INTRODUCTION

The Massachusetts Watershed Initiative (MWI) 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. Implementation of this project is underway in a process known as the "Watershed Approach". The five-year cycle of the Watershed Approach, as illustrated in Figure 6, provides the management structure to carry out the mission. This report presents the current assessment of water quality conditions in Boston Harbor. 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).

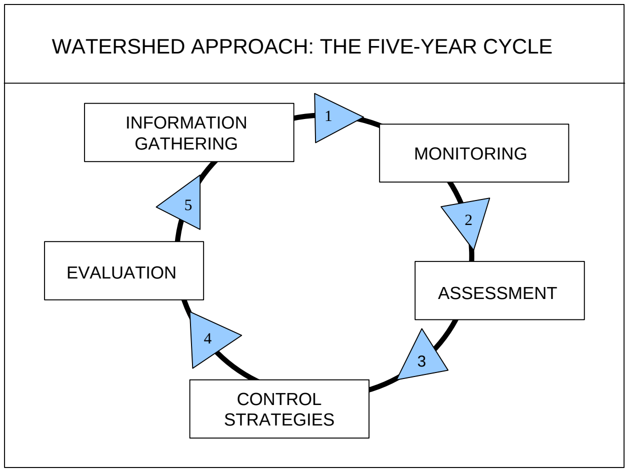

Figure 6. Five-year cycle of the Watershed Approach.

The goal of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters (Environmental Law Reporter 1988). To meet this objective, the CWA requires states to develop information on the quality of the Nation's water resources and report this information to the U.S. Environmental Protection Agency (EPA), the U.S. Congress, and the public. Together, these agencies are responsible for implementation of the CWA mandates. Under Section 305(b) of the Federal Clean Water Act, MA DEP must submit a statewide report every two years to the EPA, which describes the status of water quality in the Commonwealth. 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).

The 305(b) Report is based on the compilation of information for the Commonwealth's 27 watersheds. It compiles data from a variety of sources and provides an evaluation of water quality, progress made towards maintaining and restoring water quality, and the extent to which problems remain at the statewide level. The most recent 305(b) Report is the *Commonwealth of Massachusetts Summary of Water Quality 2000* (MA DEP 2000a). 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

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 standards are required by a CWA mandate to be reviewed and revised once 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 MA DEP 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 (ORW's) under 314 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.*

A summary of the state water quality standards (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 met (MA DEP 1996). In rivers and streams, the lowest flow conditions at and above which criteria must be met is 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 criteria must be met is the flow equal or exceeded 99% of the time on a yearly basis or another equivalent flow which has been agreed upon. In coastal and marine waters and for lakes and ponds the most severe hydrological condition is 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 (MA DEP 2001a). For external sources of information, DEP requires the following: 1) an appropriate *Quality Assurance Project Plan (QAPP)* including a Quality Assurance/Quality Control (QA/QC) plan, 2) use of a state certified lab (certified in the applicable analysis), 3) data management QA/QC be described, and 4) the information be documented in a citable report.

Table 1. Summary of Massachusetts Surface Water Quality Standards (MADEP 1996). *Note*: *Italics are direct quotations.*

Dissolved Oxygen	Class A, BCWF*, SA : ≥ 6.0 mg/L and ≥ 75% saturation unless background conditions are lower Class BWWF**, 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 Δ 1.5°F (0.8°C) for Cold Water and ≤ 83°F (28.3°C) and Δ 1.5°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, 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 Δ 4.0°F (2.2°C) between October through June
pH	Class A, BCWF, BWWF: 6.5 – 8.3 and Δ0.5 outside the background range. Class C: 6.5 – 9.0 and Δ1.0 outside the naturally occurring range. Class SA, SB: 6.5 – 8.5 and Δ0.2 outside the normally occurring range. Class SC: 6.5 – 9.0 and Δ0.5 outside the naturally occurring range.
Fecal Coliform Bacteria	Class A: an arithmetic mean of < 20 organisms /100 mL in any representative set of samples and < 10% of the samples > 100 organisms/100 mL. Class B: a geometric mean of < 200 organisms /100 mL in any representative set of samples and < 10% of the samples > 400 organisms /100 mL. (This criterion can be applied on a seasonal basis at the discretion of the DEP.) Class C: a geometric mean of < 1000 organisms /100mL, and < 10% of the samples > 2000 organisms/100 mL. Class SA: approved Open Shellfish Areas: a geometric mean (MPN method) of < 14 organisms/100 mL and < 10% of the samples > 43 organisms/100 mL (MPN method). Waters not designated for shellfishing: < a geometric mean of 200 organisms in any representative set of samples, and < 10% of the samples > 400 organisms /100 mL. (This criterion can be applied on a seasonal basis at the discretion of the DEP.) Class SB: approved Restricted Shellfish Areas: < a fecal coliform median or geometric mean (MPN method) of 88 organisms/100 mL and < 10% of the samples > 260 organisms /100 mL (MPN method). Waters not designated for shellfishing: < a geometric mean of 200 organisms in any representative set of samples, and < 10% of the samples > 400 organisms /100 mL. (This criterion can be applied on a seasonal basis at the discretion of the DEP.) Class SC: < a geometric mean of 1000 organisms/100 mL and < 10% of the samples > 2000 organisms/100mL.
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 & Grease	Class A, 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, C, SB, 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, SA: *None other than of natural origin.* Class B, C, SB, 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.*

*Class BCWF = Class B Cold Water Fishery, ** Class BWWF = Class B Warm Water Fishery, Δ criterion (referring to a change from ambient) is applied to the effects of a permitted discharge. ~ USEPA. 19 November 1999. Federal Register Document. [Online]. United States Environmental Protection Agency. http://www.epa.gov/fedrgstr/EPA-WATER/1998/December/Day-10/w30272.htm.

EPA provides guidelines to the states for making their use support determinations (EPA 1997). 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* 1993 by D. Persaud, R. Jaagumagi and A. Hayton). 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 1) ***support***, 2) ***partial support***, or 3) ***non- support***. The term *threatened* is used when the use is fully supported but may not support the use within two years because of adverse pollution trends or anticipated sources of pollution. 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, however, that not all waters are assessed. Many small and/or unnamed lakes, 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 nor is information on these waters maintained in the Waterbody System (WBS) database.

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. Three 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 which are not capable of sustaining a year-round population of cold water aquatic life, and *Marine Fishery* - suitable for sustaining marine flora and fauna.

- FISH CONSUMPTION - pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or shellfish or for the recreational use of fish, shellfish, 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).

- 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.

Additionally, there are other restrictions that denote a specific subcategory of use. These restrictions, assigned to a segment, may affect the application of criteria or specific antidegradation provision of 314 CMR 4.00. In the Boston Harbor Watershed these restrictions include:

- Combined Sewer Overflow (CSO) – These waters are identified as impacted by the discharge of combined sewer overflows in the classification tables in 314 CMR 4.06(3). Overflow events may be allowed by the permitting authority without a variance or partial use designation where the provisions 314 CMR 4.06(1)(d)10 are met. The waterbody may be subject to short-term impairment of swimming or other recreational uses, but support these uses through most of their annual period of use; and the aquatic life community may suffer some adverse impact yet is still generally viable).

[Note: The SWQS have "CSO" listed where CSO impacts occur. However, this is only a notation and does not have regulatory significance until all of the provisions of 314 CMR 4.06 (1) (d) 10 have been met (Facilities Plan Approval, Use Attainability Analysis, etc.) and MA DEP makes a formal administrative determination after a public hearing and Massachusetts Environmental Policy Act (MEPA) filing that a B (CSO) designation is supported and appropriate (Brander 2001a).]

The guidance used to assess the *Aquatic Life, Fish Consumption, Drinking Water, Shellfishing, 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, partial support, non-support) of the *Aquatic Life Use*:

Variable (#) - Indicates reference provided at the end of the designated use section	***Support*** – Data available clearly indicates support. Minor excursions from chemical criteria (Table 1) may be tolerated if the biosurvey results demonstrate support.	***Partial Support*** – Uncertainty about support in the chemical or toxicity testing data, or there is some minor modification of the biological community. Excursions not frequent or prolonged.	***Non-Support*** – 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) II or III (4)	Non-Impaired	Slightly Impaired	Moderately or Severely Impaired
Fish Community (4)	Best Professional Judgment (BPJ)	BPJ	BPJ
Habitat and Flow (4)	BPJ	BPJ	Dewatered streambed due to artificial regulation or channel alteration
Macrophytes (4)	BPJ	Exotic plant species present, but not dominant, BPJ	Exotic plant species dominant, BPJ
Plankton/ Periphyton (4)	No algal blooms	Occasional algal blooms	Persistent algal blooms
TOXICITY TESTS			
Water Column/Ambient (4)	>75% survival either 48 hr or 7-day exposure	>50 - ≤75% survival either 48 hr or 7-day exposure	≤50% survival either 48 hr or 7-day exposure
Effluent (4)	Meets permit limits	(NOTE: if limit is not met, the stream is listed as threatened for 1.0 river mile downstream from the discharge.)	
Sediment (4)	>75% survival	>50 - ≤75% survival	≤50% survival
CHEMISTRY- WATER			
Dissolved oxygen (DO) (3, 6)	Criteria (Table 1)	Criteria exceeded in 11-25% of measurements (surface area for lakes)	Criteria exceeded >25% of measurements.
pH (3, 6)	Criteria (Table 1)	Criteria exceeded in 11-25% of measurements.	Criteria exceeded >25% of measurements.
Temperature (3, 6) [1]	Criteria (Table 1) [1]	Criteria exceeded in 11-25% of measurements.	Criteria exceeded >25% of measurements.
Turbidity (4)	Δ 5 NTU due to a discharge	BPJ	BPJ
Suspended Solids (4)	25 mg/L max., Δ10 mg/L due to a discharge	BPJ	BPJ
Nutrients (3) Phosphate-P (4)	Table 1, (Site-Specific Criteria; Maintain Balanced Biocommunity, no pH/DO violations)	BPJ	BPJ
Toxic Pollutants (3, 6) Ammonia-N (3, 4, 12) [2] Chlorine (3, 6) [3]	Criteria (Table 1) 0.237 mg/L NH_3-N [2] 0.011 mg/L total residual chlorine (TRC)[3]	BPJ	Criterion is exceed in > 10% of samples.
CHEMISTRY – SEDIMENT			
Toxic Pollutants (5) [4]	≤ Low Effect Level (L-EL)[4]	One pollutant between L-EL and Severe Effect Level (S-EL)	One pollutant ≥ S-EL (severe)
Nutrients (5)	≤ L-EL	Between L-EL and S-EL	≥ S-EL
Metal Normalization to Al or Fe (4)	Enrichment Ratio ≤ 1	Enrichment Ratio >1 but ≤10	Enrichment Ratio ≥10
CHEMISTRY- EFFLUENT			
Compliance with permit limits (4)	In-compliance with all limits	NOTE: If the facility does not meet their permit limits, the information is used to threaten one river mile downstream from the discharge.	
CHEMISTRY-TISSUE			
PCB – whole fish (1)	≤500 µg/kg wet weight	BPJ	BPJ
DDT (2)	≤14.0 µg/kg wet weight	BPJ	BPJ
PCB in aquatic tissue (2)	≤0.79 ng TEQ/kg wet weight	BPJ	BPJ

[1]maximum daily mean T in a month (minimum six measurements evenly distributed over 24-hours) less than criterion, [2] [NH_3-N] at pH = 8.9 SU and 28.3°C, actual "criterion" varies with pH and temperature and is evaluated case-by-case. [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 (PCB) 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: The 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 2001a). 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 non-support in these waters.

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

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 2001b)."

MDPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially. Because of the statewide advisory, however, no waters can be assessed as support or partial support for the *Fish Consumption Use*. The following is an overview of the guidance used to assess the status (support, partial support, non-support) of the *Fish Consumption Use*.

Variable (#) - Indicates reference provided at the end of the designated use section	***Support*** – No restrictions or bans in effect	***Partial Support*** – A "restricted consumption" fish advisory is in effect for the general population or a sub-population that could be at potentially greater risk (e.g., pregnant women, and children	***Non-Support*** – 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 (8,12)	Not applicable, precluded by statewide advisory (Hg)	Not applicable	Waterbody on MDPH Fish Consumption Advisory List

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

1. Due to concerns about chemical contamination, primarily from polychlorinated biphenyl compounds (PCB) 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.

Pregnant and breastfeeding women and those who are considering becoming pregnant should not eat bluefish due to concerns about PCB contamination in this species.

DRINKING WATER USE

The 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). This use is assessed by DEP's Drinking Water Program (DWP). Below is EPA's guidance used to assess the status (support, partial support, non-support) of the drinking water use.

Variable (# indicates reference)	***Support***-- No closures or advisories (no contaminants with confirmed exceedances of MCLs, conventional treatment is adequate to maintain the supply).	***Partial Support*** – Is one or more advisories or more than conventional treatment is required	***Non-Support*** – One or more contamination-based closures of the water supply
Drinking Water Program (DWP) Evaluation	Reported by DWP	Reported by DWP	Reported by DWP

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.state.ma.us/dep/brp/dws/dwshome.htm and from the Narragansett/Mt. Hope Bay River Watershed's public water suppliers.

SHELLFISHING 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 (listed below) with respect to shellfish harvest. Shellfish areas under management closures are *not assessed.*

Variable (#) - Indicates reference provided at the end of the designated use section	***Support*** – SA Waters—Approved[1] SB Waters— Approved[1], Conditionally Approved[2] or Restricted[3]	***Partial Support*** – SA Waters— Conditionally Approved[2], Restricted[3], or Conditionally Restricted[4] SB Waters—Conditionally Restricted[4]	***Non Support*** – SA Waters—Prohibited[5] SB Waters— Prohibited[5] areas
Division of Marine Fisheries Shellfish Project Classification Area Information (11)	Reported by DMF	Reported by DMF	Reported by DMF

NOTE: Designated shellfish growing areas (as of October 2000) may be viewed using the MassGIS datalayer available from MassGIS at http://www.state.ma.us/mgis/dsga.htm.

[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 RECREATIONAL 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 (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, partial support, non-support) of the *Primary Contact Use*.

Variable (#) - Indicates reference provided at the end of the designated use section	***Support*** – Criteria are met, no aesthetic conditions that preclude the use	***Partial Support*** – Criteria exceeded intermittently (neither frequent nor prolonged), marginal aesthetic violations	***Non-Support*** – Frequent or prolonged violations of criteria, formal bathing area closures, or severe aesthetic conditions that preclude the use
Fecal Coliform Bacteria (3, 9) *	Criteria met (See Table 1) OR Dry Weather Guidance <5 samples--≤400/100mL maximum Wet Weather Guidance Dry weather samples meet and wet samples ≤2000/100mL	Dry Weather Guidance exceeded in 11-25% of the samples OR Wet Weather Dry weather samples meet and wet samples >2000/100mL	Dry Weather Guidance exceeded in > 25% of the samples
pH (3, 6)	Criteria exceeded in ≤10 % of the measurements	Criteria exceeded in 11-25% of the measurements	Criteria exceeded in >25% of the measurements
Temperature (3)	Criteria met	Criteria exceeded 11-25% of the time	Criteria exceeded 25% of the time
Color and Turbidity (3, 6)	BPJ, ∆ 5 NTU (due to a discharge) exceeded in ≤10 % of the measurements	BPJ, Guidance exceeded in 11-25% of the measurements	BPJ, Guidance exceeded in >25% of the measurements
Secchi disk depth (10) **	Lakes - ≥1.2 meters (≥ 4')	Infrequent excursions from the guidance	Frequent and/or prolonged excursions from the guidance
Oil & Grease (3)	Criteria met	BPJ, criteria exceeded 11-25% of the time	BPJ, criteria exceeded >25% of the time
Aesthetics (3) Biocommunity (4)**	No nuisance organisms that render the water aesthetically objectionable or unusable, BPJ; Cover of macrophytes < 50% within any portion of the lake area at maximum extent of growth.	BPJ, Cover of macrophytes 50-75% within any portion of the lake area at maximum extent of growth.	BPJ, Cover of macrophytes >75 within any portion of the lake area at maximum extent of growth.

Note: Excursions from criteria due to natural conditions are not considered impairment of use.
* Fecal coliform bacteria interpretations require additional information in order to apply this use assessment guidance. Small/limited datasets require an evaluation of survey conditions (i.e., interpretation of the amount of precipitation received in the subject region immediately prior to sampling and streamflow conditions) to determine whether the fecal coliform bacteria results are representative of dry or wet weather/storm water runoff conditions. When larger data sets are available, the frequency of standards/guidance exceedances is calculated.
**Any portion of a lake exhibiting impairment of the *Primary Contact Recreation Use* (swimmable) because of macrophyte cover and/or transparency (Secchi disk depth) is assessed as either partial or non-support. If no fecal coliform bacteria data are available and the lake (entirely or in part) met the transparency (Secchi disk depth) and aesthetics guidance, this use is not assessed.

SECONDARY CONTACT RECREATIONAL 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, partial support, non-support) of the *Secondary Contact Use*.

Variable (#) - Indicates reference provided at the end of the designated use section	***Support*** – Criteria are met, no aesthetic conditions that preclude the use	***Partial Support*** – Criteria exceeded intermittently (neither frequent nor prolonged), marginal aesthetic violations	***Non-Support*** – Frequent or prolonged violations of criteria, or severe aesthetic conditions that preclude the use
Fecal Coliform Bacteria (4) *	Dry Weather Guidance <5 samples--≤2000 cfu/100mL maximum >5 samples--≤1000 cfu/100mL geometric mean ≤ 10% samples ≥2000 cfu/100mL Wet Weather Guidance Dry weather samples meet and wet samples ≤4000 cfu/100mL	Wet Weather Guidance Dry weather samples meet (i.e., ≤10% samples ≥2000 cfu/100mL) and any wet samples >4000 cfu/100mL	Criteria exceeded in > 10% of dry weather samples
Oil & Grease (3)	Criteria met (See Table 1)	Criteria exceeded 11-25% of the time, BPJ	Criteria exceeded >25% of the time, BPJ
Aesthetics (3) Biocommunity (4) **	No nuisance organisms that render the water aesthetically objectionable or unusable, BPJ; Cover of macrophytes < 50% within any portion of the lake area at maximum extent of growth.	BPJ, Cover of macrophytes 50-75% within any portion of the lake area at maximum extent of growth.	BPJ, Cover of macrophytes >75 within any portion of the lake area at maximum extent of growth.

Note: Excursions from criteria due to natural conditions are not considered impairment of use.
* Fecal coliform bacteria interpretations require additional information in order to apply this use assessment guidance. Small/limited datasets require an evaluation of survey conditions (i.e., interpretation of the amount of precipitation received in the subject region immediately prior to sampling and streamflow conditions) to determine whether the fecal coliform bacteria results are representative of dry or wet weather/storm water runoff conditions. When larger data sets are available, the frequency of standards/guidance exceedances is calculated.
** In lakes if no fecal coliform data are available, macrophyte cover is the only criterion used to assess the *Secondary Contact Recreational Use*.

For the *Primary* and *Secondary Contact Recreational* uses the following steps are taken to interpret the fecal coliform bacteria results:

1. Identify the range of fecal coliform bacteria counts,
2. Calculate the geometric mean (monthly, seasonally, or on dataset), (Note: the geometric mean is only calculated on datasets with >5 samples collected within a 30-day period.)
3. Calculate the % of sample results exceeding 400 cfu/100mL (*Primary*) or 2,000 cfu/100mL (*Secondary*),
4. Determine if the samples were collected during wet or dry weather conditions (review precipitation and streamflow data)
   - Dry weather can be defined as: No/trace antecedent (to the sampling event) precipitation that causes more than a slight increase in stream flow.
   - Wet weather can be defined as: Precipitation antecedent to the sampling event that results in a considerable increase in stream flow.
5. a. Apply the following to interpret dry weather data for *Primary Contact Recreation*:
   - ≤10% of the samples exceed criteria (step 2 and/or 3, above) - assess as Support,
   - 11-25% of the samples exceed criteria (step 2 and/or 3, above) - asses as Partial Support,
   - >25% of the samples exceed criteria (step 2 and/or 3, above) - assess as Non-Support.

   b. Apply the following to interpret dry weather data for *Secondary Contact Recreation*:
   - ≤10% of the samples exceed criteria (step 2 and/or 3, above) - assess as Support,
   - >10% of the samples exceed criteria (step 2 and/or 3, above) - assess as Non-Support.
6. Apply the following to interpret wet weather data for *Primary Contact Recreation*:
   - Dry weather samples meet criteria and all wet samples ≤2000 cfu/100mL - assess as Support,
   - Dry weather samples meet criteria and any wet samples >2000 cfu/100mL - assess as Partial Support.
7. Apply the following to interpret wet weather data for *Secondary Contact Recreation*:
   - Dry weather samples meet criteria and all wet samples ≤ 4000 cfu/100mL – assess as Support,
   - Dry weather samples meet criteria and any wet samples > 4000 cfu/100mL – assess as Partial Support.

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, partial support, non-support) of the *Aesthetics Use*.

Variable (# indicates reference)	***Support*** – 1. No objectionable bottom deposits, floating debris, scum, or nuisances; 2. No objectionable odor, color, taste or turbidity, or nuisance aquatic life	***Partial Support* -** Objectionable conditions neither frequent nor prolonged	***Non-Support*** – Objectionable conditions frequent and/or prolonged
Aesthetics (3)* Visual observation (4)	Criteria met	BPJ (spatial and temporal extent of degradation)	BPJ (extent of spatial and temporal degradation

* For lakes, the aesthetic use category is generally assessed at the same level of impairment as the more severely impaired recreational use category (*Primary* or *Secondary Contact*).

References

1. Coles, J.C. 1998.*Organochlorine Compounds in Fish Tissue from the Connecticut, Housatonic and Thames River Basins Study Unit, 1992-94.* National Water-Quality Assessment Program. U.S. Department of the Interior, U.S. Geological Survey. Marlborough, MA.
2. Environment Canada. 04 November 1999. Canadian Environmental Quality Guidelines. [Online]. Environment Canada. http://www.ec.gc.ca/ceqg-rcqe/tistbl_e.doc [28 September 1998].
3. MA DEP. 1996. (Revision of 1995 report). *Massachusetts surface water quality standards.* Massachusetts Department of Environmental Protection, Division of Water Pollution Control, Technical Services Branch. Westborough, MA (Revision of 314 CMR 4.00, effective June 23, 1996).
4. MA DEP. 1999. Open File. *Department of Watershed Management 305(b) Assessment* Guid*ance.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA
5. Persaud, D., R. Jaagumagi, and A. Hayton. 1993. *Guidelines for the protection and management of aquatic sediment quality in Ontario.* Water Resources Branch, Ontario Ministry of the Environment. Queen's Printer for Ontario. Canada.
6. USEPA. 1997. Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates: Supplement. Assessment and Watershed Protection Division (4503F), Office of Wetlands, Oceans and Watersheds, Office of Water, U.S. Environmental Protection Agency. Washington, DC.
7. USEPA. 19 November 1999. Federal Register Document. [Online]. United States Environmental Protection Agency. http://www.epa.gov/fedrgstr/EPA-WATER/1998/December/Day-10/w30272.htm.
8. MA DPH. 1999. *Freshwater Fish Consumption Advisory List.* The Commonwealth of Massachusetts, Bureau of Environmental Health Assessment. Boston, MA.
9. Kimball, W.A., 1996. Memorandum to 305(b) Committee. *Re: Small data sets/ wet weather data*. Massachusetts Department of Environmental Protection, Office of Watershed Management. Grafton, MA.
10. MA DPH. 1969. *Article 7 Regulation 10.2B of the State Sanitary Code.* Commonwealth of Massachusetts. Department of Public Health. Boston, MA.
11. Churchill, N. 1999. Personal Communication. *Shellfish Project Classification Area Information as of 1 January 1999.* Department of Fisheries, Wildlife, and Environmental Law Enforcement, Division of Marine Fisheries. Pocasset, MA.
12. USEPA. 1999. *1999 Update of Ambient Water Quality Criteria for Ammonia.* U.S. Environmental Protection Agency, Office of Water and Office of Science and Technology. Washington, D.C. an Office of Research and Development, Duluth, MN.

BOSTON HARBOR WATERSHED DESCRIPTION

The Boston Harbor Watershed (Figure 7) is set in and around historic Boston Harbor, and encompasses the Mystic River Subwatershed to the North, and the Neponset and Weymouth and Weir River subwatersheds to the south, as well as the Harbor coastline and all the Harbor Islands. Although the Boston Harbor Watershed is comparatively small in area, it is unique because it sustains over one-sixth of the state's population (approximately 1,070,578 people), more than any other watershed in Massachusetts. The Boston Harbor Watershed encompasses approximately 293 square miles of land area, and includes all or part of 45 municipalities, including most of downtown Boston. The Boston Harbor Watershed is approximately 34% urban, 27% forested, and 3% wetland/salt marsh (EOEA 2000).

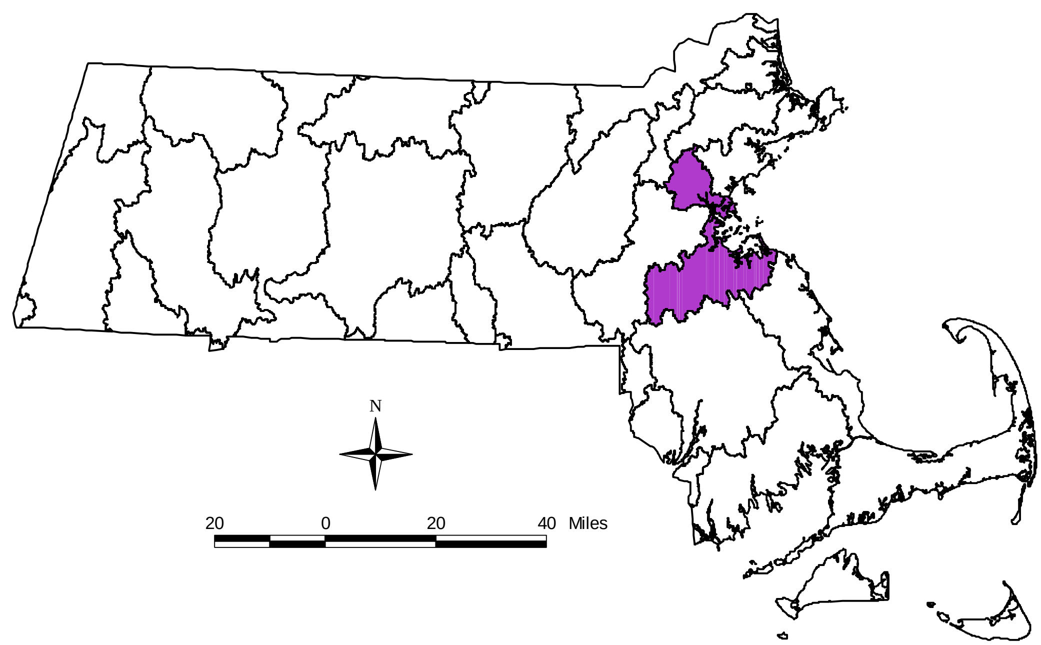

Figure 7. Location of the Boston Harbor Watershed.

MYSTIC RIVER SUBWATERSHED DESCRIPTION

The Mystic River Subwatershed (Figure 8) is bordered by the North Coastal Drainage Area to the Northeast, the Ipswich River Basin to the North, the Shawsheen River Basin to the Northwest, the Charles River Basin to the Southwest and by the Boston Harbor (Proper) Watershed to the Southeast. Nineteen communities (Arlington, Belmont, Boston, Burlington, Cambridge, Chelsea, Everett, Lexington, Malden, Medford, Melrose, Reading, Somerville, Stoneham, Wakefield, Winchester, Wilmington, Winthrop, and Woburn) lie within or partially within this subwatershed.

The headwaters of the Mystic River include the Aberjona River and Hall's Brook. The 17-mile Mystic River drains approximately 69 square miles and flows through the highly urbanized northern section of the Greater Boston area. Much of the basin is highly developed with considerable industrial and commercial activity. The outlet of Lower Mystic Lake is recognized as the beginning of the Mystic River. Horn Pond Brook in Woburn, Mill Brook in Arlington, and Alewife Brook in Cambridge contribute to the flows in the middle Mystic River. The river flows in a southeasterly direction, and is joined by the Malden River. In 1966, the Amelia Earhart Dam was built on the Mystic River just downstream from its confluence with the Malden River. After the Mystic River flows past the Charlestown piers, and under the Tobin Memorial Bridge, it is joined by the Chelsea River and then enters Boston Inner Harbor. Chelsea River is tidal and flows from Mill Creek, through Revere, Chelsea and East Boston, finally emptying into the Inner Harbor.

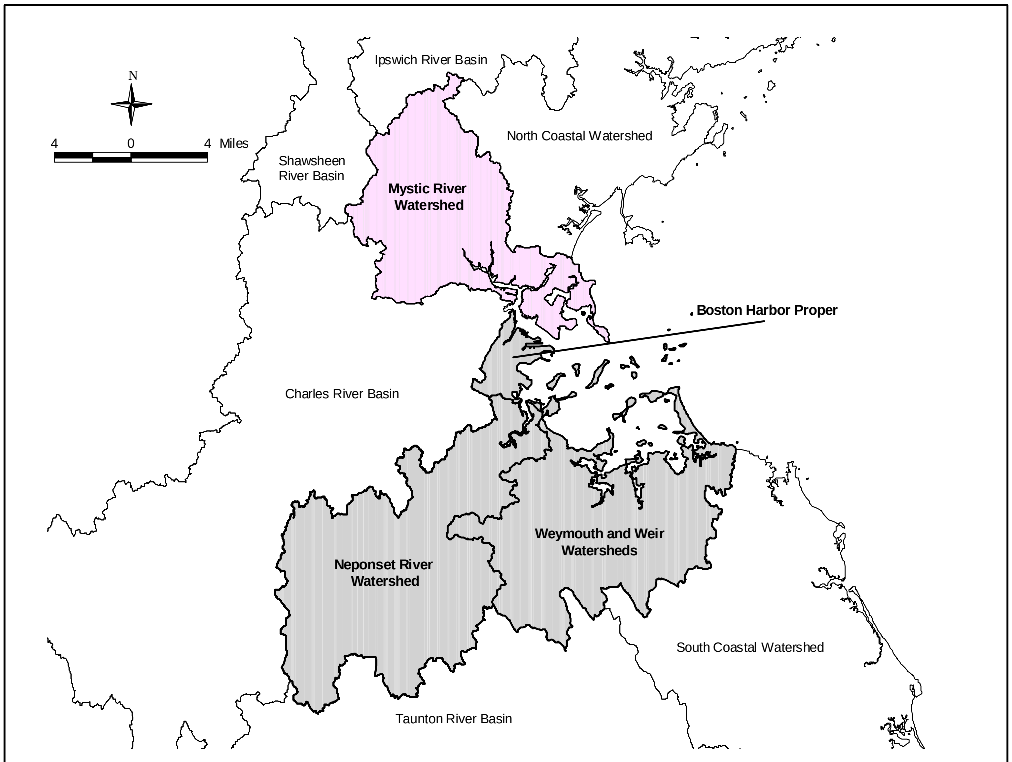

Figure 8. Location of the Mystic River Subwatershed

Recent dredging projects in the Mystic River Subwatershed include the Mystic River (to a depth of 40 feet) and the Moran Terminal, which is used exclusively for shipping automobiles (located just upstream of the Tobin Bridge, on the Mystic River, to 40 feet). Chelsea Creek is the designated port area for the off-loading of the vast majority of petroleum products (including liquefied natural gas) entering Boston Harbor. Eastern Minerals Salt Company, which provides road salt to most of the towns in Massachusetts, also has a facility located on Chelsea Creek. Chelsea Creek is a designated port area and as such recreational boating is not allowed. Recently, industries have left the Chelsea Creek area, providing open space to the adjacent communities. This has spurred grass roots organizations to call for the port area designation to be removed from this waterbody.

Currently there is one Area of Critical Environmental Concern (ACEC) partially located within the Mystic River Subwatershed, the Rumney Marshes. Rumney Marshes was officially designated as an ACEC on 22 August 1988 and lies within the towns/cities of Boston, Lynn, Revere, Saugus, and Winthrop. At least five species listed by Massachusetts as endangered, threatened, or of special concern have been recorded here. The US Fish and Wildlife Service characterized this area as "one of the most biologically significant estuaries in Massachusetts north of Boston" (DEM August 2000).

NEPONSET RIVER SUBWATERSHED DESCRIPTION

The Neponset River Subwatershed (Figure 9) is located in the western portion of the Boston Harbor Watershed. Fourteen communities (Boston, Canton, Dedham, Dover, Foxborough, Medfield, Milton, Norwood, Quincy, Randolph, Sharon, Stoughton, Walpole, and Westwood) lie within or partially within the area drained by the Neponset River.

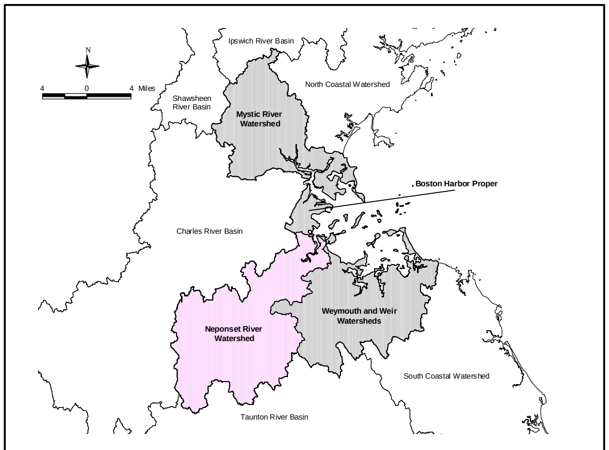

Figure 9. Location of the Neponset River Subwatershed

The Neponset River Basin borders the city of Boston on the north and Quincy on the south; it drains a watershed of 123 square miles. The headwaters of the Neponset River originate in Foxborough at Neponset Reservoir, a manmade impoundment of 272 acres. The river generally flows in a northeasterly direction and after traveling approximately 30 miles empties into Dorchester Bay. The river is impounded by 12 dams and passes through several mills and private reservoirs. The East Branch is the major tributary to the mainstem Neponset River. Mother Brook, a man-made diversion, conveys Charles River flow to the Neponset River. Most of the Neponset River is a fresh water stream. However, after the impoundment in Milton, by the Walter Baker Dam, the river becomes tidal. The first dam on the Neponset River was constructed by Israel Stoughton in 1633 (NepRWA undated). The river has a strong industrial history predating the Industrial Revolution and was used to power textile, paper, and lumber mills, in manufacturing processes, and for the disposal of by-products and wastes (NepRWA 2001b).

There are 64 lakes and ponds in the Neponset River Subwatershed, which have a total area of 1,935 acres. The largest lake in the basin is Massapoag Lake in Sharon, which is 353 acres.

Currently, there are two designated ACEC's in the Neponset River Subwatershed, the Neponset River Estuary ACEC and the Fowl Meadow and Ponkapoag Bog ACEC. The Neponset River Estuary ACEC in Boston, Milton, and Quincy was officially designated as an ACEC on 27 March 1995. The ACEC encompasses approximately 1,300 acres. Approximately 80% of the ACEC consists of floodplains and two-thirds of the ACEC is composed of open water, salt marsh, and other wetland resource areas. The Neponset River Estuary ACEC supports valuable anadromous fishery habitat, soft-shell clam beds, commercially and recreationally important finfish species, and numerous bird species. The Fowl Meadow and Ponkapoag Bog ACEC was officially designated on 20 August 1992 and encompasses approximately 8,350 acres in Boston, Canton, Dedham, Milton, Norwood, Randolph, Sharon, and Westwood. Several municipal public wells within this ACEC provide water to Canton, Dedham, and Westwood. At least 13 state-listed rare species occur in the ACEC. The National Park Service has designated the northern Fowl Meadow area and Ponkapoag Bog as a National Environmental Study Area (MA DEM August 2000).

WEYMOUTH AND WEIR SUBWATERSHED DESCRIPTION

The Weymouth and Weir Subwatershed (Figure 10) is located in the southeast region of the Boston Harbor Watershed. The following sixteen communities lie within or partially within the areas drained by the Weymouth and Weir Rivers: Abington, Avon, Braintree, Brockton, Canton, Cohasset, Hingham, Holbrook, Hull, Milton, Norwell, Quincy, Randolph, Rockland, Stoughton, and Weymouth.

This Subwatershed is comprised of five systems; Furnace Brook, Town River, Weymouth Fore River, Weymouth Back River and Weir River. Furnace Brook flows northeast draining to Quincy Bay, and the remaining four rivers flow generally northeast to Hingham Bay. The Weymouth Fore and Weymouth Back Rivers are both tidal.

Furnace Brook is a 2.7-mile brook located in Quincy. The brook flows northeasterly to Blacks Creek, and then into Quincy Bay. The Town River System originates as Town Brook in the Blue Hills. The brook flows 3.2 miles from the Old Quincy Reservoir through downtown Quincy to the Town River. The Town River then flows into Town River Bay, which joins with the Weymouth Fore River at Germantown Point, before flowing into Hingham Bay.

The Weymouth Fore River System originates at Lake Holbrook in Holbrook, and flows northerly as the Cochato River for 4.0 miles. The Farm River, a 2.7-mile river beginning in Milton, joins the Cochato River in Braintree to form the Monatiquot River. The Monatiquot River, considered the mainstem, flows north then east for a total of 4.3 miles to the Weymouth town line where the river becomes a tidal estuary and is called the Weymouth Fore River. Several of the tributaries that contribute to the rivers flow are: Lee Brook, Glovers Brook, Tumbling Brook, and Cranberry Brook. The Cranberry Brook Watershed ACEC in Braintree and Holbrook was officially designated as an ACEC on 28 July 1983. The ACEC encompasses approximately 1050 acres and includes wooded swamps, a marsh, pond, stream and two quaking sphagnum bogs. The bogs contain two carnivorous indigenous plant species, the sundew and pitcher plant. The watershed contributes high-quality water to Richardi Reservoir, which supplies water for Braintree, Holbrook, and Randolph (MA DEM August 2000).

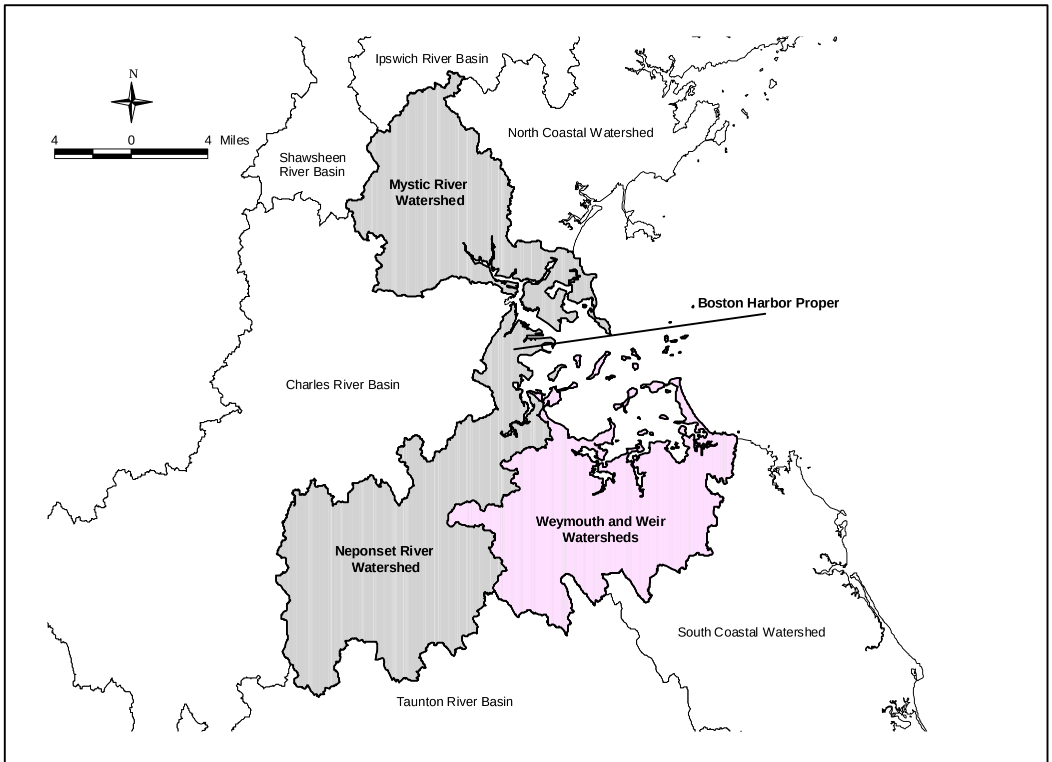

Figure 10. Location of the Weymouth and Weir Subwatershed.

The Weymouth Back River System is to the east of the Weymouth Fore River, and the hydrology parallels that of the Weymouth Fore River. The Old Swamp River originates in Rockland and flows northerly for 4.4 miles to the southern shore of Whitmans Pond, Weymouth. The Mill River originates at the outlet of Weymouth Great Pond and flows 3.5 miles to the western shores of Whitman Pond. The Weymouth Back River originates at the outlet of Whitmans Pond. It flows northerly under a network of streets and intersections for 0.8 miles to the Weymouth Back River estuary, forming the town line between Weymouth and Hingham. The Weymouth Back River ACEC in Hingham and Weymouth was officially designated as an ACEC on 10 September 1992. Fresh River (Hingham), Weymouth Back River (Weymouth), Brewer Pond (Hingham), Bouve Pond (Hingham), Whitman's Pond (Weymouth), Bear Swamp (Hingham) and Herring Brook (Weymouth) are all included within the boundaries of this 950-acre ACEC. Approximately 180 acres are tidal waters flushing into Hingham Bay and serve as shellfish areas and nursery grounds for finfish. Alewives and smelt return to this ACEC to spawn (MA DEM August 2000).

The final subwatershed is the Weir River System, the easternmost of the five rivers. The Weir River is formed at the confluence of Crooked Meadow River and Fulling Mill Brook, and flows 2.8 miles to its tidal portion in Hingham. This system is comprised of the Plymouth, Crooked Meadow and Weir Rivers. Tributaries to these rivers include Accord, Norroway, and Tumbling brooks and the Eel River. The Weir River ACEC in Cohasset, Hingham, and Hull was designated as an ACEC on 11 December 1986 and includes approximately 950 acres. This area supports over 100 species of migratory and resident bird species, as well as an abundance of shellfish and finfish. Abutting the ACEC are two recreationally important areas, a designated barrier beach (Nantasket Beach) and World's End Park (MA DEM August 2000).

BOSTON HARBOR (PROPER) DESCRIPTION

The Boston Harbor (Proper) is located on the eastern coast of Massachusetts (Figure 11). It is bordered by the Charles River Basin to the north and west, the Taunton River Basin to the south and by the South Shore Coastal Drainage Area to the southeast. Boston Harbor Proper (the marine portion of this watershed) includes shoreline areas of Boston, Quincy, Hull and Chelsea. It extends south from the Chelsea River, east from the Charles River Dam, north from Hingham Bay and east from the confluence of the Neponset River with Dorchester Bay to a line connecting the Boston Lighthouse to Deer Island in Boston and Point Allerton in Hull. The harbor includes Fort Point Channel, Dorchester Bay with an area of 809 ha (2,000 acres), Quincy Bay 4,452 ha (11,000 acres), Hingham Bay, 1,821 ha (4,500 acres) and Hull Bay, 567 ha (1,400 acres).

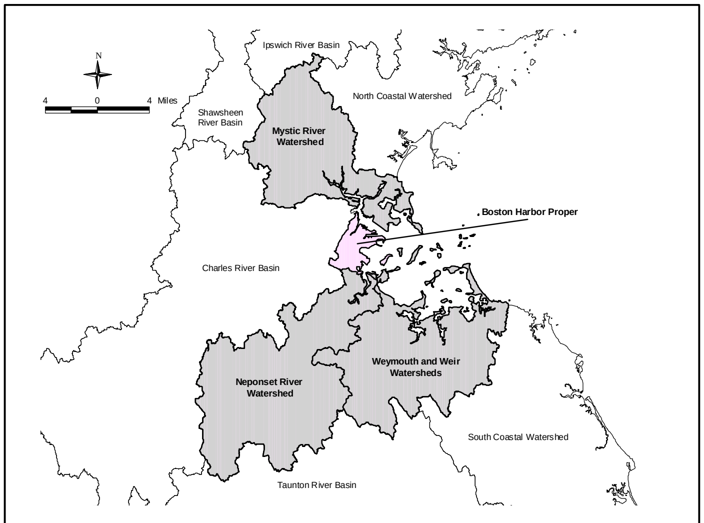

Figure 11. Location of the Boston Harbor (Proper)

The Harbor Islands State Park is comprised of 17 of the 34 Boston Harbor Islands, which range in size from less than one acre to greater than 200 acres. Together, the islands total approximately 1,600 acres. The Boston Harbor Islands Park was designated a national recreation area in 1996. Many of the islands are drumlins or glacier formed, asymmetrical, elongate masses forming sloped hills or bedrock outcroppings (Boston Harbor Islands 2002). Historical and recreational information for the Boston Harbor Islands can be found at http://www.bostonislands.org/.

The City of Boston and the Massachusetts Department of Environmental Management (MA DEM) jointly own Spectacle Island. Its original shape, two drumlins joined by a narrow sidebar, resembled a pair of spectacles and gave the island its name. Native Americans used the island to fish, harvest clams, and gather other food. After 1660, colonists used the island for pastureland and timber. Between 1717 and 1737, the island housed a quarantine hospital for patients with infectious diseases. In 1847, two resort hotels with casinos were built. Later uses included horse rendering and reclaiming grease from garbage. The City dumped garbage on the island until 1959. Leachate from the landfill contributed to harbor pollution. In 1978, DEM acquired a privately owned portion of Spectacle Island. Throughout the 1980s, extensive planning and permitting resulted in an agreement to deposit 3.6 million cubic yards of filling and excavated materials from the Central Artery/Tunnel (CA/T) project on the island. Spectacle Island will be the water-transportation hub and orientation center for information about the Boston Harbor Island National Park Area. Spectacle Island Park, which will include a visitor's center, two sandy beaches, a marina, and spectacular 360-degree views of Boston Harbor, will be managed by a partnership including the City, MA DEM, New England Aquarium, Modern Continental, and the University of Massachusetts Urban Harbors Institute (City of Boston 2000b).

Boston Harbor receives the drainage, including waste discharges, from four major coastal streams – the Mystic, Charles, Neponset and the Weymouth Fore Rivers. It also receives discharges from the entire waterfront and minor tributary areas extending from Winthrop to Hull. The total flow from tributary streams averages 350 cfs during the summer. This flow is very low compared to the daily inflow of salt water during tidal flushing, which averages 320,000 cfs for a six-hour period.

Boston Harbor is a vital seaport, shipping and receiving more than a million metric tons of containerized cargo, more than 32 million metric tons of bulk cargo (12 million in petroleum products), and more than 120,000 cruise passengers per year. As the trend in constructing larger ships continues, dredging of

Boston Harbor is performed to maintain access to the Inner Harbor by these deep draft vessels. Recent projects have dredged the Reserved Channel.

Logan Airport is a dominant feature of Boston Harbor. In 1923, the Boston Airport was opened on 189 acres on Jeffries Point in East Boston. In 1928, the ownership of the airport passed from the US Army to the Massachusetts Legislature. The Legislature renamed the airport Lt. General Edward Lawrence Logan Airport in 1956. The airport's history has been one of almost constant expansion. More than 2,200 acres of Boston Harbor has been filled in (including Bird Island Flats) to expand the airport to its present size of 2,400 acres. Today. Logan is the nation's 17th busiest airport. In 2000, Logan documented 478,873 flight operations, 27,412,926 airport passengers, and 853,347,154 pounds of freight and mail. Logan Modernization, a $1 billion program, includes first, the Logan Landside program, which involves structural changes to the airport and the second is the Logan Airside program, which involves various alternatives for reducing current and projected levels of aircraft delay and enhancing operational safety at Logan. The Landside portion of the program includes the expansion and improvement of Terminal E (to be completed in 2003), construction and opening of a new hotel in 1999, addition of a new garage, new airport roadways (to be completed in 2003), and a new jet fuel distribution and storage system that was completed in 1999. The Airside portion includes the construction of a new uni-direction over-the-water runway, centerfield taxiway, and reduced minimum approaches (MassPort 2002).

The "Big Dig", officially known as the Central Artery Tunnel project, is designed to reconstruct portions of I-93 (the Central Artery) and I-90 (the Ted Williams Tunnel). The entire project will create approximately 7.5 miles of road and tunnel, at an estimated cost of more than 14 billion dollars. The CA/T began in 1981 with a MA DPW Feasibility Assessment. Actual construction began in September of 1991, with the groundbreaking for the Ted Williams Tunnel, and the entire project is scheduled to be completed in 2004. The Ted Williams Tunnel, running from South Boston to Logan Airport, was completed in December of 1995. The Leverett Circle Connector Bridge, carrying traffic over the Charles River, was completed in October of 1999. Four other "milestones" are yet to be achieved. They are:

- The I-90 Extension, which will extend the MassPike from South Boston to the Ted Williams Tunnel. This extension is to be completed in September of 2002.
- The Northbound Central Artery, which will allow underground passage of northbound vehicles from the Leonard P. Zakim Bunker Hill Bridge. This artery is to be completed by November 2002.
- The Southbound Central Artery, which will allow underground passage of northbound vehicles from the Leonard P. Zakim Bunker Hill Bridge. This artery is to be completed by November 2003.
- The demolition of the Elevated Central Artery, which will complete the project. This demolition will allow for the construction of 27-acres of open space. The entire project is scheduled for completion in December 2004.

More than one million cubic yards of clays, dredged from the construction of the Ted Williams Tunnel, have been dumped into the Stellwagen Basin in the outer harbor. As part of the mitigation response to this action, and others, the City of Boston was required to remediate 18-acres of Rumney Marsh in Revere. Approximately 300,000 cubic yards of sand (dumped in the marsh in the 1960s) was removed and used on the CA/T and other projects. Tidal waters once again flow in and out of the marsh, and estuarine vegetation has begun to return.

Also, excavated materials from the tunnel, and the central artery have been dumped onto Spectacle Island. The footprint of the island has increased, and filled in approximately 1.6 acres of blue mussel (*Mytilus edulis*) beds. The US Army Corps of Engineers (ACOE) permitted the deposition of fill and required the City of Boston to construct a two-acre artificial reef to mitigate the loss of existing mussel beds. This reef is located in the Sculpin Ledge Channel (between Spectacle and Long Islands). The reef consists of a series of concrete tiered panels, and cobble/boulder patch reefs (Big Dig 2000).

CLASSIFICATION

The designation of Outstanding Resource Waters (ORW) is applied to those waters with exceptional socio-economic, recreational, ecological and/or aesthetic values (MA DEP 1995). 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 and 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 and those protected by special legislation (MA DEM 1993). Wetlands that border ORWs are designated as ORWs to the boundary of the defined area.

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

Consistent with the National Goal Uses of "fishable and swimmable waters", the classification of waters in the Boston Harbor Watershed according to the 1998 SWQS, include the following (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			
Mystic River Subwatershed	**Neponset River Subwatershed**	**Weymouth and Weir River Subwatershed**	**Boston Harbor Proper**
North Reservoir, Middle Reservoir, and South Reservoir, source to outlet in Winchester, Stoneham, Medford, and those tributaries thereto Fresh Pond, source to outlet in Cambridge and those tributaries thereto	None	Great Pond, source to outlet in Braintree and those tributaries thereto Upper Reservoir, source to outlet in Braintree and those tributaries thereto Whitmans Pond, source to outlet in Weymouth and those tributaries thereto Richardi Reservoir, source to outlet in Braintree and those tributaries thereto Weymouth Great Pond, source to outlet in Weymouth and those tributaries thereto Accord Pond, source to outlet in Hingham and those tributaries thereto Accord Brook, outlet of Accord Pond to water supply intake and those tributaries thereto	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			
Mystic River Subwatershed	**Neponset River Subwatershed**	**Weymouth and Weir River Subwatershed**	**Boston Harbor Proper**
Aberjona River, source to outlet Mishawum Lake (CSO)* Aberjona River, outlet Mishawum Lake to inlet Mystic Lake (CSO)* Upper Mystic Lake (CSO)* Lower Mystic Lake (CSO)* Mystic River, outlet Lower Mystic Lake to Amelia Earhart Dam (CSO)* Malden River, entire length Alewife Brook, entire length* Horn Pond, Woburn	Neponset Reservoir, Upstream of dam at outlet of Crackrock Pond (High Quality Water) Neponset River, source to Mother Brook Neponset River, Mother Brook to Milton Lower Falls Dam, Milton/Boston (CSO)*	Weymouth Fore River, Weymouth Back River (ORW), Fresh River, (ORW) Weir River, (ORW), Cranberry Brook, (ORW) Cranberry Pond, source to outlet in Braintree (ORW) Bouve Pond and Brewer Pond in Hingham (ORW) Straits Pond in Hull and Cohasset (ORW)	None

* In the 2002 update of the SWQS, the CSO designation for the Aberjona River, the Mystic Lakes, and the Neponset River will be removed. Additionally, a CSO Variance designation will be added to Alewife Brook and the Mystic River (Brander 2002).

"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."

Class SA Waters			
Mystic River Subwatershed	**Neponset River Subwatershed**	**Weymouth and Weir River Subwatershed**	**Boston Harbor Proper**
Belle Isle Inlet, and tributaries thereto (ORW)	None	Weymouth Back River, (ORW) Weir River	Quincy Bay, in Quincy from Bromfield Street near Wallaston Yacht Club northerly to buoy "C 1" southeasterly to the "Willows", sometimes known as Lord's Point on the northerly shore of Hough Neck in Quincy (CSO)* Hingham Harbor, in Hingham inside a line from Crows Point to Worlds End Promontory

* In the 2002 update of the SWQS, the CSO designation for Quincy Bay will be removed (Brander 2002).

“Class SB – These waters are designated as 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.”

Class SB Waters			
Mystic River Subwatershed	**Neponset River Subwatershed**	**Weymouth and Weir River Subwatershed**	**Boston Harbor Proper**
Mystic River, Amelia Earhart Dam to confluence with Chelsea River (CSO)*	Neponset River, Tidal portion (CSO)	Weymouth Fore River	Inside a line from the southerly tip of Deer Island to Boston Lighthouse to Point Allerton in Hull except as denoted below Boston Inner Harbor, westerly inside a line from the southern tip of Governors Island to Fort Independence including the Charles, Mystic, Island End, and Chelsea (Creek) Rivers and Reserved, Fort Point and Little Mystic Channels (CSO)* Dorchester Bay, (CSO)* Remainder of Quincy Bay, (CSO)* Hull Bay

* In the 2002 update of the SWQS, the CSO designation for Dorchester and Quincy bays will be removed. Additionally, Mystic River and Boston Inner Harbor will be designated SB/CSO (Brander 2002).

CSO-impacted Segments

A Combined Sewer Overflow (CSO) is any intermittent overflow, bypass, or other discharge from a municipal combined sewer/storm water system which results from a wet weather flow in excess of dry weather carrying capacity of the system. CSO designated segments are identified as being impacted by the discharge of combined sewer overflows. Overflows may be allowed by the permitting authority without a variance or partial use designation provided that:

a. an approved facilities plan under 310 CMR 41.25 provides justification for the overflows;
b. the Division finds through a use attainability analysis, and EPA concurs, that achieving a greater level of CSO control is not feasible for one of the reasons specified at 314 CMR 4.03(4);
c. existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected; and
d. public notice is provided through procedures for permit issuance or facility planning under M.G.L. c. 21 §§ 26 through 53 and regulations promulgated pursuant to M.G.L. c. 30A. In addition, the Division will publish a notice in the *Environmental Monitor*.

Other combined sewer overflows may be eligible for a variance granted through permit issuance procedures. When a variance is not appropriate, partial use may be designated for a segment after public notice and opportunity for a public hearing in accordance with M.G.L. c. 30A.

A CSO-impacted segment can be reclassified to B/SB (CSO), B (partial), C, or a CSO Variance can be issued only where a CSO facilities plan demonstrates that elimination of CSOs is not feasible. In those instances, the highest feasible level of CSO control must be implemented and the receiving water may be reclassified accordingly. The technical and cost information included in the CSO Facilities Plan forms the basis of these determinations and must support a Use Attainability Analysis where a downgrade to B (CSO), B (partial), or C is being considered. [NOTE: A B (CSO) designation only allows for “exceedances” of the B standard for CSO discharges and does not allow for other discharges to exceed the B standard.] A CSO Variance may be issued to allow continued discharge of CSOs while additional data and information are developed to make a final determination on the appropriate water quality standard and level of CSO control (Brander 2001a). In the Boston Harbor Watershed, the Massachusetts Water Resource Authority (MWRA), Boston Water and Sewer Commission, and the towns of Cambridge, Sommerville, and Chelsea are responsible for CSOs.

For those CSOs where elimination was determined to be infeasible, MWRA included information in its 1997 Final CSO Facilities Plan to support a Use Attainability Analysis (UAA) pursuant to 40 CFR Section 131.10 (g). A UAA is a scientific assessment of the technical and economic factors affecting attainment of a use which is conducted by the state and which supports removal of a National Goal Use based on criteria such as costs and impacts associated with attaining that use. The state submitted its final administrative determinations, including a UAA, to EPA for approval on 31 December 1997. On 27 February 1998, EPA approved the state's changes to water quality standards which included removal of CSO-impacted designations for the Neponset River, North Dorchester Bay, South Dorchester Bay, and Constitution Beach; an SB_{CSO} designation for Boston Inner Harbor; a B_{CSO} designation for the Muddy River; and a tentative determination for the issuance of a CSO Variance for the Lower Charles River Basin, Alewife Brook, and the Upper Mystic River (Brander 2001b).

For receiving waters designated SB_{CSO} (i.e., Boston Inner Harbor), the water quality standard is achieved when the discharger completes construction of the CSO abatement facilities in accordance with the approved Facilities Plan, and achieves the performance goals and water quality results defined in the Facilities Plan. This level of control, therefore, becomes the level of control necessary to attain the standard and becomes the basis for the permittee's requirements and discharge limits for each outfall to remain active in the receiving water.

For receiving waters designated SB (e.g., Dorchester Bay), no CSO discharges are authorized under the Massachusetts Water Quality Standards. Since the Facilities Plan demonstrated that the elimination of CSO discharges could feasibly be achieved through sewer separation, the water quality classification for Dorchester Bay is SB. However, at this time, there remain two CSO treatment facilities which discharge to Dorchester Bay, the Fox Point and Commercial Point CSO treatment facilities. These facilities have recently been upgraded by adding dechlorination and will remain active as interim CSO control facilities until the CSO separation projects recommended in the approved CSO facilities plan and mandated by the Federal Court are completed

On October 1, 1998, a two-year CSO Variance was issued to MWRA, Boston Water and Sewer Commission, and the Town of Cambridge and on 5 March 1999, a three-year CSO Variance was issued to MWRA and the Cities of Cambridge and Somerville, which authorize continued CSO discharges to the Charles River and the Alewife/Upper Mystic watershed. The purpose of the CSO Variance is to (1) require MWRA and the member CSO communities to expeditiously implement those CSO controls determined to be feasible and cost-effective in the 1997 approved CSO Facilities Plan, and (2) to allot additional time for the development of additional water quality data and technical information to support a final CSO abatement plan and associated water quality standard. The condition of the CSO Variance issued in Upper Mystic/Alewife Basin require the MWRA and member CSO communities to move forward with the recommended plan, further define storm water and CSO pollutant loads, and re-evaluate CSO controls. EPA and the MA DEP will review the additional information developed during the period of the CSO Variance, and after opportunity for public comment, determine whether a higher level of CSO control is feasible (Brander 2001b).

The Alewife/Upper Mystic Variance remains effective for three years to 5 March 2002 and may be extended at the discretion of the MA DEP with approval of EPA. MA DEP presently intends to extend the Alewife/Upper Mystic Variance for an additional 18 months, to September 5, 2003, to allow MWRA adequate time to properly prepare a final CSO assessment, and for the requisite public environmental review of the documents (Brander 2001b). It is also important to note that the Variance now requires MWRA to move forward with a $74 million CSO abatement program in the Alewife/Upper Mystic Basin. This program has been identified in the April 30, 2001 MWRA Notice of Project Change in lieu of the 1997 $12 million plan, since the combined sewer system and resulting CSO impacts were subsequently found to be far more extensive than previously known. A final determination on the ultimate level of CSO abatement required and the associated water quality standard will be made at the end of the Variance period.

SUMMARY OF EXISTING CONDITIONS AND PERCEIVED PROBLEMS

The Clean Water Act required that all communities in the United States upgrade their sewage treatment facilities to secondary treatment by 1977. The 301(h) provision in the Clean Water Act allowed municipalities to continue to discharge primary treated effluent to offshore receiving waters if the municipality could document that their discharge would do no environmental harm. In the late 1800s through the turn of the century, public health concerns led the Metropolitan District Commission (MDC) to construct sewer outfalls off Deer and Nut Islands. The Deer and Nut Island primary sewage treatment plants were completed in 1952 and 1969, respectively, eliminating most of the raw sewage discharges into the harbor. (Primary treatment involves the removal of total suspended solids, pathogens and toxic contaminants through settling lagoons or tanks.) In 1978, the MDC began funding scientific research to support its waiver application (under section 310(h) of the Clean Water Act) to build a large outfall at 35 meters depth in Massachusetts Bay. The initial waiver application was denied in 1983 and the MDC reapplied. While this waiver was under review, the Massachusetts Water Resource Authority (MWRA) was created. In March 1985, the EPA Regional Administrator denied the waiver application. In August 1985, the MWRA and EPA agreed that MWRA should build the Mass Bay outfall and that treatment of the effluent should be upgraded to full secondary treatment, which utilizes biological filtration to remove dissolved organic matter (Gallagher and Keay 1998). [Note: These facilities have now been constructed. MWRA now provides secondary treatment for wastewater flows and the treated effluent is discharged through a nine-mile outfall tunnel into Massachusetts Bay. Additional information on the Deer Island Treatment Plant is available online at the MWRA's website www.mwra.state.ma.us.]

Sanitary sewer overflows (SSO) are recognized as important topics across the entire Boston Harbor watershed since raw sewage discharges cause water quality violations in the receiving waters, including the Harbor. Excessive infiltration and inflow (I/I) into sanitary sewers are recognized as two of the leading problems contributing to the surcharging of sewers and overflows. In addition, excessive amounts of groundwater and storm water, as I/I, entering sewer systems designed specifically for sanitary wastewater contributes to depletion of clean water in the basin that could otherwise be utilized to replenish local surface water and groundwater public water supplies. Retention of this groundwater and storm water in the watershed could also enhance minimum stream flows necessary to support aquatic life and meet water quality standards (Chretien 2002).

The majority of the Boston Harbor watershed is developed and sewage is handled by municipal collection systems that predominantly discharge to the MWRA regional collection system. Because of the interconnection of the municipal and MWRA system, DEP has acknowledged that only a regional and cooperative effort concerning better collection system operation and maintenance and I/I reduction will effect results in the Boston Harbor Watershed (Chretien 2002).

As part of the Administrative Consent Order (ACO) with MWRA for the construction of the Braintree Weymouth Relief Facilities, MWRA agreed to establish an I/I Task Force with its member communities and other interested stakeholders including DEP. Task Force recommendations resulted from two years of meetings to help direct the activities of MWRA, municipalities, DEP, and EPA to cooperatively reduce the amount of extraneous clean water entering the regional sewer system. Implementation of these recommendations will require DEP involvement in ongoing workgroups and future workshops, such as the one on Private Inflow Redirection held in November 2001 (Chretien 2002).

DEP will be working with MWRA during 2002 to develop an Interagency Agreement to delineate responsibilities and schedules of activities to further improve the performance of the regional collection system. DEP, with EPA, has further encouraged regional collection system cooperation by including expanded provisions in the MWRA National Pollutant Discharge Elimination System (NPDES) Permit relating to collection system Operations & Maintenance (Chretien 2002).

MWRA CSO Plan
In 1987, through a Stipulation entered in the Boston Harbor Case (U.S. v. M.D.C., et al., No. 85-0489 (D. Mass)), MWRA accepted responsibility for developing a control plan to address CSO discharges from all CSOs hydraulically connected to the MWRA sewer system, including outfalls owned by the member communities. Under a Court-ordered schedule, MWRA developed a CSO Conceptual Control Plan in

1994, recommending more than 25 site-specific CSO projects located in Boston, Cambridge, Somerville and Chelsea. The CSO Conceptual Control Plan was later refined; and, on 31 July 1997, the MWRA filed a CSO Final Environmental Impact Report /Final Facilities Plan (FEIR/FFP) to the Massachusetts Environmental Policy Act (MEPA) office and MA DEP. Based on a review of this document and the comments received, a MEPA certificate for the project was issued on 30 October 1997 (Brander 2001b). Figure 12 includes a summary of the approved 1997 MWRA CSO Plan. The $581 million dollar Plan eliminates CSOs to all sensitive use areas and provides a high level of CSO control in all CSO receiving waters. The Plan is in the implementation phase and will proceed through 2008. Figure 13 notes the status of the work and CSO outfalls eliminated to date.

In 1996, design and construction milestones for the 25 projects in the Final CSO Plan were added to the Federal Court Schedule, requiring implementation of the projects from 1996 to 2008. MWRA is directly responsible for implementation of many of the projects and has negotiated agreements with three CSO communities (Boston Water & Sewer Commission, City of Cambridge, City of Somerville) for implementation of certain projects affecting the community systems. The facilities plan evaluated and selected abatement alternatives for each CSO and was conducted in accordance with EPA's National CSO Control Policy and DEP's Guidance for Abatement of Pollution from CSO Discharges (Brander 2001b).

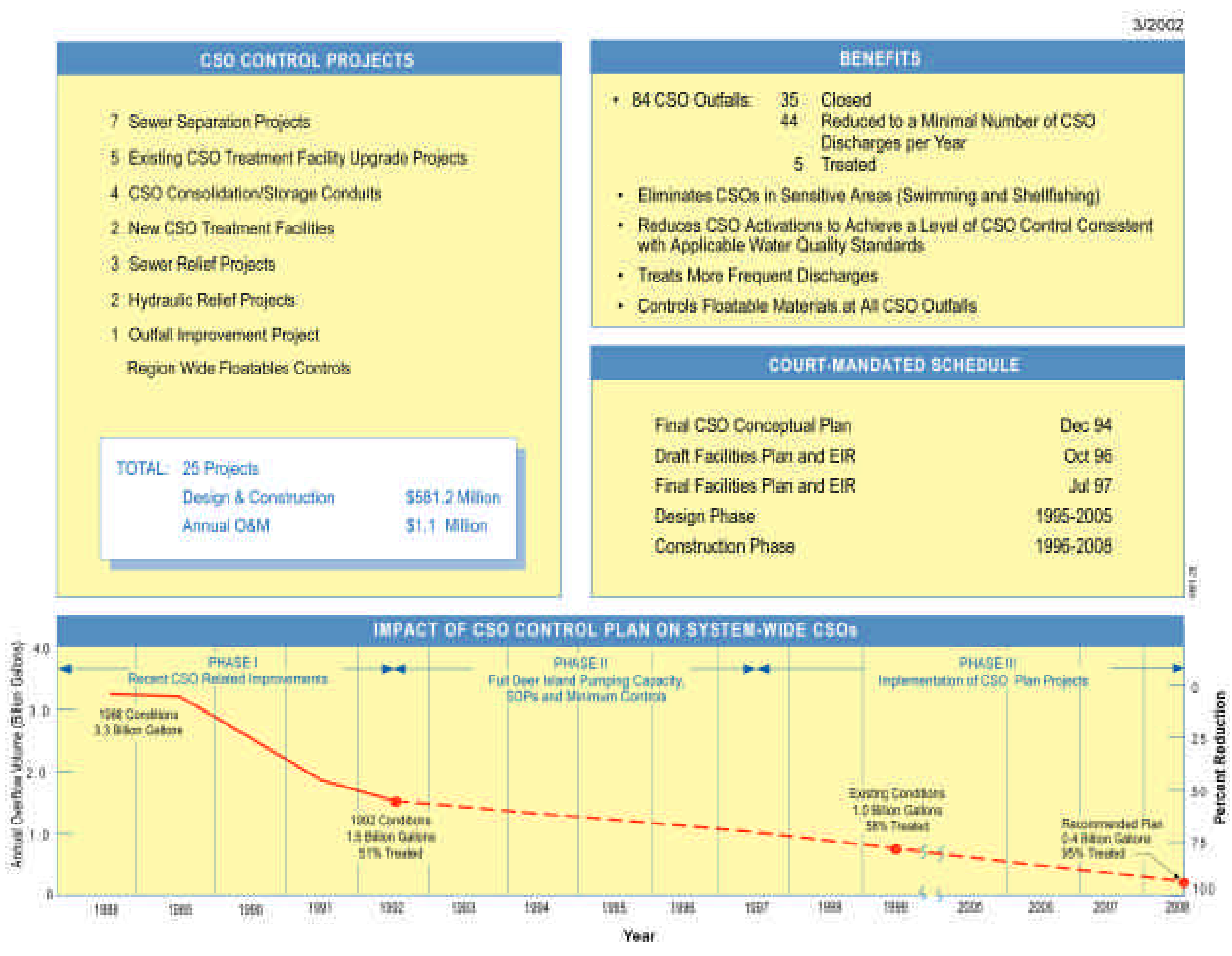

Figure 12. Summary of MWRA 1997 CSO Final Environmental Impact Report /Final Facilities Plan (FEIR/FPP). Graphic courtesy of Massachusetts Water Resources Authority.

Figure 13. MWRA System-Wide Recommended CSO Control Plan. Graphic courtesy of MWRA.

Between 1983 and 1985, the University of Massachusetts Water Resources Center Acid Rain Monitoring Project used as many as 1,000 citizen volunteers to collect and help analyze more than 40,000 samples from 2,444 lakes and 1,670 streams, respectively 87% and 69% of the named lakes and streams in the state. They also monitored a representative 453 randomly selected and 119 special interest lakes and streams for eight successive years (1985-1993) with approximately 300 volunteers. Results for the nearly comprehensive initial phases of the project show that 5.5% of lakes and streams in Massachusetts are acidified (pH < 5.0 and Acid Neutralizing Capacity (ANC) < 0 µeq/l); 57.4% were sufficiently low in acid neutralizing capacity to be considered threatened by acid deposition (0<ANC<200 µeq/l); and 37.1% were not threatened (ANC > 200 µeq/l). Spring samples contained an average of 45% more Hydronium ions (H^+) (pH 6.44 vs. 6.60) and 32% less ANC (257 vs. 376 µeq/l) than fall samples. Lakes were slightly more sensitive than streams. Geographically, higher ANC was typical of extreme western parts of the state and lower ANC was typical of the north-central and southeastern portions. Most lakes and streams exhibited no significant trend for the 10 years of the study. However, 70 of 330 streams showed statistically significant increases in ANC, 11 showed decreases, and 43 of 181 lakes increased in ANC while 7 decreased. Most of the streams and all of the lakes exhibiting statistically significant declines occurred in the southeastern portion of the state. Only three lakes and three streams became acidic (dropped below 0.0 ANC and pH 5.0) during the ten years of the study; five lakes and fifteen streams improved enough that they are no longer acidic (Godfrey *et al.* 1996).

In 2001 and 2002, the Acid Rain Monitoring Project will once again collect samples three times per year (April, July, and October) from approximately 150 lakes and ponds. Samples will be analyzed for pH, alkalinity, total phosphorus and ions. In the Boston Harbor Watershed five sites were sampled in 2001: Hemenway Pond and Pine Tree Pond in Milton, Upper Mystic Lake in Winchester, Ponkapoag Pond in Canton, and Blue Hills Reservoir in Quincy. Additional sites in the Boston Harbor Watershed that were selected but not sampled in 2001 include: Turners Pond in Melrose, Doleful Pond in Stoneham, South Walpole Street Pond in Sharon, Cranberry Pond in Foxborough, Hollingsworth Pond in Braintree, Elias Pond in Weymouth, and Weir River Street Pond in Hingham (Godfrey *et al.* 1996).

In 1994, 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 encompasses all freshwaters in Massachusetts and, therefore, the *Fish Consumption Use* cannot 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 2001b).

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 has expanded 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 2001b).

MDPH has issued specific advisories on multiple waterbodies in the Boston Harbor Watershed including (MDPH 2001a):

- Mystic River Subwatershed - Clay Pit Pond
- Neponset River Subwatershed - Neponset River and Willet Pond
- Weymouth and Weir River Subwatersheds - Cochato River, Icehouse Pond, and Sylvan Lake
- Boston Harbor Proper, including Quincy Bay (Celona 2001)

The Clean Water Act Section 303(d) requires states to identify those waterbodies that are not meeting Surface Water Quality Standards. Tables 2-5 list the waterbodies in the Boston Harbor Watershed that are on the 1998 Massachusetts Section 303(d) List Of Waters (MA DEP 1999a). Additionally, all freshwaters in Massachusetts are technically (by default) listed in 1998 as 303(d) waters with mercury as the associated stressor/pollutant due to the 1994 MDPH Interim Freshwater Fish Consumption Advisory. This Interim Freshwater Fish Consumption Advisory was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. MDPH's interim advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially (MDPH 1994).

The MDC Division of Watershed Management manages and protects the drinking water supply watersheds of Quabbin Reservoir, Ware River, and Wachusett Reservoir in central Massachusetts. The reservoirs supply water to the MWRA for distribution to nearly 2.2 million residents of Massachusetts, primarily in Greater Boston. The MDC also manages and protects the Sudbury Reservoir system, which is Greater Boston's emergency back-up water supply (MDC 2002).

Quabbin Reservoir was created in the 1930's to serve the growing needs of Eastern Massachusetts. The Windsor Dam was built to impound the Swift River and flood an area formerly occupied by four Massachusetts towns, Dana, Enfield, Greenwich, and Prescott**.** Construction on the Quabbin Reservoir began in 1936. Filling commenced on August 14, 1939 and was completed in 1946 when water first flowed over the spillway. The Quabbin Reservoir was filled with water from the Swift River and flood skimming from the Ware River during eight months of the year. At the time, the 412 billion gallon reservoir was the largest man-made reservoir in the world, which was devoted solely to water supply (MWRA 2002).

Water entering Quabbin takes up to four years to circulate and enter the main intake. To reach faucets in Boston, Quabbin Water is released down the 25-mile-long Quabbin Aqueduct to replenish Wachusett Reservoir at Oakdale where it then circulates for eight months before being drawn disinfected at the Cosgrove Intake in Clinton. The water then passes through pipes under the Sudbury Reservoir to Southborough, where fluoride, sodium carbonate (soda ash) and CO_2 (carbon dioxide) are added. The water continues through the Hultman Aqueduct (85% of water) or the Weston Aqueduct (the other 15%), emptying into the Norumbega and Weston Reservoirs. It is then piped into Boston for distribution (MWRA 2002). MWRA is currently building the Walnut Hill Treatment Plant in Marlborough. Once it is completed, the Norumbega and Weston Reservoirs will either be covered or removed from the system and the treated water will be piped from the Walnut Hill Treatment Plant into Boston.

The MetroWest Water Supply Tunnel is a 17.6-mile aqueduct that is being bored through solid bedrock 200 to 500 feet below the communities of Southborough, Marlborough, Framingham, Wayland and Weston. This new tunnel, on schedule for completion in 2003, will greatly improve water transmission reliability and redundancy. When complete in 2003, the MetroWest Water Supply Tunnel will increase the water delivery system's overall capacity by 450 million gallons per day. It will also link MWRA's reservoirs, water treatment, and storage facilities to the City Tunnel and local distribution pipes and to the people that they serve (MWRA 2002).

MYSTIC RIVER SUBWATERSHED

The Mystic River has had significant water quality problems including chemicals leaching from waste disposal sites, contaminated sediments, excessive nutrient inputs, elevated bacteria levels, and storm water runoff. Many of these conditions still prevail today.

Excerpted from the EPA New England National Priorities List (NPL) Fact Sheet (EPA 2001a):

> The Industri-Plex site is a 245-acre industrial park {located within the Aberjona River subwatershed} that from 1853 to 1931 was used for manufacturing chemicals (e.g., lead-arsenic insecticides, acetic acid, and sulfuric acid) for local textile, leather, and paper manufacturing industries. Chemicals manufactured by other industries at the site include phenol, benzene, and toluene. From 1934 to 1969, the site was used to manufacture glue from raw animal hide and chrome-tanned hide wastes. The by-products and residues from these industries caused the soils within the site to become contaminated with elevated levels of metals, such as arsenic, lead and chrome. From 1969 to 1980, the site was developed for industrial use. Excavation in the 1970's uncovered and mixed industrial by-products and wastes accumulated over 130 years. During this period, residues from animal hide wastes used in the manufacture of glue were relocated on-site from buried pits to piles near swampy areas on the property. Many of the animal hide piles and lagoons on-site were leaching toxic metals into the environment. In the 1980's, the site contained streams and ponds, a warehouse and office buildings, remnant manufacturing buildings, and hide waste deposits buried on the site. Animal hide residues are found on approximately 20 acres of the site in four different piles. Portions of the animal hide piles sloughed off, causing the release of hydrogen sulfide gases to the atmosphere and toxic metals to surrounding wetlands. Residences are located within 1,000 feet of the site,

and more than 34,000 people live within three miles of the site.

Excerpted from the EPA New England National Priorities List (NPL) Fact Sheet (EPA 2001b):

Wells G & H were two municipal wells developed in 1964 and 1967 to supplement the water supply of the City of Woburn. The wells supplied 30 percent of the city's drinking water. In 1979, city police discovered several 55-gallon drums of industrial waste abandoned on a vacant lot near the wells; subsequently these drums were removed. As a result of this discovery, the nearby wells were tested and found to be contaminated. Both of the wells were shut down in 1979 and a supplemental water supply arranged for the city. Five separate properties on the site were found to be the contributing sources of contamination to the aquifer that supplied the water to these two municipal wells. The total Superfund site covers an area of 330 acres. The population of Woburn is approximately 36,600 people. The area surrounding the site is predominantly light industrial and residential. Some nonresidential properties involved in the cleanup are fenced to limit unauthorized access. The site includes commercial and industrial parks, as well as recreational areas and some residential gardens. The Aberjona River flows through the middle of the site. Surface water runoff from the site is directed through drainage systems toward the river and its tributaries.

Numerous waterbodies in the Mystic River Subwatershed are currently included in the States 303 (d) List of Impaired Waters due to nutrients, organic enrichment/Low DO, pathogens, and noxious aquatic plants (Table 2).

Table 2. 1998 303(d) List of Impaired Waters: Mystic River Subwatershed

Name (WBID)	Description	Cause of Impairment
Bellevue Pond (MA71004)	Medford	Noxious Aquatic Plants
Black Nook (MA71005)	Cambridge	Nutrients, Noxious aquatic plants
Clay Pit Pond (MA71011)	Belmont	Pesticides
Ell Pond (MA71014)	Melrose	Nutrients, Pathogens, Suspended solids
Horn Pond (MA71019)	Woburn	Nutrients, Organic enrichment/Low DO, Noxious aquatic plants
Judkins Pond (MA71021)	Winchester	Nutrients, Organic enrichment/Low DO, Pathogens
Spy Pond (MA71040)	Arlington	Nutrients, Organic enrichment/Low DO, Noxious aquatic plants
Wedge Pond (MA71045)	Winchester	Nutrients, Noxious aquatic plants
Winter Pond (MA71047)	Winchester	Noxious aquatic plants
Chelsea River (MA71-06)	Confluence with Mill Creek to confluence with Mystic River	Unionized Ammonia, Organic enrichment/Low DO, Pathogens, Oil and grease, Taste, odor, and color, Turbidity
Mystic River (MA71-03)	Amelia Earhart Dam to confluence with Chelsea River (Includes Island End River)	Unionized Ammonia, Organic enrichment/Low DO, Pathogens, Oil and grease, Taste, odor, and color, Turbidity
Alewife Brook (MA71-04)	Little Pond, Belmont to confluence with Mystic River, Arlington/Somerville	Pathogens
Mystic River* (MA71-02)	Outlet Lower Mystic Lake, Arlington to Amelia Earhart Dam, Somerville	Metals, Nutrients, Pathogens
Malden River* (MA71-05)	Headwaters, Malden to confluence with Mystic River, Everett/Medford	Organic enrichment/Low DO, Pathogens, Suspended Solids
Aberjona River* (MA71-01)	Source in Reading to inlet Upper Mystic Lake, Winchester	Unionized Ammonia, Organic enrichment/Low DO, Pathogens

*needs confirmation (additional data collection is necessary to confirm the presence of impairment)

NEPONSET RIVER SUBWATERSHED

Historically industry, including many textile, paper, and lumber mills, thrived along the Neponset River. It was not long before the river gained a justly deserved reputation as highly polluted, with numerous untreated sewage and industrial discharges. Although the water quality problems were recognized in the late 1800's, it was not until the passage of state and federal legislation in the 1960's and 1970's that water quality issues were more seriously addressed. Today, the seventeenth, eighteenth, and nineteenth century mills have closed, connected to the sewer system, or installed waste treatment facilities. Great improvements have been made in the management of residential wastewater as well. While the Neponset River subwatershed has experienced dramatic improvements in water quality, "streamflow" or water quantity has not received as much attention, and it has become an issue of critical concern as communities continue to divert more water from aquifers and the river (NepRWA undated).

In the Neponset River Subwatershed, 38 waterbodies are listed on the States 303 (d) List of Impaired Waters. Sixteen of the 20 lakes included on the list are impaired due to noxious aquatic plants and 16 of the 18 river/estuaries are impaired due to pathogens (Table 3).

Table 3. 1998 303(d) List of Impaired Waters: Neponset River Subwatershed

1998 303(d) Listed Waterbody		Cause of Impairment
Bird Pond (MA73002)	Walpole	Priority organics, Noxious aquatic plants
Russell Pond (MA73003)	Milton	Noxious aquatic plants, Turbidity
Bolivar Pond (MA73005)	Canton	Turbidity
Cobbs Pond (MA73009)	Walpole	Noxious aquatic plants
Crackrock Pond (MA73010)		Noxious aquatic plants
Diamond Pond (MA73012)	Walpole	Noxious aquatic plants
Flynns Pond (MA73019)	Medfield	Noxious aquatic plants
Forge Pond (MA73020)	Canton	Turbidity
Lymans Pond (MA73021)	Westwood	Noxious aquatic plants
Hammer Shop Pond (MA73023)	Sharon	Noxious aquatic plants
Manns Pond (MA73028)	Sharon	Turbidity
Neponset Reservoir (MA73034)	Foxborough	Noxious aquatic plants, Turbidity
Ganawatte Farm Pond (MA73037)	Walpole/Sharon/Foxborough	Noxious aquatic plants
Farrington Pond (MA73040)	Stoughton	Noxious aquatic plants
Plimpton Pond South (MA73042)	Walpole	Priority organics, Flow alteration
Popes Pond (MA73044)	Milton	Noxious aquatic plants, Turbidity
Woods Pond (MA73055)	Stoughton	Noxious aquatic plants
Town Pond (MA73056)	Stoughton	Noxious aquatic plants
Turners Pond (MA73059)	Milton	Turbidity
Memorial Pond (MA73064)	Walpole	Noxious aquatic plants, Turbidity
Mother Brook (MA72-13)	Mother Brook Dam, Dedham to confluence with Neponset River, Boston	Nutrients, Organic enrichment/Low DO, Pathogens
Neponset River (MA73-01)	Outlet of Neponset Reservoir, Foxborough to confluence with East Branch, Canton	Priority organics, Metals, Nutrients, Siltation, Organic enrichment/Low DO, Pathogens, Suspended solids, Noxious aquatic plants, Turbidity
Neponset River (MA73-02)	Confluence with East Branch, Canton to confluence with Mother Brook, Boston	Priority organics, Metals, Organic enrichment/Low DO, Pathogens, Oil and grease, Turbidity
Neponset River (MA73-03)	Confluence with Mother Brook, Boston to Milton Lower Falls Dam, Milton/Boston	Priority organics, Metals, Organic enrichment/Low DO, Pathogens, Oil and grease
Neponset River (MA73-04)	Milton Lower Falls, Milton/Boston to mouth at Dorchester Bay, Boston/Quincy	Organic enrichment/Low DO, Pathogens, Turbidity
Gulliver Creek (MA73-30)	From the confluence Unquity Brook to confluence Neponset River, Milton	Pathogens
Unquity Brook (MA73-26)	Headwaters west of Randolph Ave to confluence with Gulliver Creek, Milton	Organic enrichment/Low DO, Pathogens
Pine Tree Brook (MA73-29)	Outlet of Pine Tree Brook Reservoir through Pope's Pond to confluence Neponset River, Milton	Organic enrichment/Low DO, Other habitat alterations, Pathogens

Table 3 (Continued). 1998 303(d) List of Impaired Waters: Neponset River Subwatershed.

1998 303(d) Listed Waterbody		Cause of Impairment
Ponkapoag Brook (MA73-27)	Outlet of Ponkapoag Pond to confluence with Neponset River, Canton	Pathogens
Purgatory Brook (MA73-24)	Headwaters, Westwood, to confluence with Neponset River, Norwood	Pathogens
Plantingfield Brook (MA73-23)	Headwaters east of Thatcher Street, Westwood, to the confluence with Purgatory Brook, Norwood	Flow alteration
East Branch (MA73-05)	Outlet Forge Pond, Canton to confluence with Neponset River	Cause unknown, Metals, Thermal Modification, Flow alteration, Pathogens
Pequid Brook (MA73-22)	Headwaters east of York Street through Reservoir Pond to the inlet of Forge Pond, Canton	Organic enrichment/Low DO, Pathogens
Massapoag Brook (MA73-21)	Outlet Hammer Shop Pond, Sharon, through Manns Pond, Trowel Shop Pond, and Shepard Pond to the inlet of Forge Pond, Canton	Cause Unknown
Beaver Brook (MA73-19)	Headwaters just were of Moose Hill Street through Sawmill Pond to confluence with Massapoag Brook, Sharon	Organic enrichment/Low DO
Beaver Meadow Brook (MA73-20)	Outlet of Glen Echo Pond, Stoughton, to the inlet of Bolivar Pond, Canton	Organic enrichment/Low DO, Pathogens
Traphole Brook (MA73-17)	Headwaters west of Everett Street, Sharon, to confluence with confluence with Neponset River, Sharon/Norwood	Pathogens
Hawes Brook (MA73-116)	Outlet of Ellis Pond to confluence with Neponset River, Norwood	Pathogens
Germany Brook (MA73-15)	Headwaters, east of Winter Street, to inlet of Ellis Pond, Norwood	Pathogens
Mine Brook (MA73-09)	Outlet of Jewells Pond, Medfield, to the inlet of Turner Pond, Walpole	Organic enrichment/Low DO
Mill Brook (MA73-08)	From Dover/Medfield Border to inlet of Jewell Pond, Medfield	Cause unknown

The Foxborough Company, a former metal plating and manufacturing company that currently is involved in light manufacturing and electronic assembly, discharged process wastewater and sanitary wastewater to the inlet stream of the Neponset Reservoir. The process discharge was connected to the Mansfield WWTP in 1987 and the sanitary discharge was connected in 1989. In 1994, the facility went to a closed-loop system, eliminating its Non Contact Cooling Water (NCCW) discharge. Neponset Reservoir, headwaters of the Neponset River, received the treated process wastewater discharge from Foxborough Company for many years. This discharge contaminated the sediments in the reservoir with heavy metals. The reservoir is currently classified by MA DEP as a (4-0011387) Tier 1A, Phase II hazardous waste site.

WEYMOUTH AND WEIR SUBWATERSHED

From 1925 until its retirement in 1978, Edgar Station was one of Boston Edison Company's three major fossil fuel electrical power generation facilities. Coal fired Units 1, 2 and 3, totaling 160 Milliwatts, were on line by 1929. The plant was expanded in the post-war years with the addition of Unit 4; replicate Units 5 and 6 were added in the early 50's bringing total plant capacity to approximately 400 Milliwatts. Units 4, 5 and 6 fired pulverized coal but were later converted to fire 2.2% sulfur residual oil. All six units used a "once through" cooling water system; the facility was permitted for a heat rejection rate of approximately 4500 million British Thermal Units per hour (MA DEP 22 February 2000).

Edgar Station was retired in 1978 although the property continues to house some electrical transmission facilities and two 12 Milliwatt distillate oil fired simple cycle combustion turbine peaking units. The transmission facilities include Boston Edison Company's switchyard and two underground 115 kilovolts lines. The 115-killvolt lines are owned by New England Electric Systems and provide power to the Quincy area. Boston Edison Company will continue to operate the existing switchyard on a portion of Sithe's property for which it has a permanent easement. Upon retirement, several of the Edgar Station turbine generator sets were removed and sold. The plant's five 250-foot stacks were dismantled in 1993 (MA DEP 22 February 2000).

Excerpted from Baird & McGuire Superfund Site Page developed by MA DEP (MA DEP 13 November 1998):

> The Baird & McGuire Superfund Site is located on South Street near the Holbrook/Randolph line. Eight of the twenty acres comprising the site have been owned by Baird & McGuire, Inc., since 1912. For more than 70 years (from 1912 to 1983), Baird & McGuire operated a chemical manufacturing and batching facility on the property. Activities included mixing, packaging, storing and distribution of various products, including herbicides, pesticides, disinfectants, soaps, floor waxes, and solvents. The property originally included a laboratory, storage and mixing buildings, an office building, and a tank farm. Some of the raw materials used at the site were stored in the tank farm and piped to the laboratory or mixing buildings. Other raw materials were stored in drums. Waste disposal methods at the site included direct discharge into the soil, a nearby brook, wetlands, and a former gravel pit. Hazardous wastes historically were disposed of in an on-site lagoon and cesspool. Also included on site were two lagoons open to rain and large areas of buried wastes such as cans, debris, lab bottles, and hundreds of bottles of chemicals. The lagoon area has been capped with clay. The on-site buildings were in various states of disrepair and unsecured; early activities conducted by EPA included demolishing all but one of the buildings and the tank farms. The tank farm area was temporarily capped. The site is completely fenced and groundwater recirculation system was operated to contain the groundwater plume until permanent remedies were implemented. The site is 500 feet west of the Cochato River. The Cochato River had, at one time, been diverted into the Richardi Reservoir, a water system serving nearly 90,000 people in the Towns of Holbrook, Randolph, and Braintree. Currently, the Cochato River is not being used as a supply source for the Richardi Reservoir. The South Street well field, part of the municipal water supply for Holbrook, is located within 1,500 feet of the site and was shut down in 1982.
>
> The groundwater at the Baird & McGuire Site is contaminated with pesticides and organic and inorganic chemicals. Studies found significant levels of Volatile Organic Compounds (VOCs), other organic compounds, arsenic, and pesticides including DDT and chlordane in Cochato River sediments. Site soils were found to be contaminated with VOCs, polycyclic aromatic hydrocarbons (PAHs), other organic compounds, pesticides, dioxin, and heavy metals such as lead and arsenic. Dioxin also has been detected in area wetland soils. The groundwater discharge is believed to be partially responsible for contamination of Cochato River sediments and adjoining wetlands. Field investigations in 1987 and 1988 determined that contaminated groundwater and surface runoff from the site continue to be the principal sources of contamination of the wetlands adjacent to the site. The investigations defined the contaminants of concern and recommended alternatives for final surface water and sediment cleanup.
>
> *Remedial Activities*
> The Superfund cleanup project at the Baird & McGuire Site is divided into four operable units. The Record of Decision (ROD) for the first two operable units was signed in September 1986; the ROD for the third operable unit was signed in September 1989; and the ROD for the fourth operable unit was signed in September 1990. The goals of the first three operable units are to manage migration and control the source of contamination. The goal of the fourth operable unit is to replace the "Lost Demand" to the Town of Holbrook due to contamination of the South Street Wells.
> *Operable Unit # 1: Groundwater Treatment Plant (GWTP)*
> Construction of the GWTP was completed in 1992. This treatment plant removes metals and VOCs from the contaminated groundwater at this site. In 1998 new construction at the site involves the addition of new wells to pump contaminated groundwater as well as to recover Light Non-Aqueous Phase Liquids, which are present in the top layer of the aquifer.
> *Operable Unit # 2: Contaminated Soil Incineration*
> The soils at Baird & McGuire were contaminated with creosotes, VOCs, pesticides, herbicides and metals (arsenic and lead). This soil was incinerated over a two-year period, from 1995 through 1997, to destroy the organic compounds. Incinerated ash was tested to insure that the metals would not

leach into the groundwater. The site is now graded, topsoil placed and upland areas seeded. Wetlands on site have been restored and planted.

Operable Unit # 3: Cochato River Sediment Dredging

The Cochato River, which is located downstream of the site, was dredged to remove contaminated sediments. Approximately 1,500 cubic yards of these sediments were treated in the incinerator. Sediment and fish sampling continues on an annual basis. The investigations also determined that site contaminants were being effectively trapped in river sediments and were not migrating down-river. In late 1989, a remedy was selected that included excavating and incinerating 1,500 cubic yards of sediments on site. Design of cleanup actions was completed in 1991. Construction activities were completed in 1995. A total of 4,712 cubic yards of contaminated sediment were removed from the river. Annual sampling of the river sediments and five year sampling of fish in the river and in Sylvan Lake will continue for 30 years to ensure that contaminant levels do not increase. Frequency of sampling may decrease after year five if contaminant levels decrease significantly.

Operable Unit # 4: Donna Road Water Supply

To replace the "lost demand" of the South Street Wells contaminated by Baird & McGuire, the ROD determined that the Donna Road Aquifer should be developed to supply the Town of Holbrook with 310,000 gallons per day. The design of the treatment system for manganese and iron began in 1991 and was completed in 1994. Due to a request from the town, the redesign of the treatment facility to include automated operation began in 1998.

Sanitary sewer overflows have been a chronic problem in the Weymouth Fore River and Back River watersheds contributing to violations of water quality standards, particularly during periods of high groundwater after rain events. These overflows have been in areas of public water supplies, shellfish beds, and bathing beaches. The overflows have occurred from the municipal sewer systems, as well as the MWRA interceptor system serving the communities on the South Shore. The primary causes of the sewer overflows are hydraulic deficiencies in the MWRA system and the municipal systems, excessive amounts of infiltration and inflow getting into the municipal systems, and poor operation and maintenance of the municipal systems (Chretien 2002).

DEP began an initiative in 1998 that continues through today to reduce the frequency, duration, and volumes of overflows from the MWRA Braintree-Weymouth Interceptor and the Braintree and Weymouth municipal sewer systems. Braintree and Weymouth are the two largest municipal systems contributing excessive amounts of infiltration and inflow into the MWRA Braintree-Weymouth Interceptor. In assessing compliance, DEP considers each day that an overflow occurs from each different point in a sewer system as a separate “event” and constitutes a separate violation of Department regulations (Chretien 2002).

In the Town of Weymouth, overflows have occurred to Whitman’s Pond, Mill River, Back River, Fore River, Old Swamp River, and other undetermined locations. A total of 530 overflow events occurred from 1992 to March 1999. Overflows have occurred, at least, at the following locations: Westlake Drive Easement, Ruggiano Circle, Montcalm Street, Neck Street Pump Station (Fort Point), Route 3 clover leaf at Main Street, Summer Street Ejector Station, Roseen Avenue, Weymouth Landing at Brookside Rd., Weymouth Landing at Washington St. and Front Street, Middle Street, Cynthia Circle, Pine Street at Pleasant Street, Todd Lane, Belmont Street Ejector Station, Weymouth Commons, Essex Street and Essex Street easement, Meetinghouse Lane, Westlake Drive, Fort Point Road, Blossom Lane, Idlewell Boulevard, Old Country Way, Winter Street easement, Essex Heights Drive easement, Thicket Street Ejector Station, Woodbine Road Ejector Station, Bridge Street, Oakdale Road, Moreland Road, Abigail Adams Circle, Laudervale Road, Biscayne Avenue, Seminole Avenue, and Hibiscus Avenue (Chretien 2002).

In the Town of Braintree, sanitary sewer overflows have occurred at various locations throughout the Town including the Howard Street Pumping Station, the Allen Street Siphon, Trotters Green, the Beach Front area, Surrey Lane, Union Street, the Common Street Pump Station, Bestick Road, the Grove Street Pump Station, the Brookside Road Pump Station, and Prospect Street. These overflows have discharged to the Fore River and the Monatiquot River. There were more than 120 overflow events from 1993 to 1999 (Chretien 2002).

Under certain wet weather flow conditions, overflows from the existing MWRA regional sewer system have discharged into the Fore River, Monatiquot River and Smelt Brook. The MWRA Smelt Brook Siphon has been the most significant location of overflows resulting from surcharging in the MWRA system caused by excessive wet weather flows being contributed by the Towns of Weymouth, Braintree, Randolph, Holbrook, and Hingham. Since 1996 the MWRA Smelt Brook Siphon has overflowed several times each year and has overflowed for periods of up to 11 days on certain occasions (Chretien 2002).

In 1993, MWRA identified hydraulic deficiencies in their own sewer system serving the communities of Braintree, Weymouth, Holbrook, Randolph, and Hingham. MWRA had not yet started construction in 1998 to eliminate these hydraulic deficiencies. In order to ensure construction on a specified schedule, DEP signed an ACO with the MWRA requiring that the MWRA construct the Braintree-Weymouth Relief Facilities. DEP presently oversees compliance of the $175 million MWRA construction project that will increase existing sewer service capacity for the member communities from 55 MGD to 73 MGD by July 2003 (Chretien 2002).

In 1999, Braintree and Weymouth signed ACOs with DEP to address their own sewer system improvements. As an outcome of the ACO with the Town of Weymouth, the Town will be undertaking a $15 million capital improvement project in addition to extensive infiltration and inflow removal work. Both Braintree and Weymouth have identified and removed hundreds of illegal sump pumps. As required by the ACO with DEP, Braintree has also undertaken substantial infiltration reduction projects (Chretien 2002).

The Town of Randolph, the next largest community tributary to the MWRA Braintree-Weymouth Interceptor, received $210,000 from the Clean Water State Revolving Fund (SRF) in 2002 to perform a sewer investigation in the Amelian Road area, which had also been a site of severe sewer overflows in March 2001 (Chretien 2002).

The Town of Weymouth obtained $360,000 of funding from the Clean Water SRF to develop a Stormwater Management Plan intended to support the Town's compliance with EPA Phase II Storm water requirements (Chretien 2002).

Both Braintree and Weymouth were required to perform dry weather sampling of storm drains as part of the sewer ACO with DEP. The dry weather sampling is intended to identify and eliminate any possible illegal connections of sanitary waste to the storm drain system (Chretien 2002).

In the Weymouth and Weir Subwatershed, 17 waterbodies are included on the States 303 (d) List of Impaired Waters, most due to noxious aquatic plants, organic enrichment/low DO, and/or pathogens (Table 4).

Table 4. 1998 303(d) List of Impaired Waters: Weymouth and Weir Subwatershed

1998 303(d) Listed Waterbody		Cause of Impairment
Foundry Pond (MA74011)	Hingham	Nutrients, Siltation, Noxious aquatic plants
Lake Holbrook (MA74013)	Holbrook	Noxious aquatic plants
Old Quincy Reservoir (MA74017)	Braintree	Noxious aquatic plants
Sylvan Lake (MA74021)	Holbrook	Pesticides, Priority organics
Ice House Pond (MA74028)	(No description)	Pesticides
Weymouth Fore River (MA74-14)	Route 53 to mouth	Pathogens
Cochato River (MA74-06)	Outlet Lake Holbrook to confluence with Farm and Monatiquot Rivers	Pesticides, Organic enrichment/Low DO, Pathogens
Weymouth Back River (MA74-13)	Bay Colony Railroad tracks to the mouth	Pathogens
Weir River (MA74-11)	Rockland Street and outlet Straits Pond to mouth at Worlds End	Pathogens
Town River Bay (MA74-15)	(No description)	Organic enrichment/Low DO, Pathogens

Table 4. (Continued.) 1998 303(d) List of Impaired Waters: Weymouth and Weir Subwatershed

1998 303(d) Listed Waterbody		Cause of Impairment
Furnace Brook* (MA74-10)	From headwaters near Chickatawbut Road to confluence with Blacks Creek	Organic enrichment/Low DO
Monatiquoit River*(MA74-08)	Confluence with Cochato and Farm rivers to confluence with Weymouth Fore River	Organic enrichment/Low DO, Pathogens
Weymouth Back River* (MA74-05)	Outlet Whitmans Pond to tidal area	Organic enrichment/Low DO, Pathogens
Mill River* (MA74-04)	Outlet Weymouth Great Pond to inlet Whitmans Pond	Nutrients, Pathogens, Noxious aquatic plants
Old Swamp River* (MA74-03)	Headwaters to inlet Whitmans Pond	Pathogens
Weir River* (MA74-02)	Confluence with Crooked Meadow River and Fulling Mill Brook to tidal area	Nutrients, Pathogens
Crooked Meadow River* (MA74-01)	Outlet Cushing Pond to confluence with Weir River	Nutrients, Organic enrichment/Low DO, Noxious aquatic plants

*needs confirmation (additional data collection is necessary to confirm the presence of impairment)

BOSTON HARBOR (PROPER) SUBWATERSHED

Boston Harbor has been the recipient of over 350 years of solid and liquid wastes. Twenty-six years after the founding of Boston, city regulations for the disposal of waste demanded that solid wastes be deposited into the harbor only on an outgoing tide at Mill Creek. This disposal procedure was to continue for the next 325 years. During the 19th century the City of Boston designed and constructed a sewage elimination system. The system carried raw sewage from the various shoreline communities into the harbor. The majority of raw sewage discharges were eventually curtailed by the mid-1960s. Effluent was then piped to the recently constructed facilities on Deer and Nut Islands. Both of these facilities were initially designed as primary treatment facilities. Each would separate solid wastes from the waste stream. Primary treated wastewater was allowed to flow into the harbor. The solids were collected, digested, and released to the harbor on an outgoing tide. The Deer Island sludge outfall was located on the north side of Presidents Road. The Nut Island sludge discharge was located on the southeastern side of Presidents Road, near Long Island. This discharge technique was sometimes less than effective at Nut Island, as an eddy off of Long Island would retain the discharged solids and transport them into the harbor on an incoming tide (Gallagher and Keay 1998).

The MWRA Boston Harbor benthic monitoring program has documented the recovery of benthic communities in areas of Boston Harbor as improvements are made to the quality of wastewater discharges. A summary of the improvements follows:

- cessation of sludge discharge into the Harbor - 1991
- operation of a new primary treatment facility at Deer Island - 1995
- initiation of secondary treatment (first battery) - 1997
- continuation of secondary treatment implementation (second battery) - 1998
- cessation of effluent discharge from Nut Island and its transfer to Deer Island - 1998
- cessation of effluent discharge to Boston Harbor - 2000

The observed changes in the structure of the Harbor's infaunal communities, coupled with data from sediment profile image studies, provide good evidence for improvement in the condition of benthic habitats in the Harbor since the cessation of sludge discharge in 1991. Most notable was the dramatic increase in abundance and geographic spread of the amphipod *Ampelisca* spp. Also important was the general increase in infaunal abundance and species numbers that occurred after 1991 (Kropp et al. 2000).

Spectacle Island, one of the many Boston Harbor Islands, is jointly owned by the City of Boston and the Commonwealth of Massachusetts, Department of Environmental Management. The island's original shape, two drumlins joined by a narrow sidebar, resembled a pair of spectacles and gave the island its name. Native Americans used the island to fish, harvest clams, and gather other food. After 1660, colonists used the island for pastureland and timber. Between 1717 and 1737, the island housed a quarantine hospital for patients with infectious diseases. In 1847, two resort hotels with casinos were built. Later uses included horse rendering and reclaiming grease from garbage. The City dumped garbage on the island until 1959. Leachate from the landfill contributed to harbor pollution. In 1978, DEM acquired a privately owned portion of Spectacle Island. Throughout the 1980s, extensive planning and permitting resulted in an agreement to deposit 3.6 million cubic yards of filling and excavated materials from the Central Artery/Tunnel project. Spectacle Island will be the water-transportation hub and orientation center for information about the Boston Harbor Island National Park Area. Spectacle Island Park, which will include a visitor's center, two sandy beaches, a marina, and spectacular 360-degree views of Boston Harbor, will be managed by a partnership including the City, DEM, New England Aquarium, Modern Continental, and the University of Massachusetts Urban Harbors Institute (City of Boston 2000b).

In Boston Harbor (Proper), ten segments are on the States 303 (d) List of Impaired Waters due to pathogens (Table 5).

Table 5. 1998 303(d) List of Impaired Waters: Boston Harbor Proper

1998 303(d) Listed Waterbody		Cause of Impairment
Boston Harbor (MA70-01)	Includes President Roads and Nantasket Roads	Pathogens
Boston Inner Harbor (MA70-02)	Includes Fort Point Channel and Reserved Channel	Pathogens
Dorchester Bay (MA70-03)	(No description)	Pathogens
Quincy Bay (MA70-04)	From Bromfield Street near the Wallaston Yacht Club north to buoy C"1" southeast to the "Willows" (also known as Lord's Point) on the northerly shore of Houghs Neck, Quincy	Pathogens
Quincy Bay (MA70-05)	Portion not designed SA	Pathogens
Hingham Bay (MA70-06)	Vicinity of Nut Island Treatment Plant	Pathogens
Hingham Bay (MA70-07)	(No description)	Pathogens
Hingham Harbor (MA70-08)	(No description)	Pathogens
Hull Bay (MA70-09)	(No description)	Pathogens
Winthrop Bay (MA70-10)	(No description)	Pathogens

SOURCES OF INFORMATION

Multiple federal, state, and local agencies provided information used in the water quality assessment of Boston Harbor. Within the Department of Environmental Protection information was obtained from three programmatic bureaus: Bureau of Resource Protection (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, habitat assessment, and biological data were provided by the Bureau of Resource Protection, Division of Watershed Management (DWM) Watershed Planning Program. MA DEP's Northeast Regional Office and the DWM Watershed Permitting Program provided water withdrawal and wastewater discharge permit information. [Note: The Bureau of Resource Protection DWM Drinking Water Program evaluates the status of the *Drinking Water Use* and this information is therefore not provided in this assessment report.]

Federal

The U.S. Geological Survey's National Water-Quality Assessment (NAWQA) Program is designed to assess historical, current, and future water-quality conditions in representative river basins and aquifers nationwide. One of the primary objectives of the program is to describe relations between natural factors, human activities, and water-quality conditions and to define those factors that most affect water quality in different parts of the Nation. The NAWQA Program's unique design provides consistent and comparable information on water resources in 60 important river basins and aquifers across the Nation. Together, these areas account for 60 to 70 percent of the Nation's water use and population served by public water supplies and cover about one-half of the land area of the Nation (http://water.usgs.gov/nawqa/). USGS sampled the Aberjona River at Winchester and the Neponset River at Norwood from October 1998 through September 1999 as part of the NAWQA Program New England Coastal Basins Study unit. These data are published in the Water Resources Data Massachusetts and Rhode Island Water Year 1999 and 2000 reports (Socolow *et al.* 2000 and Socolow *et al*. 2001).

A New England Coastal Basin (NECB) Mercury Study was also initiated by USGS in 1999 when the results of their National Mercury Pilot Study showed some of the highest mercury concentrations in the country were in the NECB study area (USGS 13 June 2001). The dominant source of mercury identified in the NECB study area was atmospheric deposition. In collaboration with USGS's Toxics Substances Hydrology Program (an extension of the National Mercury Pilot Study), Urban Land Use Gradient Study (part of the NAWQA program) and the MA DEP Merrimack Valley Fish Study, USGS collected sediment, water, and/or fish tissue for total and/or methyl mercury analysis from 22 streams north of Boston in 1999 and 30 sites in the NECB in 2000. Both the Neponset River at Norwood and the Aberjona River at Winchester were sampled by USGS between September 1998 and August 2000.

As part of Massachusetts Watershed Initiative Project 99-02/MWI, USGS conducted surveys in the Boston Harbor Watershed on nine streams: Aberjona River near Woburn, Aberjona River at Washington Street, near Winchester, Aberjona River at Winchester; Mill Brook at Arlington; Mystic River at Medford, Mystic River at Main St., Medford; Alewife Brook near Arlington; Monatiquot River at East Braintree; Town Brook at Quincy; Old Swamp River near South Weymouth; Weymouth Back River at East Weymouth; and Weir River at Rt. 3A Bridge near Hingham. Water quality data collected during May, June, July, and September for water years 1998-1999 included discharge (cfs), barometric pressure, pH, specific conductance, dissolved oxygen, air and water temperature, fecal coliform and *E. coli* bacteria, and nutrients (ammonia/nitrogen, phosphorus) (Socolow *et al.* 2000 and Socolow *et al.* 2001).

According to climate statistics collected by NOAA, 1999 was the driest growing season on record in several northeast states, including Massachusetts. Additionally, streamflow data collected by the U.S. Geological Survey showed that the average monthly stream flows in the summer were lower than have been recorded in decades. Data from 30 USGS streamflow stations, each having more than 40 years of measurements, showed the lowest average flow recorded for June at ten of the stations (USGS 5 June 2001).

The United States Army Corps of Engineers (ACOE) New England Division conducted a use attainability study of the East Branch Neponset River subwatershed in 1996 to examine high water temperatures during summer months. The study concluded that instream temperatures were affected by numerous impoundments, dams, wetland areas, and general low flows. The study determined that by increasing flows and decreasing open unshaded areas, water temperatures could potentially be lowered (ACOE 1998). ACOE is currently involved in many projects in the Boston Harbor Watershed including: the Town Brook flood control protection project in the Towns of Braintree and Quincy, dredging the Mystic River, Reserve Channel, and Chelsea Creek, a feasibility study of salt marsh restoration in Broad Meadows in Quincy, Billings Creek coastal wetlands study in the Neponset Subwatershed, and a habitat restoration project on the Neponset River involving the removal of the Walter Baker and Tilestone and Hollingsworth dams (ACOE 31 October 2001).

State

Many of the rivers in the Boston Harbor Watershed receive the discharge of treated municipal and industrial wastewater, contact and non-contact cooling water.

Waste Water Treatment Plants (WWTPs): There are two WWTP's that discharge into the Boston Harbor Watershed. These facilities treat wastewater from domestic and industrial sources within the WWTP service area (MA DEP 2001c).

- The **Town of Hull (MA0101231)** is permitted to discharge 3.07 million gallons per day (MGD) to the Boston Harbor/Atlantic Ocean. The current permit includes secondary limits: Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS) = 30 mg/L; fecal coliform bacteria = 200 cfu/100mL; and LC_{50} = 100%. This permit is scheduled to be reissued in Spring 2002.

- The **Massachusetts Water Resource Authority Deer Island Facility's (MA01013284)** peak capacity is 1.27 billion gallons of wastewater per day with a dry weather flow limit of 436 MGD. Average daily flow is about 380 MGD. The permit includes limits for: Chemical Biological Oxygen Demand (CBOD)= 25 mg/L; TSS = 30 mg/L; fecal coliform bacteria = 14,000 cfu/100mL; LC_{50} = 50%; and CNOEC = 1.5%. The permit also includes several additional requirements including: ambient monitoring, contingency plan, water conservation within service area, pollution prevention, and industrial pre-treatment program (Hogan 2001).

  Wastewater "influent" from MWRA's 43 customer communities arrives at the Deer Island Facility through four underground tunnels. At the plant, there are three main pump stations: North Main

Pump Station and the Winthrop Terminal Headworks (capacity 910 MGD) and the Lydia Goodhue Pump Station with an additional capacity of 360 MGD. The pumping capacity at the new Deer Island plant has increased the volume of wastewater that can be taken into the plant from the conveyance tunnels. This can significantly reduce back-ups and overflows throughout the system due to storm events and reduces CSOs (MWRA 13 December 2001).

After pumping, the wastewater receives primary treatment through various settling procedures. Secondary treatment mixers, reactors and clarifiers remove non-settleable solids through biological and gravity treatment. The implementation of this secondary treatment began in 1997. A second "battery" of treatment was completed in 1998 and the third was completed in 2001. Sludge and scum from both levels of treatment are thickened and digested. One of the by-products of this process, methane gas, is used in the plant's on-site power generating facility. Digested sludge leaves Deer Island by barge for MWRA's Pelletizing Facility at Fore River in Quincy, where it is further processed into a fertilizer product (MWRA 13 December 2001).

After passing through primary and secondary treatment, wastewater is disinfected with sodium hypochlorite to kill bacteria. After disinfection and dechlorination, the effluent is discharged via a 9.5-mile 24-foot-diameter outfall tunnel into Massachusetts Bay. More than 50 individual diffuser pipes, each with eight small ports, are employed to achieve rapid and thorough mixing into surrounding water (MWRA 13 December 2001).

Combined Sewer Overflows (CSOs): There are five permittees discharging CSO into the Boston Harbor Watershed: the cities of Chelsea, Somerville, and Cambridge; Boston Water & Sewer Commission; and the MWRA (Brander 2001a).

- **City of Chelsea (MA0101877)** discharges via four CSO locations within the Mystic River Subwatershed: one to Mystic River, three to Chelsea River. The permit expired 13 August 1998 and EPA expects to re-issue in 2002.
- **City of Somerville (MA01101982)** is permitted to discharge via eight CSO locations within the Mystic River Subwatershed; six of the CSO outfalls have been eliminated. Of the remaining two, one discharges to Alewife Brook and one to the Mystic River. The permit expired 29 September 1997. The permit is expected to be reissued in 2002.
- **City of Cambridge (MA0101974)** discharges via 11 CSO locations; six within the Mystic River Subwatershed (Alewife Brook) and five to the Charles River in the Charles River Basin. The permit expired 25 April 1998. The permit is expected to be reissued in 2002.
- **Boston Water & Sewer Commission (MA01011992)** discharges via 53 CSO locations to Boston Harbor Watershed including the Mystic, Charles, and Muddy rivers, Fort Point and Reserved channels, and Boston Harbor Proper. The permit expired 29 September 1992. The permit is expected to be reissued in 2002.
- **MWRA (MA0103284)** discharges via 15 CSO locations: four to Boston Harbor; one to Alewife Brook; two to Mystic River; and seven to Charles River.

Power Plants (MA DEP 2001c)*:* There are several power generation facilities within the Boston Harbor Watershed.

- **Sithe-Mystic (MA0004740)** discharges 754 MGD from four power generation units to Mystic River subwatershed. The permit contains a 93 °F temperature limit and a 0.1mg/L total residual chlorine limit (one unit at a time discharging for a maximum of two hours). The permit was reissued in 2001.
- **Sithe-New Boston Station (MA0004731)** has two condenser cooling water discharges (258 and 232 MGD) to the Boston harbor proper. The permit contains a 96 °F temperature limit with a $\leq$ 25 °F temperature change. The permit expired on 15 January 1999. The permit is expected to be reissued in 2003.
- **Braintree Electric Light Department- Potter Cogeneration (MA0005517)** discharges ancillary water from the cogeneration plant to Weymouth and Weir subwatersheds. The permit expires 20 March 2005.
- **Cabot Power- Island End Cogeneration, Everett, (MA0040126)** discharges 40,000 GPD of floor drain and boiler blowdown water to the Mystic River subwatershed. The facility has a total suspended solid (TSS) limit of 30mg/L. The permit was issued 19 May 2000.

Oil Terminals (MA DEP 2001c)*:* There are multiple oil terminals located within the Boston Harbor Watershed. There are two approaches to oil terminal NPDES permit limits. The first approach includes a TSS limit of 30 mg/L; an oil & grease limit of 15 mg/L; a benzene limit of 500 μg/L; flow reporting requirements; and PAH monitoring requirements. The second approach also includes secondary limits of PAHs (31ng/L) (Hogan 2001).

Permitted facilities in the Boston Harbor Watershed include:

- **Citgo Petroleum, (MA0004782)**
- **Exxon Terminal, Everett (MA0000833)**
- **Gulf Oil, Chelsea (MA0001091)**
- **Chelsea Sandwich (MA0003280)**
- **Global Oil Terminal, Revere (MA0000825)**
- **Irving Oil Terminal, Revere (MA0001829)**
- **Global Revco Terminal, Revere (MA3298)**
- **Global Petroleum Corp., Revere (MA0003425)**
- **Coastal Oil New England, S. Boston (MA0004405)**
- **TOSCO East Boston Terminal (MA0004006)**

The Central Artery Tunnel Project Discharges (MA DEP 2001c) resulting from the "Big Dig" include:

- **Massachusetts Bay Transit Authority (MBTA)- South Boston Piers/Transitway Project (MA0036781)** is permitted to discharge construction dewatering via eight outfalls to the Boston Harbor Proper. The permit has a TSS limit of 100 mg/L (average) and a 250 mg/L daily maximum: and a Total Petroleum Hydrocarbon (TPH) limit of 5 mg/L. The permit also requires a Best Management Practices (BMP) Plan and expires 12 August 2002.
- **Massachusetts Highway Department (MA0033928)** is permitted to discharge construction dewatering via 45 outfalls, only a small portion of which are operational at any one time, to the Boston Harbor Proper. The permit includes both dry and wet weather monitoring requirements and limits. During dry weather conditions the TSS limit is 100 mg/L, average and 250 mg/L daily maximum. During wet weather condition MassHighway is required to monitor only for TSS. The TPH limit during both wet and dry weather conditions is 5 mg/L. Under this permit a storm water pollution prevention plan (SWPPP) is required. The permit expires 21 December 2002.

Other Industrial Discharges (MA DEP 2001c): The majority of industrial process wastewaters are treated at WWTPs under conditions of their industrial pre-treatment program. This program is controlled by the municipality and is a condition of the municipal WWTP NPDES permit. There are several industries within the Boston Harbor Watershed that have permits for the discharge of non-contact cooling water (NCCW) and storm water. These discharges can be authorized and controlled under either a general or an individual permit. The list below does not include any general permitted storm water discharges in the Boston Harbor Watershed, as there are too many to list (>50).

- **Gillette Company – Safety Razor Division (MA0003832)** is permitted to discharge 53.1 MGD of NCCW to Boston Harbor Proper. The existing permit includes a maximum temperature limit of 83°F. The permit is currently being reissued with Gillette seeking an increase in flow.
- **UMass Boston** is covered under the EPA general NCCW permit to discharge 8 MGD to the Boston Harbor Proper. This general permit includes an 83°F maximum temperature limit.
- **Olin Corporation, Wilmington (MA0005304)** is permitted to discharge treated groundwater contamination to the Mystic River Subwatershed. The permit includes organics and ammonia limits, an LC_{50} = 100% and a Chronic No Observed Effect Concentration (CNOEC) = 100%. The permit expires 13 March 2005.
- **Plymouth Rubber, Canton (MA0000884)** is permitted to discharge 2.6 MGD of NCCW (with no temperature limit) to the Neponset River Subwatershed. The facility is also permitted to discharge storm water a TSS permit limit of 50 mg/L and a SWPPP is required.
- **Sensor Electronics- Metal Bellows Division (MA00023050)** is permitted to discharge 1500 GPD of plating wastewater (heavy metal limits) and 20,000 GPD NCCW (83°F temperature limit) to the Neponset River Subwatershed. This permit expired on 18 August 1991. The permit is scheduled to be reissued in 2002.

- **Factory Mutual Engineering Corporation, Norwood (MA0003638)** is permitted to discharge sprinkler testing water to the Neponset River Subwatershed. The permit is currently out for review.
- **Baker Process**, (formerly known as **Bird Machine), South Walpole (MA0000230)** is permitted to discharge both storm water (TSS limit of 50 mg/L) and NCCW (83°F temperature limit) to the Neponset River Subwatershed. The permit expired 30 October 2000.
- **Certainteed Inc.**, (formerly known as **Bird Incorporated), Norwood (MA0003531)** is permitted to discharge contact cooling water (temp = 83°F; TSS = 40 mg/L; LC_{50} = 100%), NCCW (TSS = 20 mg/L), and storm water (TSS= 10 mg/L) to the Neponset River Subwatershed. The permit also requires a SWPPP. The permit expires 30 October 2002.
- **Clean Harbors (MA0031551),** a hazardous waste disposal company located in Braintree, is permitted to discharge storm water to the Weir River Subwatershed. The permit includes limits for: TSS= 20 mg/L; oil/grease = 5 mg/L; lead = 5 µg/L; PAH = 10 µg/L; benzene = 5 µg/L; PCB = 1µg/L; and LC_{50} = 100%. The permit is currently being reissued.
- **Avon Custom Mixing Service (MA0026883)** is permitted to discharge NCCW (temp = 85°F) and sanitary wastewater (secondary limits) to the Weir River Subwatershed. The permit expired on 30 October 1991. The permit was reissued and is under appeal.

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, construction activity disturbing five acres of land or greater, and ten categories of industrial activity. Phase II expands the original program to certain small MS4s in urbanized areas and uses six minimum control measures to reduce the discharge of 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/good housekeeping. More information on EPA's storm water program is available online at http://cfpub1.epa.gov/npdes/home.cfm?program_id=6.

The City of Boston is a Phase I community. The Boston Water and Sewer Commission (the Commission) operates the separate storm drainage system serving the City of Boston. The Commission applied to EPA in 1993 for an NPDES storm water individual permit for the system under Phase I and received the permit in October 1999. The Commission operated drain system has 104 major and 102 lesser outfalls. The system currently serves 13.85 square miles of Boston. The remainder of Boston is served by combined sewers and the Commission is currently undertaking two major separation efforts under the MWRA CSO Control Plan. There are other public storm drains in the city owned by other state agencies such as the Massachusetts Department of Public Works, Massachusetts Turnpike Authority and the Metropolitan District Commission. While currently unpermitted, these other public agencies will be required to obtain coverage for outfalls from separate drainage they operate under an NPDES storm water general permit by March 10, 2003 (Scarlet 2002).

All other communities in the Boston Harbor Watershed are required to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. EPA is currently writing this general permit (with input from MA DEP) and a preliminary draft is currently available for internal review. The draft for public comment should be available by the end of June 2002. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems (MS4) will be issued by December 9, 2002. The towns must submit applications for coverage under the permit to EPA by March 10, 2003 (Scarlet 2002).

Site specific evaluations of other water quality issues in Boston Harbor related to either wastewater discharges and/or water withdrawals were conducted by 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.

The two WWTP's and eight industrial discharges in the Boston Harbor 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 February 1996 to March 2001 were reviewed and summarized (ranges) for use in the assessment of current water quality conditions in the Boston Harbor Watershed. These include:

- Hull WWTP (MA0101231)
- MWRA Deer and Nut Islands (MA0102351)
- MWRA Mass Bay (MA0103284)
- Monsanto Everett (MA0000809)
- Exxon Everett (MA0000833)
- Olin Chemical (MA0005304)
- Factory Mutual Engineering (MA0003638)
- Bird Roofing (MA0003531) (a.k.a Certainteed)
- MBTA Quincy Pump Station (MA0033987)
- Twin Rivers Technologies L. P. (MA0004073)
- Mobile Oil East Boston (MA000406)

Water Management Act

A list of registered and permitted Water Management Act (WMA) withdrawals (both public water suppliers and other industrial users) is provided in Appendix G, Table G1 (LeVangie 2001).

In cases where water withdrawal information was available, it was included in the segment assessment. In order to determine where stream segments might be affected by water withdrawal activities, a review of the WMA files is necessary. Additionally, there are three facilities that have also applied for a Nonconsumptive Use Status (water they use is discharged at or near the withdrawal point in substantially unimpaired quality and quantity):

- Town of Arlington (dewatering) - Accepted 5 October 2000
- Hollingsworth and Vose Company - Accepted 2 January 1989
- Neponset Reservoir Company - Accepted 31 January 1989

Agency Monitoring

MWRA’s monitoring of Boston Harbor, its tributaries, and Massachusetts and Cape Cod bays includes studies on water quality (1993-present), hydrographic data in the Inner Harbor, CSO receiving waters and anthropogenic virus monitoring. The water quality monitoring began in 1993 to document water quality changes as pollution abatement projects are implemented. MWRA collects water quality data from 33 stations in the Boston Harbor Watershed including: chlorophyll, Enterococcus and fecal coliform bacteria, TSS, dissolved oxygen, percent saturation, temperature, turbidity, nutrients (dissolved and/or particulate nitrogen and phosphorus), and Secchi disk depth (Coughlin 2001a and 2002). In addition, MWRA analyzes samples for fecal coliform bacteria from Metropolitan District Commission beaches (41 sampling stations) within the Boston area (Coughlin 2001b). Under their NPDES permit, MWRA is required to monitor the biological communities (fish and benthic) in the Boston Harbor proper.

MWRA’s 2000 biomonitoring program for fish and shellfish represents the final year of baseline monitoring (Lefkovitz et al. 2001). All 2000 fish and shellfish samples were collected before the new outfall went on-line in September 2000. The goal of this program was to obtain data that may be used to identify potential environmental impacts of the effluent discharge on Massachusetts Bay, and to evaluate the facility’s compliance with their NPDES discharge permit.

Monitoring was also conducted to further define the baseline conditions of three indicator species winter flounder (*Pseudopleuronectes americanus*), lobster (*Homarus americanus*), and blue mussel (*Mytilus edulis*). Specimens were collected from three core sites in Boston Harbor and the Bays: Deer Island Flats, the Outfall Site, and East Cape Cod Bay. Additionally, flounder were collected at two ancillary sites, Broad Sound (BS) and off Nantasket Beach, to provide information on flounder in the general area of the former Deer Island outfall. Caged mussels, collected from Rockport, MA, were deployed at three sites (Boston Harbor, Cape Cod Bay and Massachusetts Bay) to evaluate the potential for bioaccumulation (Lefkovitz *et al.* 2001).

The species collected were characterized in terms of biological parameters (e.g., length, weight, age); external condition; and concentrations of organic and inorganic compounds in both edible and liver/hepatopancreas tissue. Flounder livers were also examined for the extent and severity of lesions. In addition, body burdens of pesticides (PCBs, lead and mercury) were compared to the Food and Drug Administration Action Limits and MWRA's Appreciable Change levels to evaluate potential risk or trends (Lefkovitz *et al.* 2001).

The MWRA Boston Harbor benthic monitoring program includes three components: sediment profile images, sediment geochemistry and infaunal communities (Kropp *et al.* 2000). MWRA began its studies of the infaunal communities and benthic habitats in Boston Harbor in 1991, just prior to the cessation of sludge dumping into the Harbor. The principle aim of the Harbor studies is documentation of continuing recovery of benthic communities in areas of Boston Harbor as improvements are made to the quality of wastewater discharges (Kropp *et al.* 2000).

Other state agencies contributing information to this report include: the Massachusetts Department of Public Health (MDPH), the Department of Fisheries, Wildlife, and Environmental Law Enforcement (DFWELE) Division of Fisheries and Wildlife (MassWildlife), its Riverways Program and its Department of Marine Fisheries (DMF), the Department of Environmental Management (MA DEM), Office of Coastal Zone Management (CZM), and Metropolitan District Commission (MDC).

Local/Citizen Monitoring
In addition to state and federal agencies, regional, local, and citizen monitoring groups provide data/information for the watershed management process that may be used to indicate areas of both high and degraded water quality, as well as causes and sources of contamination.

The Mystic River Watershed Association (MyRWA) is a grass roots membership organization that advocates for protection of the waters and related resources in the basin's 21 communities. The mission of the Mystic River Watershed Association is to restore clean water in the Mystic River watershed, protect its waters and related natural resources, and establish programs of public information and education to these ends. MyRWA strives to be an "umbrella" organization by forging linkages with other citizens' groups, businesses and government agencies to address the critical environmental issues in the watershed (MyRWA Undated).

From July 2000 to December 2000, MyRWA sampled water quality as part of the Mystic Monitoring Network on the Aberjona River, Alewife Brook, Malden River, Meetinghouse Brook, Mill Brook, Mystic River, Upper Mystic Lake, and Winn Brook. Parameters measured include fecal coliform bacteria, TSS, nitrite, nitrate, total phosphorus, conductivity, pH, dissolved oxygen, water temperature as well as observations of water color, odor, and general description of the sample area (MyRWA 2001).

The MyRWA, with support of the DFWELE Riverways Program, has also organized Stream Teams in various subwatersheds since 1995 to establish stewardship of streams by local citizens, schools, businesses and civic groups. These include: Alewife/Mystic River Advocates, Friends of the Mystic River and the Alewife Brook/ Little River Stream Team (DFWELE 28 July 1999).

The Alewife/Mystic River Advocates and the Friends of the Mystic River conducted shoreline surveys of the Mystic River, Alewife Brook, and the Malden River during spring 1995 and fall 1996. They noted general water quality such as color, odor, depth, aquatic vegetation; bank conditions; and land use. As part of a section 319 Nonpoint Source Grant awarded to the City of Somerville, Alewife/Mystic River Advocates collected water quality samples from Alewife Brook between November 1999-November 2000. Parameters measured included pH, dissolved oxygen, percent saturation, total dissolved solids, temperature, nitrate-nitrogen, and general shoreline conditions (AMRA 1997).

"The Alewife Brook Stream Team is a citizen advocacy group formed to encourage responsible stewardship of the Alewife Reservation and abutting properties; stewardship that maintains and improves the reservation's role as a habitat resource while encouraging responsible public access" (DFWELE 2000a). This shoreline survey, conducted 3 June 2000, was divided into 21 segments and extended from the Blair Pond and Little Pond, through the Little River and Alewife Brook to the confluence with the Mystic River. Teams noted instances of trash, erosion, land use, pipes, aquatic vegetation, wildlife, and objectionable odors (sewage). Based on their survey, the stream team has developed an Action Plan (DFWELE 2000a).

A concerned citizen, R. Frymire, sampled source pipes in the Alewife Brook, Little River, Wellington Brook, and Little Pond for fecal coliform bacteria during November and December 1999 for MyRWA. Samples were analyzed at the Charles River Watershed Association Laboratory. His results indicated elevated levels of fecal coliform at many of the sampling locations (Frymire 2000).

In 1999, sediment samples were collected from Alewife Brook, Mill Brook (Arlington), and Mystic Lakes for contaminant analysis as part of a Tufts Masters thesis research (Ivushkina 1999). Samples were analyzed using Instrumental Neutron Activation Analysis and Flame Atomic Absorption Spectroscopy for a suite of elemental contaminants.

The Neponset River Watershed Association (NepRWA) is a private nonprofit conservation group made up of citizens, local officials, and local business people. The watershed association works to protect and restore the natural resources of the Neponset River and its watershed for the use and enjoyment of present and future generations. The Watershed Association conducts water quality testing and other kinds of environmental monitoring; it works to clean up pollution sources, to restore anadromous and warm water fisheries, to encourage public access and recreation along the river, to prevent flooding, and to protect key parcels of open space (NepRWA undated).

As part of the Citizen's Water Monitoring Network (CWMN), NepRWA sampled water quality at 39 sites on the Neponset River, Mine Brook, School Meadow Brook, Spring Brook, Germany Brook, Hawes Brook, Meadow Brook, Traphole Brook, Massapoag Brook, Steep Hill Brook, Pequid Brook, East Branch Neponset River, Purgatory Brook, Pecunit Brook, Ponkapoag Brook, Mother Brook, Pine Tree Brook, Unquity Brook and Willett Pond. Parameters measured include fecal coliform bacteria, TSS, nitrite/nitrate, total nitrogen, total phosphorus, orthophosphate, pH, dissolved oxygen, and water temperature. Samples were collected once a month during January, March, May, and July – December (NepRWA 1998, 1999, 2001a and 2001b). In addition, fish population and macroinvertebrate surveys were conducted in conjunction with MA DEP as part of the BUDGETS (Balancing Uses with Demands and Generating Effective Techniques for Sustainability) project (Berasi and Harrahy 2001).

NepRWA, with support of the DFWELE Riverways Program, have also organized Stream Teams in various subwatersheds to establish stewardship of streams by local citizens, schools, businesses and civic groups. These include: Friends of the Neponset Estuary, Canton River Watershed Watchdogs, and the Hawes Brook Preservation Society (DFWELE 28 July 1999).

The Fore River Watershed Association (FRWA) has the goal of improving the water quality in the Fore River and its tributaries in order to return swimming and shellfishing to the river on an unrestricted basis (Franklin 2001). FRWA collected bacteria samples between 23 April 1996 and 20 October 1997 on the Town River, Town Brook, Phillips Creek, Lower Mill Cove, Smelt Brook, and the Montaquot River. Between 14 April and 15 May 1997, FRWA conducted a study to determine the presence of river herring in the Montaquot River.

The Weir River Watershed Association has developed a flow monitoring program of the Weir River and its tributaries in response to concerns regarding impacts from drinking water withdrawals. The goals of the project are to establish a baseline and gain further understanding of the hydrology of the river by measuring water levels and flows at nine stations along the Weir River, Fulling Mill Brook, and Accord Brook over a one year period (Woods 2001).

The Boston Harbor Association with financial support of the Massachusetts Port Authority, the mayor's office, the City of Boston Environment Department, the Massachusetts Water Resources Authority, the United States Environmental Protection Agency, the Massachusetts Environmental Trust, and the Massachusetts Coastal Zone Management, initiated a program, Boston Harbor Marine Debris Salvage Program, to clean up the waterfront and inner tributaries of Boston Harbor. Together, these groups funded daily patrols, and removal of flotsam, from "high activity areas" (the downtown waterfront, the Charlestown Navy Yard, and the East Boston waterfront). Other patrol areas included the South Boston waterfront, the Outer Fort Point Channel, and Chelsea Creek. More than 130 barrels of small debris, 300 pieces of large debris, and 30 pieces of piers and other oversized debris were collected between July 1, 2000 and September 15, 2000 during the 2000 pilot program. The 2001 program expanded the clean-up effort in terms of financing, patrol area, and amount of debris collected. The project funding was increased from $85,000 in 2000 to $125,000 in 2001. The 2001 project added the Charles River and the Mystic River to the patrol area. The 2001 project operated from 18 June to 1 October. The amount of debris removed totaled more than 57 tons in 2001. This project has led to efforts to curtail the entrance of debris from the shore to the harbor. The Boston Conservation Commission and the MA DEP have developed certain conditions to keep waterfront construction debris from entering the harbor. Numerous cleanup projects along the Charles River, the Mystic River, and harbor beaches have also resulted (East Boston 21 August 2000).

Within the Boston Harbor Watershed there are many formal bathing beaches that monitor pollutants that pose a threat to beach water quality. Swimming in unsafe water may result in minor illnesses, such as sore throats or diarrhea, or more serious illnesses such as meningitis, encephalitis, or severe gastroenteritis. Children, the elderly, and people with weakened immune systems have a greater chance of becoming ill when they come in contact with contaminated water. EPA recommends that state and local officials monitor water quality (*E. coli*, *Enterococcus*, and/or fecal coliform bacteria counts) and issue an advisory or closure when beaches are unsafe for swimming. By issuing beach advisories and closings, state and local officials are reducing swimmer exposure to contaminated water and protecting public health (EPA 20 July 2000). Although these samples are not necessarily collected under an approved Quality Assurance Project Plan, MA DEP, after review and validation for quality assurance, use these data, in conjunction with beach closure information, to determine if the waterbodies are meeting their national goals of being swimmable and fishable (assess *Primary* and *Secondary Contact Recreational uses)*.

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 (MDPH) 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.state.ma.us/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 2002).

TOTAL MAXIMUM DAILY LOADS (TMDL)

As part of the Federal Clean Water Act, states are required to develop total maximum daily loads (TMDLs) for lakes, rivers and coastal waters not meeting the states surface water quality standards as indicated by the states 303d list of impaired waters. A TMDL is the greatest amount of a pollutant that a waterbody can accept and still meet standards. Further information on the 303d list and the TMDL program are available on the MA DEP website at: http://www.dep.state.ma.us/dep/brp/wm/wmpubs.htm.

RIVERS

The Neponset River fecal coliform bacteria Total Maximum Daily Load has been prepared through the collective efforts of the EPA and the MA DEP as well as support from local stakeholder groups (MA DEP 2001d). Data collected by MA DEP and NepRWA, beginning in 1994 to the present, document consistent exceedances of fecal coliform standards. In order to prevent further degradation in water quality and to ensure that the Neponset River meets state water quality standards, this TMDL will outline corrective actions to achieve that goal. This TMDL will not address other pollutants identified on the 303(d) list that may be contributing to the non-attainment of Surface Water Quality Standards. Additional TMDL reports will be prepared, as necessary, to address those pollutants in the future.

A basin-wide implementation strategy is proposed to implement the fecal coliform TMDLs through the following mechanisms:

- Development of comprehensive storm water management programs including identification and implementation of Best Management Practices (BMPs)
- Illicit Discharge Detection and Elimination
- Leaking Sewer Pipes and Sanitary Sewer Overflows
- Inspection and upgrade of on-site sewage disposal systems as needed

LAKES

Within the Mystic, Neponset, and Weymouth & Weir subwatersheds of the Boston Harbor Watershed, there are a total of thirty-four ponds on the 303 (d) list for which the most common cause of impairment is noxious aquatic plants (Tables 2-5). Baseline lake surveys were completed on four ponds in 1999 by DWM for the purpose of TMDL development: **Winter Pond** (MA71047), Winchester in the Mystic River Subwatershed; **Cobbs Pond** (73009), Walpole; **Ganawatte Farm Pond** (MA73037), Walpole/Sharon/Foxborough; and **Turners Pond** (MA73059), Milton in the Neponset River Subwatershed. A draft TMDL for all four ponds is scheduled to be completed in 2006 (Mattson 2002).

In addition, draft phosphorus TMDLs based on previous diagnostic/feasibility studies are being developed for two ponds in the Mystic River Subwatershed -- **Ell Pond** (MA71014), Melrose and **Spy Pond** (MA71040), Arlington and two ponds in the Weymouth & Weir Subwatershed -- **Foundry Pond** (MA74011), Hingham; and **Lake Holbrook** (MA74013), Holbrook. TMDLs for the remaining Boston Harbor Watershed lakes are scheduled to be developed in accordance with the five-year cycle of the Watershed Initiative.

OBJECTIVES

This report summarizes information generated in the Boston Harbor Basin through *Year 1* (information gathering in 1996) and *Year 2* (environmental monitoring in 1997) activities established in the “Five-Year Cycle” of the Watershed Initiative. Data collected by the MA DEP Division of Watershed Management (DWM) in 1999, in accordance with their Quality Assurance Project Plans (MA DEP 1999b, MA DEP 1999c, and MA DEP 1999d), are provided in Appendices A, B, and C (QA/QC, water quality data, and one technical memorandum entitled *Boston Harbor Watershed 1999 Biological Assessment*). Together with other sources of information (identified in each segment assessment), the status of water quality conditions of lakes and streams in the Boston Harbor Basin was assessed in accordance with EPA’s and MA DEP’s use assessment methods. Not all waters in the Boston Harbor Basin are included in the DEP/EPA Water Body System (WBS) database or this report.

The objectives of this water quality assessment report are to:

1. Evaluate whether or not surface waters in the Boston Harbor Watershed, defined as segments in the WBS database, currently support their designated uses (i.e., meet water quality standards),
2. Identify water withdrawals and/or major point (wastewater discharges) and nonpoint (land-use practices, storm water discharges, etc.) sources of pollution that may impair water quality conditions,
3. Identify the presence or absence of any non-native macrophytes in lakes,
4. Identify waters (or segments) of concern that require additional data to fully assess water quality conditions,
5. Recommend additional monitoring needs and/or remediation actions in order to better determine the level of impairment or to improve/restore water quality, and
6. Provide information to the Boston Harbor Watershed team for use in its annual and 5-year watershed action plans.

SEGMENT REPORT FORMAT

RIVERS

The segment order in this assessment report follows the Massachusetts Stream Classification Program (Halliwell *et al*. 1982) hierarchy. Stream segments are organized hydrologically (from most upstream to downstream). Tributary summaries follow the segment into which they discharge. Each segment summary 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., MA71-01) 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 within Massachusetts (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 Geographic Information System (GIS) analysis using the MassGIS land use coverage developed at a scale of 1:25,000 and based on aerial photographs taken in 1985 and 1990 (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 (MassGIS 2000) data layers (stream segments and quadrangle maps).

WATER WITHDRAWALS AND WASTEWATER DISCHARGE PERMIT INFORMATION

WMA water withdrawal, NPDES wastewater discharge (when provided).

Sources of information: WMA registrants and permittees (LeVangie 2001, O'Keefe 2002); NPDES open permit files located in Worcester DEP Office (MA DEP 2001c); MWRA CSO status (Brander 2001a, 2001b, and 2002); storm water permits (Scarlet 2002).

USE ASSESSMENT

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

Sources of information include: DWM 1999 Survey data (Appendices A-C); the MA DEP DWM Toxicity Testing Database "TOXTD" (Dallaire 2000) Stream Team reports; NepRWA (NepRWA 1998, 1999, 2001a and b); MyRWA (MyRWA 2001); MWRA (Coughlin 2001a, 2001b, and 2002); USGS (Socolow et. al 1999, Socolow et. al. 2000). The MDPH Freshwater Fish Consumption Advisory List (MDPH 2001a) was used to assess the *Fish Consumption Use* and the DMF Shellfish Status Report was used to assess the *Shellfishing Use* (DFWELE 2000b). Where other sources of information were used to assess designated uses, citations are 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 monitoring and implementation needs.

LAKES

The assessed lakes, identified with their WBID code numbers, are listed alphabetically in the Mystic, Neponset, or Weymouth and Weir Lake Assessments sections 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).