Additional information is available from the Natural Heritage and Endangered Species Program Website: http://www.mass.gov/dfwele/dfw/nhesp/nhesp.htm

SUMMARY OF HISTORICAL CONDITIONS AND PERCEIVED PROBLEMS

Historic investigations of water quality in the SuAsCo Watershed by the Massachusetts Division of Water Pollution Control (now the Department of Environmental Protection) have been extensive (see the MA DEP document *Publications of the Division of Watershed Management Watershed Planning Program 1963-2004* for a complete list). All of these reports reach similar conclusions about water quality problems in the SuAsCo Watershed and the major associated causes- flow alteration and pollutant discharges. The Assabet, Sudbury, and Concord rivers have all been impounded by dams creating systems with rapidly moving headwaters and slow moving impounded sections. The Assabet River has been described as "strangled by lack of flow, held back by small impoundments, and burdened by pollution" (Cooperman and Jobin 1971). The Sudbury-Concord system has been described as a "snake-like lake" (Hogan 1975). There are eight dams along the Assabet River mainstem, six on the Sudbury River mainstem, and two on the Concord River mainstem. Historic pollution problems in the SuAsCo Watershed include low dissolved oxygen, high phosphorus and nitrogen/ammonia concentrations, sedimentation, and elevated fecal coliform bacteria counts (Cooperman and Jobin 1971 and Hogan 1975). Wastewater discharges from {then} ten municipal treatment plants were the predominant point sources of pollution in the watershed. All plants have now been upgraded to tertiary treatment (nitrogen and phosphorus removal). Dissolved oxygen concentrations and fecal coliform bacteria counts had "improved considerably" in a study of the Assabet River following the upgrades (Hanley 1988). However, eutrophication and low flows continue to be problematic with excessive growths of algae and aquatic macrophytes occurring throughout the watershed. Effluent from the treatment plants accounts for the majority of flow in the {Assabet} system.

STREAMFLOWS AND DROUGHTS

The Massachusetts Water Resources Commission (WRC) defines a flow stressed basin as "a basin or sub-basin in which the quantity of streamflow has been significantly reduced, or the quality of the streamflow is degraded, or the key habitat factors are impaired". The WRC has preliminarily classified the SuAsCo Watershed as a medium stressed basin. The Nashoba Brook subwatershed has preliminarily been classified as a high stressed basin. "The stressed basin classification is intended to flag areas which may require a more comprehensive and detailed review of environmental impacts or require additional mitigation." Additional information on stressed basins is available from the WRC http://www.mass.gov/dcr/waterSupply/intbasin/stressed_basins.htm.

Between 1998 and 2002 there were two major drought periods: the summer of 1999 and the fall/winter/spring of 2001/2002. In June of 1999 the United States Geological Survey (USGS) issued a drought statement; new minimum monthly discharges were recorded at 10 real-time streamflow gages with 40 or more years of records. The Assabet River at Maynard previous minimum monthly discharge of 39.0 cfs was recorded in 1949. The minimum monthly flow for June 1999 was 28.8 cfs. The drought continued through August (USGS 5 June 2001). In 2000 runoff was normal with no floods or droughts recorded (Socolow *et al*. 2001). Runoff was also generally normal in 2001 with the exception of a flood event in March (Socolow *et al*. 2002). Beginning on 28 December 2001 the Massachusetts Drought Management Task Force (DMTF) issued a drought advisory for the Northeast Region of Massachusetts. From January 2002 to May 2002 the region was in a DMTF drought watch (one step higher or worse than a drought advisory). From June through 20 December 2002 the state remained in a drought advisory. The state's rainfall declined steadily after the middle of August 2001 with cumulative precipitation ~50% below normal for the months of September, October and November. December was also below normal for precipitation. In addition, streamflow was near record lows in many areas of the state. Ground water levels declined, although they are slower to respond than streamflow to the rainfall deficit (Marler 2003).

SUPERFUND SITES

Adding to the problems of pollution and degraded water quality in the SuAsCo Watershed are seven Superfund Sites. In 1980 EPA established the Superfund Program to identify, investigate, and remediate hazardous waste sites throughout the United States. The following descriptions of National Priorities List (NPL) sites in the SuAsCo Watershed were obtained from EPA fact sheets. Additional information on the Superfund program is available from EPA's Superfund website http://www.epa.gov/superfund/index.htm**.**

Assabet River Watershed

The **Fort Devens-Sudbury Training Annex** is a former U.S. Army installation that covers approximately four square miles (2,750 acres) and includes portions of the towns of Maynard, Stow, Hudson, and Sudbury (Segment MA82B-05, MA82B-08, and MA82092). Hudson Road divides the site into two sections. Established in 1942, the Annex has served as an ammunition depot, an ordnance test station, a troop training and research area, and a laboratory disposal area. The Caphart Family Housing Area, a military family housing are, is located in the southern smaller section of the Annex. In the northern portion, operations include a United States Air Force (USAF) radar installation, an air drop zone, a Federal Emergency Management Agency (FEMA) regional operations center, storage in several out of a total of 50 bunkers, and a guardhouse at the main gate. Approximately 35,700 people obtain drinking water from public and private wells located within three miles of the Annex, but no private or public drinking water sources have been reported as contaminated. Since 1980 the Army has conducted investigations at the Annex to address potentially contaminated areas. Some areas identified include a landfill, a former fire training and flame retardant clothing test area, underground storage tanks, a rail yard maintenance area, a pesticide storage area, an ammunition demolition area, and various reported disposal areas. All areas have been cleaned up. This site was deleted from the NPL on January 29, 2002 (EPA 2004f).

The 23-acre **Hocomonco Pond** (Segment MA82060) site included a recreational pond that was closed by the State in 1980. From 1928 to 1946 the site was used as a wood-treating operation. The business consisted of saturating wood products with creosote for preservation. During the operations wastewater was discharged into a pit lagoon. The lagoon was excavated on the property to store spillage and waste from the wood-treating operation. As this lagoon became filled with waste creosotes, sludges, and water, its contents were pumped into a low depression, also known as Kettle Pond. The wood-treatment facility operated until the mid-1940s when it was converted into an asphalt mining plant. Discarded aggregate

and asphalt are common throughout the site. The last use of the site was as a cement plant where dry cement was distributed in bulk. An open-jointed storm drainage system was installed in 1976 per order of the Westborough Conservation Commission to collect runoff from Smith Valve Parkway and contain a small watercourse that crossed the site. Unknowingly the storm drain was laid adjacent to the east side of the former lagoon. Rainwater passing through the drainage system transported contaminants from the lagoon through the storm drain and into the Hocomonco Pond. The surface water and groundwater have shown creosote contamination. Approximately 2,500 people depend on groundwater from this area as a drinking water supply and 14,000 people use the surface water for other purposes. All live within three miles of the site. The nearest residences lie 2,000 feet from the site. The groundwater, soil, and sediments from the pond and its shore are contaminated with creosotes, carcinogenic compounds, and heavy metals including arsenic and chromium. The Kettle Pond area, Hocomonco Pond, and a discharge stream were dredged and contaminated sediments were disposed of in an on-site lined landfill. An Explanation of Significant Differences for a Technical Impracticability Waiver was approved September 1999 for the site. The waiver of groundwater clean up goals (due to Dense Non-Aqueous Phase Liquids /creosote) resulted in the site receiving a construction complete status. (The presence of Dense Non-Aqueous Phase Liquids /creosote below the groundwater creates a limitation that makes groundwater remediation using available remedial technology technically impracticable.) EPA and the MA DEP will be working with the property owner (Town of Westborough) within the next 1-2 years to develop a redevelopment/re-use plan for the property. Long-term groundwater and sediment monitoring and Dense Non-Aqueous Phase Liquid recovery will continue for several years to ensure the protectiveness of the remedy and for future Five Year Reviews (EPA 2004b).

The **W. R. Grace Acton Plant** site (Segments MA82B-07 and MA82B-13) is located in the towns of Acton and Concord, Massachusetts, off Independence Road and covers approximately 260 acres. The site is bounded in the North in part by Fort Pond Brook and to the East and South by the Assabet River. Industrial parks border the site to the south and residential housing borders the site on the northeast. The site was the former location of the American Cyanamid Company and the Dewey & Almy Chemical Company. These companies produced sealant products for rubber containers, latex products, plasticizers, resins, and other products. Operations at the W. R. Grace facility included the production of materials used to make concrete, container sealing compounds, latex products, and paper and plastic battery separators. Effluent wastes from these operations flowed into several unlined lagoons (the Primary Lagoon, Secondary Lagoon, North Lagoon, and Emergency Lagoon), and solid and hazardous wastes were buried in or placed onto an on-site industrial landfill and several other disposal areas. These other waste sites include the Battery Separator Lagoons, the Battery Separator Chip Pile, the Boiler Lagoon, and the Tank Car Area. In addition, the by-products of some chemical processes were disposed of in the Blowdown Pit. Since 1973 residents in South Acton have filed complaints about periodic odors and irritants in the air around the W. R. Grace plant. Investigations in 1978 indicated that two municipal wells, Assabet #1 and #2, were contaminated. As a result of these findings the Town took precautionary action and closed the two wells. The Acton Water District operates and maintains air strippers to remove any volatile organic compounds that may be present in groundwater pumped from Assabet 1, Assabet 2, Scribner, Lawsbrook and Christofferson town wells. The Acton Water District routinely samples and treats the water they provide to users to assure that safe quality standards are met. Discharge to all lagoons and the Battery Separator Area ceased in 1980. Groundwater is contaminated with Volatile Organic Compounds (VOCs) and heavy metals including iron, manganese, lead, arsenic, chromium, and nickel. The soil and sludge in the disposal areas are contaminated primarily with arsenic and VOCs, including vinyl chloride, ethyl benzene, benzene, 1,1-dichlorethylene, and bis (2-ethylhexyl)phthalate. The potentially responsible parties have been performing a Remedial Investigation/Feasibility Study of on and off Site groundwater, surface water and sediments to determine the nature, extent and levels of contamination. A Final Remedial Investigation/Feasibility Study will be prepared and submitted under EPA and MA DEP oversight. The study includes the preparation of ecological & human health risk assessments to determine if there are any unacceptable risks to the environment or people (EPA 2004d).

The **Nuclear Metals, Inc**. (NMI) site, also known as the Starmet Corporation, is located on a 46.4-acre parcel located at 2229 Main Street in Concord, Massachusetts (Segment MA82B-07). The facility includes five interconnected buildings, a paved parking area, a sphagnum bog, a cooling water recharge pond, and a holding basin. The topography of the property slopes down to the north. The property is bordered to the north by Main Street, commercial and residential properties, and the Assabet River; to the

east by woodland and residential properties; to the west by woodland and commercial/industrial properties; and to the south by woodland and residential properties. In 1958 NMI began operating a manufacturing facility on previously undeveloped land. Nuclear Metals, Inc. produced depleted uranium products, primarily as penetrators for armor piercing ammunition. They also manufactured metal powders for medical applications, photocopiers, and specialty metal products, such as beryllium tubing used in the aerospace industry. From 1958 to 1985 NMI discharged wastes to an unlined holding basin. Cast depleted uranium ingots or billets were jacketed in copper, and then heated and extruded into long rod stock. The extruded depleted uranium rod had a resulting thin layer of copper coating, which was removed in a nitric acid pickling operation. During the pickling process "small quantities" of copper and uranium were dissolved in the nitric acid. The spent nitric acid solution was collected, neutralized with a lime slurry, and then discharged to the unlined, in-ground holding basin. Small quantities of other specialty metal products including steel jacketed beryllium, stainless steel, and titanium alloys were also pickled at various times with several different acids (nitric, hydrofluoric, and sulfuric) and discharged to the holding basin. The discharge to the holding basin ceased in 1985 when NMI began using an acid closed-loop recycling process. In addition to natural and depleted uranium (as elemental, oxide, and fluoride), NMI handled thorium and thorium oxide under license to the Nuclear Regulatory Commission (NRC); sulfuric and nitric acids for process activities; 1,1,1-trichloroethane as a solvent; trichlorofluoroethane as a degreaser; zirconium; magnesium; beryllium; acetone; hydrogen peroxide; flammable gases (propane and acetylene); and oxygen. Two 10,000-gallon underground storage tanks were used for the storage of No. 4 fuel oil. Several of the following oils were used and recycled on site: DTE light, DTE heavy, Medium DTE 25, vacuum oil (HE1SO), and No. 7d (EPA 2004g).

On 1 October 1997 NMI was renamed Starmet Corporation. In March 1997 the company's license to handle source material (including depleted uranium, thorium, and thorium oxide) under the NRC was transferred to the Massachusetts Department of Public Health, Radiation Control Program. In accordance with Massachusetts state license SM-0179 Starmet is allowed to use source material (including depleted uranium, thorium, and thorium oxide) to manufacture, research, develop, and distribute metallic products in a variety of forms including castings, extrusions, and metal powders (EPA 2004g).

In June 2002 EPA assumed the semi-annual groundwater monitoring program previously performed by Starmet. During the June 2002 sampling event EPA also sampled sediment and surface water on-site and in the Assabet River. Starmet is currently in violation of its MDPH radioactive materials license because it has failed to remove the stored drums of depleted uranium materials from the site Starmet filed for Chapter 11 bankruptcy protection on April 3, 2002. EPA is currently negotiating for the performance of a Remedial Investigation/Feasibility Study (RI/FS), and an Engineering Evaluation and Cost Analysis (EPA 2004g).

Sudbury River Watershed

The **Natick Laboratory Army Research, Development, and Engineering Center (Natick Laboratory)** (Segment MA82127) is a 78-acre facility located in Natick, Massachusetts. The Natick Laboratory occupies a peninsula on the eastern shore of Lake Cochituate State Park and recreational area and is bordered on the north and west by a residential area. The Army purchased the site in 1949 from the Metropolitan District Commission. At the time of purchase the property was primarily used as a forested recreational area, but it also included a gravel pit in a section of the site now known as the Building T-25 Area. The Army built the Natick Laboratory in 1954 and has since used the area for industrial, laboratory, and storage activities for research and development in the areas of food science, aeromechanical, clothing, material, and equipment engineering. During its operation the Army used a variety of substances including the VOCs: tetrachloroethene, trichloroethene, carbon disulfide, benzene, chloroform, and acetone; "standard laboratory chemicals;" mineral spirits/turpentine; paints; inks; lubricants; gasoline; tetraethyl lead, a gasoline additive; pesticides; and metal dusts. In addition, radioactive materials and chemical agents were used for food irradiation, tracer studies and clothing absorption tests, respectively. In 1989 personnel at the facility noticed a sheen on the site runoff water generated during rainstorms. Construction workers also noticed a benzene-like odor in soil near a boring that was drilled for the construction of a gymnasium on site. The Army conducted soil gas surveys in the Building T-25 and Gymnasium Areas and detected several types of VOCs. In addition, soil, groundwater, and surface water samples revealed elevated levels of VOCs and a variety of heavy metals, such as barium, arsenic, copper, chromium, lead, and zinc. Other potential sources of contamination have been identified near the

laboratory. Petroleum, organic compounds, and chlorinated solvents have been discovered in soil and groundwater on a property previously used as a laundromat, which is located approximately 3,600 feet from the Army's Facility. Several other potential sources of groundwater contamination, including automotive garages and other laundromats, have been identified. The Springvale municipal well field is located 2500 feet northwest of the facility and may be threatened by the contaminated groundwater. About 37,000 people obtain their drinking water from wells within 4 miles of the site. The Army is currently upgrading their treatment system to more fully contain contaminated ground water on the facility. The conclusions of a Tier II Ecological Risk Assessment prompted a Tier III Ecological Risk Assessment Investigation, which was performed in 2002. A report is due out in early 2003 describing the possible risks to the sediment-based aquatic food chain. The Army has identified several other areas of possible contamination at the site as part of their Master Environmental Plan and Installation Action Plan. Investigations are scheduled to be performed at some of these areas to determine the full extent of contamination (EPA 2004h).

The **Nyanza** Chemical Waste Dump site is a 35-acre parcel of land located adjacent to an active industrial complex (Segment MA82A-02). From 1917 to 1978 the site was used to produce textile dyes, intermediates, and other products. Nyanza Inc. operated on this site from 1965 until 1978, when it ceased operations. These companies generated large volumes of industrial wastewater containing high levels of acids and numerous organic and inorganic chemicals, including mercury. Some of the wastes were partially treated and discharged into the Sudbury River through a small stream, referred to as Chemical Brook. Over 45,000 tons of chemical sludges generated by Nyanza's wastewater treatment processes, along with spent solvents and other chemical wastes, were buried on site. The area that contains the largest amount of buried waste and exposed sludge is referred to as the Hill section. The groundwater, soil, sediments, and surface water are contaminated with heavy metals and chlorinated organics. The groundwater and soil are also contaminated with spent solvents and chemical wastes. Wetlands nearby and fish in the Sudbury River are contaminated with mercury. Sediments in the Sudbury River also have high mercury levels. According to the September 1996 Fact Sheet excavation, consolidation and capping of contaminated materials on-site; construction of a ground water/surface water diversion trench and restoration of disturbed wetland areas were completed in September 1992 (EPA 1996). All cleanup activities were completed for groundwater contamination on site in 1992. Multiple studies of the river and sediments were conducted between 1993 and 1995. Clean up of off-site groundwater contamination has been delayed due the discovery of additional contaminated areas; additional data collection and risk assessment activities continued through 2002. Cleanup (dredging and disposal of mercury contaminated sediments into the capped area) of the on-site wetlands and drainage ways was completed by August 2001 (EPA 2004e). Data collection and risk assessment activities continued in 2002 to address contamination of the Sudbury River sediments and fish (Sprague 2004).

Concord River Watershed

The **Silresim** Chemical Corporation (Segment MA82A-10) site is located at 86 Tanner Street in Lowell and covers approximately 5 acres in an industrial area. Starting in 1971 Silresim began reclaiming a variety of chemical wastes, waste oil, solvents, and sludges containing heavy metals. In 1977 Silresim declared bankruptcy and abandoned the site, leaving behind 30,000 decaying drums and several large storage tanks. The state began to clean up the site in 1978. The site is located 1 mile south of the central business district of Lowell and several hundred feet from the nearest residential area. Approximately 10,000 people live within 1 mile and an estimated 24,000 people live within 3 miles of the site. Groundwater flows generally to the northwest towards Meadow Brook, which drains into the Concord and then the Merrimack River. The groundwater is contaminated with VOCs, semi-volatile organic compounds, pesticides, polychlorinated biphenyls, and heavy metals. The soil is polluted with VOCs, semi-volatile organic compounds, pesticides, and PCBs. Low levels of dioxin also are present in the soil. EPA is currently conducting a pilot study to evaluate the effectiveness of electrical resistive heating for removing VOC contamination from the soil and groundwater (EPA 2004c).

21E TIER CLASSIFIED OIL AND HAZARDOUS WASTE SITES

Massachusetts General Law, Chapter 21E, the state Superfund law, was originally enacted in 1983 (and amended in 1992, 1995, and 1998), creating the Waste Site Cleanup Program. Contaminated properties regulated under this law are often called “21E sites”. The regulations adopted to implement c. 21E are called the Massachusetts Contingency Plan (MCP). The 1992 amendments to c. 21E privatized the

program, enabling potentially responsible parties, or PRPs, to hire licensed site professionals (LSPs) to oversee most cleanups (with limited MA DEP oversight) and to ensure compliance with the MCP. Sites that are not cleaned up within one year of being reported are ranked by complexity, the number of sources, and how serious a potential threat the contamination poses- Tier I (serious, with Tier 1A the most serious) or Tier II (less serious). Additional information on the MCP is available from the Bureau of Waste Site Cleanup on the Internet at http://www.mass.gov/dep/bwsc/files/oview.htm . As of 8 March 2004, there were 208 classified sites in the SuAsCo Watershed- 10 sites were Tier 1A, 10 were Tier 1B, 32 were Tier 1C, 59 were Tier 1D, and 97 were Tier II sites. See Appendix J for a complete list and map.

LANDFILLS

The MA DEP Bureau of Waste Prevention (BWP) Division of Planning and Evaluation tracks the operational status of the solid waste landfills, combustion facilities, and transfer stations in Massachusetts. BWP maintains this information in a database that is available on the MA DEP website http://www.mass.gov/dep/bwp/dswm/dswmpubs.htm. In the SuAsCo Watershed 33 solid waste facilities have been identified (Appendix K). Eight are still active. Five of the eight are transfer stations, one is a compost site, and two are lined, partially capped municipal landfills. Ten of the sites have been closed; all of these have been capped, but, none have liners. The remaining 15 sites are listed as inactive (MA DEP 2004b).

WATER SUPPLY

The waters of the SuAsCo Watershed have historically been used as water supplies for metropolitan Boston. A history of water supply for Boston and Eastern Massachusetts is available from the Massachusetts Water Resource Authority's website: http://www.mwra.state.ma.us/04water/html/wat.htm. A detailed report, *Sudbury Reservoir Watershed System Public Access Plan Update 2002*, was published by the former Metropolitan District Commission, Division of Watershed Management in 2002 and provides much more detail of the Sudbury Reservoir system and outlines plans for public access and watershed protection. This report is available online at http://www.mass.gov/mdc/sudaccplan.htm. The following was excerpted from the Metropolitan District Commission report.

> …Limited yield, urbanization of the watersheds, and unsatisfactory water quality led to an investigation for additional water supply of satisfactory quantity and quality. The creation of the Wachusett and Quabbin Reservoirs meant that increasingly substandard source waters from many of the reservoirs in the Sudbury System could be discontinued.
>
> In 1947 Whitehall, Hopkinton, Ashland, and Cochituate reservoirs were transferred to the predecessor agency of the Department of Conservation and Recreation for use as state parks. Evidence of serious toxic pollution to the Sudbury River surfaced in the late 1960s. In 1970, the Nyanza textile plant was cited as a source of mercury contamination and the site was designated as an EPA Superfund site in 1982. Wastes had contaminated the sediments in Reservoirs Nos. 1 and 2. The entire Sudbury System was officially removed from active use and classified as an emergency water supply in 1976. Today only the northern reservoirs (Sudbury and Reservoir No. 3) are classified as a reserve drinking water supply. Reservoirs Nos. 1 and 2 are unlikely to be used as water supply in the foreseeable future. Some discussions have occurred regarding disposition of these two reservoirs and Metropolitan District Commission lands surrounding them for recreational use. No decisions, however, have been reached on this issue. The Sudbury Reservoir and Reservoir No. 3 remain the only reserve drinking water supply source for over two million residents of Eastern Massachusetts. Although not currently in use, the reservoirs are on standby status and could be activated in the event of an emergency to provide drinking water.
>
> In 1997, the MWRA and Metropolitan District Commission completed the Watershed Protection Plan for Sudbury Reservoir and Framingham Reservoir #3. The Plan was initiated by the agencies to determine appropriate water quality goals for this reserve drinking water supply and to develop a watershed protection plan to meet those goals while balancing available Metropolitan District Commission resources. Three major goals were recommended in this plan, developed for Metropolitan District Commission's Division of Watershed Management by Comprehensive Environmental, Inc.

These goals are:

- ❖ Institute a water quality monitoring program.
- ❖ Support watershed and water quality education and awareness programs.
- ❖ Provide technical assistance to watershed communities on water quality protection measures.

MERCURY

Within the last decade the northeastern United States has been identified as receiving elevated rates of mercury deposition from the atmosphere and high levels of mercury contamination in non-commercial freshwater fish (Tatsutani 1998). Mercury is a trace metal that exists in the earth's crust. It is a toxicant that, once mobilized in the environment, can be transformed into methylmercury, a particularly toxic form that can bioaccumulate. Most of the mercury contamination in the northeastern United States has been linked to air emissions (incinerators, fossil fuel combustion facilities) from both local and mid-western sources. Currently there are 11 site-specific MDPH fish consumption advisories in the SuAsCo Watershed. Nine of these are due to elevated levels of mercury (MDPH 2004).

SOURCES OF INFORMATION

Multiple local, state, and federal agencies provided information used in the water quality assessment of the SuAsCo Watershed. Within the Department of Environmental Protection (MA DEP) information was obtained from three programmatic bureaus: Bureau of Resource Protection (BRP, see below), Bureau of Waste Prevention (industrial wastewater discharge information) and the Bureau of Waste Site Cleanup (hazardous waste site cleanup information). Specifically, water quality (Appendix A), habitat assessment and biological data (Appendix D), toxics in fish flesh data (Appendix B), and lake synoptic survey data (Appendix C) were provided by MA DEP BRP Division of Watershed Management (DWM) Watershed Planning Program. The MA DEP Central Regional Office SuAsCo Watershed Team and the DWM Watershed Permitting Program provided water withdrawal and wastewater discharge permit information (Water Management Act and National Pollutant Discharge Elimination System) (Appendix E). [Note: The BRP DWM Drinking Water Program evaluates the status of the *Drinking Water Use* so this information is, therefore, not provided in this assessment report.] Projects funded through various MA DEP grant and loan programs also provide valuable information that may be used in the water quality assessment report. A summary of these projects for the SuAsCo Watershed is provided in Appendix F.

Federal

EPA

The United States Environmental Protection Agency is responsible for overseeing the Superfund Program. In the SuAsCo Watershed there are seven Superfund Sites on the National Priorities List.

Nyzanza

In 1993 EPA formed a multi-agency committee, comprised of representatives from the U.S. Fish and Wildlife Service, the National Biological Service, the U.S. Geological Survey, the U.S. Army Corps of Engineers, and the National Oceanic and Atmospheric Administration, to design a comprehensive investigation that would lead to a remedy decision for the Sudbury River. The investigations focused on collecting data to evaluate the following:

- the movement of mercury between the sediment, surface water, and living creatures in the River;
- the movement of mercury within the food chain;
- the physical transport mechanisms which move mercury along the River; and
- the effect of wetlands on the mercury in the River.

Four 21-day bioaccumulations tests were conducted with burrowing mayfly nymphs (*Hexagenia* sp.) experimentally exposed to surficial sediments collected from the Sudbury River Watershed between July 1994 and September 1995. The objectives of the study were to determine if the mayfly nymphs accumulated methyl mercury, to determine if the accumulation of methyl mercury in mayflies was related to total mercury concentration in sediment, and to assess which contaminated areas on the Sudbury River have the greatest potential for methyl mercury transfer from sediments into the benthic food chain. A total of nine sites in the watershed were tested over the four rounds of testing. Growth and survival of mayfly nymphs (a total of 15 nymphs were

allocated to each test beaker while a composite of ten nymphs were analyzed for total and methyl mercury concentrations) were recorded. Sediment samples were also analyzed for total and methyl mercury. Results of this study can be found in Naimo *et al.* (2000).

Freshwater mussels (*Elliptio complanata*) were transplanted into eight locations in the Sudbury River Watershed to evaluate the bioavailability of total and methyl mercury and the potential impacts to resident species. The caged mussels (three replicate cages with each cage containing 35 organisms for a total of 105 organisms/site) were deployed in June 1994 at a total of eight stations- a reference station in Whitehall Reservoir, a reference station in the Sudbury River upstream from the Nyanza site, and six stations in the river/impoundments downstream from Nyanza. The caged mussels were retrieved in September 1994. Survival, growth and tissue concentrations of total and methyl mercury were measured. Sediment samples (three replicates) at each site were also collected and analyzed for selected metals, total solids content, total organic carbon and grain size. Results of this study can be found in Beckvar *et al*. (2000).

Sediment, fish prey organisms (small fish, crayfish, and dragonfly larvae), and predator fish (primarily largemouth bass) were collected from four sites in the Sudbury River Watershed to characterize total mercury content of predator fish species in reference and contaminated sites in both impounded and free-flowing reaches in different seasons and to characterize total and methyl mercury concentrations in invertebrates and forage fish at these sites to assist in the determination of food chain pathways of mercury. Fish and sediment samples were collected between September 1993 and October 1994. Prey organisms were collected from each site one year after the predator fish and sediment samples had been collected. A total of four locations were sampled- Whitehall Reservoir, the Sudbury River near Cedar Street bridge in Hopkinton, Framingham Reservoir #2 and the Sudbury River near Sherman Bridge in Wayland. Whole fish and fillets were digested and analyzed for select metals (As, Cd, Cr, Pb, Sb, and Hg). Three surficial sediments samples were collected from each location and were analyzed for acid volatile sulfide (AVS), simultaneously-extracted metals (SEM), selected metals (Hg, As, Cd, Cr, Pb and Sb), total organic carbon. Prey organisms were analyzed for total and methyl mercury. Results of this study can be found in Haines *et al*. (2003).

Sediment cores were collected from five areas along the Sudbury River downstream from the Nyanza site (Framingham Reservoir #2, Framingham Reservoir #1, two wetland sites – one main channel and one off-channel within the Great Meadows National Wildlife Refuge, and Fairhaven Bay) as well as the reference station, Whitehall Reservoir, in May 1994. Cores were sectioned and each stratum was analyzed for age determination and sediment accumulation rates as well as analysis of volatile solids content and total mercury. Results of this study can be found in Frazier *et al.* (2000).

Sediment cores were collected from two reference stations, Whitehall Reservoir and a riparian wetland site in Hop Brook in Wayland, as well as downstream from the Nyanza site in Framingham Reservoir #2 and transects along two Sudbury River sites. Sampling was conducted between August 1994 and September 1995. The total mercury and methyl mercury concentrations in the sediment cores were analyzed to determine the potential for transport from the reservoir and wetland sediments to the water column. Pore water concentrations of both total and methyl mercury were also analyzed. Results of this study can be found in Colman *et al.* (1999).

Investigations are still being conducted to follow up on the studies. EPA and their constituents are in the process of collecting field data (fish contaminants- see USFWS below- and mammals, birds, and surface water quality – see USGS below) for the Nyanza site to examine the load of mercury in the river as it passes the site now that the ongoing sources at the site have been addressed. Avatar, an EPA contractor also working on the Nyanza site, planned and conducted a sediment/crayfish/small fish collection field event in October 2003. The *Five Year Review for the Nyanza Chemical Waste Dump Superfund Site* report released by EPA and Shaw Environmental in 2004 determined that remedial actions taken at the Operable Unit #1 and #3 are protective of human health and the environment. A “protectiveness determination” for Opearble Unit #2 and

#4 (Sudbury River) could not be determined due to the ongoing studies referred to above. The report does state, "While contaminants in groundwater discharging into the Sudbury River may have caused toxicity to one of the three test species, the discharge has not resulted in bulk sediment toxicity or bioaccumulation of VOCs and does not appear to be affecting the benthic macroinvertebrate community structure relative to a reference location. Results indicated that the aquatic life was impacted in one of the three areas studied, but that the impact could not definitively be tied to the groundwater plume or other existing natural habitat conditions such as storm water runoff, low dissolved oxygen levels, stagnant water, and high amounts of detritus (leaf litter)" (EPA 2004i).

Nuclear Metals

A large compendium of work plans was developed for the Nuclear Metals site by the prime contractor and sent to EPA/MA DEP for review in mid-December 2003. Approval of these work plans occurred in 2004 with fieldwork begining in 2005. The emphasis of the initial investigation will be to characterize the on-site source area. The Assabet River, as a receptor of contaminated groundwater, may be sampled as part of the ecological and human health risk assessments. In 2002 and 2003 sampling was not conducted to characterize impacts to the river related to Nuclear Metals (Keefe 2003).

WR Grace

Samples were collected from both Fort Pond Brook and the Assabet River as part of the WR Grace-Acton Superfund Remediation. The Human Health and Eco-Risk Assessments were discussed in December 2003 between MA DEP, EPA, and W.R. Grace. A Final Document was expected within 30 - 60 days after comments were received. A Draft Remedial Investigation/Feasibility Study is currently scheduled to be submitted in 2005 (Reagor 2005).

USFWS

The US Fish and Wildlife Service (USFWS) examined contaminants in the Sudbury River Watershed in 1986, 1987, and 1989. Fish sampling was conducted at eight stations in 1986. In 1987 sediment was collected from 17 stations and fish were collected from 13 stations (small mammals and red-winged blackbirds were also examined). In 1989 sediment was collected from 14 stations. The contaminants examined included PCBs, PAHs, organochlorine pesticides, and metals. Fish collected below the Saxonville Dam in 1986 and 1987 exhibited elevated levels of PCBs (> 2 ppm). Sediments, collected from an un-named stream (named Raytheon Brook in this report) in 1987 and 1989 revealed elevated levels of PCBs, PAHs, mercury, arsenic, lead, cadmium, and chromium. This study points towards the wetlands abutting this stream as a source of contamination. Sediments collected from station SU2 (located within Reservoir Number 1 – a reserve source of drinking water) in 1987 revealed elevated levels of mercury. Fish collected from Heard Pond in 1986 displayed elevated levels of lead, dieldrin, and PCBs (Eaton and Carr 1991). In 2003 the USFWS also collected largemouth bass, brown bullheads, and yellow perch for fish contaminant monitoring in the Sudbury and Concord rivers as a follow up to remediation activities at the Nyanza Superfund Site (Smithwood 2004). The samples had not gone to the EPA lab as of September 2003 (Sprague 2003).

USGS

The United States Geologic Survey (USGS) maintains four stream gages in the SuAsCo Watershed- 0109700-Assabet River at Maynard, 01098530- Sudbury River at Saxonville, 01099500- Concord River below River Meadow Brook at Lowell, and 01093700 Nashoba Brook near Acton.

USGS assisted EPA with monitoring for the Nyanza Superfund Site Remediation in the Sudbury River. In the fall of 2003 they collected surface water samples and examined mercury loads within the river (similar to their 1994 study).

From April 1997 to July 2000 USGS examined the trophic ecology and ground-water contributing area of Walden Pond (Colman and Friesz 2001). The study determined that Walden Pond, a glacial kettle-hole lake with no inlets or outlets, gains water from the aquifer along its eastern perimeter and loses it to the aquifer along its western perimeter. Colman and Friesz (2001) determined that Walden Pond is a

mesotrophic lake and that the entire hypolimnion becomes devoid of dissolved oxygen before fall turnover in late November.

In 1998 and 1999 USGS conducted a study of the interaction between the South Basin of Lake Cochituate and the associated aquifer. The study concluded that 1.6 MGD of lake water infiltrated the aquifer and that 1.0 MGD was discharged to the Natick Springvale wellfield (Friesz and Church 2001).

The National Water Quality Assessment Program (NAWQA) New England Coastal Basins (NECB) study team, in collaboration with the USGS Toxic Substances Hydrology Program, conducted a regional study of how total mercury (HgT) and methyl mercury (MeHg) in water and streambed sediments and HgT in fish varied in relation to the amount of urbanization in a watershed. The purposes of this study were to (1) determine whether gradients in HgT and MeHg contamination are evident along urban gradients; and (2) to evaluate whether Hg loading rates or ecosystem factors were more influential in generating regional Hg gradients in fish in New England streams. Fish tissue and streambed sediment were sampled in the SuAsCo Watershed during 2000 at three sites: the Assabet River at Northborough, Elizabeth Brook near Stow, and the Sudbury River at Ashland.

The NECB study unit also collected water column samples and discharge measurements from the Assabet River at Allen Street and Boundary Street in Northborough in 2000 and 2001; Elizabeth Brook off White Pond Road near Stow in 2000; Fort Pond Brook at River Road; and the Sudbury River at Concord Street in Ashland in 2000. Additionally, monthly discharge measurements were collected at 27 partial record stations throughout the Assabet River Watershed in 2001 and 2002 (Socolow *et al.* 2001, 2002, and 2003).

The purpose of the *Simulation of Ground-Water Flow and Evaluation of Water-Management Alternatives in the Assabet River Basin* study (DeSimone 2004) was 1) to increase understanding of the effects of current and future water withdrawals and wastewater discharges on water resources in the Assabet River Watershed and 2) to evaluate the effects of alternative water-management practices. Using a computer model four scenarios were examined. Scenario 1 examined the effects of no water withdrawals and no wastewater discharges and estimated that tributary flows in most subbasins would increase. Scenario 2 simulated withdrawals and discharges at maximum permitted levels with a resultant decrease in tributary flows in most subbasins, especially the mainstem upper and middle subbasins. Scenario 3 simulated groundwater discharge at four hypothetical sites with resultant increases in tributary flows in tributaries adjacent to the discharge sites and in downstream reaches of the river, especially in the headwaters area. Scenario 4 determined that streamflow depletion could be reduced by careful management of monthly withdrawals with and without groundwater discharge. Simulated flow increased by using water sources upstream from the lakes and especially with groundwater discharge.

Parker *et al* (2004) utilized four methods (R2Cross, Wetted Perimeter, Tennant, and Range of Variability Approach) to determine streamflow requirements for habitat protection at critical reaches in the Assabet River watershed (mainstem Assabet River near Westborough, Cold Harbor Brook, Danforth Brook, Fort Meadow Brook, and Elizabeth Brook). Fish community assessments were also conducted at or near rifle sites throughout the watershed. The fish community in the mainstem Assabet consisted of ~53% macrohabitat generalists, ~22% fluvial dependants, and ~25% fluvial specialists. In the tributaries, the fish community consisted of ~51% macrohabitat generalists, ~18% fluvial dependents, and ~31% fluvial specialists.

State

Many of the rivers in the SuAsCo Watershed receive the discharge of treated municipal and industrial wastewater, contact and non-contact cooling water, and storm water (MA DEP 2004b). Below is a summary of the National Pollutant Discharge Elimination System (NPDES) permits issued for the SuAsCo Watershed.

Publicly Owned Treatment Works (POTWs), Waste Water Treatment Plants (WWTPs), Water Pollution Control Facilities (WPCFs): There are seven facilities that discharge into the SuAsCo Watershed. These facilities treat wastewater from domestic and industrial sources within the WWTP service area. In the winter of 2004 draft permits were issued for the major WWTPs (Marlborough West, Hudson, Maynard,

and Westborough) in the Assabet River Watershed. The draft permits require effluent total phosphorus removal to 0.1 mg/L on a seasonal basis by 2009. This limit is a result of the recently completed Assabet River Nutrient TMDL (see TMDL section for more details). The permit limits specified in the 2001 permits are presented below and utilized for the purposes of this report. The total phosphorus limit in the 2001 permits is an interim limit. The final permit limit is "highest and best practical treatment" and is also a seasonal average (a numeric limit defining this in not included). These permits specified that if upon completion of a TMDL and a Comprehensive Wastewater Management Plan (CWMP) it was determined that either a higher or lower limit will result in compliance with water quality standards, then the final permit limit will be modified accordingly.

Assabet River Watershed

- The Town of Hudson (MA0101788) is permitted (14 January 2001) to discharge 2.65 MGD of treated sanitary wastewater via outfall 001 to the Assabet River. The permit expired in 2004.The facility's whole effluent toxicity limit is C-NOEC =29% effluent and LC_{50} = 100% effluent. The current permit includes secondary limits for fecal coliform bacteria = 200 cfu/100mL, total residual chlorine (TRC)= 39 µg/L, and copper = 18 µg/L. Additionally there are seasonal limits for BOD, TSS, total phosphorus, and ammonia nitrogen as follows.

	November 1- March 31	April 1- October 31
BOD	15.0 mg/L	15.0 mg/L
TSS	15.0 mg/L	15.0 mg/L
Total phosphorus	Report	0.75 mg/L
	November 1- April 30	May 1- October 31
Ammonia-nitrogen	Report	3 mg/L

  If the average monthly flow exceeds 2.65 MGD for two consecutive months during May 1 through October 31 of any year the flow limit will be changed to 3.0 MGD and the seasonal limits shall be changed to reflect the revised dilution. These limits will become effective ninety days after the second consecutive month of flows above 2.65 MGD and will be expressed as annual average limits, to be reported on a 12-month rolling basis. Alternatives to increasing this discharge will be evaluated as part of a Comprehensive Wastewater Management Plan (CWMP).

- The City of Marlborough is permitted (12 February 2001) to discharge 2.89 MGD of treated sanitary wastewater from the Marlborough Westerly Treatment Work via outfall 001 to the Assabet River. The permit expired in 2004.The facility's whole effluent toxicity limit is C-NOEC $\geq$40% effluent and $LC_{50} \geq$ 100% effluent. The current permit includes secondary limits for fecal coliform bacteria = 200 cfu/100mL, TRC= 28 µg/L, and copper = 13 µg/L. Additionally there are seasonal limits for CBOD, BOD, TSS, and total phosphorus as follows.

	April 1- October 31	November 1- March 31
CBOD	15 mg/L	--
BOD	--	30 mg/L
TSS	15 mg/L	30 mg/L
Total phosphorus	0.75 mg/L	Report

  Seasonal limits for ammonia-nitrogen are as follows:

November 1- April 30	Report
May 1- May 31	5 mg/L
June 1- October 31	2 mg/L

- The Town of Maynard (MA0101001) is permitted (12 February 2001) to discharge 1.45 MGD of treated sanitary wastewater via outfall 001 to the Assabet River The permit expired in 2004.The facility's whole effluent toxicity limit is C-NOEC $\geq$14% effluent and LC_{50} = 100% effluent. The current permit includes secondary limits for BOD= 30 mg/L, TSS= 30 mg/L, fecal coliform bacteria = 200 cfu/100mL, total residual chlorine (TRC)= 0.079 mg/L, and copper = 37 µg/L. Additionally there are seasonal limits for total phosphorus (April 1- October 31 =0.75 mg/L and November 1- March 31 = report) and ammonia-nitrogen (November 1- April 30 = report and May 1- October 31 = 12 mg/L).

- The Town of Westborough (MA0100412) is permitted (12 February 2001) to discharge 7.68 MGD of treated sanitary wastewater via outfall 001 to the Assabet River. The permit expired in 2004.The facility's whole effluent toxicity limit is C-NOEC and $LC_{50} \geq 100\%$ effluent. The current permit includes secondary limits for fecal coliform bacteria = 200 cfu/100mL, TRC= 11 µg/L, and copper = 9.3 µg/L. Additionally there are seasonal limits for CBOD, BOD, TSS, and total phosphorus as follows.

	April 1- October 31	November 1- March 31
CBOD	--	25 mg/L
BOD	10 mg/L	--
TSS	15 mg/L	30 mg/L
Total phosphorus	0.75 mg/L	Report

Seasonal limits for ammonia-nitrogen are as follows:

November 1- April 30	Report
May 1- May 31	Report
June 1- October 31	1 mg/L

Sudbury River Watershed

- The City of Marlborough is permitted (8 October 1988) to discharge 5.5 MGD of treated sanitary wastewater from the Marlborough Easterly Advance Treatment Works (MA0100498) via outfall 001 to Hop Brook. The permit contains seasonal limits for BOD, TSS, total phosphorus and ammonia as follows.

	December 1- March 31	April 1- November 30
BOD	20 mg/L	7.0 mg/L
TSS	20 mg/L	15.0 mg/L
Total phosphorus	0.75 mg/L	0.75 mg/L
Ammonia-nitrogen	4.4 mg/L	0.50 mg/L

This permit included monitoring requirements for pH, dissolved oxygen (0400-0700), total phosphorus, ammonia-nitrogen, and fecal coliform bacteria at the inlet of Hager Pond, outlet of Hager Pond, Outlet of Grist Millpond, Outlet of Stearns Millpond, Landham Road in Sudbury, Sudbury River at Pelham Island Road in Wayland, and the Sudbury River at Route 27 in Wayland.

EPA released a draft permit for public comment on 11 December 2003. The draft permit includes seasonal limits for BOD, TSS, ammonia-nitrogen, and total phosphorus (60 day rolling average). The draft permit also includes quarterly toxicity testing requirements with an $LC_{50} \geq 100\%$ effluent and a C-NOEC $\geq$99% effluent. The permit also requires that the City control and develop an Infiltration/Inflow removal program.

Concord River Watershed

- The Town of Billerica (MA0101711) is permitted (2 January 2002) to discharge 5.4 million gallons per day (MGD) of treated sanitary wastewater (annual average) via outfall 001 to the Concord River. The permit expired in 2004.The facility's whole effluent toxicity limit is C-NOEC $\geq$24% effluent and $LC_{50} \geq 100\%$ effluent. The current permit includes secondary limits: BOD = 45 mg/L, TSS = 45 mg/L, and fecal coliform bacteria = 200 cfu/100mL. Additionally, there are seasonal limits for phosphorus (May 1- October 31 = 0.75 and November 1- April 31 = report) and ammonia nitrogen (June 1 to September 30 =6 mg/L and October 1 – May 31 = report). For the first year of the permit Billerica will monitor effluent phosphorus with no limit. After the first year the limit of 0.75 mg/L will be in effect for the May-October period. If upon completion of a TMDL it is determined that a higher or lower limit will result in compliance with water quality standards then the limit in the next permit will be established accordingly.

The Town of Concord (MA0100668) is permitted (19 January 2002) to discharge 1.2 MGD of treated sanitary wastewater via outfall 001 to the Concord River. The permit will expire in 2005.The facility's whole effluent toxicity limit is $LC_{50} = 100\%$ effluent. The current permit includes secondary limits: BOD = 30 mg/L, TSS = 30 mg/L, and fecal coliform bacteria = 200

cfu/100mL. Additionally, there are seasonal limits for total phosphorus (May 1- October 31 = 0.75 and November 1- April 31 = report) and ammonia nitrogen (report). The total phosphorus limit is an interim limit. This limit shall be expressed as a seasonal average (May through September) and will be calculated as the arithmetic mean if all samples taken during the period and be reported in the September discharge monitoring report. The final permit limit is "highest and best practical treatment) and is also a seasonal average. A numeric limit defining this is not included in this permit. Upon completion of activities in the compliance schedule or as a result of additional water quality data of a TMDL the permit limit may be modified to incorporate a numerical limit.

Other permitted discharge

- The Town of Acton (0-656) is authorized (7 January 2000) to discharge 250,000 gpd of sanitary wastewater to the **ground** from the Acton WWTP located on Adams Street. The permit includes limits for BOD (20mg/L), TSS (20mg/L), oil & grease (15 mg/L), fecal coliform (200 mg/L), total nitrate –nitrogen (10 mg/L), total nitrogen (10 mg/L), and total phosphorus (0.5 mg/L until flow is >125,000 gpd or 1 March 2004 whereby the limit is 0.2 mg/L).

Combined Sewer Overflows (CSOs)

The Lowell Regional Water and Wastewater Utilities (LRWWU) (MA0100633) has 9 permitted CSO outfalls. One of the CSO outfalls, the Warren Street CSO Diversion Structure, discharges to the Concord River while the remainder discharge to the Merrimack River. According to Camp Dresser and McKee's (CDM) June 2001 draft LRWWU Long-term CSO control plan "…the Warren Street CSO Structure to the lower Concord River has been shown to contribute the largest volume of CSO discharges per year at 202 MG, which represents 57 percent of the total average annual volume for the collection system. LRWWU is presently under an Administrative Order from EPA to implement CSO projects that mitigate CSO discharges throughout their system, including at the Warren Street CSO. These Phase I projects will reduce the annual CSO volume from 202 MG to approximately 65 MG annually on average at Warren Street. MA DEP and EPA are continuing to review the information in Lowell's Long-Term CSO Control Plan, along with other water quality data, to determine the scope and schedule for additional CSO projects that will be necessary to mitigate or eliminate CSO discharges from Lowell's combined sewer system. Lowell is also continuing to implement the "Nine Minimum Controls" programs to mitigate the frequency, duration, and impacts of their CSO discharges (Brander 2003).

While the CSO projects moving forward now will mitigate CSO discharges to the Concord River, the discharges continue to violate the Class B standard, as no CSO discharges are allowed to Class B receiving waters. A CSO-impacted segment can only be reclassified to B (CSO) or B (partial) or C if the findings of the CSO planning efforts identify levels of CSO control reflective of those classifications to be the highest feasible level of control. MA DEP has not made such a determination at this time. MA DEP will review the information in the Final Long-Term CSO Control Plan and make this determination, after receiving public input. If MA DEP determines that a modification to the water quality standard is warranted, MA DEP will submit to EPA for review and approval, a Use Attainability Analysis, which documents that one of the criteria of 314 CMR 4.03(4) has been met (Brander 2003).

Hydroelectric power plants:

There are no Federal Energy Regulatory Commission (FERC) licensed hydroelectric power plants in the SuAsCo Watershed. However, there are three FERC exempt power-generating facilities in the SuAsCo Watershed, which are described briefly below.

Project Name	Project Number	Owner Name	Issuance Date	River/Location	Kilowatts
Centennial Island	2998	Centennial Island Hydroelectric Co.	29 September 1981	Concord River	640
Mill Pond	5018	Wellesley Rosewood Mills, LLC	3 October 1983	Assabet River	125
Assabet	7148	Acton Hydro Company, Inc.	16 November 1983	Assabet River	178

Other Municipal Discharges

There are several municipal discharges within the SuAsCo Watershed that have permits for the discharge of treated effluent, process wash water, or storm water. These discharges are authorized under either a general or an individual permit (Appendix D, Table D1, D2, and D3).

- Wayland Business Center LLC
- Middlesex School WWTP
- MWRA Cosgrove Intake Facility
- MWRA Wachusett Lower Gatehouse and Wachusett Aqueduct
- US Army Natick R& D Lab
- MWRA MetroWest Water Supply Tunnel
- Massachusetts Correctional Institute-Concord
- Massachusetts Correctional Institute-Billerica
- Framingham District Court
- Hudson DPW, Gates Pond Water Treatment Plant (WTP)
- Ashland WTP
- Billerica WTP
- Earth Tech/Town of Ashland
- H20 Engineering/Town of Sudbury
- Sudbury Water Department
- Westborough Department of Public Works (DPW)

Industrial Discharges

There are several industries within the SuAsCo Watershed that have permits for the discharge of contact cooling water, non-contact cooling water (NCCW), and storm water. These discharges are authorized and controlled under either a general or an individual permit (Appendix D, Table D2 and D3).

- Bay State Sterling, Inc
- Ashland Sand and Stone Company
- Atlantic-Acton Realty Limited (a.k.a. S/P Acton Realty Trust, a.k.a. Powder Mill Plaza)
- Murphy's Automotive
- Eastern Terminals
- Trimount Bituminous Products
- Mobil Oil Corp. –Stowe
- Raytheon-Sudbury Factory
- Deblois Oil Company
- Cabot Corporation
- Hudson Light & Power Department
- L'Energia Limited Partnership (a.k.a. UAE Lowell Power LLC)
- Penn Culvert Company
- Sperry Corporation
- Stow Partners LLC (a.k.a. Belden Wire and Independent Cable)
- W.R. Grace & Company-Acton
- Coatings Engineering
- Arrow Automotive
- Baker Commodities
- Gotham Ink of New England Inc.
- Haartz Corporation
- Majilite Manufacturing, Inc.
- Kidde-Fenwal, Inc.
- Four-In-One Co. Inc (a.k.a. Stickney & Poor Co.)
- Aerodyne Research
- Best Western at Historic Chelmsford
- Superior Printing Inks

Storm water

Phase I of the EPA's Storm Water Program was promulgated in 1990 under the Clean Water Act and relies on NPDES permit coverage to address storm water runoff from medium and large municipal separate storm sewer systems (MS4s) generally serving populations of 100,000 or greater (in Massachusetts only Boston and Worcester), construction activity disturbing five acres of land or greater, and ten categories of industrial activity. Operators of industrial facilities included in one of the 11 categories of "storm water discharges associated with industrial activity" that discharge storm water to a municipal separate storm sewer system or directly to waters of the United States require authorization under a NPDES industrial storm water permit. Additional information can be found on the EPA's website http://cfpub1.epa.gov/npdes/stormwater/indust.cfm. The *Multi Sector General Permit*-2000, published in the Federal Register on 30 October 2000, replaces the original permit that EPA issued in 1995. This permit will expire in 2005. EPA will then reissue the permit for another term of five years. At the time of reissuance a new Notice of Intent must be submitted immediately by the facilities to maintain coverage. In the SuAsCo Watershed EPA has issued multi-sector storm water general permit coverage to 56 industrial facilities. See Appendix E, Table E4 for a listing of these facilities and location.

Phase II expands the original program to certain small MS4s in urbanized areas and uses six minimum control measures to reduce the discharge of pollutants to the maximum extent practicable, protect water

quality, and satisfy requirements of the Clean Water Act. The six measures are public education and outreach, public participation/involvement, illicit discharge detection and elimination, construction site runoff control, post-construction runoff control, pollution prevention, and good housekeeping (EPA 25 June 2002). The NPDES Storm Water Phase II General Permit requires operators of regulated small municipal separate storm sewer systems (MS4s) to develop a storm water management program that prevents harmful pollutants from being washed or dumped directly into the storm sewer system and then discharged into local waterbodies. More information on EPA's storm water program is available online at http://cfpub1.epa.gov/npdes/home.cfm?program_id=6.

To determine which communities were regulated under the Phase II permit program, EPA used a mapping system of urbanized areas defined by the U.S. Census Bureau in 2000. As a result of the mapping communities were to be located either totally or partially in the regulated Urbanized Area. All communities in the SuAsCo Watershed (Acton, Ashland, Bedford, Berlin, Billerica, Bolton, Boxborough, Boylston, Carlisle, Chelmsford, Clinton, Concord, Framingham, Grafton, Harvard, Holliston, Hopkinton, Hudson, Lincoln, Littleton, Lowell, Marlborough, Maynard, Natick, Northborough, Sherborn, Shrewsbury, Southborough, Stow, Sudbury, Tewksbury, Upton, Wayland, Westborough, Westford, and Weston) are Phase II communities. The majority of these communities applied to EPA and MA DEP for coverage under the Phase II Storm Water General Permit, issued on 1 May 2003. Municipalities that are totally regulated must implement the requirements of the Phase II permit in the entire town, while communities that are partially regulated need to comply with the Phase II permit only in the mapped Urbanized Areas (see http://www.epa.gov/region01/npdes/stormwater/ma.html for detailed maps for each community). Storm water general permits will be issued after administrative review by EPA. EPA will complete a thorough review of the communities' storm water management program in coordination with MA DEP during the five year permit term. Phase II Storm Water General Permits will expire on 1 May 2008 (Domizio 2004).

Water Management Act (WMA) permits

The Massachusetts Department of Environmental Protection's Water Management Program reviews the compliance of each permitted and registered public water supply entity for its compliance with total permitted and registered withdrawal volumes, water conservation standards of the Commonwealth, wellhead protection measures, and any specific permit conditions such as wetlands and streamflow monitoring requirements. The WMA Program seeks to involve the technical expertise of the Massachusetts Department of Conservation and Recreation, Division of State Parks and Recreation in developing permit-specific monitoring conditions and any subsequent amendments to them. Monitoring results from permits where long-term data have been evaluated indicate that wetlands monitoring that focuses on vegetative changes alone has not proven to be the optimal method of evaluating the impacts of withdrawals. More recent wetlands monitoring conditions have been written to include hydrologic monitoring, as well. In general, interpretation of both wetlands and hydrologic results is obscured by the complexities induced by other, unquantified basin impacts. Without an understanding of streamflow requirements for the protection of all potentially impacted flora and fauna, combined with a quantified water balance for each of the major watersheds and for some of the more highly utilized sub-basins, true "management" of the Commonwealth's waters remains an unreached goal.

Site-specific evaluations of other water quality issues in the SuAsCo Watershed related to either wastewater discharges or water withdrawals were conducted by MA DEP DWM either through field investigations (where resources could be allocated) or through the review of discharge monitoring reports and annual water withdrawal reports submitted by the permittees.

TOXTD

Six municipal WWTPs in the SuAsCo Watershed submit toxicity testing reports to EPA and MA DEP as required by their NPDES permits. Data from these toxicity reports are maintained by DWM in a database entitled "Toxicity Testing Data - TOXTD". Information from the reports includes: survival of test organisms exposed to ambient river water (used as dilution water), physicochemical analysis (e.g., hardness, alkalinity, pH, total suspended solids) of the dilution water, and the whole effluent toxicity test results. Data from 1998 to 2003 were reviewed and summarized (ranges) for use in the assessment of current water quality conditions in the SuAsCo Watershed. Toxicity testing data are required in the following NPDES permits.

- Billerica WWTP
- Concord WWTP
- Hudson WWTP
- Marlborough West WWTP
- Maynard WWTP
- Westborough WWTP

MDPH

In 1994 the Massachusetts Department of Public Health (MDPH) issued a statewide *Interim Freshwater Fish Consumption Advisory* for mercury (MDPH 1994). This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. The advisory encompassed all freshwaters in Massachusetts so the *Fish Consumption Use* could not be assessed as support. In July 2001 MDPH issued a new, more inclusive fish consumption advisory for both fresh and salt waters in the Commonwealth (MDPH 2001). Currently, there are 11 site-specific MDPH fish consumption advisories in the SuAsCo Watershed- nine because of elevated levels of mercury, one for elevated levels of polychlorinated biphenyls, and one for elevated levels of polycyclic aromatic hydrocarbons (MDPH 2004).

DFG

The Department of Fish and Game (formerly the Department of Fisheries, Wildlife & Environmental Law Enforcement) is composed of three divisions: the Division of Marine Fisheries (DMF), the Division of Fisheries and Wildlife (MDFW), and the Public Access Board (PAB). In 2004 the Environmental Law Enforcement Division was transferred from the DFG to the Executive Office of Environmental Affairs.

DMF, in collaboration with the US Fish and Wildlife Service, Community Council, and the former SuAsCo Watershed Team, has been working to reintroduce clupeids to the Concord River. DMF is preparing a series of technical reports on anadromous fish passage in Massachusetts (Reback *et al.* in preparation).

MDFW conducted fish population surveys throughout the SuAsCo Watershed during the summers of 1998-2002 (Richards 2003a). A watershed-based fisheries management plan will be produced by MDFW at a later date.

The Natural Heritage and Endangered Species Program developed the Living Waters project to identify, map, and protect core habitats and critical supporting watersheds that are important for rare species. The Living Waters Report (NHESP 2003) is intended as a conservation tool to be used in conjunction with the BioMap Project.

The Public Access Board, the smallest of the agencies within the DFG, provides boat and canoe access sites at more than 200 locations on coastal waters, ponds, and rivers throughout Massachusetts, including 10 in the SuAsCo Watershed. (Specific information can be found in the individual segment descriptions.) The PAB acquires property and easements for the purpose of providing access and designates roads and facilities to be built, improved, operated, and maintained. Boat launching facilities are managed by staff from the Division of Fisheries & Wildlife, the Department of Environmental Management, or municipalities. Information about the location of public access sites is available through the PAB's website: http://www.mass.gov/dfwele/pab/pab_toc.htm.

MA DCR

The Massachusetts Department of Conservation and Recreation(MA DCR), Division of State Parks and Recreation, formerly the Department of Environmental Management, conducts bacteria monitoring at their public beaches in state forests, parks, and reservations. Data are maintained in a database by MDPH. MA DCR also awards Lake and Pond Program grants to communities and citizen groups to monitor water quality and provide educational materials to the public about various lake issues. MA DCR Lakes and Pond Program grant projects in the SuAsCo Watershed are discussed in the Lakes Assessment Section of this report.

MA DEP

The Massachusetts Department of Environmental Protection, Division of Watershed Management (DWM), monitoring in the SuAsCo Watershed in 2001 included water quality sampling at fourteen stations during July and September, baseline lakes sampling (five lakes), macroinvertebrate and periphyton community assessments and fish toxics monitoring.

Additional work conducted by DWM in 1996 (assisted by EPA and the Organization for the Assabet River) included: benthic macroinvertebrate community assessment, fish toxics monitoring, bacteriological sampling of selected tributaries, lake synoptic surveys, wastewater discharge sampling (EPA), dissolved oxygen measurements along mainstem (EPA and OAR), and water quality sampling for phosphorus analysis (OAR).

The MA DEP, Central Regional Office, Bureau of Resource Protection, conducts a water quality monitoring program in six of the watersheds that occur within Central Massachusetts, including the SuAsCo. Through this Strategic Monitoring and Assessment of River basin Teams (SMART) program, water quality was sampled at five locations from March to November 2000 -two stations on the Assabet River, one station on the Concord River, one station on the Sudbury River, and one station on Nashoba Brook. Data from this program for 2000 are summarized in each segment and provided in Appendix I of this report. Data from the 2001 sampling season, while not available at the time of assessment, has been provided in Appendix I for reference. A technical memorandum by Therese Beaudoin, MA DEP, Central Regional Office, is in preparation. SMART monitoring also includes field observations and photographic documentation of watershed conditions.

Additionally, MA DEP provides funding for various grant and loan programs that provide valuable information that may be used in the water quality assessment report. A summary of these projects for the SuAsCo Watershed is provided in Appendix D.

Regional Monitoring

The Organization for the Assabet River (OAR) has been conducting water quality monitoring at 29 sites in the Assabet River Watershed for ten years. Since 2000 the monitoring has been conducted under an EPA and MA DEP approved QAPP. Samples are analyzed for temperature, DO, pH, conductivity, total suspended solids, total phosphorus, and ammonia-nitrogen. OAR also organized stream teams that conducted shoreline surveys between 1998 and 2002 including the Northborough Stream Team (Assabet River, Howard Brook, and Cold Harbor Brook), the Mill Pond Stream Team, and the Acton Stream Team (Fort Pond Brook and Nashoba Brook). Additional information on the Organization for the Assabet River is available on their website: www.assabetriver.org. OAR also maintains a webpage entitled *News from around the Sudbury, Assabet, and Concord River Watershed* that provides information on the various lake and river groups throughout the watershed and their potential upcoming projects (www.assabetriver.org/streamwatch/around_watershed.htm).

The Ashland Conservation Commission, in conjunction with the University of Massachusetts Co-operative Extension Program and the MA Riverways Program, organized stream teams and conducted shoreline surveys of the Sudbury River, Cold Spring Brook, Washakum Brook, and Indian Brook in the summer of 2002 (Ashland ConComm 2002).

The Sudbury Watershed Monitoring and Protection Group (SWAMP) conducted a shoreline survey of the Sudbury River from Fruit Street in Hopkinton to the Chattanooga Mill Site in Ashland in October 1998 (SWAMP 1998). SWAMP became the Sudbury River Watershed Organization (SWRO) and expanded

their mission to include the entire Sudbury River Watershed. SWRO is currently working with USGS on a habitat evaluation project in the Sudbury Subwatershed.

Concord River Environmental Stream Team (CREST) conducted a shoreline survey of the Concord River in May 1999 (CREST 1999).

The Mill Brook Task Force Stream Team conducted a shoreline survey of Mill Brook in May 2000 (MBTF 2000 and MBTF 2002).

Since 1988 the Acton Board of Health has been monitoring fecal coliform bacteria levels at 47 sites in the Fort Pond and Nashoba Brook subwatersheds on a quarterly basis (Reagor 2005). Due to the lack of temporal coverage (only four samples per year from each site) and the lack of a MA DEP approved Quality Assurance Project Plan, the data generated through this project were not utilized in this report.

With funding from the former Massachusetts Watershed Initiative and the 104(b) Grant Program ENSR International conducted field investigations of the Assabet and Concord systems to collect measurements of the hydrology, water quality, and aquatic biology. The Assabet River was sampled during 13 surveys between July 1999 and September 2000 (ENSR 2001) while the Concord River was sampled during 12 surveys between June 2001 and September 2002 (ENSR 2003). These data will be used in conjunction with other data (e.g., historic agency and volunteer monitoring data) to develop nutrient TMDLs. Due to data quality concerns only data from the biological, sediment, and tributary surveys were utilized in this report. It should be noted that dissolved oxygen data were not collected during worse case (pre-dawn) conditions.

ENSR has also conducted bacteria surveys, nutrient surveys and *in situ* water quality surveys in the Sudbury River Watershed during wet and dry weather conditions in July and August of 2002 and 2003 as part of a source identification study (ENSR 2004a).

Several small tributaries contribute inflow to Hop Brook. However, the Marlborough Easterly WWTP discharges directly upstream from Hager Pond and accounts for a significant amount of flow and nutrient loadings. Numerous studies have been conducted on the Hop Brook system. In 1984 USGS determined that approximately 50% of the flow in Hop Brook is effluent and the effluent may account for as much as 90% of the flow during drought conditions. Additionally, USGS concluded that without the WWTP discharge, Hop Brook would be nearly dry during drought conditions (USGS 1984 as referenced in ENSR 2000). In 1999 ENSR conducted a nutrient impact evaluation of the Hop Brook system. Water quality sampling was conducted at 28 stations (top and bottom, in stream and in lake) throughout the Hop Brook watershed during baseflow/dry conditions and during wet weather. Additional follow up sampling was conducted in 2003. This study focused on the role of internal phosphorus loading from the sediments of the impoundments in the Hop Brook watershed (ENSR 2004b).

Environmental Science Services, Inc (ESS) conducted a nutrient and limnological study of Lake Boon during the summer and fall of 1998. The study included in-lake water quality monitoring for DO, pH, temperature, total phosphorus, ammonia-nitrogen, and conductivity; aquatic weed mapping; and sediment analysis (ESS 1999).

In August 2001 the Massachusetts “Beach Bill” was enacted by the legislature and signed by the Governor (MGL. C111. S5S). This act created minimum standards for public bathing waters adjacent to any public or semi-public bathing beach in the Commonwealth. A “public bathing beach” is defined as a beach open to the general public whether or not any entry fee is charged that permits access to bathing waters. A “semi-public bathing beach” is defined as a bathing beach used in connection with a hotel, motel, trailer park, campground, apartment house, condominium, country club, youth club, school, camp, or similar establishment where the primary purpose of the establishment is not the operation of the bathing beach and where admission to the use of the bathing beach is included in the fee paid for use of the premises. A semi-public bathing beach shall also include a bathing beach operated and maintained solely for the use of members and guests of an organization that maintains such bathing beach. Under the Beach Bill the Massachusetts Department of Public Health was directed to establish minimum uniform water quality standards for coastal and inland beach waters as well as determining the frequency and

location of testing, reporting requirements, and requirements for notifying the public of threats to human health or safety. *105 CMR 445.000: Minimum Standards for Bathing Beaches (State Sanitary Code, Chapter VII)* outlines MDPH's guidelines for the Beach Bill and is available online at http://www.mass.gov/dph/dcs/bb4_01.pdf. Additionally, under the Beach Bill and MDPH guidelines, local boards of health and state agencies are responsible for collecting samples from public beaches using testing procedures consistent with the American Public Health Association's *Standard Methods for Examination of Water and Waste Water* or methods approved by EPA. Operators of semi-public beaches are responsible for the costs of testing their beaches. Results of testing, monitoring, and analysis of public and semi-public beaches must be submitted in an annual report to MDPH by 31 October of each year (MDPH 2002a and b).

Research has indicated that a strong correlation exists between percent impervious cover and water quality (Center for Watershed Protection 1998). Impervious cover influences streams by increasing surface runoff during storm events. In natural settings very little annual rainfall is converted to runoff and about half is infiltrated into the ground and water table. This water is filtered by the soils and serves to supply aquifers and adjacent surface waters with clean water during dry periods. In urbanized areas less annual rainfall infiltrates and more volume is converted to runoff. The volume of runoff becomes greater and occurs more frequently and at higher magnitudes. As a result less water is available to streams during dry periods and more flow occurs during storms. Impervious cover can be a very useful indicator with which to measure the impacts of land development on aquatic systems. It can also serve as an indicator of potential problems in a watershed. The Rapid Watershed Planning Handbook (Center for Watershed Protection 1998) has defined the following three impact categories based on the percentage of impervious cover.

Water Quality	**Impervious Cover**	***Description***
Sensitive Stream	0-10%	❖ High habitat/water quality rating characterized by stable channels and good habitat structure with diverse communities of fish and aquatic insects. ❖ Hydrologic regime is consistent with natural conditions. ❖ Species sensitive to pollution are within normal abundance ranges.
Impacted Stream	11-25%	❖ Some decline in habitat and water quality is evident. ❖ Erosion and stream channel widening become evident. ❖ Sensitive fish and aquatic insects begin to drop in overall numbers. ❖ Water quality is classified as fair or good.
Nonsupporting Stream	Exceeds 25%	❖ Stream channels become highly unstable, severe widening occurs. Down-cutting and streambank erosion are chronic problems. ❖ Biological quality is relatively poor with only pollutant tolerant species existing within its reaches. ❖ Water quality is considered fair to poor. ❖ Not a candidate for stream restoration

MASSACHUSETTS YEAR 2002 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 MA DEP 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 in 2002 that would meet the reporting requirements of both sections 305(b) and 303(d) of the CWA.

The Massachusetts Year 2002 Integrated List of Waters was published by the MA DEP in September 2003 (MA DEP 2003a). 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 state-wide 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 Total Maximum Daily Load (TMDL) 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., 2004). Because of the uncertainty related to making predictions about conditions in the future the MA DEP made a decision not to utilize Category 4B in the 2002 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.

TOTAL MAXIMUM DAILY LOADS (TMDLS)

While the EPA's guidance for the preparation of the Integrated List provided an overall framework for a five-part list of waters, the development, submittal, and review of Category 5 was subject to the prevailing regulation governing the implementation of Section 303(d) of the CWA and, so, this category was approved as the Massachusetts 2002 303(d) List by the EPA on October 1, 2003. States must develop TMDLs for each of the waterbodies in Category 5 and establish pollution control strategies to restore these waters to meet water quality standards. A TMDL is the greatest amount of a pollutant that a waterbody can accept and still meet water quality standards. Further information on the 303(d) List and the TMDL Program is available on the MA DEP website at: http://www.mass.gov/dep/brp/wm/tmdls.htm. Table 2 identifies the waterbodies in the SuAsCo Watershed on the Massachusetts 2002 Integrated List of Waters in Category 5 – Waters Requiring a TMDL (MA DEP 2003a).

Table 2. List of Waterbodies in the SuAsCo Watershed appearing on the 2002 Integrated List of Waters in Category 5- Waters Requiring a TMDL (MA DEP 2003a). *Note: "Exotic species" is not a pollutant requiring a TMDL.

Waterbody	WBID	Location	Pollutant Needing TMDL [EPA Approval Date/Document Control Number]
Assabet River Reservoir (82004)	MA82004_2002	Westborough	-Metals -Noxious aquatic plants -Turbidity -(Exotic species*)
Boons Pond (82011)	MA82011_2002	Stow/Hudson	-Metals -Noxious aquatic plants [6/28/2002/CN119.0] -(Exotic species*)
Carding Mill Pond (82015)	MA82015_2002	Sudbury	-Nutrients -Noxious aquatic plants
Lake Cochituate (82020)	MA82020_2002	(North Basin)Natick/ Framingham/Wayland	-Priority organics -Organic enrichment/Low DO
Lake Cochituate (82125)	MA82125_2002	Natick/Wayland	-Priority organics -Organic enrichment/Low DO
Lake Cochituate (82126)	MA82126_2002	Natick	-Priority organics
Lake Cochituate (82127)	MA82127_2002	Natick	-Priority organics -Organic enrichment/Low DO
Dudley Pond (82029)	MA82029_2002	Wayland	-Turbidity -(Exotic species*)
Farm Pond (82035)	MA82035_2002	Framingham	-Noxious aquatic plants -Turbidity -(Exotic species*)
Fort Meadow Reservoir (82042)	MA82042_2002	Marlborough/Hudson	-Nutrients
Framingham Reservoir #1 (82044)	MA82044_2002	Framingham	-Metals -Noxious aquatic plants -(Exotic species*)
Framingham Reservoir #2 (82045)	MA82045_2002	Framingham/Ashland	-Metals -Turbidity
Grist Mill Pond (82055)	MA82055_2002	Sudbury/Marlborough	-Nutrients -Pathogens -Noxious aquatic plants
Hager Pond (82056)	MA82056_2002	Marlborough	-Nutrients -Pathogens -Noxious aquatic plants -Turbidity
Heard Pond (82058)	MA82058_2002	Wayland	-Metals -Noxious aquatic plants -(Exotic species*)
Hocomonco Pond (82060)	MA82060_2002	Westborough	-Priority organics -Noxious aquatic plants
Hopkinton Reservoir (82061)	MA82061_2002	Hopkinton/Ashland	-Organic enrichment/Low DO -(Exotic species*)
Long Pond (82072)	MA82072_2002	Littleton	-Nutrients -Organic enrichment/Low DO -Noxious aquatic plants

Table 2 (Continued). List of Waterbodies in the SuAsCo Watershed appearing on the 2002 Integrated List of Waters in Category 5- Waters Requiring a TMDL (MA DEP 2003a). *Note: "Exotic species" is not a pollutant requiring a TMDL.

Waterbody	WBID	Location	Pollutant Needing TMDL [EPA Approval Date/Document Control Number]
Nutting Lake (82088)	MA82088_2002	Billerica	-Metals -(Exotic species*)
Nutting Lake (82124)	MA82124_2002	Billerica	-Metals
Puffers Pond (82092)	MA82092_2002	Maynard/Sudbury	-Metals
Saxonville Pond (82097)	MA82097_2002	Framingham	-Metals -Noxious aquatic plants -(Exotic species*)
Stearns Mill Pond (82104)	MA82104_2002	Sudbury	-Nutrients -Noxious aquatic plants -Turbidity
Sudbury Reservoir (82106)	MA82106_2002	Southborough/Marlborough	-Metals
Walden Pond (82109)	MA82109_2002	Concord	-Metals -Organic enrichment/Low DO
Warners Pond (82110)	MA82110_2002	Concord	-Metals -Noxious aquatic plants -(Exotic species*)
Whitehall Reservoir (82120)	MA82120_2002	Hopkinton	-Metals -Nutrients -Organic enrichment/Low DO -Noxious aquatic plants -(Exotic species*)
Assabet River (8246775)	MA82B-01_2002	Outlet Flow Augmentation Pond to Westborough WWTP, Westborough. Miles 31.8-30.4	-Nutrients -Organic enrichment/Low DO -Pathogens
Assabet River (8246775)	MA82B-02_2002	Westborough WWTP, Westborough to Route 20 Dam, Northborough. Miles 30.4-26.7	-Metals -Nutrients -Organic enrichment/Low DO -Pathogens
Assabet River (8246775)	MA82B-03_2002	Route 20 Dam, Northborough to Marlborough West WWTP, Marlborough. Miles 26.7-24.3	-Nutrients -Pathogens
Assabet River (8246775)	MA82B-04_2002	Marlborough West WWTP, Marlborough to Hudson WWTP, Hudson. Miles 24.3-16.4	-Cause Unknown -Metals -Nutrients -Organic enrichment/Low DO -Pathogens
Assabet River (8246775)	MA82B-05_2002	Hudson WWTP Hudson to Routes 27/62 at USGS Gage, Maynard. Miles 16.4-7.6	-Nutrients -Organic enrichment/Low DO -Pathogens
Assabet River (8246775)	MA82B-06_2002	Routes 27/62 at USGS Gage, Maynard to Powdermill Dam, Acton. Miles 7.6-6.4	-Priority organics -Metals -Nutrients -Organic enrichment/Low DO -Thermal modifications -Taste, odor and color -Suspended solids -Noxious aquatic plants
Assabet River (8246775)	MA82B-07_2002	Powdermill Dam, Acton to confluence with Sudbury River, Concord. Miles 6.4-0.0	-Nutrients -Organic enrichment/Low DO -Pathogens
Concord River (8246500)	MA82A-07_2002	Confluence with Assabet and Sudbury Rivers in Concord to Billerica Water Supply Filtration Plant building in Billerica. Miles 15.4-5.9	-Metals -Nutrients -Pathogens
Concord River (8246500)	MA82A-08_2002	Billerica Water Supply Filtration Plant building in Billerica to the Roger Street bridge in Lowell.	-Metals -Nutrients
Concord River (8246500)	MA82A-09_2002	Rogers Street bridge in Lowell to confluence with Merrimack River, Lowell. Miles 1.0-0.0	-Metals -Nutrients -Pathogens
Eames Brook (8248125)	MA82A-13_2002	Outlet of Farm Pond to confluence with the Sudbury River, Framingham. Miles 0.5-0.0	-Cause Unknown -Noxious aquatic plants -(Exotic species*)

Table 2 (Continued). List of Waterbodies in the SuAsCo Watershed appearing on the 2002 Integrated List of Waters in Category 5- Waters Requiring a TMDL (MA DEP 2003a). *Note: "Exotic species" is not a pollutant requiring a TMDL.

Waterbody	WBID	Location	Pollutant Needing TMDL [EPA Approval Date/Document Control Number]
Elizabeth Brook (8247150)	MA82B-12_2002	From outlet of unnamed pond (Delaney Project) west of Harvard Road to inlet Fletchers Pond, Stow. Miles 3.8-0.0	-Cause Unknown
Hop Brook (8247825)	MA82A-05_2002	Outlet of Carding Millpond to confluence with Landham Brook, Sudbury. Miles 7.1-0.0	-Nutrients -Organic enrichment/Low DO -Suspended solids -Noxious aquatic plants
Indian Brook (8248400)	MA82A-12_2002	Outlet of Icehouse Pond, Hopkinton through Hopkinton Reservoir to confluence with Sudbury River, Ashland. Miles 5.3-0.0	-Cause Unknown
Pine Brook (8247950)	MA82A-14_2002	Source near Rice Road (southwest of Wayland/Weston town line) to confluence with Sudbury River, Wayland. Miles 3.4-0.0	-Cause Unknown
River Meadow Brook (8246525)	MA82A-10_2002	Outlet Russell Mill Pond, Chelmsford to confluence with Concord River, Lowell. Miles 6.6-0.0	-Pathogens
Sudbury River (8247650)	MA82A-02_2002	Fruit Street Bridge, Hopkinton to outlet Saxonville Pond, Framingham. Miles 29.1-16.2	-Metals
Sudbury River (8247650)	MA82A-03_2002	Outlet Saxonville Pond to confluence with Wash Brook, Sudbury. Miles 16.2-10.6	-Metals
Sudbury River (8247650)	MA82A-04_2002	Confluence Wash Brook, Sudbury to confluence with Assabet River, Concord. Miles 10.6-0.0	-Metals
Unnamed Tributary (8247890)	MA82A-15_2002	Source northeast of Indian Head Hill (near Route 20) to inlet Hager Pond, Marlborough. Miles 0.9-0.0	-Nutrients -Organic enrichment/Low DO -Suspended solids -Noxious aquatic plants
Unnamed Tributary (8247885)	MA82A-16_2002	Outlet of Hager Pond to inlet of Grist Millpond, Marlborough. Miles 0.1-0.0	-Nutrients -Organic enrichment/Low DO -Suspended solids -Noxious aquatic plants
Unnamed Tributary (8247880)	MA82A-17_2002	Outlet Grist Millpond to inlet Carding Millpond, Sudbury. Miles 0.5-0.0	-Nutrients -Organic enrichment/Low DO -Suspended solids -Noxious aquatic plants
Wash Brook (8247800)	MA82A-06_2002	Confluence of Hop Brook and Landham Brook, Sudbury to confluence with Sudbury River, Wayland. Miles 3.3-0.0	-Nutrients -Pathogens -Suspended solids -Noxious aquatic plants

Assabet River

MA DEP, in conjunction with ACOE, developed a nutrient (total phosphorus) TMDL for the Assabet River. The TMDL for the Assabet River (seven segments) was finalized and approved by EPA in 2004. The TMDL development process begins with assessment of the present condition of a waterbody and concludes with specification and implementation of a set of modified loadings deemed necessary to bring the waterbody into compliance with water quality standards. The steps of the TMDL can be divided into Assessment (Steps 1 and 2); Analysis (Steps 3 and 4), often through numerical modeling; and Planning (Step 5). ENSR International, through funding from the former Massachusetts Watershed Initiative and the 104(b) grant program, conducted the field investigations and the review of previous water quality studies in support of the "Assessment" phase of the TMDL process, as well as developed and calibrated the Hydrologic Simulation Program-Fortran (HSPF) model. The assessment study found that the major source of nutrient loading to the river is point sources (municipal waste water treatment plants). Additionally, the role of sediment as a nutrient recycler, especially phosphorus, has been identified as a significant component promoting macrophyte growth, particularly in impounded sections of the Assabet River. The five major impoundments provide an optimum habitat for macrophyte growth and especially for

the floating macrophytes (e.g., *Wolfia* sp. and *Lemna* sp.). While both phosphorus and nitrogen are nutrients, phosphorus generally is considered to be limiting or more easily made so in freshwater. This, in part, rests on the fact that phosphorus is easier to remove and that some organisms can convert atmospheric nitrogen into a useable form thereby creating a nearly limitless supply (Allan, 1995; NAP 2000 as referenced in MA DEP undated). In the case of the Assabet River, not only is the habitat for nitrogen fixation available but it is likely enhanced by the presence of duckweed (*Lemna* sp.) as a host for nitrogen-fixing bacteria (MA DEP undated). It should be noted that during modeling a simulation was run whereby one of the major WWTP discharges was to the ground with nearly complete removal of total nitrogen. This simulation did not result in a "substantial difference in predicted biomass… help[ing] confirm total phosphorus as the main concern" (MA DEP undated). Therefore the TMDL was developed for total phosphorus.

The calculated TMDL for total phosphorus in the Assabet River is 27.5 lbs/day. In 1999 the total phosphorus load was 127.1 lbs/day (including a margin of safety). Meeting the TMDL will require a reduction of 78% or 99.6 lbs/day. The MA DEP is proposing a two-phased adaptive management approach to accomplish this reduction. ***"Phase 1** will establish* WWTP *effluent total phosphorus limits of 0.1 mg/l at all major* WWTPs *discharging to the Assabet River and allow the communities sufficient time to fund and implement a detailed evaluation of impoundment sediment as a potential alternative to lower permit limits (MA DEP undated)."* [The minor WWTP effluents will be required to reduce their discharge of phosphorus to 0.5 mg/L during the growing season.] During the non-growing season, effluent limits for phosphorus will not presently be required; however, year round monitoring and reporting of effluent data for total and dissolved phosphorus will be required. This is due to concerns that particulate phosphorus could potentially settle in the impoundments during the non-growing season and become available for plant growth during the growing season. In addition, the WWTPs will be required to optimize the removal of particulate phosphorus during the non-growing season. "***Phase 2** limitations will be established in permits to be reissued in 2009 if sediment remediation, based upon the results of the sediment/dam evaluation, is not pursued, and/or new phosphorus criteria that may be developed in the interim by DEP and USEPA are applicable* (MA DEP undated)."

EPA issued the draft 2004 NPDES permits for the four major WWTPs in fall 2004 with the 0.1 mg/L seasonal limit (to be attained by 2009). Public meetings were held and a public comment period has recently been closed. EPA is working to address comments and will issue the final permits in the coming months.

The reduction in sediment phosphorus flux, which may occur naturally once the WWTP effluent concentration is reduced, can likely be expedited with measures such as dredging, encapsulating and/or dam removal. State and federal funding was secured to quantify and qualify the sediments in the Assabet River, as well as to begin the process of evaluating management options (Dunn 2004). USGS, under contract to MA DEP, has completed sediment mapping and sampling and prepared a draft report (Zimmerman 2004). Additional federal funds are currently being sought to continue this process (Dunn 2004). It is anticipated that this will be an ongoing project to last several years. The study will include, but not necessarily be limited to, identifying options for sediment remediation, investigation of potential sediment transport issues and downstream impacts, evaluation of legal issues, and recommendations for cost effective solutions to achieve water quality standards (MA DEP undated).

Lake Boon

A phosphorus TMDL for Lake Boon in Hudson/Stow was developed by MA DEP and accepted by EPA in June 2002. The report concluded that excessive macrophyte growth is due to natural conditions and anthropogenic inputs. The TMDL recommended watershed management to limit development, development and implementation of mandatory septic system inspection and maintenance programs by the towns, public education and storm water runoff control programs, a macrophyte management program, and monitoring. Authority to regulate nonpoint source pollution is limited to local governments and implementation will require cooperation among local volunteers, watershed associations, and municipal officials (MA DEP 2002a). In December 2002 a watershed survey was conducted by the Lake Boon Association and Lake Boon Commission. It identified sources of nonpoint source pollution. In 2002 the towns were also awarded a s. 319 grant to implement best management practices in the Lake Boon watershed.

Other waters in the SuAsCo Watershed undergoing Phase I TMDL development
Additional work has begun on TMDLs for the Concord River and Hop Brook (Sudbury watershed). In 2001 ENSR was awarded a contract to collect data for the Assessment phase of the TMDL process for the Concord River. At this time the analysis phase has not yet commenced.

In 1998 ENSR was awarded a 104(b)(3) grant to provide a comprehensive, up-to-date evaluation of water quality problems in the Hop Brook watershed and to evaluate recommendations for in-lake and watershed remediation measures to alleviate chronic problems associated with excess algal growth and aquatic weed growth, particularly in Hager Pond, Carding Millpond, Grist Millpond, and Stearns Millpond (See Appendix D). ENSR was subsequently awarded a contract to conduct a follow up investigation and to provide the technical basis for a TMDL for Hop Brook. This study was completed in 2003 (ENSR 2004b).

OBJECTIVES

This report summarizes information generated in the SuAsCo Watershed through *Year 1* (information gathering in 1999) and *Year 2* (environmental monitoring in 2000) activities established in the "Five-Year Cycle" of the watershed approach. Surveys conducted by DWM in 2001 included water quality sampling at fourteen stations during July and September, baseline lakes sampling (five lakes), macroinvertebrate and periphyton community assessments and fish toxics monitoring. The water quality monitoring data are available in a technical memorandum by Brian Friedmann (Appendix A). The fish toxics data are available in the technical memorandum entitled *2001 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys* (Maietta *et al.* 2002 and Appendix B). The lakes data are available in the technical memorandum entitled *2001 Baseline Lakes Survey Tech Memo* (Mattson and Haque 2004 and Appendix C). The macroinvertebrate data are presented in a separate technical memorandum (Nuzzo 2004 and Appendix D). Together with other sources of information (identified in each segment assessment) the status of water quality conditions of rivers and lakes in the SuAsCo Watershed was assessed in accordance with EPA's and MA DEP's use assessment methods. Not all waters in the SuAsCo Watershed are included in the MA DEP/EPA database or this report.

The objectives of this water quality assessment report are to:

1. evaluate whether or not surface waters in the SuAsCo Watershed, defined as segments in the database, currently support their designated uses (i.e., meet surface water quality standards),
2. identify water withdrawals (habitat quality/water quantity) and major point (wastewater discharges) and nonpoint (land-use practices, storm water discharges, etc.) sources of pollution that may impair water quality,
3. identify the presence or absence of any exotic 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 or remediation actions in order to better determine the level of impairment and to improve or restore water quality, and
6. provide information for the development of a SuAsCo Watershed action plan.

REPORT FORMAT

RIVERS

The rivers assessed in the SuAsCo River Watershed are presented in the River Segment Assessment section of this report. The order of river segments follows the Massachusetts Stream Classification Program (Halliwell *et al*. 1982) hierarchy. River segments are organized hydrologically (from most upstream to downstream) and tributary segments follow after the river segment into which they discharge. Each river segment assessment is formatted as follows.

SEGMENT IDENTIFICATION

Name, water body identification number (WBID), location, length, classification.

Sources of information: coding system (waterbody identification number e.g., MA82A-01) used by MA DEP to reference the stream segment in databases such as 305(b) and 303(d), the Massachusetts SWQS (MA DEP 1996), and other descriptive information.

SEGMENT DESCRIPTION

Major land-use estimates (the top three uses for the subwatershed, excluding "open water"), and other descriptive information.

Sources of information: descriptive information from USGS topographical maps, base geographic data from MassGIS, land use statistics from a GIS analysis using the MassGIS land use coverage developed at a scale of 1:25,000 and based on aerial photographs taken in 1999 (UMass Amherst 1999).

SEGMENT LOCATOR MAP

Subbasin map, major river location, segment origin and termination points, and segment drainage area (gray shaded).

Sources of information: MassGIS data layers (stream segments and quadrangle maps from MassGIS 2002).

WATER WITHDRAWALS AND WASTEWATER DISCHARGE PERMIT INFORMATION

Water withdrawal, NPDES wastewater discharge

Sources of information: WMA Database Printout (LeVangie 2003); open permit files located in the Central Region and Northeast Region MA DEP Offices (MA DEP 2004a); Hogan 2004; Firmin 2004; Webber 2004a, b, and c; Kickham 2004; O'Keefe 2005; and Peters 2004.

USE ASSESSMENT

Aquatic Life, Fish Consumption, Drinking Water (where applicable – see note below), Primary Contact, Secondary Contact, and Aesthetics.

Sources of information include: MA DEP DWM 1995/1996 and 2001 survey data (Appendix B, C, and G); MA DEP DWM Toxicity Testing Database "TOXTD". The MDPH Freshwater Fish Consumption Advisory Lists (MDPH 2001 and MDPH 2004) were used to assess the *Fish Consumption Use*. Where other sources of information were used to assess designated uses, citations were included.

[Note: Although the *Drinking Water Use* itself was not assessed in this water quality assessment report, the Class A waters were identified.]

SUMMARY

Use summary table (uses, status, causes and sources of impairment).

RECOMMENDATIONS

Additional protection, monitoring and implementation needs.

LAKES

The assessed lakes, identified with their WBID code numbers, are listed alphabetically in the Lake Assessment section of this report. The status of the individual uses is summarized for these lakes for each watershed. The location, acreage, trophic status, use assessments, and causes of impairment, are then summarized for each individual lake (listed alphabetically).