INTRODUCTION

The Massachusetts Watershed Approach is a collaborative effort between state and federal environmental agencies, municipal agencies, citizens, non-profit groups, businesses and industries in the watershed. The mission is to improve water quality conditions and to provide a framework under which the restoration and/or protection of the watershed's natural resources can be achieved. Figure 7 illustrates the management structure to carry out the mission. This report presents the current assessment of water quality conditions in the Buzzards Bay Watershed. The assessment is based on information that has been researched and developed by the Massachusetts Department of Environmental Protection (MA DEP) through the first three years (information gathering, monitoring, and assessment) of the five-year cycle in partial fulfillment of MA DEP's federal mandate to report on the status of the Commonwealth's waters under the Federal Water Pollution Control Act (commonly known as the Clean Water Act [CWA]).

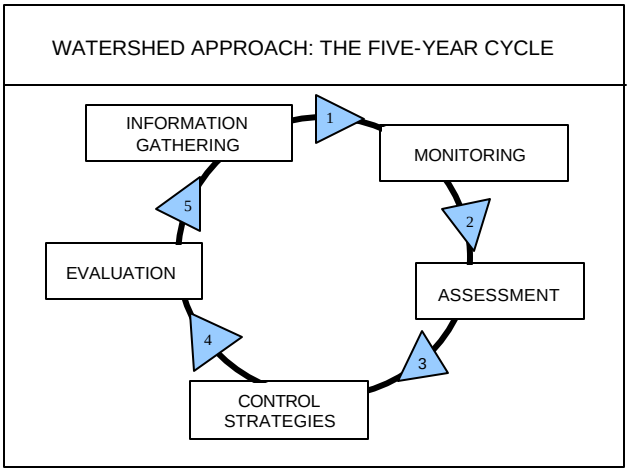

Figure 7: Five-year cycle of the Watershed Approach.

The goal of the CWA is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters (Environmental Law Reporter 1988). To meet this objective, the CWA requires states to develop information on the quality of the Nation's water resources and report this information to the United States Environmental Protection Agency (EPA), the United States Congress, and the public. Together, these agencies are responsible for implementation of the CWA mandates. Under Section 305(b) of the Federal Clean Water Act, every two years MA DEP must submit a statewide report (to the EPA) that describes the status of water quality in the Commonwealth. Up until 2002, this was accomplished as the statewide Summary Of Water Quality (the 305(b) Report). States are also required to submit, under Section 303(d) of the CWA, a List Of Waters requiring a total maximum daily load (TMDL) calculation. In 2002, however, EPA required the states to combine elements of the statewide 305(b) Report and the Section 303(d) List Of Waters into one "Integrated List of Waters". This statewide list is based on the compilation of information for the Commonwealth's 27 watersheds. Massachusetts has opted to write individual watershed water quality assessment reports and use them as the supporting documentation for the Integrated List. The assessment reports utilize data compiled from a variety of sources and provide an evaluation of water quality, progress made towards maintaining and restoring water quality, and the extent to which problems remain at the watershed level. Instream biological, habitat, physical/chemical, toxicity data and other information are evaluated to assess the status of water quality conditions. This analysis follows a standardized process described below (Assessment Methodology). Once the use assessments have been completed, the segments are categorized for the Integrated List.

ASSESSMENT METHODOLOGY

WATER QUALITY CLASSIFICATION

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

Inland Water Classes

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

Coastal and Marine Classes

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

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

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

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

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

EPA provides guidelines to the States for making their use support determinations (EPA 1997 and 2002, Grubbs and Wayland III 2000 and Wayland III 2001). The determination of whether or not a waterbody supports each of its designated uses is a function of the type(s), quality and quantity of available current information. Although data/information older than five years are usually considered "historical" and used for descriptive purposes, they can be utilized in the use support determination provided they are known to reflect the current conditions. While the water quality standards (Table 1) prescribe minimum water quality criteria to sustain the designated uses, numerical criteria are not available for every indicator of pollution. Best available guidance in the literature may be applied in lieu of actual numerical criteria (e.g., freshwater sediment data may be compared to *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario* 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 ***support*** or ***impaired***. When too little current data/information exists or no reliable data are available, the use is ***not assessed***. In this report, however, if there is some indication that water quality impairment may exist, which is not "naturally occurring", the use is identified with an "Alert Status". Detailed guidance for assessing the status of each use follows in the Designated Uses Section of this report. It is important to note that not all waters are assessed. Many small and/or unnamed ponds, rivers, and estuaries are currently ***unassessed***; the status of their designated uses has never been reported to EPA in the Commonwealth's 305(b) report or the Integrated List of Waters nor is information on these waters maintained in the waterbody system database (WBS) or the new assessment database (ADB).

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

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

Note: *Italics are direct quotations.*
Δ criterion (referring to a change from natural background conditions) is applied to the effects of a permitted discharge.

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

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

DESIGNATED USES

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

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

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

AQUATIC LIFE USE

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

Variable	***Support*** - Data available clearly indicates support or minor modification of the biological community. Excursions from chemical criteria (Table 1) not frequent or prolonged and may be tolerated if the biosurvey results demonstrate support.	***Impaired*** There are frequent or severe violations of chemical criteria, presence of acute toxicity, or a moderate or severe modification of the biological community.
BIOLOGY		
Rapid Bioassessment Protocol (RBP) III*	Non/Slightly impacted	Moderately or Severely Impacted
Fish Community	Best Professional Judgment (BPJ)	BPJ
Habitat and Flow	BPJ	Dewatered streambed due to artificial regulation or channel alteration, BPJ
Eelgrass Bed Habitat (Howes *et al.* 2002)	Stable (No/minimal loss), BPJ	Loss/decline, BPJ
Macrophytes	BPJ	Exotic species present, BPJ
Plankton/Periphyton	No/infrequent algal blooms	Frequent and/or prolonged algal blooms
TOXICITY TESTS**		
Water Column/Ambient	≥75% survival either 48 hr or 7-day exposure	<75% survival either 48 hr or 7-day exposure
Sediment	≥75% survival	<75% survival
CHEMISTRY-WATER**		
Dissolved oxygen (DO)/percent saturation (MA DEP 1996a, EPA 1997)	Infrequent excursion from criteria (Table 1), BPJ (minimum of three samples representing critical period)	Frequent and/or prolonged excursion from criteria [river and shallow lakes: exceedances >10% of measurements; deep lakes (with hypolimnion): exceedances in the hypolimnetic area >10% of the surface area].
pH (MA DEP 1996a, EPA 19 November 1999)	Infrequent excursion from criteria (Table 1)	Criteria exceeded >10% of measurements.
Temperature (MA DEP 1996,EPA 1997)	Infrequent excursion from criteria (Table 1) [1]	Criteria exceeded >10% of measurements.
Toxic Pollutants (MA DEP 1996a, EPA 19 November 1999) Ammonia-N (MA DEP 1996a, EPA 1999) Chlorine (MA DEP 1996, EPA 19 November 1999)	Infrequent excursion from criteria (Table 1) Ammonia is pH and temperature dependent[2] 0.011 mg/L (freshwater) or 0.0075 mg/L (saltwater) total residual chlorine (TRC) [3]	Frequent and/or prolonged excursion from criteria (exceeded >10% of measurements).
CHEMISTRY-SEDIMENT**		
Toxic Pollutants (Persaud *et al.* 1993)	Concentrations ≤ Low Effect Level (L-EL), BPJ	Concentrations ≥ Severe Effect Level (S-EL) [4], BPJ
CHEMISTRY-TISSUE		
PCB – whole fish (Coles 1998)	≤500 µg/kg wet weight	BPJ
DDT (Environment Canada 04 November 1999)	≤14.0 µg/kg wet weight	BPJ
PCB in aquatic tissue (Environment Canada 04 November 1999)	≤0.79 ng TEQ/kg wet weight	BPJ

*RBP II analysis may be considered for assessment decision on a case-by-case basis, **For identification of impairment, one or more of the following variables may be used to identify possible causes/sources of impairment: NPDES facility compliance with whole effluent toxicity test and other limits, turbidity and suspended solids data, nutrient (nitrogen and phosphorus) data for water column/sediments. [1]Maximum daily mean T in a month (minimum six measurements evenly distributed over 24-hours) less than criterion. [2] Saltwater is temperature dependent only. [3] The minimum quantification level for TRC is 0.05 mg/L. [4]For the purpose of this report, the S-EL for total polychlorinated biphenyl compounds (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: 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 2002c). The MDPH list identifies waterbodies where elevated levels of a specified contaminant in edible portions of freshwater species pose a health risk for human consumption. Hence, the Fish Consumption Use is assessed as non-support in these waters.

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

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

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

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

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

Variable	***Support*** No restrictions or bans in effect	***Impaired*** There is a "no consumption" advisory or ban in effect for the general population or a sub-population for one or more fish species or there is a commercial fishing ban in effect
MDPH Fish Consumption Advisory List (MDPH 2001a, MDPH 2002c)	Not applicable, precluded by statewide advisory (mercury and/or PCB)	Waterbody on MDPH Fish Consumption Advisory List

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

DRINKING WATER USE

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

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

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

SHELLFISH HARVESTING USE

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

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

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

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

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

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

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

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

PRIMARY CONTACT RECREATION USE

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

Variable	***Support*** Criteria are met, no aesthetic conditions that preclude the use	***Impaired*** Frequent or prolonged violations of criteria and/or formal bathing area closures, or severe aesthetic conditions that preclude the use
Bacteria (MDPH 2002a) Minimum Standards for Bathing Beaches State Sanitary Code and MA DEP 1996a	At "public bathing beach" areas: Formal beach postings/advisories neither frequent nor prolonged during the swimming season (the number of days posted or closed cannot exceed 10% during the locally operated swimming season). Other waters: Samples* collected during the primary contact season must meet criteria (Table 1). Shellfish Growing Area classified as "Approved" by DMF.	At "public bathing beach" areas: Formal beach closures/postings >10% of time during swimming season (the number of days posted or closed exceeds 10% during the locally operated swimming season). Other waters: Samples* collected during the primary contact season do not meet the criteria (Table 1).
Aesthetics (MA DEP 1996a) - *All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance* [growth or amount] *species of aquatic life*		
Odor, oil and grease, color and turbidity, floating matter	Narrative "free from" criteria met or excursions neither frequent nor prolonged, BPJ.	Narrative "free from" criteria not met - objectionable conditions either frequent and/or prolonged, BPJ.
Transparency (MDPH 1969)	Public bathing beach and lakes – Secchi disk depth ≥1.2 meters (≥ 4') (minimum of three samples representing critical period*).	Public bathing beach and lakes - Secchi disk depth <1.2 meters (< 4') (minimum of three samples representing critical period*).
Nuisance organisms	No overabundant growths (i.e., blooms or dense/very dense biovolume of non-native macrophytes) that render the water aesthetically objectionable or unusable*, BPJ.	Overabundant growths (i.e., blooms or dense/very dense biovolume of non-native macrophytes) rendering the water aesthetically objectionable and/or unusable*, BPJ.

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

SECONDARY CONTACT 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 or impaired) of the *Secondary Contact Use*. Excursions from criteria due to natural conditions are not considered impairment of use.

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

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

AESTHETICS USE

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

Variable	***Support*** Narrative "free from" criteria met	***Impaired*** Objectionable conditions frequent and/or prolonged
Aesthetics (MA DEP 1996a) Visual observations	Narrative "free from" criteria met, BPJ (≤10% extent of spatial and temporal degradation).	Narrative "free from" criteria not met, BPJ (>10% extent of spatial and temporal degradation).

BUZZARDS BAY WATERSHED DESCRIPTION

The National Estuary Program (NEP) was established in 1987 by amendments to the Clean Water Act to identify, restore, and protect nationally significant estuaries of the United States. The Buzzards Bay Project (BBP, http://www.buzzardsbay.org), established in 1985 and accepted into the NEP in 1987, is one of 28 National Estuary Programs in the United States. The mission of the BBP, a unit of the Massachusetts Office of Coastal Zone Management, is "to provide technical assistance and funding to municipalities surrounding the Bay to facilitate implementation of the recommendations in the Buzzards Bay Comprehensive Conservation Management Plan (CCMP)." The following basin description was adapted from the CCMP (BBP August 1991).

"Buzzards Bay is a moderately large estuary located between the westernmost part of Cape Cod, southeastern Massachusetts, and the Elizabeth Islands (Figure 8). The Bay is 28 miles long, averages about 8 miles in width, and has a mean depth of 36 feet. It is approximately 228 square miles in size. The coastline stretches over 280 miles and includes 11 miles of public beaches."

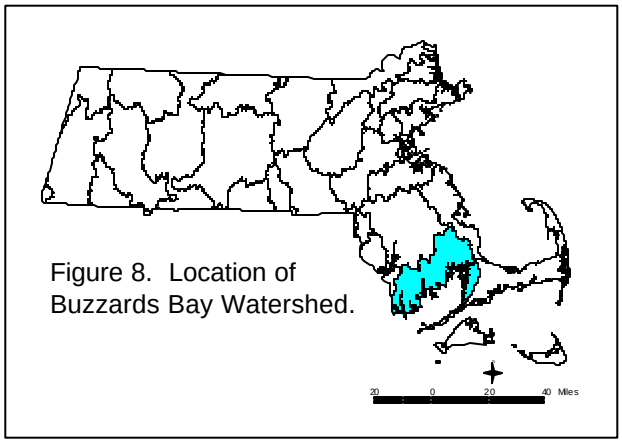

Figure 8. Location of Buzzards Bay Watershed.

The Buzzards Bay drainage basin covers 432 square miles and includes all or sections of 17 municipalities in Massachusetts and Rhode Island. The Bay itself is part of an interconnected hydrologic system that includes several rivers. The largest river basins along the western shore include the Agawam, Wankinco, Weweantic, Mattapoisett, Acushnet, Paskamanset, and Westport. The prominent freshwater streams along the eastern shore are the Back, Pocasset, and Wild Harbor Rivers and Herring Brook. Groundwater seepage is also part of the inflow to Buzzards Bay. "In general, rivers within the drainage basin are slow-moving, meandering streams near their headwaters and for most of their freshwater length. Nearing the coast, the action of the tides rapidly widens the channels as the transition occurs from freshwater stream to tidal estuary. On average, Buzzards Bay rivers are considerably shorter (usually much less than 20 miles) and have smaller drainage areas than other rivers within the state."

Today, approximately 373,690 people live in the watershed with approximately 40% residing in the Greater New Bedford area (CBB Undated a).

Physical Features of the Bay

The Bay was formed during the last ice age approximately 15,000 years ago. Before that Buzzards Bay was periodically submerged as glaciers advanced and retreated through the region, causing sea levels to rise and fall. The southeastern side of the Bay (Bourne, Falmouth, and the Elizabeth Islands) consists of glacial debris deposited by the glacier's leading edge. Consequently, it has a relatively smooth shoreline composed mostly of sand and gravel particles. The northwestern side (Wareham to Westport), with its numerous elongated bays and inlets, was formed by the glacier's retreat to the north. Many of these bays and inlets have since become sheltered from the ocean through the formation of barrier spits.

The distribution and stability of a bay environment depends on three primary physical characteristics of the water: circulation, salinity, and temperature. Tidal currents and wind are the dominant circulation forces in Buzzards Bay because the Elizabeth Islands protect the Bay from large, long-period, open-ocean waves. Complete tidal mixing of Bay water with ocean water is estimated to occur every 10 days.

Water temperatures in the Bay range from a summer maximum of 71.6° F (22° C) to 28°F(-3° C) in winter. During colder winters, the upper reaches of the Bay often freeze, whereas during the spring and summer, solar warming keeps surface waters warmer than the deeper waters. The shallowness of the Bay, combined with surface wave mixing and turbulent tidal flow, prevents strong thermal stratification, so that the Bay is well mixed through most of the year.

Salinity has a small annual range and gradually increases offshore. There are few large streams bringing fresh water into the Bay, with the result that salinity offshore is essentially the same as that of other embayments, such as Block Island and Vineyard Sounds, which receive relatively little fresh water. In the semienclosed embayments along shore, salinity is more variable. Overall, the Bay is a tidally dominated, well-mixed estuarine system.

Land Use Within the Bay

In 1984, much of Buzzards Bay remained undeveloped, with slightly over 60% of the land classified as forest and 14% of the land classified in the residential/commercial/industrial categories. Much of the forested land is away from the coast. When land use within a half mile of the coast is examined, only 40% is forested, and more than 30% is in the residential/industrial/commercial categories. Within specific embayment drainage basins, there is considerable variation as well.

Based on the latest land use figures (MassGIS 2002), the residential, commercial, and industrial uses account for about 12% of the watershed, and approximately 79% of the watershed is undeveloped forest, agriculture or wetland areas. Yet only 10% of the total land area is protected open space. Still, the CCMP statement of 1991 remains true today … *"The large amount of undeveloped land highlights the importance of wise land-use planning to protect Buzzards Bay."*

There are two Areas of Critical Environmental Concern (ACECs) in the Buzzards Bay Watershed, the Back River and Pocasset River, both of which are located entirely within the town of Bourne. The Bourne Back River ACEC was officially designated on 24 April 1989 and lies south of the Cape Cod Canal. This ACEC encompasses 1,850 acres (2.89 mi^2) and contains unaltered and undeveloped salt marshes, tidal flats, and freshwater wetlands. The Back River contains at least three known state-listed rare and endangered species, including osprey, spotted turtle, and diamondback terrapin. The area is used extensively by recreational and educational groups, including the local school system, the Northeast Marine Environmental Institute, and the Woods Hole research community.

The 150-acre (0.23 mi^2) Pocasset River ACEC, located on the eastern shore of Buzzards Bay, was officially designated on 5 December 1980. This ACEC runs from the Shore Road Bridge to the headwaters of the Pocasset River and is a relatively undeveloped, important wildlife habitat. The freshwater ponds within this ACEC were originally used by an iron foundry and are spring fed, remaining ice-free in winter and serving as important seasonal habitat for bird species. The ponds support recreational fishing, while the town's most productive oyster crop is found in the more saline waters of the estuary. A comprehensive ecological inventory of the lower portions has been conducted and a new species of crustacean was first discovered in the river (MA DEM March 2003).

CLASSIFICATION

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

"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).

- Copicut Reservoir, Source to outlet in Fall River and Dartmouth and those tributaries thereto (PWS)
- Sand Pond, Source to outlet in Wareham and those tributaries thereto (PWS)

"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."

- Buttermilk Bay
- Onset Bay
- Wareham River, Entire Length
- Horseshoe Pond to confluence
- Sippican River, County Road to confluence
- Sippican Harbor
- Aucoot Cove
- Mattapoisett Harbor
- Nasketucket Bay
- Outer New Bedford Harbor
- Clark Cove, New Bedford-Dartmouth (CSO)
- Apponagansett Bay, Dartmouth
- Slocums River
- Wesport River, West Branch, Entire Length
- Pocasset River (ORW)

"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."

- Agawam River, Source to Wareham STP
- Wewantic River, Source to Outlet of Horseshoe Pond
- Sippican River, Source to County Road, Marion, Wareham
- New Bedford Reservoir, Source to Outlet
- Acushnet Reservoir, Outlet of New Bedford Reservoir
- Westport River, East Branch, Outlet Noquochoke Lake to Old County Road, Westport

"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."

- Agawam River, From Wareham STP to confluence
- Acushnet River, Main Street to Rte 6 (CSO)
- Acushnet River, Inlet New Bedford Harbor (CSO)
- Westport River, East Branch, from Old Colony Road to confluence
- Cape Cod Canal, Bourne
- Cape Cod Canal, Sandwich

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. A Use Attainability Analysis is a scientific assessment of the technical and economic factors affecting attainment of a use that is conducted by the state and that supports removal of a National Goal Use based on criteria such as costs and impacts associated with attaining that use. [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 2002).

Outstanding Resource Water (ORW) designation applies to those waters with exceptional socio-economic, recreational, ecological and/or aesthetic values. ORWs have more stringent requirements than other waters because the existing use is so exceptional or the perceived risk of harm is such that no lowering of water quality is permissible. ORWs include certified vernal pools; all designated Class A Public Water Supplies; and may include surface waters found in National Parks, State Forests and Parks, Areas of Critical Environmental Concern (ACEC) 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 Buzzards Bay Watershed not otherwise designated in the SWQS are designated *Class B, High Quality Waters* for inland waters and Class SA, 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.

"Vernal pools are small, shallow ponds characterized by lack of fish and by periods of dryness. Vernal pool habitat is extremely important to a variety of wildlife species including some amphibians that breed exclusively in vernal pools, and other organisms, such as fairy shrimp, which spend their entire life cycles confined to vernal pool habitat. Many additional wildlife species utilize vernal pools for breeding, feeding and other important functions. Certified vernal pools are protected if they fall under the jurisdiction of the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00). Certified vernal pools are also afforded protection under the state Water Quality Certification regulations (401 Program), the state Title 5 regulations, and the Forest Cutting Practices Act regulations. However, the certification of a pool only establishes that it functions biologically as a vernal pool. Certification does not determine that the pool is within a resource area protected by the Wetlands Protection Act (NHESP 1999)." Increased vernal pool certification was a long-term priority of the EOEA's Buzzards Bay Watershed Team. Since the team's focus in 2001, certification data has been collected for more than 70 additional vernal pools in the towns of Dartmouth and Rochester. This is nearly a 300% increase over the two-dozen vernal pools previously certified. Currently 64 vernal pools (Harding 2003) have received full certification. These are located in the towns of Plymouth, Carver, Rochester, Mattapoisett, New Bedford, Fall River, Dartmouth, and Westport. Species of special concern observed in these pools include the spotted turtle (*Clemmys guttata*), the Mystic Valley Amphipod (*Crangonyx aberrans*), and the four-toed salamander (*Hemidactylium scatatum*). Other obligate vernal pool species observed include the spotted salamander (*Ambystoma maculatum*), marble salamanders, unidentified mole salamanders, fairy shrimp (Order Anostraca) and the wood frog (*Rana sylvatica*). Numerous facultative species of frogs, newts (a form or lifestage of a salamander), turtles, and a variety of benthic macroinvertebrates were also documented in vernal pools in the Buzzards Bay Watershed (NHESP 2002). Additional information is available from the Natural Heritage and Endangered Species Program Website:
http://www.state.ma.us/dfwele/dfw/nhesp/nhesp.htm

SUMMARY OF EXISTING CONDITIONS AND PERCEIVED PROBLEMS

The Buzzards Bay drainage area has been the subject of several MA DEP water quality studies in the past. A list of these studies is available in *Publications of the Division of Watershed Management Watershed Planning Program 1963 - 2003* (MA DEP 2003). Early efforts included the 1971 surveys of the Acushnet River and New Bedford Harbor, a 1975 water quality survey of the western shore of Buzzards Bay from the Massachusetts/Rhode Island boundary to Buttermilk Bay, and a 1976 water quality survey of Cape Cod, which included stations on the eastern shore of the Bay in Bourne and Falmouth. In 1985 and 1986 the Massachusetts Division of Water Pollution Control carried out a comprehensive water quality monitoring program by dividing the entire Buzzards Bay drainage into five individual study areas. These surveys represent the last attempt by the MA DEP to perform extensive, area-wide, water quality surveys in Buzzards Bay. At that same time, MA DEP used a number of different bacterial indicators to evaluate nonpoint sources of fecal contamination, and a special cranberry bog input study was performed. Finally, in 1987 and 1988, a caged-mussel biomonitoring pilot study was undertaken at three sites in the vicinity of Clark's Cove, New Bedford. Since that time, MA DEP monitoring efforts have focused primarily on individual problem areas. For example, fish toxics monitoring was performed in selected waterbodies potentially affected by landfills or waste sites.

To address water quality impairments across the entire Buzzards Bay watershed, the EPA designated Buzzards Bay a No Discharge Area (NDA) for boat sewage in August 2001 Encompassing 210 square miles in 11 coastal communities, Buzzards Bay is the largest No Discharge Area in Massachusetts. A No Discharge Area is a designated body of water in which the discharge of all boat sewage, even if it is treated, is prohibited. With 13,000 boats registered in the Buzzards Bay area and with a well-established transient fleet visiting each year, thousands of gallons of raw or partially treated sewage are prevented from entering Buzzards Bay. Untreated or partially treated sewage, such as that from boat heads, contains high concentrations of nitrogen and bacteria. In fact, many marine sanitation devices discharge "treated" waste with bacteria counts five to 70 times higher than that allowable for shellfishing or swimming waters. None of the devices available today are designed to reduce the nitrogen concentration in "treated" wastes. Nitrogen can be a problem in poorly flushed embayments because it stimulates harmful algal growth and contributes to reductions in dissolved oxygen. Both of these conditions can decrease the survivorship and reproductive potential of marine life. Boaters can use any of the 37 pumpout or dump facilities located throughout the Buzzards Bay Watershed to dispose of their sewage.

Cranberries have been grown in southeastern Massachusetts for almost 100 years. Operations associated with cranberry bogs, particularly fertilization practices, may be detrimental to surface water quality. In 2001, the University of Massachusetts Cranberry Experiment Station was awarded a s. 319 grant (Project 01-12/319, Appendix D) to study the phosphorus dynamics in six cranberry bogs. The project is expected to be completed in 2004.

Buzzards Bay was selected by CZM in 2000 as a pilot study area for the use of *bilge socks*, another water quality tool offered to boaters. By soaking up and bonding to oil and gas that get into the bilge, bilge socks help boaters prevent the release of petroleum products to coastal waters. Bilge socks were distributed free of charge through the local harbormasters.

Past water quality surveys in the Buzzards Bay drainage area have documented a number of site-specific sources of pollution, depending upon the individual subwatersheds in question. For example, New Bedford Harbor and the lower Acushnet River watershed is the most urbanized area of the Buzzards Bay drainage. These waterbodies have a history of contamination from municipal and industrial wastewater treatment facilities, combined sewer overflows (CSO), and urban runoff. Sediments in the Acushnet estuary and New Bedford inner and outer harbors have been severely contaminated by PCBs and, as a result, are a designated EPA Superfund site.

The Agawam River exhibits excessive growth of algae and aquatic macrophytes. These result from nutrient inputs from both the Wareham Waste Water Treatment Plant (WWTP) as well as upstream nonpoint sources. Other rural subwatersheds around Buzzards Bay are also affected by nonpoint sources, such as agricultural runoff.

There are five EPA designated Superfund sites in the watershed: Atlas Tack in Fairhaven; Re-Solve, Inc. in Dartmouth; Sullivan's Ledge in New Bedford; Massachusetts Military Reservation; and New Bedford Harbor. The water quality implications of each are described below.

The **Atlas Tack Corporation** formerly manufactured cut and wire tacks, steel nails, and similar items on a 24-acre site in Fairhaven located in the Outer New Bedford Harbor subwatershed (Segment MA95-63). From the 1940s until the late 1970s wastes containing cyanide and heavy metals, including high levels of arsenic, were discharged into an unlined acid neutralizing lagoon located approximately 200 feet east of the manufacturing building and adjacent to a saltwater tidal marsh in the Buzzards Bay Estuary. Other contaminated areas at the site include a filled wetland, former dump, and other chemical spills. The area is residential and commercial. Approximately 7,200 people live within a 1-mile radius and approximately 15,150 people live within 3 miles of the site. The groundwater is contaminated with cyanide and toluene that has leached from the site lagoons. The on-site soil is contaminated with volatile organic compounds (VOCs), including toluene and ethyl benzene; heavy metals, including chromium, cadmium, lead, and nickel; pesticides; polychlorinated biphenyls (PCBs); and polycyclic aromatic hydrocarbons (PAHs). The marsh south of the lagoon and estuarine areas in Buzzards Bay are also contaminated causing an ecologic risk to the wildlife. The Remedial Action (cleanup activities) is awaiting funding of $13.1 million for this fiscal year (FY04). The Remedial Action will be performed in three phases: Phase I - demolition of the manufacturing and power plant buildings; Phase II - excavation of contaminated soils and debris from the commercial and debris and fill areas; and, Phase III - excavation of marsh soils and creek bed sediments. The Remedial Design has been completed for Phase I and II. As part of the design for Phase III, EPA recently performed a bioavailability study of the contaminated marsh area on the site. Results of the study will allow EPA to determine the nature and extent of toxicity present to the ecological community by way of uptaking available contaminants and will more clearly define the limits of excavation in the marsh. All contaminated materials, estimated at 54,000 cubic yards, will be shipped off-site to licensed landfills. Site restoration of each area will follow excavation and after confirmatory soil sample analysis shows that the cleanup levels have been met. (EPA 13 December 2002a).

The **Re-Solve, Inc. Superfund Sit**e is a former waste chemical reclamation facility situated on 6 acres of land in Dartmouth in the Copicut River subwatershed (Segment MA95-43). Between 1956 and 1980, Re-Solve handled a variety of hazardous materials, including solvents, waste oils, organic liquids and solids, acids, alkalies, inorganic liquids and solids, and polychlorinated biphenyls (PCBs). Residues from the distillation tower, liquid sludge waste, impure solvents, and burned tires were disposed of in four on-site unlined lagoons. The lagoon contents were burned periodically to reduce the VOC content. An oil waste that accumulated at the bottom of the degreaser distillation still was disposed of on one portion of the site through landfarming. This oil waste also was spread throughout the site to control dust. Cooling water from the distillation tower was discharged to a shallow on-site lagoon. In 1974, the State issued Re-Solve a license to collect and dispose of hazardous waste. In 1980, the State agreed to accept Re-Solve's offer to surrender its disposal license on the condition that all hazardous waste be removed from the site. In 1981, legal action resulted in all drums, debris, and buildings being removed, but the contents of the four lagoons remained. Approximately 300 people live within a 1-mile radius of the site. Three residences are located within 150 yards of Re-Solve. The site is bounded by wetlands to the north, east, and southeast, and the land surrounding the site is predominantly zoned for single-family residential use. The bottoms of the lagoons are situated in the water table and some contaminants have migrated to groundwater and sediments. All residences obtain their water from private wells located on their property. Groundwater is contaminated with VOCs and PCBs. Sediments are contaminated with PCBs and VOCs. Soil contains PCBs, lead, and VOCs including, trichloroethylene (TCE), vinyl chloride, methylene chloride, and toluene. Surface water is contaminated with PCBs and VOCs. Fish from the adjacent Copicut River and Cornell Pond contain elevated levels of PCBs and mercury (mercury is not related to the site). The Copicut River, located about 500 feet from the site, has been designated for the protection and propagation of fish, other aquatic life, and wildlife. The site is located over an aquifer that serves as a local drinking water source for private residential wells and serves as a recharge area for part of a nearby town where a new municipal well is being planned. Contaminants are moving off site in surface water runoff and groundwater. Monitoring of the system will continue for treated water effluent, treated air effluent, and surrounding groundwater, surface water and wetlands. In addition, annual monitoring of selected residential wells surrounding the site and fish from Copicut River and Cornell Pond will continue. Since 1998, EPA has hosted an annual fishing derby at Cornell Pond to ensure appropriate fish species were collected under

the site's environmental monitoring program. The fishing derbies have been held in September or October, to tap into the experience of local fishermen for collecting fish from the pond. The derbies actively and safely involve the community in an important fish monitoring program and provide EPA with an opportunity to re-emphasize the Massachusetts Department of Public Health Fish Advisory not to consume American Eel and limit consumption of other fish species caught from the pond or river. Public recreational fishing (catch and release) is permitted at the pond and river. At the conclusion of the derbies, awards were issued to each fisherman catching the largest fish species. The fishing derbies have been an overwhelming success and the community looks forward to the event every year. In 1999, the potentially responsible parties, with EPA and U.S. Fish and Wildlife Service oversight, implemented a voluntary ecological beneficial re-use program at the site. The parties designed and installed a 4-acre native upland meadow cover which replaced the existing gravel cover at the site. This restoration and beneficial ecological re-use was intended to re-establish native species at the site and enhance environmental habitat (EPA 13 December 2002b).

The 12-acre **Sullivan's Ledge** disposal area, in the northwestern corner of New Bedford (Paskamansett River subwatershed -Segment MA95-11), operated as a quarry until about 1932. In 1935, the City of New Bedford acquired the site through tax title foreclosure. Between the 1940s and the 1970s, local industries used the quarry pits and adjacent areas for disposal of hazardous material and other wastes including electrical capacitors, fuel oil, volatile liquids, tires, scrap rubber, demolition materials, brush and trees.

Approximately 98,500 people live within 3 miles of the site in this residential area. An unnamed stream borders the site and discharges into Middle Marsh, which is on the golf course. Immediately north of the marsh lie railroad tracks, the Apponagansett Swamp, and the City of New Bedford municipal landfill. Volatile organic compounds in the on-site and immediately off-site groundwater increase with depth. Inorganic compounds and PCBs also are present in the groundwater. The soil is contaminated with PCBs and PAHs. The soils along the eastern and southern boundaries contained the highest contaminant concentrations. Soils have eroded from the site into the unnamed stream and have been transported from the site. Sediments in the unnamed stream, Middle Marsh, four golf course water hazards, and a portion of the Apponagansett Swamp were contaminated with PCBs. The quarry area was capped to reduce potential exposures. Likewise, the unnamed stream, Middle Marsh, and water hazards have been cleaned and the resulting materials buried within the on-site cap. The EPA chose the following remedies for cleaning up the disposal area portion of the site: excavate and dispose of sediments from the stream and the golf course water hazards; construct an impermeable cap over an 11-acre area to cover the quarry pits and contain the contaminated surface soils and sediments that would be placed on site; divert and line a portion of the unnamed stream to prevent water from being pulled into extraction wells; install an active pumping system to collect contaminated shallow bedrock groundwater, a passive collection system to collect contaminated seeps and shallow groundwater, and a treatment system to treat collected groundwater; restore and enhance the wetlands to reasonably similar hydrologic and botanical conditions that existed prior to excavation; monitor the site with 5-year reviews; and use institutional controls to ensure that the bedrock groundwater will not be used for drinking water since it cannot be cleaned to drinking water standards. The groundwater treatment plant began operating in late 1999. Construction on the cap began in the spring of 1998 and was completed in 2000. In 1989, the EPA began a study of the contamination in the Middle Marsh sediments. In 1991, the EPA released results of the studies, which indicated significant PCB accumulation in wildlife in and around Middle Marsh. While sediments in the Marsh also were found to be heavily contaminated with PCBs, the threat to human health was judged to be negligible. A decision on the appropriate cleanup remedy was reached in late 1991. The EPA chose the following remedy for Middle Marsh: establish security measures and clear the land, excavate contaminated sediments from portions of the Middle Marsh and the adjacent wetland, screen and dewater the excavated sediments, dispose of the excavated materials beneath the cap to be constructed at the Sullivan's Ledge Disposal Area, restore the affected wetlands, use institutional controls to prevent future residential use of and restrict access to the area, and establish a long-term environmental monitoring plan. In the event that the Sullivan's Ledge Disposal Area would be unavailable for disposal, the EPA also selected a contingency remedy that includes the same site preparation, excavation, wetlands restoration, institutional controls and long-term monitoring as the remedy described above. However, excavated sediments would be treated by solvent extraction and replaced within Middle Marsh. Initial construction activities began in 1999 and were completed during 2000 (EPA 13 December 2002c).

The Otis Air National Guard Base/Camp Edwards site covers approximately 22,000 acres (Figure 9) and is commonly known as the **Massachusetts Military Reservation (MMR**). Although the occupants and property boundaries have changed several times since MMR was established in 1935, the primary mission has always been to provide training and housing to Air Force and Army units. The EPA has designated the Sagamore Lens underlying MMR as a sole source aquifer under the Safe Drinking Water

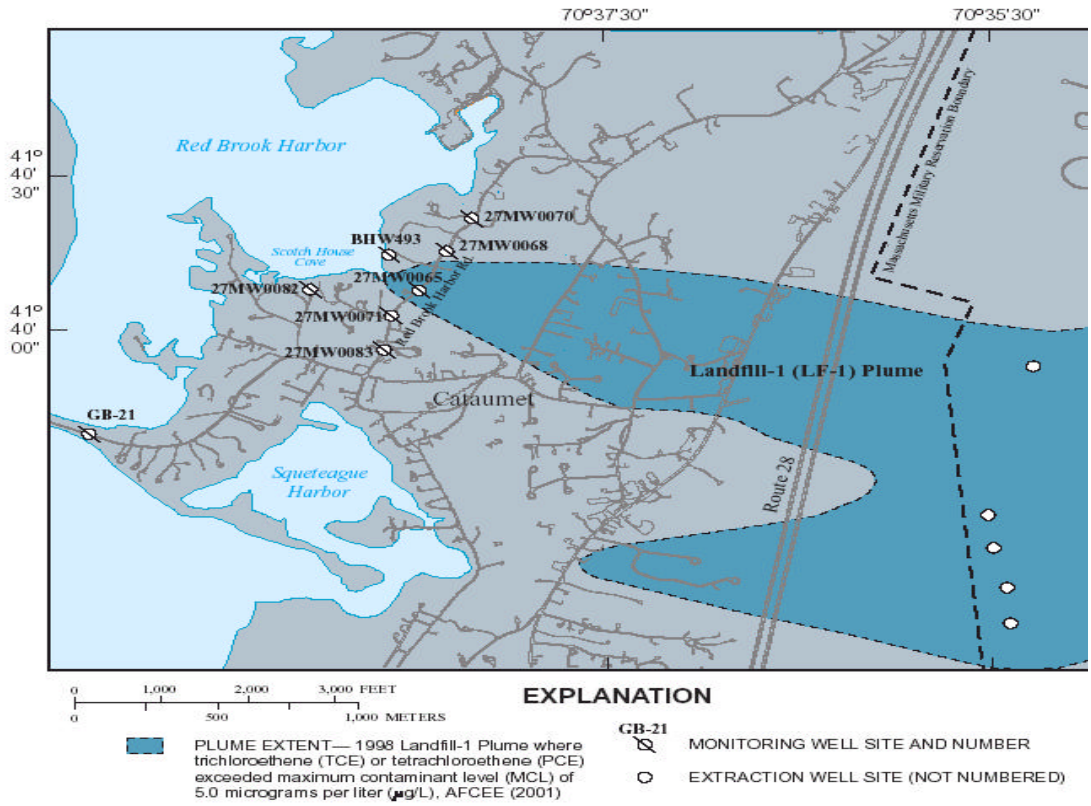

Figure 9. Location of Landfill-1 plume and geophysical logging sites in the vicinity of Red Brook Harbor, Cape Cod, Massachusetts, August 2000. Courtesy of USGS (McCobb and LeBlanc 2002).

Act. A review of past and present operations and waste disposal practices identified numerous potentially contaminated areas causing the EPA to designate MMR a Superfund site. The Air Force Center for Environmental Excellence (AFCEE) is the lead agency in the cleanup of seven groundwater plumes emanating from the MMR. These contaminated areas are the result of historic chemical/fuel spills, fire training activities, landfills, drainage structures and effluent from the former sewage treatment plant. Of particular importance to the Buzzards Bay Watershed is a plume emanating from a former landfill (LF-1) that has contaminated several private wells, two Bourne public water supply wells in Cataumet. The LF-1 plume has two lobes, a northern lobe that has reached the coast at Red Brook Harbor (Segment MA95-18) and a southern lobe heading toward the coast at Squeteague Harbor (Segment MA95-55) (McCobb and LeBlanc 2002). A second plume from the central impact area has impacted the Bourne public water supply wells in Monument Beach. In 1995, the landfill was capped and by 1999, AFCEE began the groundwater extraction and treatment operations along the MMR western boundary between the northern and southern lobes of the LF-1 plume. The system is designed to extract water from those zones within the plume that contain the highest concentrations of contaminants such as tetrachloroethene or perchloroethene (PCE), trichloroethene (TCE), and carbon tetrachloride. It is estimated that the cleanup operation will last another 20-25 years. In 2000, the USGS investigated where freshwater discharges to the harbor and what concentrations of VOCs are in the groundwater as it enters the harbor (McCobb 2001). In 1997 and 2001, the MDPH sampled shellfish in Red Brook and Squeteague Harbors and found that certain VOC's were either not detected or at concentrations below "any available health-based screening value for fish or shellfish" (MDPH 2002d). In June 2002, the AFCEE funded a pipeline linking the Bourne Water District water main to the Upper Cape Water Supply Cooperative supply thereby

making up for the Town's projected drinking water shortfalls. The AFCEE also plans to continue monitoring at Red Brook and Squeteague Harbors as well as at monitoring and extraction wells in and around the LF-1 plume area. Additional information is available at http://www.mmr.org/Cleanup/index.htm and http://water.usgs.gov/pubs/wri/wri024166.

The 18,000-acre **New Bedford Harbor** Superfund site (Segments MA95-33, 95-39, 95-39, 95-42, 95-62,and 95-63) is an urban tidal estuary with sediments that are highly contaminated with polychlorinated biphenyls and heavy metals. At least two manufacturing facilities in the area used PCBs while producing electric devices from 1940 to the late 1970s, when EPA banned the use of PCBs. These facilities discharged industrial wastes containing PCBs directly into the harbor and indirectly via the City's sewerage system. As a result, the harbor is contaminated in varying degrees for at least 6 miles, from the upper Acushnet River into Buzzards Bay. Bioaccumulation of PCBs within the marine food chain has resulted in closing the area to lobstering and fishing, and recreational activities and harbor development have been limited by the widespread PCB problem. Over 100,000 people live within 3 miles of the site (EPA 13 February 2003).

Measurements taken in New Bedford Harbor indicate tidal action transports up to 0.5 pounds per day of PCBs from the upper harbor to the lower harbor and, ultimately, Buzzards Bay. This site is being addressed in the following four stages: early action and three long-term remedial phases focusing on the Acushnet River, the upper and lower harbor, and the Buzzards Bay area (EPA 13 February 2003).

> Early Action - In May 2001, EPA completed the excavation and restoration of the highly PCB-contaminated shoreline in Acushnet near a residential area and installed temporary fencing at two New Bedford shoreline locations to minimize exposure to contaminated shoreline sediments. According to a 2000 Dredging Study prepared by the EPA and ACOE, final dredging of the approximately 200 acres of PCB-contaminated sediment is currently scheduled to begin in fall 2003.
>
> Acushnet River - A 5-acre northern portion of the Acushnet River Estuary contaminated with high levels of PCBs has been identified as the "hot spot" area of the superfund site. Between April 1994 and September 1995, approximately 14,000 cubic yards of sediment were dredged from the hot spot and temporarily stored in a lined and covered holding pond while the EPA reconsidered permanent storage alternatives. By May 2000 all the dredge spoils were transported to an offsite Toxic Substances Control Act permitted landfill.
>
> Upper and Lower New Bedford Harbor - After an extensive process of studying New Bedford Harbor and developing consensus for a solution to the widespread PCB problem in the Upper and Lower Harbor areas, EPA issued a final ROD in September 1998. The selected remedy calls for dredging and shoreline containment of approximately 450,000 cubic yards of contaminated sediment and wetlands in four combined disposal facilities.
>
> Buzzards Bay Area - The EPA plans to initiate additional investigations of this area of the site (south of the hurricane barrier) to determine if additional cleanup actions are necessary.

EPA investigations identified the Aerovox facility as the primary source of PCBs to New Bedford Harbor. PCB wastes were discharged from Aerovox's operations directly to the upper harbor through open trenches and discharge pipes, or indirectly throughout the site via combined sewer overflows (CSOs) and the City's sewage treatment plant outfall. Secondary inputs of PCBs were also made from the Cornell Dubilier Electronics, Inc. (CDE) facility (EPA 29 July 2003).

Aerovox Incorporated consented to a clean up plan on its property adjacent to the upper harbor. The administrative consent orders issued in 1982 and 1999 required isolation of the contaminated soil, monitoring of the groundwater until 2014, measures to protect employees, relocation to a new facility, implementation of a security plan at the closed facility, establishment of a trust fund with annual deposits, and when $4.8 million was accumulated in the fund, demolition of the facility and capping the site. The company has relocated to a new facility. However, in June 2001, Aerovox filed a voluntary Chapter 11 bankruptcy petition (EPA 29 July 2003).

Cornell Dubilier Electronics, Inc. (CDE) consented in 1983 to address handling, discharging, and releases of PCB and to monitor the groundwater. CDE also removed and disposed of PCB-contaminated sediments from portions of the municipal sewer system downstream of the CDE plant in the fall of 1984. The City of New Bedford, pursuant to the state's hazardous waste regulations, encased and abandoned approximately one and one-half mile of sewer interceptor that had a build-up of PCB-contaminated grit (EPA 29 July 2003).

In 1991 and 1992, a settlement was reached between the United States National Oceanic and Atmospheric Administration (NOAA), the Commonwealth, and five of the original six defendants which, at various times, owned or operated either of the two capacitor manufacturing facilities along the New Bedford Harbor. The companies (Aerovox Incorporated, Belleville Industries, Inc., AVX Corporation, CDE, Inc., and Federal Pacific Electric Company) agreed to pay damages for injury to natural resources at and near the site caused by releases of PCBs and to repay EPA for the response costs incurred (EPA 29 July 2003).

Other factors influencing water quality in the Buzzards Bay Watershed include mercury contamination, nutrient enrichment, and combined sewer overflows. The northeastern United States has been identified as receiving elevated rates of mercury deposition from the atmosphere and having high levels of mercury contamination in freshwater fishes (Tatsutani 1998). All forms of mercury are toxic to humans and have no known function in any normal biological process. Mercury can be transformed into methylmercury. The ability of methylmercury to bind to proteins (e.g., muscle tissues) contributes to its ability to biologically concentrate into aquatic organisms by factors ranging from 10, 000 to 1,000,000 its concentration in water (Stein *et. al.* 1996). Aside from point discharges, most of the mercury contamination in the northeastern United States has been linked to air emissions (incineration, fossil fuel combustion, and sewage treatment plant operation), and agricultural practices (herbicides, fungicides) from both local and up-wind sources. The primary vector of mercury exposure in people is through the consumption of contaminated foodstuffs.

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 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 2001a).

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 2001a)

MDPH has issued site-specific advisories on the following waterbodies in the Buzzards Bay Watershed (MDPH 2002c):

- Copicut River and Cornell Pond (Dartmouth),
- Noquochoke Lake (Dartmouth),
- Turner Pond (Dartmouth/New Bedford),
- Snipituit and Long ponds (Rochester),
- New Bedford Harbor (New Bedford/Fairhaven).

The Coalition for Buzzards Bay Baywatchers conducted weekly monitoring in the 28 major harbors and coves in Buzzards Bay (http://www.savebuzzardsbay.org/wwd/research/baywatchers.htm). The Buzzards Bay Water Quality Monitoring Program was initiated in 1992 to “assess and evaluate nitrogen-related water quality and long-term ecological trends in Buzzards Bay” (Howes *et al.* 1999). Data from this program are collected in support of the Buzzards Bay Health Index, developed by the Coalition to gauge the health of an embayment, and to provide a “bay at a glance picture of conditions” throughout Buzzards

Bay (Howes *et al.*1999). The index uses oxygen saturation, Secchi disk depth (transparency), phytoplankton pigments (chlorophyll a and phaeopyhtin), dissolved inorganic nitrogen, and total organic nitrogen (dissolved and particulate) to give a score of 0-100. Additional information is presented in the Coalition's *Baywatchers III- A Decade of Monitoring Buzzards Bay Embayments 1992-2001* (CBB Undated b).

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The following waterbodies in the Buzzards Bay Watershed appear on the *Baywatchers III- A Decade of Monitoring Buzzards Bay Embayments 1992-2001* with Good/Excellent water quality (Five Year Average Health Index Scores range between 65-100)

- Fiddlers Cove Onset Harbor
- Shell Point Bay
- Back River
- Buttermilk Bay
- Pocasset River
- Pocasset Harbor, Inner
- New Bedford Harbor, Outer
- Blankenship Cove
- Sippican Harbor, Outer
- Red Brook Harbor, Outer
- Mattapoisett Harbor, Inner
- Cuttyhunk Pond
- Phinney's Harbor
- Onset Bay, Inner
- West Falmouth, Mid-Harbor
- Rands Harbor
- West Falmouth - Harbor Head
- Clarks Cove, Inner
- Quissett Harbor, Inner
- Onset Bay, Outer
- Westport River, Inlet
- Megansett Harbor
- Clarks Cove, Outer
- West Falmouth, Outer Harbor
- Mattapoisett Harbor, Outer
- Pocasset Harbor, Outer
- Hiller's Cove
- Aucoot Cove, Mid-Harbor
- Quisett Harbor, Outer
- Aucoot Cove, Outer
- Penikese Island

The following waterbodies in the Buzzards Bay Watershed appear on the *Baywatchers III- A Decade of Monitoring Buzzards Bay Embayments 1992-2001* with Fair water quality (Five Year Average Health Index Scores range between 35-65).

- Little River, Inner
- Wareham River, Inner
- Marks Cove
- New Bedford Harbor, Inner
- Little Bay (Nasketucket)
- Cuttyhunk, West End Pond
- Wareham River, Outer
- Wild Harbor River
- West Falmouth, Snug Harbor
- Little Sippewisset Marsh
- Weweantic River, Outer
- Broadmarsh River
- Little River, Outer
- Mattapoisett Harbor, River Mouth
- Slocums River, Outer
- Aucoot Cove, Inner
- Wild Harbor
- Apponagansett Bay, Mid-Harbor
- Westport River, Inner West Branch
- Sippican Harbor, Inner
- Squeteague Harbor
- Onset Bay, East River
- Nasketucket Bay
- Eel Pond, Bourne
- Little Buttermilk Bay
- Apponagansett Bay, Outer
- Westport River, Outer East Branch
- Hen Cove
- Red Brook Harbor, Inner

The following waterbodies in the Buzzards Bay Watershed appear on the *Baywatchers III- A Decade of Monitoring Buzzards Bay Embayments 1992-2001* with Poor/Eutrophic Conditions (Five Year Average Health Index Scores <35).

- Nasketucket River
- Agawam River
- Eel Pond, Mattapoisett
- Westport River, Upper East Branch
- Acushnet River
- Apponagansett Bay, Inner
- Slocums River, Inner
- Wesport River, Mid East Branch
- Hammet Cove
- Weweantic River, Inner

The Clean Water Act Section 303(d) requires states to identify those waterbodies that are not meeting standards and prioritize the development of TMDLs for these waterbodies. Table 2 identifies the waterbodies in the Buzzards Bay Watershed on the most recent, EPA approved, 1998 Massachusetts Section 303(d) List Of Waters (MA DEP 1999). Additionally, all freshwaters in Massachusetts are technically (by default) listed 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). EPA released guidance on November 19, 2001 for the preparation of an *Integrated List of Waters* that would combine reporting elements of both § 305(b) and § 303(d) of the CWA. The integrated list format allows states to provide the status of all their assessed waters in a single multi-part list. In October of 2002, MA DEP released Massachusetts *Year 2002 Integrated List of Waters - Context and Rationale for Assessing and Reporting the Quality of Massachusetts Surface Waters* and *Massachusetts Year 2002 Integrated List of Waters Part 2 – Proposed Listing of Individual Categories of Waters* for public comment. The list received approval from EPA on 1 October 2003.

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Table 2. 1998 303(d) List of Waters in the Buzzards Bay Watershed

Waterbody	WBID	Description	Cause of Impairment
Bates Pond	MA95007	Carver	Noxious Aquatic Plants
Buttonwood Park Pond	MA95020	New Bedford	Noxious Aquatic Plants
Cedar Dell Lake	MA95021	Dartmouth	Noxious Aquatic Plants
Cornell Pond	MA95031	Dartmouth	Priority Organics, Metals
Crane Brook Bog Pond	MA95033	Carver	Noxious Aquatic Plants
Federal Pond	MA95055	Carver	Noxious Aquatic Plants
Fuller Street Pond	MA95058	Carver	Noxious Aquatic Plants
Kings Pond	MA95078	Plymouth	Noxious Aquatic Plants
Little Long Pond	MA95089	Wareham	Noxious Aquatic Plants
Little Rocky Pond	MA95091	Plymouth	Noxious Aquatic Plants
Long Duck Pond	MA95097	Plymouth	Noxious Aquatic Plants
Mare Pond	MA95172	Plymouth	Noxious Aquatic Plants
Mill Pond	MA95105	Wareham	Noxious Aquatic Plants
New Bedford Reservoir	MA95110	Acushnet	Noxious Aquatic Plants
New Long Pond	MA95112	Plymouth	Noxious Aquatic Plants
Noquochoke Lake	MA95113	Dartmouth	Priority Organics, Metals, Noxious Aquatic Plants, Turbidity
Noquochoke Lake {South Basin}	MA95170	Dartmouth	Priority Organics, Metals, Noxious Aquatic Plants, Turbidity
Noquochoke Lake {North Basin}	MA95171	Dartmouth	Priority Organics, Metals, Noxious Aquatic Plants, Turbidity
Parker Mills Pond	MA95115	Wareham	Noxious Aquatic Plants
South Meadow Brook Pond	MA95139	Carver	Noxious Aquatic Plants
Southwest Atwood Bog Pond	MA95141	Carver	Noxious Aquatic Plants
Three Cornered Pond	MA95145	Plymouth	Noxious Aquatic Plants
Tihonet Pond	MA95146	Wareham	Organic enrichment / Low DO
Tinkham Pond	MA95148	Mattapoisett/Acushnet	Noxious Aquatic Plants
Turner Pond	MA95151	New Bedford/Dartmouth	Turbidity
White Island Pond {East Basin}	MA95166	Plymouth	Nutrients, Organic enrichment/Low DO, Noxious Aquatic Plants
White Island Pond {West Basin}	MA95173	Plymouth	Nutrients, Organic enrichment/Low DO, Noxious Aquatic Plants
Acushnet River *	MA95-31	Outlet New Bedford Reservoir to Hamlin Road culvert	Nutrients, Siltation, Organic enrichment/Low DO, Pathogens
Acushnet River *	MA95-32	Hamlin Road to culvert at Main Street	Nutrients, Organic enrichment/Low DO, Pathogens

* Segments Needing Confirmation for all causes of impairment

Table 2. (Continued). 1998 303(d) List of Waters in the Buzzards Bay Watershed

Waterbody	WBID	Description	Cause of Impairment
Acushnet River	MA95-33	Outlet Main Street culvert to Coggeshall Street bridge	Priority organics, Metals, Nutrients, Organic enrichment/Low DO, Pathogens
Agawam River	MA95-29	Wareham WWTP to confluence with Wankinco River, Wareham	Nutrients, Other habitat alteration, Pathogens, Noxious Aquatic Plants
Apponagansett Bay	MA95-39	Dartmouth	Priority organics, Pathogens
Aucoot Cove	MA95-09	(No description)	Pathogens
Buttermilk Bay	MA95-01	Bourne/Wareham	Pathogens
Buttonwood Brook*	MA95-13	Headwaters, New Bedford, to Apponagansett Bay, Dartmouth	Pathogens
Cape Cod Canal	MA95-14	(No description)	Pathogens
Clark Cove	MA95-38	(No description)	Priority organics, Pathogens
Copicut River	MA95-43	Outlet of Copicut Reservoir, Dartmouth/Fall River to the inlet of Cornell Pond, Dartmouth	Priority organics, Metals
Hiller Cove	MA95-10	(No description)	Pathogens
Little Sippewisset Marsh	MA95-24	Falmouth	Pathogens
Mattapoisett Harbor	MA95-35	(No description)	Pathogens
Mattapoisett River*	MA95-36	Outlet Snipatuit Pond, Rochester to River Road Bridge, Mattapoisett	Pathogens
New Bedford Inner Harbor	MA95-42	Coggeshall Street Bridge to Hurricane Barrier	Priority Organics, Metals, Nutrients, Organic enrichment/Low DO, Pathogens
Onset Bay	MA95-02	Wareham	Pathogens
Outer New Bedford Harbor	MA95-27	(Buzzards Bay) Waters landward of a line drawn from Ricketson Point to Wilbur Point	Priority organics, Nonpriority organics, Metals, Organic enrichment/Low DO, Pathogens
Paskamanset River*	MA95-11	Outlet Turners Pond Dartmouth/New Bedford to confluence with Slocums River, Dartmouth	Pathogens
Phinneys Harbor	MA95-15	(No description)	Pathogens
Pocasset Harbor	MA95-17	(No description)	Pathogens
Quissett Harbor	MA95-25	Falmouth	Pathogens
Red Brook Harbor	MA95-18	(No description)	Pathogens
Sippican River*	MA95-07	County Road to confluence with Weweantic River, Marion/Wareham	Pathogens
Sippican Harbor	MA95-08	(No description)	Pathogens
Slocums River	MA95-34	Rock O'Dundee Road to mouth at Buzzards Bay, Dartmouth	Pathogens
Snell Creek	MA95-45	Drift Road to confluence with East Branch Westport River	Pathogens
Wareham River	MA95-03	Route 6 bridge to mouth at Buzzards Bay	Pathogens
West Falmouth Harbor	MA95-22	Falmouth	Pathogens
East Branch Westport River	MA95-40	Outlet Lake Noquochoke to Old County Road bridge	Pathogens
Weweantic River*	MA95-04	Route 28 Bridge to inlet of Horseshoe Pond, Wareham	Pathogens
Weweantic River	MA95-05	Outlet Horseshoe Pond, Wareham to mouth at Buzzards Bay, Marion/Wareham	Pathogens

* Segments Needing Confirmation for all causes of impairment

Combined Sewer Overflows from the City of New Bedford discharge to Clark's Cove (outfalls 003-011), Buzzards Bay Outer Harbor (outfalls 012-018), the Acushnet River (outfalls 019-027and 039-041), and to Buzzards Bay Inner Harbor (outfalls 028-037). The New Bedford CSO Facilities Plan was completed in September 1990 by Camp, Dresser, & McKee (CDM). The Plan divided the CSO area into 6 subareas and evaluated a range of CSO alternatives. A key consideration was the protection of the Clark's Cove area (CSO areas 1 and 2), which has swimming beaches and is among the most productive shellfish beds in the state (Brander 2002). The recommended plan called for:

- Subarea 1: CSO storage, with storage of up to the 3-month storm, and excess CSO flows redirected to the Inner Harbor instead of Clark's Cove, where CSO flows from this area presently discharge;
- Subarea 2: CSO storage, up to the 6-month storm, with excess CSO flows conveyed to Clark's Cove. This level of protection, which was in fact found to be *more costly* than complete sewer separation in this area, was identified during the planning process by DMF as being the level of control needed to reopen the shellfish beds. [It should be noted that those beds have been conditionally reopened at this time, despite the fact that the CSO abatement facilities have not been constructed.]
- Subareas 3, 4, 5, & 6: These areas all overflow to the Inner and Outer New Bedford Harbor. Sewer separation was the recommended plan in each of these subareas.

The cost of the 1990 recommended plan was $191 million. The City is presently finalizing a scope of work to reassess the 1990 plan and financial capability will likely be a substantial constraint to implementation of extensive CSO controls (Brander 2002).

In recent years, the City of New Bedford has aggressively worked to eliminate discharges of untreated waters (Furtado 2003). Completed projects include:

- the construction of a state-of- the-art wastewater treatment facility (improving water quality),
- the demolition and reconstruction of four state-of the-art pump stations (eliminating numerous overflows and dry weather discharges),
- the creation of a CSO crew that investigates all CSOs whenever there is at least 0.3 inches of rain and at a minimum of once every two weeks regardless of the weather,
- the daily patrol of the City's waters by City shellfish constables, complimented seasonally (April-October) by MA Environmental Police, to note and report any unusual discharges,
- the daily operation of City street sweepers and catch basin cleaners,
- the elimination of approximately 200 cross connections, following dye testing at thousands of properties, reviewing films of sewers, and identification through general maintenance (daily rodding, jetting, and vac-truck use),
- the upgrade of approximately eight (in recent years) collection systems to separate the storm water from sanitary waste water thereby eliminating the discharge of numerous gallons of untreated waters, and
- the elimination of eleven CSOs (Apponogansett St., Seymour St., Gifford St., Pearl St., Wamsutta St. at Acushnet Ave., Kenyon St. at N. Front St., Howard Ave., Coggeshall St., Butler St., Cove St. at East Rodney French Blvd., and Ricketson St) by redirecting flows and new sewer installations.

The 1990 Plan was developed prior to the 1994 federal CSO policy and the 1997 MA DEP CSO Guidance. At that time no efforts were made to modify the water quality standard (which would need to be done in any case where CSOs are not eliminated). Therefore, the continued CSO discharges continue to violate water quality standards. The upcoming Plan reassessment will focus on identifying the highest feasible level of CSO control. The final CSO Plan will have to be integrated with the water quality standards, and the standards modified as necessary pursuant to all procedural requirements (Brander 2002).

SOURCES OF INFORMATION

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

Federal

The United States Environmental Protection Agency, in partnership with the National Oceanic and Atmospheric Administration, the Army Corps of Engineers, the United States Fish & Wildlife Service, and the Commonwealth of Massachusetts, is working to clean up and restore New Bedford Harbor as a result of PCB and heavy metal contamination. Clean up is ongoing and will take more than ten years to complete. Two rounds of restoration activities not directly related to the clean up have been proposed. Round One is currently underway with some projects already completed. Projects funded during Round One include Restoration of Padanaram Salt Marsh, construction of two recreational parks, installing an additional opening in the hurricane barrier to increase tidal exchange, restoring eel grass beds, herring runs, and roseate tern nesting colonies, developing a master plan for open space planning, and inventory wetlands for future restoration. Funding has been secured for 17 projects in Round Two. Additional information is available online from the New Bedford Harbor Superfund website: http://www.darp.noaa.gov/neregion/newbed.htm

The United States Army Corps Of Engineers (ACOE) is charged with reducing flood damage and implementing controls, preparing for and responding to natural disasters, remediating and restoring the environment, protecting stream banks and shorelines, maintaining navigation on the country's waterways, as well as supporting the military. In the Buzzards Bay Watershed, the New England District operates and maintains two hurricane barriers and the Cape Cod Canal. Additionally, the New England District is responsible for the dredging of Buttermilk Bay, New Bedford/Fairhaven and Westport harbors and assisting the EPA with remediation at three Superfund sites. Each project is described in more detail in the segment within which it is located.

The United States Geologic Survey (USGS) maintains one stream gage in the Buzzards Bay Watershed (01150933) located in the Paskamanset River near South Dartmouth. The period of record for this gage is October 1995-present (Socolow *et al* 2001).

State

Many of the rivers and estuaries in the Buzzards Bay Watershed receive the discharge of treated municipal and industrial wastewater, contact and non-contact cooling water, and storm water (MA DEP 2002b). Below is a summary of the NPDES permits issued for the Buzzards Bay Watershed.

Publicly Owned Treatment Works (POTWs), Waste Water Treatment Plants (WWTPs), Water Pollution Control Facilities (WPCFs): There are five facilities that discharge into the Buzzards Bay Watershed. These facilities treat wastewater from domestic and industrial sources within the WWTP service area.

- The Town of Marion (MA0100030) is permitted (30 November 1998) to discharge 0.5 million gallons per day (MGD) of treated sanitary wastewater via outfall 001 to an unnamed tributary to Aucoot Cove. The permit will expire in 2003.The facility's whole effluent toxicity limit is C-NOEC

and LC_{50} >100% effluent. The current permit includes secondary limits: Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS) = 10 mg/L; fecal coliform bacteria = 200 cfu/100mL; and seasonal ammonia nitrogen limits (May 1 to June 14 = 2.6 mg/L and June 15 to October 15 =1.74 mg/L). Marion received a Clean Water State Revolving Fund Loan to upgrade the existing treatment plant in FY2003. Upgrades will provide pretreatment (grit and screenings removal) and sequencing batch reactors (SBRs) for ammonia removal and will reduce the nitrogen load to Aucoot Cove and Buzzards Bay. The plant construction will begin in August 2003 and the plant should begin startup in spring 2005.

- The Town of Dartmouth (MA0101605) is permitted (17 October 1998) to discharge 4.2 MGD of wastewater treatment plant effluent via outfall 001 to Buzzards Bay. The permit will expire in 2003. The facility's whole effluent toxicity limit is $LC_{50} \geq 100\%$ effluent and C-NOEC $\geq$ 11% effluent. The current permit includes secondary limits: BOD and TSS = 30 mg/L and fecal coliform bacteria = 200 cfu/100mL. Between January 1996 and July 2002, Dartmouth conducted 13 whole effluent toxicity tests for outfall 001(to Buzzards Bay via an offshore outfall south of Salters Point and east of Mishaum Point) using the inland silverside, *M. beryllina*. The facility was in compliance with their permit limits; LC_{50}s were all greater than 100% effluent and C-NOEC's ranged between 50 and 100% effluent. Survival of *M. beryllina* in ambient water was good (range 88-100%).

- The Town of Dartmouth (MA0033588) is also permitted (16 September 1992) to discharge emergency overflow from lagoons from the water treatment plant via outfall 001 which discharges to the ground and ultimately to the Paskamansett River. This facility has never discharged (Burns 2003).

- The City of New Bedford (MA0100781) is permitted (2 January 2001) to discharge 30 MGD of treated effluent via outfalls 001 and 002 to Buzzards Bay. The permit expires in 2006. The facility's whole effluent toxicity limit is LC_{50} >100% effluent and C-NOEC > 12.5% effluent. The current permit includes secondary limits: Chemical Biological Oxygen Demand = 25 mg/L; TSS = 30 mg/L; fecal coliform bacteria = 200 cfu/100mL; TRC = 67.5 ug/L; Total Copper = 33.6 ug/L and Total Nickel = 74.5 ug/L. Concentrations of TRC reported in the facilities whole effluent toxicity tests between October 1996 and October 2002 ranged from BDL and 0.850 mg/L.

- The Town of Wareham (MA0101893) is permitted (30 October 1991) to discharge 1.8 MGD of treated sanitary wastewater via outfalls 001-004 to the Agawam River. The facility's whole effluent toxicity limit is $LC_{50} \geq 100\%$ effluent and C-NOEC $\geq$ 14% effluent. The permit includes secondary limits: BOD = 10 mg/L, TSS = 10 mg/L, fecal coliform bacteria = 88cfu/100mL, and TRC= 91 ug/L. This facility's permit is currently in the process of being renewed. The draft permit was released for public comment and contains a flow decrease to a maximum of 1.47 MGD and a seasonal total nitrogen limit of 4.0 mg/L. It is likely that the permit will have a flow limit of 1.57 MGD as a result of an error in the Inflow/Infiltration (I/I) calculation (Hogan 2003). Wareham plans to upgrade the WPCF to include a new headworks facility with new septage receiving system, two flow equalization basins, a new biological nutrient removal process, UV disinfection system, a biofiltration odor control system, one new 18" outfall pipe, a new solids thickening process. Additionally, the Town plans to extend the sewer to 12 "needs" areas. The facility, operational since 1972, currently provides secondary treatment through conventional activated sludge processes followed by disinfection and filtration (CDM 2001a and 2001b).

- The Town of Fairhaven (MA0100765) is permitted (21 March 2003) to discharge 5 MGD treated sanitary wastewater via outfall 001 to the Acushnet River (New Bedford Inner Harbor). The facility's whole effluent toxicity limit is a maximum daily LC_{50}= 100% effluent. The permit includes secondary limits for BOD=45 mg/L, TSS= 45 mg/L, fecal coliform bacteria= 260 cfu/100mL, and TRC= 107ug/L maximum daily. The permittee is required to install an ultraviolet ray (UV) disinfection system by April 1, 2004 to meet the more stringent TRC limits. (The prior permit limit of 0.29 mg/L TRC will remain in effect until April 2004.) An Infiltration and Inflow Plan must be developed and implemented to eliminate all unauthorized discharges. Furthermore, by October

2004 a Nitrogen Removal Optimization Study must be submitted to identify operational criteria that can achieve maximum practicable removal of nitrogen at the existing facility.

Combined Sewer Overflows (CSOs): There is one permittee discharging CSO into the Buzzards Bay Watershed, which is summarized below (Brander 2002).

- City of New Bedford (MA0100781) discharges via nine CSO locations to Clark's Cove (outfalls 003-011), seven CSOs to Buzzards Bay Outer Harbor (outfalls 012-018), 12 CSOs to the Acushnet River (outfalls 019-027and 039-041), and nine CSOs to Buzzards Bay Inner Harbor (outfalls 028-037). The permit will expire 2 January 2004.

Power Plants: Mirant Canal L.L.C. (formerly Southern Energy Canal L.L.C. and Canal Electric), located in Sandwich on the Cape Cod Canal, is a 565 megawatt oil and gas-fired power-generating unit. The facility is permitted (MA0004928, 23 June 1989) to discharge:

- 518 MGD of condenser cooling water via outfall 001(86°F temperature limit and a TRC limit of 0.1 mg/L),
- 2.5 MGD of intake screen sluice and flume flushing water via outfall 002 (90°F temperature limit),
- 0.072 MGD of floor and equipment drain No. 1 via outfall 010 (oil & grease = 10 mg/L),
- 0.25 MGD of equipment washes, chemical cleaning, and ash sluice blowdown via outfall 011 (total copper= 1.0 mg/L, total iron=1.0 mg/L, TSS= 30 mg/L, oil & grease= 10 mg/L), and
- 0.07 MGD demineralizer and condensate polisher wastes via outfall 012 (TSS= 30mg/L, oil & grease= 15 mg/L).

Hydroelectric power plants: There are no Federal Energy Regulatory Commission (FERC) licensed hydroelectric power plants in the Buzzards Bay Watershed. There is, however, one FERC-exempt power-generating facility, which is briefly described below.

Project Name	Project Number	Owner Name/Issuance date	River/Location	Kilowatts
Wareham (Tremont)	3894	Town of Wareham /27 May 1981	Weweantic River	300

Other Industrial Discharges: There are several industries within the Buzzards Bay Watershed that have permits for the discharge of contact cooling water, non-contact cooling water (NCCW), and storm water. These discharges can be authorized and controlled under either a general or an individual permit.

- Massachusetts Maritime Academy (MA00243680) is permitted (20 April 2001) to discharge 0.14 MGD treated sanitary wastewater and untreated boiler water blow-down via outfall 001 and 10,000 GPD treated swimming pool discharge water via outfall 002 to the Cape Cod Canal. The facility's whole effluent toxicity limit is $LC_{50} \geq 50\%$ effluent. The existing facility is an extended aeration facility that provides secondary wastewater treatment. A new facility will be constructed to replace the existing facility and will also provide secondary treatment. New processes will include influent screening, influent pumping, an alkalinity addition system, two sequential batch reactors for sludge treatment and UV disinfection units. The current permit includes secondary limits for both the existing facility and upgraded facility: BOD and TSS = 30 mg/L; fecal coliform bacteria = 100 MPN/100mL (existing facility); and 14 MPN/100mL (upgraded facility). A TRC limit of 1.0 mg/L daily is allowed until the UV disinfection system becomes fully operational.
- The City of New Bedford (MA0034428) is permitted (24 June 1992) to discharge site dewatering discharges via outfalls 045, 046, and 047 to Clark's Cove and storm water via outfalls 042-044 to Clark's Cove and Outer New Bedford Harbor. The permit expired in 1997. The facility's permit includes a Total Petroleum Hydrocarbon (TPH) limit of 5 mg/L maximum daily and a 50 mg/L maximum daily TSS limit for the site dewatering discharges and a 5 mg/L maximum daily TPH limit for storm water.
- Cornell-Dubilier Electronics Corporation (MA00003930) is permitted (28 February 2001) to discharge storm water via outfall 002 to Fort Phoenix Reach near the Acushnet River Estuary in Lower New Bedford Harbor. The permit will expire in 2006. Cornell-Dubilier Electronics operated a capacitor manufacturing operation. From the 1940s-1978, the facility released PCB contaminated wastewater onto shoreline mudflats and into New Bedford Harbor. The facility was

required to monitor storm water discharges at the site due to residual PCB contamination. See Summary of Existing Conditions and Perceived Problems for additional information.

- Tremont Nail Company (MA0005801) is permitted (18 February 1986) to discharge 60,000 GPD of contact cooling water from heat quench tanks via outfall 001 to the Wankinco River. The permit includes an 81°F temperature limit and also includes secondary limits for TSS= 20 mg/L, oil & grease = 15 mg/L and total iron =2.0 mg/L (dissolved iron = 1.0 mg/L).
- Acushnet Company- Titleist Golf Division (MA0005428) is permitted (20 November 1986) to discharge sanitary waste via outfall 008 and treated process waste, NCCW, and boiler blow-down from outfall 010 to the Acushnet River. The permit includes a 92 °F temperature limit for outfall 010 and secondary limits for BOD= 30 mg/L, TSS = 30 mg/L, oil & grease = 10 mg/L, fecal coliform bacteria = 200cfu/100mL.
- Acushnet Company- Rubber Division (MA0003913) is permitted (20 November 1986) to discharge 0.75 MGD of non-contact cooling water (NCCW) via outfall 001 and storm runoff via outfalls 002 and 003 to the Acushnet River. The permit includes a temperature limit of 80°F as well as limits for total chromium= 0.3 mg/L, oil & grease= 15 mg/L maximum daily, and TSS= 9lbs/day.
- Aerovox Inc. (MA0003379) is permitted (17 December 2000) to discharge storm water via outfalls 003 and 005-007 to the Acushnet River/New Bedford Harbor. The permit includes an oil & grease limit = 15 mg/L. Aerovox operated a capacitor manufacturing operation from 1978-2001.From the 1940s-1978, the facility released PCB contaminated wastewater onto shoreline mudflats and into New Bedford Harbor. The facility was required to monitor storm water discharges at the site due to residual PCB contamination. See Summary of Existing Conditions and Perceived Problems for additional information.
- Old Rochester Regional School District (MA0102318) is permitted (30 October 1998) to discharge 0.0225 MGD effluent to Coen Brook, a tributary to Mattapoisett Harbor, from POTW outfall 001. The facility's whole effluent toxicity limit is LC_{50}= 100% effluent and C-NOEC = 64%. The permit includes secondary limits: BOD= 30 mg/L, TSS =30 mg/L, fecal coliform bacteria= 200 cfu/100mL, TRC= 0.017 mg/L, and total ammonia= 2.7 mg/L. The permit will expire in 2003. Old Rochester Regional School District tied in to the Mattapoisett sewer system in the summer of 2002 (Greenway 2003).
- Revere Copper Products, Inc (MA0004821) is permitted (26 December 2000) to discharge plate mill cooling, hot breakdown mill, hot breakdown furnace, and hot roll mill discharge via internal outfall, treated wastewater from sheet washing, plate washing, boiler condensate and chemical wastewater via internal outfall 002A, and 165,000 gpd of compressor cooling, furnace cooling, boiler condensate blowdown, and storm water via outfall 002 (includes discharges resulting from internal outfalls 002A and 004B) to the Acushnet River. The permittee is also authorized to discharge storm water via outfall 004C. The facility's whole effluent toxicity limit is LC_{50}= 100% effluent and temperature limit = 85°F. The permit also includes secondary limits: Outfall 002B -- TSS= 30 mg/L, oil & grease= 15 mg/L, total chromium= 0.4 mg/L, total copper= 0.7 mg/L, total lead= 0.2 mg/L, total nickel= 1.8 mg/L, and total zinc= 1.2 mg/L; Outfall 002A-- TSS= 30 mg/L, total chromium= 0.6 mg/L, total copper= 1.5 mg/L, total lead= 0.4 mg/L, total nickel= 1.5 mg/L, and total zinc= 1.5 mg/L; Outfall 002-- TSS= 20 mg/L, total chromium= 0.6 mg/L, total copper= 0.7 mg/L, total lead= 0.4 mg/L, total nickel= 1.5 mg/L, and total zinc= 1.5 mg/L.
- Trio Algarvio Inc. (MA0110329) is permitted (20 March 1996) to discharge 0.15 MGD via outfalls 001 and 002 to New Bedford Inner Harbor. The permit includes secondary limits for BOD= 30 mg/L and TSS= 30 mg/L. Trio Algarvio owns a fish processing plant for monkfish and whiting and a fish farm for raising summer flounder.
- Eastern Energy Corporation (MA0034274) is permitted (17 July 1992) to discharge to wetlands adjacent to Acushnet Cedar Swamp via outfalls 001-003. (In 1995, Eastern Energy was a proposed bituminous coal-fired energy facility that would burn 1,161,576 tons/year http://www.state.ma.us/dep/files/mercury/hgch3c.htm)
- Goodyear Tire and Rubber (MA0005606) is permitted (5 August 1986) to discharge 0.5 MGD NCCW and storm water via outfall 001 to Clark's Cove. The permit includes a temperature limit of 80°F, TSS= 10 mg/L, and oil & grease= 5 mg/L.
- Lobster Trap Company (MA0029092) is permitted (August 2, 1993) to discharge 7456 GPD of treated wastewater from one outfall into the Back River, Bourne. The permit includes limits for

TSS= 30 mg/L, BOD of 30 mg/L, and fecal coliform concentrations not exceeding class SA water quality standards.

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 pollutants to the maximum extent practicable, protect water quality, and satisfy requirements of the Clean Water Act. The six measures are public education and outreach, public participation/involvement, illicit discharge detection and elimination, construction site runoff control, post-construction runoff control, pollution prevention and good housekeeping (EPA 25 June 2002). More information on EPA's storm water program is available online at http://cfpub1.epa.gov/npdes/home.cfm?program_id=6. All communities in the Buzzards Bay Watershed (Fall River, Westport, Dartmouth, New Bedford, Acushnet, Freetown, Fairhaven, Carver, Marion, Mattapoisett, Wareham, Plymouth, Bourne, Rochester, and Falmouth) must submit Notices of Intent (NOIs) to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. Additionally, the communities are required to develop, implement, and enforce a storm water management program to reduce the discharge of pollutants from their system, over the five-year permit term. A summary description of the storm water management program is part of the Notice of Intent. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems was published on 1 May 2003. Permit applications from the communities were due to EPA and MA DEP by 30 July 2003. Each community will receive authorization to discharge when a complete Notice of Intent has been verified by EPA and MA DEP (Scarlet 2003).

Water Management Act

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

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

TOXTD

The five WWTP's in the Buzzards Bay Watershed and two industrial dischargers 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 1996 to 2002 were reviewed and summarized (ranges) for use in the assessment of current water quality conditions in the Buzzards Bay Watershed.

Toxicity testing data is required in the following NPDES permits:

- Wareham WWTP MA0101893
- Dartmouth WWTP MA0101605
- New Bedford WWTP MA0100781
- Town of Marion MA0100030
- Fairhaven WWTP MA01000765
- Revere Copper MA0004821
- Massachusetts Maritime Academy MA0024368

MDPH

In 1994, the Massachusetts Department of Public Health (MDPH) issued a statewide *Interim Freshwater Fish Consumption Advisory* for mercury (MDPH 1994). This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. The advisory 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 2001). Currently, there are three site-specific freshwater fish consumption advisories for water bodies in the Buzzards Bay Watershed (Copicut River (including Cornell Pond), Noquochoke Lake, and Turner Pond) because of PCB contamination and elevated mercury concentrations in fishes (MDPH 2002c). Additionally, there is saltwater fish consumption advisory for New Bedford Harbor (including Clarks Cove and Apponagansett Bay) due to PCB contamination (MDPH 2001a and EPA May 2002).

The MDPH Bureau of Environmental Health Assessment annually provides a fact sheet that addresses health concerns related to the recreational use of selected water bodies, including the nearshore waters of Buzzards Bay, and reflects the results of chemical testing at the Massachusetts Military Reservation. To review the latest fact sheet, see http://www.state.ma.us/dph/beha/epi/reports/cape/pond%5Ffact%5Fsht.htm.

DFWELE

The Department of Fisheries, Wildlife & Environmental Law Enforcement (DFWELE) was composed of four divisions: The Division of Marine Fisheries (DMF), The Division of Fisheries and Wildlife (MassWildlife), the Public Access Board (PAB), and the Environmental Law Enforcement Division. [NOTE: This agency is now called the Department of Fish and Game.]

DFWELE (MassWildlife) conducted fish population surveys in eleven lakes within the Buzzards Bay Watershed during the summers of 1998-2002. The species list and counts for fish are provided in the lakes assessment section, Tables 5 and 6. A watershed-based fisheries management plan will be produced by DFWELE at a later date.

The Division of Marine Fisheries Shellfish Management Program maintains information used to classify their shellfish management areas (e.g., approved, conditionally approved, prohibited). These classifications are subsequently used to regulate the harvesting of various shellfish (DFWELE 2000). DMF shellfish management areas include acreage in the Buzzards Bay Watershed not specifically addressed (i.e., designated as a segment) in this report. Appendix E includes the complete listing of DMF shellfishing closures as of July 2000 in the Buzzards Bay Drainage Area. Maps of DMF's shellfish growing areas can be obtained online at the address below:
http://www.state.ma.us/dfwele/dmf/ProgramsAndProjects/dsga.htm#shelsani

DMF conducts fecal coliform bacteria sampling as part of their sanitary surveys by which shellfish growing area classifications are assigned. These surveys also include shellfish species identification, habitat location, relative abundance and documentation of related fisheries. A shoreline survey is conducted to identify pollution sources and evaluate potential impacts with the understanding that hydrographic characteristics may influence contaminant distribution and removal over the growing area. Supplementary analysis may be required for naturally occurring pathogens (i.e., *Vibrio* spp.), marine biotoxins (i.e., Paralytic Shellfish Poisoning) as well as hazardous wastes in growing areas with a known history of contamination by these harmful substances.

Sanitary surveys must be repeated at least every twelve years for all growing areas with the exception of those classified as Prohibited (Kennedy 2001). However, survey information is updated through annual and triennial reports and classifications are maintained with extensive monitoring. A growing area classification may be downgraded and management plans amended, based on the findings of annual and triennial reviews. Classification upgrades can only be made based on the findings of a full sanitary survey.

DMF provided technical assistance for work in and around New Bedford Harbor and at the Buzzards Bay Disposal Site near Cleveland Ledge. Additionally, DMF has performed a bi-annual trawl survey along the entire coast for the last 24+ years (Malkoski 2002).

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

MA DEM

The Massachusetts Department of Environmental Management (MA DEM) conducts bacteria monitoring at their public beaches in state forests, parks, and reservations. Data is maintained in a database by MDPH. MA DEM also awards Lake and Pond Grants to communities and citizen groups to monitor water quality and provide educational materials to the public about various lake issues. MA DEM Lakes and Pond Grant projects in the Buzzards Bay Watershed are discussed in the Lakes Assessment Section of this report. [NOTE: This agency is now called the Department of Conservation and Recreation, Division of State Parks and Recreation.]

MA DEP

The Massachusetts Department of Environmental Protection Division of Watershed Management (DWM) monitoring in the Buzzards Bay Watershed in 2000 included fish toxics monitoring at White Island Pond and Noquochoke Lake, baseline lake monitoring at eight lakes to support TMDL development, and benthic macroinvertebrate sampling upstream and downstream from the Marion POTW. Additional work conducted by DWM included benthic macroinvertebrate sampling, fish population sampling, and water quality monitoring at four stations in October 1996 as part of the Numeric Biocriteria Project in 1995-1996.

The Massachusetts Estuaries Project (MEP) is a collaborative project between MA DEP, EPA, the UMass Dartmouth School for Marine Science and Technology (SMAST), the Office of Coastal Zone Management (CZM), the Cape Cod Commission, and several municipalities to classify the nitrogen sensitivity of southeastern Massachusetts's coastal bays and estuaries. "SMAST technical experts will work with MA DEP to evaluate the nitrogen sensitivity through comprehensive water quality testing, quantitative TMDL modeling, and preparation of technical reports allowing communities to consider how implementation of nitrogen management scenarios within watersheds will influence water quality in embayments. The major project goals are to: (1) develop a coastal TMDL working group for coordination and rapid transfer of results, (2) determine the nutrient sensitivity of each of the 89 embayments in southeastern Massachusetts, (3) provide necessary data collection and analysis required for quantitative modeling, (4) conduct quantitative TMDL analysis, outreach, and planning, and (5) keep each embayment's model "alive" to address future regulatory needs (Howes *et al.* Undated)."

"The Estuaries Project is comprised of four phases relating to project design, project development, implementation of approach, and application of management models to on-going management issues. The project phases are further described as: *Phase I* - Assemble a working group, design the project organizational framework, evaluate existing management models and select appropriate approach for regional implementation, and survey existing data sources with regard to potential to support selected approach; *Phase II* - Determine the prioritization procedure and select initial embayments, promote water

quality data collection in embayments with insufficient baseline data, educate local stakeholders as to Project goals, approach, results and data needs and complete the assessment of existing data and data gaps. Also, establish necessary regulatory stakeholder committees and increase the analytical capability of the Project Team relative to collection of field data needed to support the management approach; *Phase III* - Implement embayment management approach on a 2-year cycle, which includes field data collection, modeling, reporting, and a significant level of public outreach. Year 1 focuses on site-specific data collection to fill data gaps, Year 2 focuses on modeling, synthesis, and evaluation of management options; *Phase IV* - Keep quantitative models and embayment specific management approaches "alive" for future DEP and other management/planning needs and to provide a platform (upon request) for tracking embayment changes (Howes *et al.* Undated)."

The Estuaries Project is currently in Phase III. The *Embayment Water Quality Assessment Interim Report Priority Embayments 1-20* was published in September 2002 and provides water quality and bacteriological assessments for the first 20 priority embayments. Embayments discussed in this report pertinent to the Buzzards Bay Watershed include the West Falmouth Harbor System, the New Bedford Inner Harbor System, and the Wareham River System. Additional information on the Estuaries Project is available on the MA DEP website at http://www.state.ma.us/dep/smerp/smerp.htm.

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

CZM

As part of the National Coastal Assessment -- Coastal 2000, the Massachusetts Office of Coastal Zone Management is coordinating a comprehensive assessment of the Commonwealth's coastal sediments, waters, and biota. Staff from UMass Boston, UMass Dartmouth-SMAST, and CZM collected nutrient, total suspended solids, and chlorophyll *a* discrete samples; measured dissolved oxygen, temperature, conductivity, pH, and light attenuation *in situ*; conducted sediment sampling and analysis for chemistry and toxicity, and surveyed the macrobenthic community structure at seven stations in the Buzzards Bay Watershed. Three of these stations are in current Buzzard Bay segments; two on the Westport River and one on the Wareham River. Additionally, DMF examined the fish community from seven stations within the Buzzards Bay Watershed (Krahforst 2000). In 2003, 15 stations will be added in Buzzards Bay.

The Buzzards Bay Project has been mapping storm water discharges to Buzzards Bay and along streams near the coast to create the *Buzzards Bay Stormwater Atlas*. All known storm water discharge pipes and road-cuts have been inventoried, using maps and tables, in the towns of Westport, Dartmouth, Fairhaven, Mattapoisett, Marion, Wareham, Bourne, and Falmouth. BBP is establishing priorities for storm water remediation based on drainage system size and available water quality data of the storm water discharges and the receiving surface waters. The Atlas is summarized, and the draft report is posted on the BBP website at http://www.buzzardsbay.org/stormatlas/stormatlas.htm.

Local Monitoring

Between October 1987 and October 1998, Dr. Jefferson Turner, students, and research associates of the University of Massachusetts-Dartmouth School of Marine Science and Technology conducted 141 monitoring cruises of Buzzards Bay. Eight stations were monitored for the following parameters: temperature, salinity, Secchi depth, ammonium, nitrate+nitrite, phosphate, silicate, chlorophyll *a* + phaeopigments, and bacterioplankton abundance. They concluded that Buzzards Bay is a favorable habitat for phytoplankton with the waters "well-mixed and well–illuminated and nutrient replete" (Turner *et al* 2000). Additionally, Turner *et al.* (2000) noted that the New Bedford sewage outfall had localized negative impacts on the water quality of New Bedford Harbor prior to upgrading to secondary treatment in September 1996.

The Coalition for Buzzards Bay (CBB) is a membership-supported non-profit organization *"dedicated to the restoration, protection, and sustainable use and enjoyment of our irreplaceable Bay and its watershed*". The Coalition strives to improve the health of the Bay ecosystem for all through education, conservation, research, and advocacy *(www.savebuzzardsbay.org).* The Coalition's Baywatchers conduct weekly monitoring in the 28 major harbors and coves in Buzzards Bay. In accordance with an EPA

approved Quality Assurance Project Plan, weekly samples are collected from May to September and analyzed for dissolved oxygen, temperature, salinity, and water clarity. Additionally, biweekly sampling for nutrients is conducted in July and August (Howes *et al.* 1999). While for various reasons these data were not used for use impairment decisions, MA DEP did utilize these reports to identify sources of impairment and areas of concern. Any segment that was shown to have a low health index score was identified at least with an Alert Status for further investigation.

The Westport River Watershed Alliance (WRWA, http://www.wrwa.com) is dedicated to promoting the environmental integrity of the watershed and its coastal environs, to advocating the wise use and preservation of natural resources in the watershed for the aesthetic, recreational, and economic benefit of the citizens of the area, and to educating the general public about the interrelationship of our waters, soils, plants, animals, and people (WRWA undated). In 1995, the Westport River Watershed Alliance initiated its Adopt-A-Watershed Project (AAW). The purpose of AAW is to develop a prototype for watershed management while involving local residents as stewards of their backyard watersheds. As part of the AAW, fifteen stations on the Westport River and its tributaries were monitored for temperature, salinity, pH, turbidity, and fecal coliform and *E. coli* bacteria between March and October 2001 (WRWA 2001).

Mass Community Water Watch (http://www.waterwatchonline.org/ma/) conducted a shoreline survey along the middle portion of the Acushnet River from the Hamlin Street Bridge to the Coggeshall Street Bridge. Monthly surveys were conducted between October 1999 and April 2000 at five stations. Volunteers noted water conditions (e.g., color, odor, scum, oil sheens), stream bank characteristics, discharge and runoff, and flora/fauna present (MCWW 2000).

The Weweantic River Stream Team conducted a shoreline survey of the Weweantic River in May 2001. Volunteers noted water conditions (e.g., substrate type, oil sheens), stream bank characteristics, and flora and fauna (WRST 2002). The stream team developed an action plan to address issues related to fish passage, recreation and access, cleanups, and water quantity.

Applied Science Associates (ASA) conducted a flushing analysis of the Acushnet River to support TMDL work. The analysis involved field sampling and numerical computations/modeling. The objective was to determine the flushing characteristics of the New Bedford Inner Harbor/Acushnet River Estuary and residence time of the Fairhaven Wastewater Treatment Plant effluent (ASA 2002b).

Applied Coastal Research and Engineering, Inc. was awarded a Massachusetts Watershed Initiative grant in FY 2002 to conduct flushing studies for the Slocums and Little River in Dartmouth. This involved collecting quality-assured field data (such as tidal cycle, bathymetry and streamflow) and developing hydrodynamic models for each embayment as well as the potential movement of water between the Slocums and Little River (Ruthven *et. al.* 2003).

Camp Dresser & McKee (CDM) prepared an Environmental Notification Form (ENF) for the Town of Wareham Water Pollution Control Facility in July 2001. In preparation for the ENF, CDM conducted a water quality investigation of the Wareham River Estuary Complex in 1999. The study involved determining river stage, conducting stage-discharge studies, collecting tide data, freshwater nutrient sampling, estuarine sampling, tidal exchange sampling, WPCF sampling, and bathymetry. Data were collected from freshwater and estuarine locations in the Agawam, Wankinco, Weweantic, and Wareham Rivers (CDM 2000, 2001a, 2001b).

Environmental Science Services, Inc. (ESS) conducted a bacteriological non-point source pollution assessment of the East Branch Westport River during the fall and winter of 2001-2002. The project, funded through the Massachusetts Watershed Initiative (01-02/MWI), included wet and dry weather water quality sampling at fourteen locations, an assessment of land-use practices, and the development of designs for recommended structural Best Management Practices (BMPs) (ESS 2003).

ENSR International conducted a Diagnostic/Feasibility Study of New Bedford Reservoir for the Town of Acushnet. ENSR examined the physical, chemical, and biological features of the reservoir in the first phase of developing a management program for the reservoir. The study examined the watershed and

lake features by investigating land use practices; conducting surface water sampling for dissolved oxygen, temperature, pH, specific conductance, Secchi transparency, turbidity, total alkalinity, nitrate and nitrite (06 August only), ammonia, total Kjeldahl nitrogen, total phosphorus and ortho-phosphorus; collecting plankton samples; and surveying the aquatic vascular plant community (ENSR 2002).

In August 2001, the Massachusetts "Beach Bill" was enacted by the legislature and signed by the Governor (MGL. C111. S5S). This act created minimum standards for public bathing waters adjacent to any public or semi-public bathing beach in the Commonwealth. A "public bathing beach" is defined as a beach open to the general public whether or not any entry fee is charged that permits access to bathing waters. A "semi-public bathing beach" is defined as a bathing beach used in connection with a hotel, motel, trailer park, campground, apartment house, condominium, country club, youth club, school, camp, or similar establishment where the primary purpose of the establishment is not the operation of the bathing beach, and where admission to the use of the bathing beach is included in the fee paid for use of the premises. A semi-public bathing beach shall also include a bathing beach operated and maintained solely for the use of members and guests of an organization that maintains such bathing beach. Under the Beach Bill, the Massachusetts Department of Public Health was directed to establish minimum uniform water quality standards for coastal and inland beach waters as well as determining the frequency and location of testing, reporting requirements, and requirements for notifying the public of threats to human health or safety. *105 CMR 445.000: Minimum Standards for Bathing Beaches (State Sanitary Code, Chapter VII)* outlines MDPH's guidelines for the Beach Bill and is available online at http://www.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 2002a and b).

TOTAL MAXIMUM DAILY LOADS (TMDL)

As part of the Federal Clean Water Act states are required to develop Total Maximum Daily Loads (TMDL) for lakes, rivers, and coastal waters not meeting the states surface water quality standards as indicated by the states 303(d) 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 303(d) List and the TMDL program is available on the MA DEP website at: http://www.dep.state.ma.us/dep/brp/wm/wmpubs.htm.

Under the Estuaries Project, UMass-Dartmouth School of Marine Science and Technology (SMAST) and MA DEP will assess 89 coastal embayments in southeastern Massachusetts. While the major focus of the project is on embayments impaired by nutrient loadings, those waters affected by bacterial contamination will also be considered. Assessments and management recommendations are to be based on sound water quality data and valid scientific and technical methodologies (MA DEP 2002a). Additional information is available on the MA DEP website at http://www.state.ma.us/dep/smerp/smerp.htm.

While the entire project is scheduled for completion in four phases over the course of six years, one initial phase involves the development of a prioritization procedure for selecting the embayments to evaluate further. All data and information will be assembled for each embayment and reviewed for adequacy and completeness. Data collection to fill information gaps will be planned and assessments will be completed to determine which embayments are actually impaired and in need of TMDLs as a step toward their restoration. To this end a standard methodology is being developed for assessing the embayments and, over the course of the project, assessments of the individual embayments will be completed and submitted to MA DEP. Those found to be impaired will be included with the 303(d) List Of Waters (i.e., Category 5 of the Integrated List) in future revisions. And, TMDLs and management recommendations will be developed (MA DEP 2002a). A complete list of waterbodies/systems (21 in the Buzzards Bay Watershed) that will be included in the Massachusetts Estuaries Project can be found as Appendix A of the 2002 Integrated List of Waters (http://www.state.ma.us/dep/brp/wm/tmdls.htm).

There are 24 ponds in the Buzzards Bay Watershed on the Massachusetts 1998 303(d) List of Waters for which the causes of impairment include noxious aquatic plants. Water quality monitoring was conducted in eight of these lakes in 2000: Turner Pond (MA95151), New Bedford Reservoir (MA95110), East White Island Pond (MA95166), West White Island Pond (MA95173), Crane Brook Pond (MA9595033), New Long Pond (MA95112), Federal Pond (MA95055), and Parker Mills Pond (MA95115).

The single draft TMDL report for total phosphorus, which is being developed for the eight lakes sampled in 2000, has been delayed until the C*ranberry Bog Phosphorus Dynamics TMDL Project* (DeMoranville 2001) has been completed (Mattson 2002).

Baseline lake surveys included the preparation of a bathymetric map (if not already available), mapping of aquatic vegetation, Secchi disc depth readings, *in situ* water quality profile measurements (i.e., temperature, pH, dissolved oxygen, percent saturation, specific conductivity) at one or more stations, water quality sampling for total phosphorus analysis at MA DEP's Wall Experiment Station (WES), algae (phytoplankton) counts and chlorophyll *a* determinations. Each of the ponds was visited on three separate occasions.

APRIL 2003 OIL SPILL IN BUZZARDS BAY

The following information on the April 2003 Buzzards Bay Oil Spill was excerpted from the Buzzards Bay National Estuary Project website (HTTP://WWW.BUZZARDSBAY.ORG/OILSPILL-4-28-03.HTM). This spill, as of 8 May 2003, affects 40 miles of shoreline throughout the watershed (see Figure10 below). The assessments of the designated uses for waterbodies in the Buzzards Bay Watershed are reflective of information obtained prior to this spill. This oil spill will continue to have lasting environmental impacts on the aquatic life, recreation, shellfish harvesting, and aesthetic quality in Buzzards Bay.

It is believed that Bouchard Barge 120, a 25 –year-old single hulled barge, owned by Bouchard Transportation Co. Inc., carrying 865,200 gallons of Number 6 ("Bunker C") fuel oil started leaking oil Sunday night (April 27), somewhere outside of Buzzards Bay, possibly in Rhode Island waters. Sometime Sunday the vessel arrived at Buoy 10 to facilitate the cleanup (about a distance of 18 miles). The anchorage is also called "Anchorage Lima" and is in central Buzzards Bay, about 5 miles WNW of Woods Hole in Falmouth and 3 Miles SE of West Island in Fairhaven. The starboard storage tank was reported ruptured on the bottom of the hull below the water, likely the result of striking bottom. On Monday (April 28), the Coast Guard estimated more than 14,700 gallons had already spilled from a 12-foot by 2-foot crack or gash on the underside of the barge. The oil barge was en route from Philadelphia to the Mirant Power Generating facility in Sandwich, which is located along the Cape Cod Canal. The problems were first reported by the Company 5:30 p.m. Sunday.

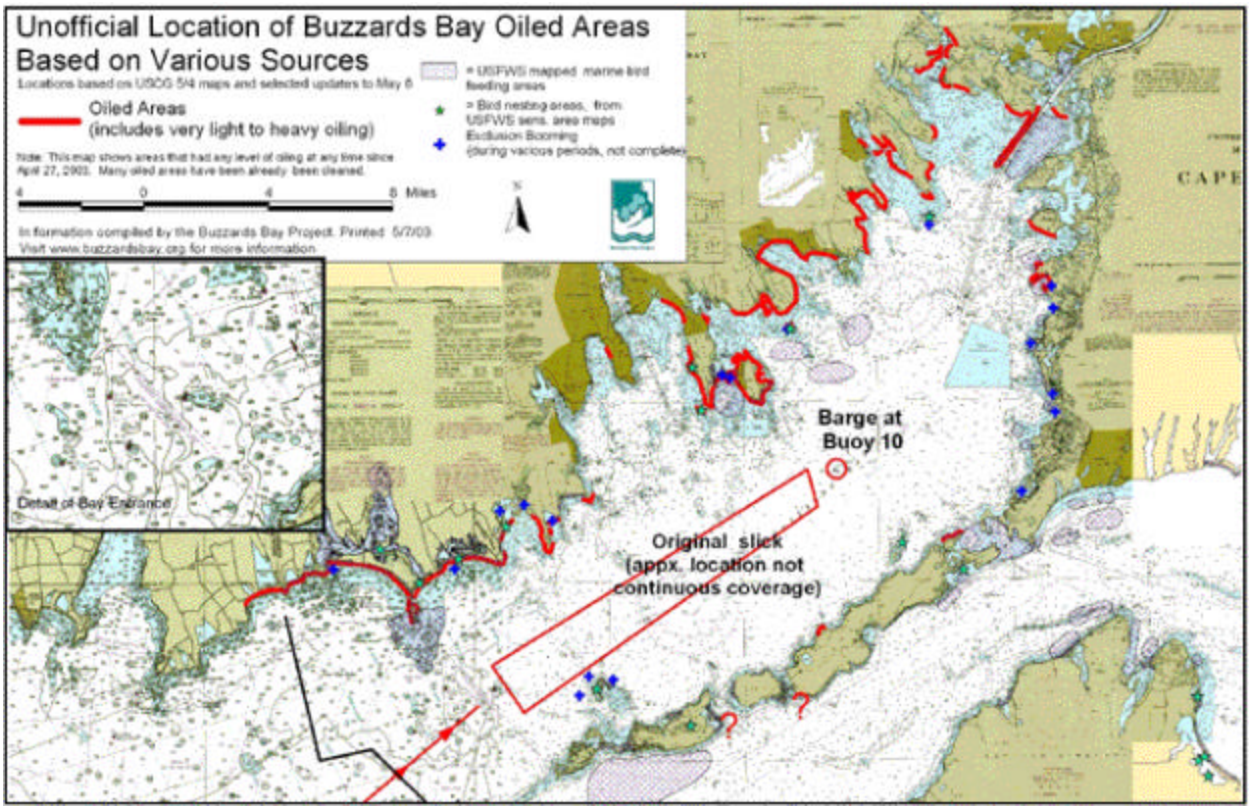

Figure 10. Location of Buzzards Bay Oiled Areas. Graphic Courtesy of Buzzards Bay Project.

Number 6 fuel oil is a heavy oil used by ocean liners and tankers as fuel and for oil burning power plants. It is thick, viscous, and sticky. Its consistency makes it ideal for sea-going skimming operations, but it is much more difficult to treat and cleanup when it lands ashore or on animals. Only 5-10% is expected to evaporate in the first few hours. Its specific gravity is very close to water, so it may float or sink, or do both. As the lighter hydrocarbons evaporate, the oil can become heavier, and sink. It will make a conspicuous "bath tub ring" along shore wherever it lands. Removal is needed where it lands because

degradation is very slow, taking months to years. "Adverse effects of floating No. 6 fuel oil are related primarily to coating of wildlife dwelling on the water surface, smothering of intertidal organisms, and long-term sediment contamination. Number 6 fuel oil is not expected to be as acutely toxic to water column organisms as lighter oils, such as No. 2 fuel oil. Direct mortality rates can be high for seabirds, waterfowl, and fur-bearing marine mammals, especially where populations are concentrated in small areas, such as during bird migrations or marine mammal haulouts." This is the largest oil spill in Buzzards Bay in 25 years and the forth largest recorded. It is also the largest spill of No. 6 Fuel, which can result in high bird and mammal mortality depending upon conditions and species affected.

Buzzards Bay is a major transit route for small tanker and barge traffic transporting heating and industrial oil and gasoline into Sandwich, greater Boston and northern New England markets. Nearly 1.6 billion gallons of oil pass through the canal annually with additional deliveries made to New Bedford. Buzzards Bay has been the site of several catastrophic oil spills. Between 1969 and the present, we estimate that over 1700 tons of petroleum have entered Buzzards Bay through documented oil spills.

The largest spill occurred in 1969 when 189,000 gallons of #2 fuel oil spilled when the barge *Florida* ran aground off West Falmouth. In recent years, improvements to navigation and more rigorous pilotage requirements are believed to be minimizing risks of future spills in Buzzards Bay. Nonetheless, smaller spills from barge and vessel groundings in the Bay have continued during the 1980s and 1990s. One of the more memorable of these was the grounding of the Queen Elizabeth II in 1992.

Please visit the Buzzards Bay Project and the Coalition for Buzzards Bay websites for updated information as it becomes available.

OBJECTIVES

This report summarizes information generated in the Buzzards Bay Watershed through *Year 1* (information gathering in 1999) and *Year 2* (environmental monitoring in 2000) activities established in the "Five-Year Cycle" of the watershed approach. Surveys conducted by DWM in 2000 were limited to fish toxics monitoring and baseline lake TMDL water quality monitoring. The fish toxics data are available in the technical memorandum entitled *2000 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys* TM-S-13 (Maietta and Colonna-Romano 2001). Additionally, at the request of EPA Region 1, DWM conducted benthic macroinvertebrate sampling upstream and downstream from the Marion POTW discharge in its unnamed receiving stream known locally as "Effluent Brook". An unpublished technical memorandum, dated August 21, 2000, describes the results of this study. Together with other sources of information (identified in each segment assessment), the status of water quality conditions of rivers, ponds, and estuaries in the Buzzards Bay Watershed was assessed in accordance with EPA's and MA DEP's use assessment methods. Not all waters in the Buzzards Bay Watershed are included in the MA DEP/EPA Waterbody System Database or this report.

The objectives of this water quality assessment report are to:

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

REPORT FORMAT

RIVERS/ESTUARIES/COASTAL EMBAYMENTS

The order of segments follows the Massachusetts Stream Classification Program hierarchy (Halliwell *et al.* 1982). Segments are organized hydrologically (from most upstream to downstream) and tributary segments follow after the segment into which they discharge. Each segment assessment is formatted as follows:

SEGMENT IDENTIFICATION

Name, Waterbody identification number (WBID), location, length, classification.

Sources of information: coding system (waterbody identification number, e.g., MA95-01) used by MA DEP to reference the stream segment in databases, such as 305(b) and 303(d), and the classification (MA DEP 1996a).

SEGMENT DESCRIPTION

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

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

SEGMENT LOCATOR MAP

Major waterbody locations, segment origin and termination points, and segment subwatershed (gray shaded).

Sources of information: Data layers published through MassGIS including the Hydrography (1:25,000) datalayer (MassGIS 2002).

WATER WITHDRAWALS AND WASTEWATER DISCHARGE PERMIT INFORMATION

Water withdrawals and NPDES wastewater discharges (when provided):

Sources of information: Water Management Act (WMA) Database Printout (LeVangie 2002, O'Shea 2003, Drake 2003); open permit files located in Worcester and Lakeville MA DEP Offices (Burns 2003, MA DEP 2002b and c), New Bedford CSO status (Brander 2002), storm water permits (Scarlet 2003).

Cranberry Bog Cultivation:

For the purpose of this report, water use for cranberry cultivation within the subwatershed has been estimated by using a volume of 10 acre-feet of water per acre of bog per year (1 acre-foot = 325,900 gallons). The acreage of cranberry bog within the subwatershed has been estimated by using the MassGIS layer for Open Space – Cranberry Bogs. The figure of 10 acre-feet of water per acre of bog per year is based on a study conducted by the Cape Cod Cranberry Growers Association for the Massachusetts Water Management Act Program. It should be noted that this figure is used for "old style" bogs, those bogs that do not employ best management practices (BMPs) that conserve water. Most bogs constructed today, and many renovated older bogs, use BMPs, such as laser leveling, on-site reservoirs, tailwater recovery, etc., which result in reduced water usage (between 5 and 6 acre-feet of water per acre of bog per year). Therefore, the estimate of water usage within the subwatershed for cranberry cultivation is a conservative number (O'Shea 2002).

USE ASSESSMENT

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

Sources of information include: MA DEP eelgrass bed habitat data (Costello 2003), DWM 2000 Survey data (Appendices A, B and C), and the MA DEP DWM Toxicity Testing Database "TOXTD" were used to assess the *Aquatic Life Use* in selected segments. The MDPH Freshwater Fish Consumption Advisory List (MDPH 2002c) was used to assess the *Fish Consumption Use*; and the DMF Shellfish status report was used to assess the *Shellfish Harvesting Use* (DFWELE 2000). MDPH beach closure database information was used to assess the Primary Contact Recreational Use (MDPH 2002b). 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 lakes assessed in the Buzzards Bay Watershed, identified with their Waterbody System Identification (WBID) code numbers, are listed alphabetically in the Lakes Segment Assessment section of this report. Lake assessments were based on information gathered during DWM 1995 synoptic lake surveys and DWM 2000 Baseline Lakes surveys, as well as pertinent information from other sources (e.g., abutters, herbicide applicators, diagnostic/feasibility studies, MDPH, etc.). These lake surveys focused on observations of water quality and quantity (e.g., water level, sedimentation, etc.), the presence of native and non-native aquatic plants (both distribution and areal cover) and presence/severity of algal blooms (MA DEP 1995). In cases where it is best professional judgment that conditions have not changed since the 1995 surveys, these data were used for assessment purposes. Fish consumption advisory information was obtained from the MDPH to assess the *Fish Consumption Use* (MDPH 2002c). Although the *Drinking Water Use* was not assessed in this water quality assessment report, the Class A waters were identified. Information on drinking water source protection and finish water quality is available at the MDPH web site and from the Buzzards Bay Watershed public water suppliers.

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THE WESTPORT RIVER DRAINAGE AREA

The Westport River Drainage Area is located in Westport with its headwaters in Fall River, Freetown and Dartmouth. The drainage area consists of the following 11 segments:

- Copicut River (Segment MA95-43)
- Unnamed Tributary (Segment MA95-57)
- Shingle Island River (Segment MA 95-12)
- East Branch Westport River (Segment MA95-40)
- Bread and Cheese Brook (Segment MA95-58)
- Snell Creek (Segment MA95-44)
- Snell Creek (Segment MA95-45)
- Snell Creek (Segment MA95-59)
- East Branch Westport River (Segment MA95-41)
- West Branch Westport River (Segment MA95-37)
- Westport River (Segment MA95-54).

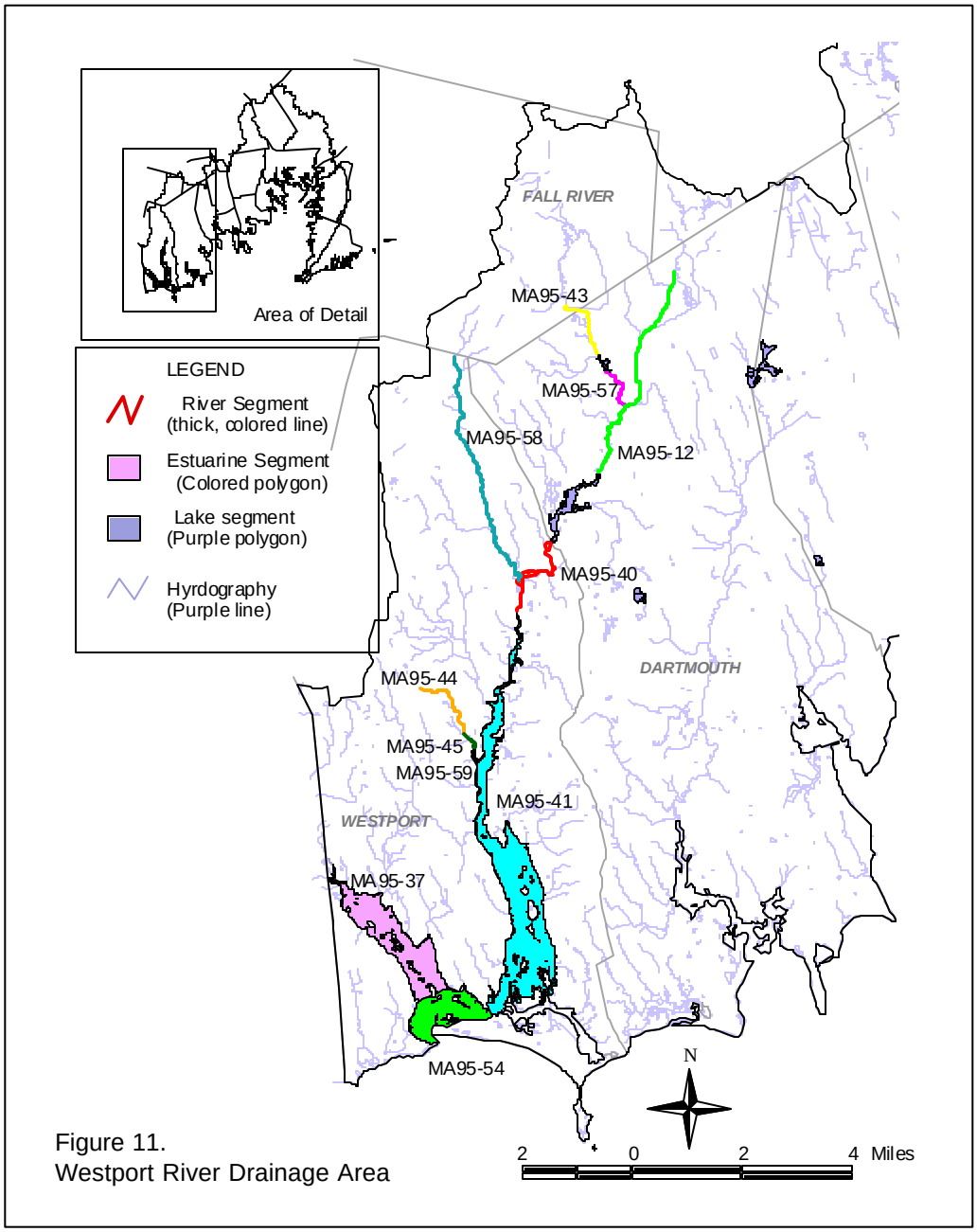
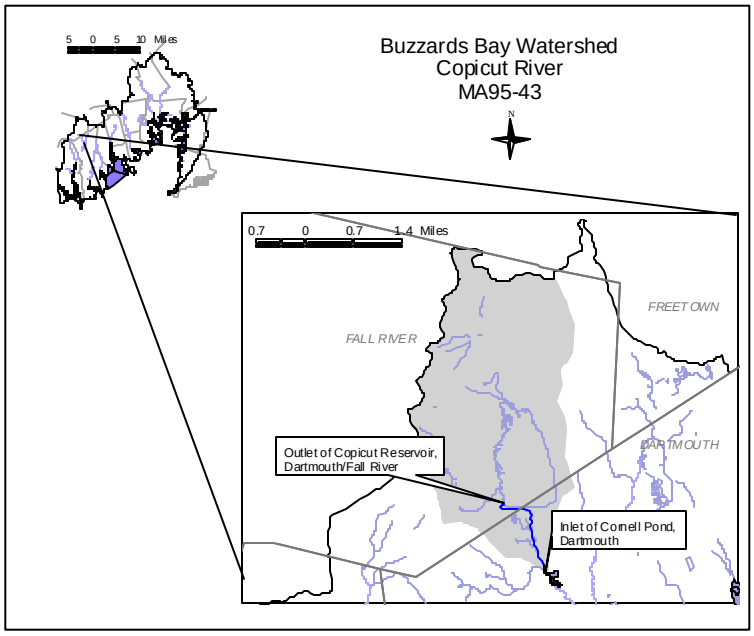


Figure 11.
Westport River Drainage Area

COPICUT RIVER (SEGMENT MA95-43)

Location: Outlet of Copicut Reservoir, Dartmouth/Fall River to the inlet of Cornell Pond, Dartmouth
Segment Length: 1.34 miles
Classification: Class B



The drainage area of this segment is approximately 7.4 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	76%
Wetlands	5%
Open Land	3%

This segment is on the 1998 Massachusetts List of Waters as not meeting the water quality standards for priority organics and metals (MA DEP 1999).

The Re-Solve, Inc. Superfund Site is a former waste chemical reclamation facility situated on 6 acres of land in Dartmouth. Between 1956 and 1980, Re-Solve handled a variety of hazardous materials, including solvents, waste oils, organic liquids and solids, acids, alkalies, inorganic liquids and solids, and polychlorinated biphenyls (PCBs). Residues from the distillation tower, liquid sludge waste, impure solvents, and burned tires were disposed of in four on-site unlined lagoons. The lagoon contents were burned periodically to reduce the volatile organic compounds (VOCs) content. An oil waste that accumulated at the bottom of the degreaser distillation still was disposed of on one portion of the site through landfarming. This oil waste also was spread throughout the site to control dust. Cooling water from the distillation tower was discharged to a shallow on-site lagoon. The groundwater is contaminated with VOCs and PCBs. Sediments are contaminated with PCBs and VOCs and the soil contains PCBs, lead, and VOCs including, trichloroethylene (TCE), vinyl chloride, methylene chloride, and toluene. Surface water is contaminated with PCBs and VOCs. Fish from the adjacent Copicut River and Cornell Pond contain elevated levels of PCBs and mercury; mercury is not related to the site (EPA 13 December 2002b).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

Facility	PWS ID	WMA Permit Number	WMA Registration Number	Source S = Surface	Authorized Withdrawal (MGD)	Average Withdrawal (MGD)		
						1999	2000	2001
Fall River Water Department**	4095000	None	42409501 and 42409502	Narragansett 4095000-01S & 4095000-02S Buzzards Bay 4095000-03S	Both Basins Combined= 14.59 MGD [6.37+8.22+0.1]	6.76*	7.72*	10.05*

* Applies to Buzzards Bay Number Only

**Fall River Water Department is authorized to withdraw a combined volume of 14.59 MGD/ 5325.35 MGY from a linked reservoir system that is located within two basins: the Copicut in the Buzzards Bay Watershed and the North and South Watuppa Ponds located in the Mt. Hope Basin. A single source meter is located at the point at which the water from the Copicut enters the North Watuppa Pond. A single intake is at South Watuppa Pond. When the elevation of South Watuppa falls, water flows into South Wautuppa Pond from the Copicut, therefore it is not possible, as the system is configured, to actually separate the withdrawals by basin. The assigned volumes to each basin were based on historic average use, not assigned for any reasons that were related to environmental protections. All are registered sources and compliance is measured using the total volume of 14.59 MGD, not individual basin volumes. The Water Resources Commission Interbasin Transfer (IBT) regulations do not apply to

registered sources, therefore, an IBT application is not required. Fall River has consistently operated within its total registered volume for the combined basins.

NPDES SURFACE DISCHARGE SUMMARY

There are no regulated wastewater discharges in this segment. Dartmouth and Fall River are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

Although no habitat quality and/or flow data are currently available for the Copicut River, the large water withdrawal combined with the small size of the drainage area are of concern.

The *Aquatic Life Use* is currently not assessed, however, potential effects of water withdrawals are of concern and, therefore, the *Aquatic Life Use* is identified with an Alert Status.

FISH CONSUMPTION

In 1988, DWM conducted fish toxics monitoring in Copciut Reservoir, Cornell Pond, and Noquochoke Lake to bracket the ReSolve Superfund site (Maietta 1989a). Based on elevated concentrations of PCBs and mercury in fish tissue MDPH issued a fish consumption advisory for the Copicut River and Cornell Pond, Dartmouth. The MDPH advisory recommends the following:

1. Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from the Copicut River or Cornell Pond.
2. The general public should not consume any American eel (*Anguilla rostrata*) from Copicut River or Cornell Pond.
3. The general public should limit consumption of largemouth bass (*Micropterus salmoides)* to two meals per month.

Based on the MDPH site-specific fish consumption advisory this segment is assessed as impaired for the *Fish Consumption Use*.

Copicut River (MA95-43) Use Summary Table

Designated Uses		Status	Causes	Sources	
			Known	Known	Suspected
Aquatic Life*		NOT ASSESSED			
Fish Consumption		IMPAIRED	Mercury, PCBs	Contaminated sediments, CERCLA NPL (Superfund site)	Atmospheric deposition
Primary Contact		NOT ASSESSED			
Secondary Contact		NOT ASSESSED			
Aesthetics		NOT ASSESSED			

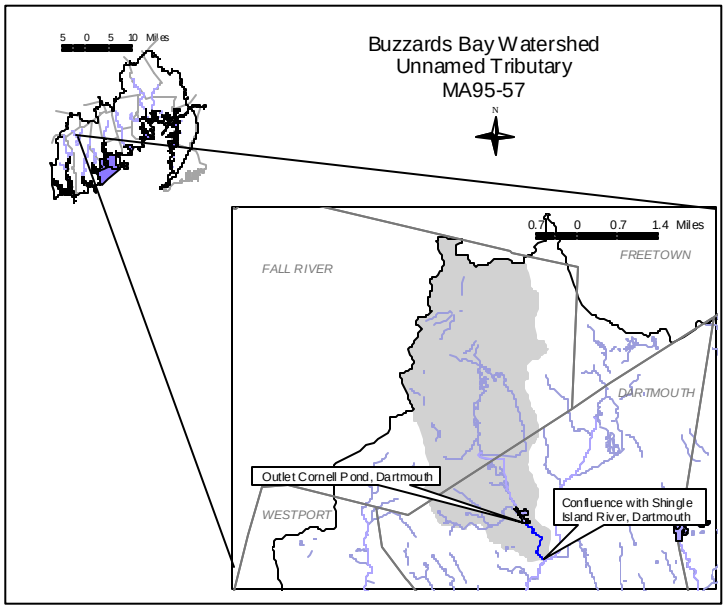
* Alert status issue identified-- see details in use assessment section

RECOMMENDATIONS COPICUT RIVER (MA95-43)

- Continue to review the status of the Re-Solve Inc. Superfund site cleanup and review any environmental monitoring data and/or need for additional monitoring to assess the *Aquatic Life Use* and/or *Fish Consumption Use.*

UNNAMED TRIBUTARY (SEGMENT MA95-57)

Location: Outlet Cornell Pond, Dartmouth to confluence with Shingle Island River, Dartmouth
Segment Area: 1.01 miles
Classification: Class B



The drainage area of this segment is approximately 34.3 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	91%
Open Land	3%
Wetlands	1%

See details of the Re-Solve, Inc. Superfund Site, a former waste chemical reclamation facility in Copicut River segment (MA95-43).

WMA WATER WITHDRAWAL AND NPDES DISCHARGE SUMMARY

There are no regulated water withdrawals/wastewater discharges in this segment. However, it should be noted that Dartmouth and Fall River are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

A habitat assessment was conducted on this unnamed tributary as part of the Biocriteria Development Project (NB03COP) on 27 September 1996. The sampling reach received a habitat score of 145 out of 200 due to a lack of epifaunal substrate, moderate embeddedness (50-75% of the substrate surrounded by fine sediment), and moderate sediment deposition while instream flows were optimal (MA DEP 1996b).

The large water withdrawal from Copicut Reservoir (see details in Copicut River) combined with the small size of the drainage area is of concern due to the potential negative effects on instream habitat.

Biology

DWM conducted fish population sampling on this unnamed tributary downstream of Old Fall River Road, Dartmouth (Station NB03COP). Seven American eel (*Anguilla rostrata*), one yellow perch (*Perca flavescens*), four redfin pickerel (*Esox americanus americanus*), two brown bullhead (*Ameiurus nebulosus*), one largemouth bass (*Micropterus salmoides*), and one bluegill (*Lepomis macrochirus*) were collected (MA DEP 1996b).

As part of the Biocriteria Development Project DWM conducted benthic macroinvertebrate sampling on this unnamed tributary along the same reach as fish population sampling using a modified RBP III approach (MA DEP 1996b and Nuzzo 1999). Metrics calculated for these samples were not consistent with those used for assessment purposes, therefore, details are not provided here. Please refer to *The Massachusetts Pilot Study on Numeric Biocriteria for Streams and Small Rivers 1996 Data on Macroinvertebrates* report prepared by Lotic Inc. (1998) for additional information.

Chemistry-water

Additionally, this unnamed tributary was sampled approximately 50 meters downstream of Old Fall River Road, Dartmouth as part of the Biocriteria Project on 8 October 1996. The results from Station NB03COP are:

Parameter	Result
Measurement Depth (m)	0.1i
Time	12:18
Temperature (°C)	11.4
pH (SU)	6.4
Conductivity (µS/cm)	79
Total Dissolved Solids (mg/L)	50.5
Dissolved Oxygen (mg/L)	9.8
Percent Saturation (%)	89
Turbidity (NTU)	14i

i= inaccurate readings from Hydrolab likely

The *Aquatic Life Use* is currently not assessed, however, potential effects of water withdrawals are of concern and, therefore, the *Aquatic Life Use* is identified with an Alert Status. Sediment deposition and embeddedness were also noted.

FISH CONSUMPTION

In 1988 DWM conducted fish toxics monitoring in three lakes in the vicinity of the ReSolve Superfund Site: Copicut Reservoir, Cornell Pond, and Noquochoke Lake. Based on data from this survey MDPH issued a fish consumption advisory for the Copicut River and Cornell Pond, Dartmouth due to elevated levels of mercury and PCBs in fish tissue (Maietta 1989a).

At this time a site-specific advisory for this unnamed tributary has not been issued by MDPH, therefore the *Fish Consumption Use* is currently not assessed.

AESTHETICS

During the habitat assessment survey conducted on this unnamed tributary sulfur odors, road runoff, iron deposits, foam, turbidity, abundant trash, and very soft, "mucky" substrates were noted (MA DEP 1996b).

The Aesthetics Use is not assessed, however, it is identified with an Alert Status because of the trash, foam, turbidity and odors noted during the survey conducted in the fall of 1996.

Unnamed Tributary (MA95-57) Use Summary Table

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

* Alert Status issues identified-- see details in use assessment sections

RECOMMENDATIONS UNNAMED TRIBUTARY (MA95-57)

- Continue to review the status of the Re-Solve Inc. Superfund site cleanup and review any environmental monitoring data and/or need for additional monitoring to assess the status of the *Aquatic Life Use*.

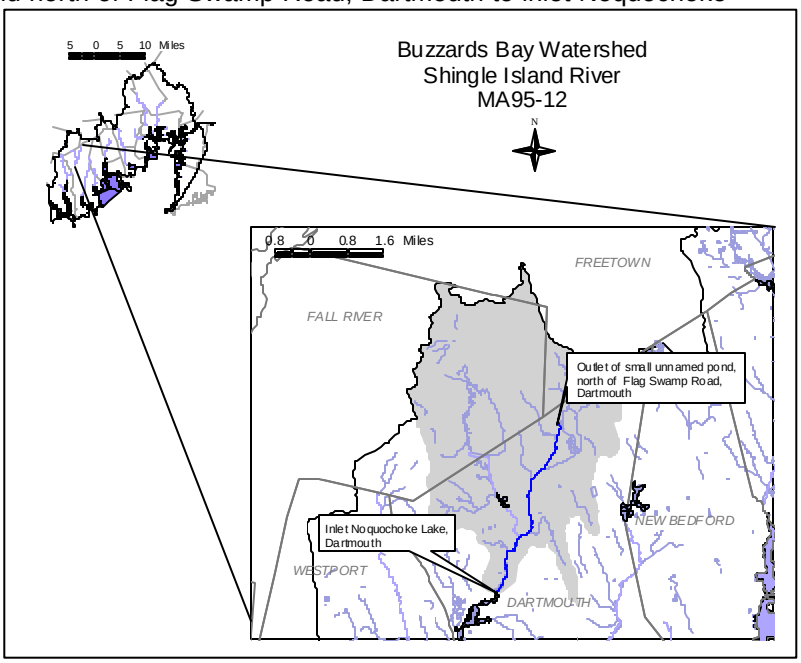
- In 1996 DWM identified sediment deposition (most likely from road runoff) in this unnamed tributary south of Old Fall River Road. As part of a shoreline survey, evaluate the extent of sedimentation problems in this subwatershed. Conduct biomonitoring in this subwatershed bracketing these nonpoint sources to determine if sedimentation and/or other nutrient inputs negatively effect the aquatic life. Conduct bacteria monitoring to determine if road runoff is a source of bacteria to this segment and to assess the recreational uses. As a follow up to the survey(s), determine the need to implement erosion control measures and best management practices.

- MDPH is currently reevaluating the fish consumption advisory for Copicut River/ Cornell Pond to determine if this unnamed tributary should be included. Additional fish toxics monitoring should be considered if deemed necessary.

- Work with Riverways, the Coalition for Buzzards Bay, Westport River Watershed Alliance and other concerned parties to form stream teams for the Westport River drainage area. Determine the current need to conduct a stream cleanup in this subwatershed. Review final stream team report(s) for information to assess the *Aesthetic Use*.

SHINGLE ISLAND RIVER (SEGMENT MA 95-12)

Location: Outlet of small unnamed pond north of Flag Swamp Road, Dartmouth to inlet Noquochoke Lake, Dartmouth
Segment Length: 5.00 miles
Classification: Class B



The drainage area of this segment is approximately 20.1 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	75 %
Residential	8 %
Open Land	5 %

The Greater New Bedford Compost Site, a landfill owned by the Greater New Bedford Refuse District, is partially located within this subwatershed near the Dartmouth/Freetown town line (MA DEP BWP 2000).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are 169.391 acres of cranberry bog open space in the Shingle Island River subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 1.51 MGD (this includes the estimate of water use for the upstream segment MA95-43).

NPDES SURFACE DISCHARGE SUMMARY

Dartmouth and Fall River are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Biology

DWM conducted fish population sampling (8 October 1996) on the Shingle Island River downstream of Old Fall River Road (Station NB14SHI) in Dartmouth as part of the Biocriteria Development Project. Only two fish were collected: tesselated darter (*Etheostoma olmstedi*) and an American eel (*Anguilla rostrata*). On replicate sampling, no fish were captured, however, a single American eel was sighted. Invertebrate collection was conducted just prior to fish sampling and electrofishing was difficult due to deep, very dark, 'tea stained" water (MA DEP 1999b).

As part of the Biocriteria Development Project DWM conducted benthic macroinvertebrate sampling on the Shingle Island River along the same reach as fish population sampling using a modified RBP III approach (MA DEP 1996b and Nuzzo 1999). Metrics calculated for these samples were not consistent with those used for assessment purposes, therefore, details are not provided here. Please refer to *The Massachusetts Pilot Study on Numeric Biocriteria for Streams and Small Rivers 1996 Data on Macroinvertebrates* report prepared by Lotic Inc. (1998) for additional information.

Habitat and Flow

As part of the fish population and benthic macroinvertebrate sampling for the Biocriteria Project, DWM conducted a habitat assessment of the Shingle Island River, downstream of Old Fall River Road. There were no dams or channelization present in this reach. Substrates were comprised of sand, silt, and clay. This reach was described by DWM biologists as " classic meandering, low gradient stream

through an extensive flood plain". This stream was used as a reference station and received a habitat score of 141 out of 180 due to the lack of epifaunal substrate, sediment deposition, and lack of riffles. *Sparganium* sp. (bur-reed) was present over 40% of the reach (MA DEP 1996b).

Chemistry-water

DWM sampled the Shingle Island River at approximately 150 meters downstream of Old Fall River Road in Dartmouth (station NB14SHI) as part of the Biocriteria Development Project on 8 October 1996.

Parameter	Result
Measurement Depth (m)	0.2
Time	14:23
Temperature (°C)	10.0
pH (SU)	5.0
Conductivity (µS/cm)	60
Total Dissolved Solids (mg/L)	38.6
Dissolved Oxygen (mg/L)	9.1
Percent Saturation (%)	80
Turbidity (NTU)	7i

i= inaccurate readings from Hydrolab likely

The *Aquatic Life Use* is currently not assessed, however, potential effects of water withdrawals (public water supply and cranberry bogs) are of concern and, therefore, the *Aquatic Life Use* is identified with an Alert Status. Sediment deposition and embeddedness were also noted.

FISH CONSUMPTION

Although fish were not collected from the Shingle Island River the presence of site-specific advisories in Cornell Pond and Noquochoke Lake (Maietta 1989a) suggest that this segment should be included.

At this time a site-specific advisory for the Shingle Island River has not been issued by MDPH, therefore the *Fish Consumption Use* is currently not assessed.

AESTHETICS

As part of the fish population and benthic macroinvertebrate sampling for the Biocriteria Project, DWM conducted a habitat assessment of the Shingle Island River, downstream of Old Fall River Road (Station NB14SHI). No aesthetic quality degradation (odors, turbidity, oil, grease, etc.) was identified (MA DEP 1996b).

Shingle Island River (MA95-12) Use Summary Table

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

* Alert Status issues identified -- see details in the use assessment section

RECOMMENDATIONS SHINGLE ISLAND RIVER (MA95-12)

- Develop a monitoring plan to evaluate the potential impacts of water withdrawals on streamflow/habitat in this segment/subwatershed to assess the *Aquatic Life Use*.

- In 1996 DWM identified sediment deposition (most likely from road runoff) in the Shingle Island River downstream of Old Fall River Road. As part of a shoreline survey, evaluate the extent of sedimentation problems in this subwatershed. Conduct biomonitoring in this subwatershed bracketing these nonpoint sources to determine if sedimentation and/or other nutrient inputs negatively affect the aquatic life. Conduct bacteria monitoring to determine if road runoff is a source of bacteria to this segment and to assess the recreational uses. As a follow up the survey(s), determine the need to implement erosion control measures and best management practices.

- MPDH is currently reevaluating their Fish Consumption Advisory for the Shingle Island River. Additional fish toxics monitoring should be considered for this segment if deemed necessary to refine the extent of the advisory.

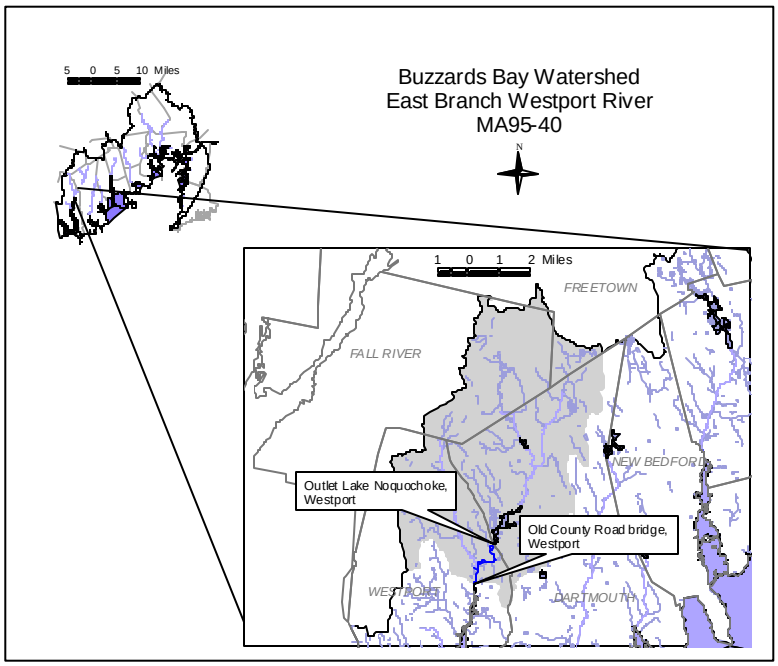
EAST BRANCH WESTPORT RIVER (SEGMENT MA95-40)

Location: Outlet Lake Noquochoke, Westport to Old County Road bridge, Westport
Segment Length: 2.85 miles
Classification: Class B, Warm Water Fishery

The drainage area of this segment is approximately 40.2 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	70 %
Residential	14 %
Agriculture	4 %

This segment is on the 1998 Massachusetts 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).



WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

Facility	PWS ID	WMA Permit Number	WMA Registration Number	Source (G = ground)	Authorized Withdrawal (MGD)	Average Withdrawal (MGD)		
						1999	2000	2001
Dartmouth Water Department**	4072000	9P242407201	42407202	4072000-04G	Registered = 1.35 Permitted = 2.11	3.07	2.97	2.83

*Excludes any authorized cranberry growers.

**Dartmouth Water Department has twelve withdrawal points in the Buzzards Bay Watershed – eleven in Segment 95-11 and one in Segment 95-40. The Authorized Withdrawal and Average Withdrawal volumes indicated are system wide for all seven sources combined.

There are 169.391 acres of cranberry bog open space in the East Branch Westport River subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 1.51 mgd. This estimate includes estimated water use for the upstream segment MA95-12.

NPDES SURFACE DISCHARGE SUMMARY

The following general storm water permit was issued by the EPA in October 2001 and will expire in October 2005:

Mid City Scrap Iron & Salvage MAR05B830

Westport is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

The Westport River Watershed Alliance (WRWA) conducted temperature, salinity, pH, and turbidity monitoring at two stations, 3--Head of Westport River at Old Colony Road and A-1-- Westport River at Rte 177, between March and October 2001. Samples were collected during ebb or flood tide between 0600

hours and 1300 hours (Carvalho-Souza 2002 and WRWA 2001). As part of this project, ESS was commissioned to design a BMP (pocket wetland) for the stormdrain on the south side of Old Colony Road, east bank of the river.

With funding from the Massachusetts Watershed Initiative's Buzzards Bay Team, ESS conducted a bacteriological NPS assessment of the East Branch Westport River near the Head of Westport between 7 June 2001 and 30 January 2002. Sampling included storm drain sampling and instream sampling at three stations for turbidity, pH, conductivity, and flow: (upstream to downstream) WR8—East Branch, upstream of Forge Pond at 251 Reed Road; WR6—East Branch behind Primrose Lane, opposite Ferry Farm; WR3—East Branch at Head Bridge at Old Colony Road (ESS 2003). The information collected was used as support for a successful s. 319 grant awarded to the Town of Westport to address two of the major storm water discharges into the upper reaches of the river (Pierce 2003).

Habitat and Flow

As part of the bacteriological NPS assessment of the East Branch Westport River, ESS noted that the bank of the river is "coincident with a stone wall" (ESS 2003), which implies the stream has been straightened. Flow readings taken between 7 June 2001 and 30 January 2002 during the ESS assessment ranged from 11.94 to 737.64 cfs (n=18).

Chemistry-water

pH

pH reported by WRWA ranged from 4.93 to 8.18 SU with 21 of the 38 less than 6.5 SU (55%), while pH values reported by ESS ranged from 5.6 SU to 7.5 SU (n=18) with six values less than 6.5 SU.

Temperature

WRWA temperatures ranged from 1.11 to 26.67 °C. Temperatures reported by ESS ranged from 2.0°C to 23.0°C (n=18).

Turbidity

Turbidity ranged from 0.74 to 6.14 NTU (n=37). Turbidity readings reported by ESS ranged between 0.9 and 52.6 NTU (n=15), but only one measurement exceeded 25 NTU.

Salinity

Salinity ranged from 0.0 to 3.2 ppt (n=38).

Too limited data (lack of biological and DO data) are available to assess the status of the *Aquatic Life Use;* therefore, it is currently not assessed.

FISH CONSUMPTION

Although there are currently three site-specific advisories in waterbodies upstream of this segment, due to a lack of data the *Fish Consumption Use* is currently not assessed.

PRIMARY AND SECONDARY CONTACT RECREATION

WRWA collected fecal coliform and *Enterococci* bacteria samples at Station A-1 (Westport River at Rte 177), and Station 3 (Head of Westport River at Old Colony Road) between March and October 2001. Samples were collected during both wet and dry weather. The majority of high counts were recorded during wet weather conditions.

Station	Fecal Coliform Bacteria Range (cfu/100mL)	Geometric Mean (cfu/100 mL)
A-1 (n=18, 16 during primary contact season)	2 – 2,470	83.5 3 samples > 400 (19%) 1 sample > 2,000 (5%)
3 (n=18, 16 during primary contact season)	25 - 84,000	375 (7 greater than 400 – 44%) (4 greater than 2,000 – 22%)

Enterococci counts ranged between 2 and 201,000 cfu/200mL (n=35). Twenty-six of the 35 samples (74%) had counts greaterthan 61 cfu/100mL and six counts were greater than 1,000 cfu/100mL, primarily collected during wet weather conditions (Carvalho-Souza 2002).

ESS collected fecal coliform bacteria samples from their three water quality stations on this segment of the East Branch Westport River as part of a NPS bacteriological assessment project (01-02/MWI). Samples were collected on 7 June, 21 September, 20 November, and 17 December 2001, and 4 and 30 January 2002 during wet and dry weather. Results from the first two sampling rounds were censored due to lab error. None of the samples exceeded 46 cfu/100 mls (ESS 2003). Additionally, three storm drains were also sampled. Sampling from the storm drains suggested that station WR5 at Gifford Road, between Rte 177 and Old Colony Road, may be a significant source of fecal coliform bacteria during wet weather (counts were 580,000 and 2,100,000 cfu/100mL; n=2). Station WR5 is immediately downstream from the Ferry Farm. The area has three small detention/infiltration basins, however, they do not appear to be designed properly. ESS recommended that the downgradient side of the system be constructed or reinforced with a water impermeable material, as well as implement vigorous behavioral BMPs at the farm.

The Town of Westport was awarded a s. 319 grant for a storm water mitigation project in 2002. The project will install two BMPs at storm water drains (one near a farm on Gifford Road and one near Head of Westport) in order to treat the first flush using sediment collection and effluent infiltration. Pre- and post implementation water quality monitoring will be conducted. The project is expected to take 2½ years to complete. QAPP development began in January 2003 (Peirce 2003).

Based on the elevated fecal coliform bacteria counts during wet weather conditions documented by WRWA, the *Primary Contact Recreational Use* is assessed as impaired. The *Secondary Contact Recreational Use* is assessed as support in the upper 2.53 miles and impaired downstream from the Gifford Road storm drain (lower 0.32 miles).

East Branch Westport River (MA95-40) Use Summary Table

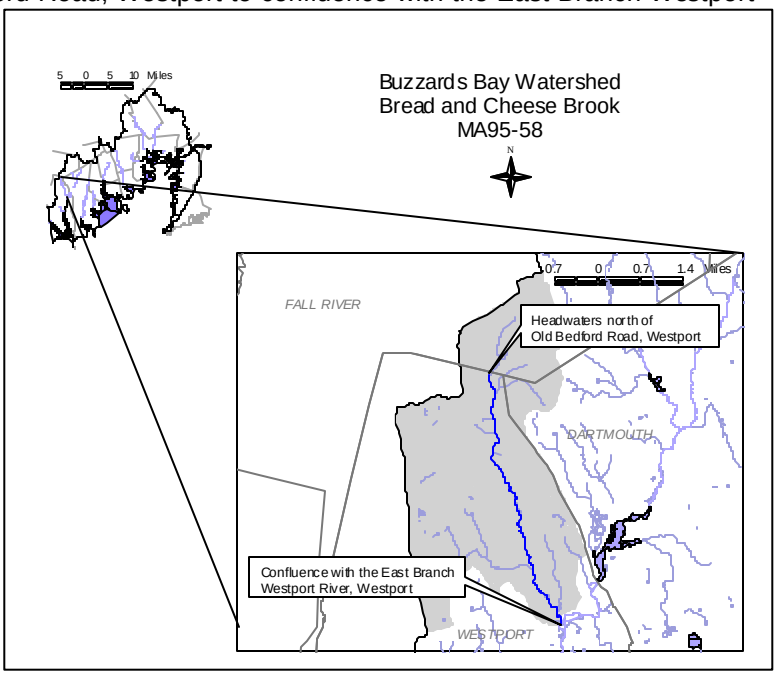
Designated Uses		Status	Causes	Sources	
			Known	Known	Suspected
Aquatic Life		NOT ASSESSED			
Fish Consumption		NOT ASSESSED			
Primary Contact		IMPAIRED	Fecal coliform bacteria	Unknown	Municipal separate storm sewer systems, highway/road runoff, Animal feeding operations
Secondary Contact		2.53 mi SUPPORT 0.32 mi IMPAIRED	Fecal coliform bacteria	Unknown	Municipal separate storm sewer systems, highway/road runoff, Animal feeding operations
Aesthetics		NOT ASSESSED			

RECOMMENDATIONS EAST BRANCH WESTPORT RIVER (MA95-40)

- Continue to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, the Phase II community storm water management programs, and implementation of BMPs to assess the recreational uses.
- Continue to work with the WRWA to promote education and outreach programs to protect surface water resources. Offer technical support and guidance to WRWA to continue/expand their water quality monitoring program. Review final reports to assess the *Aquatic Life Use* and the recreational uses.
- Additional fish toxics monitoring should be conducted downstream of Noquochoke Lake in the East Branch Westport River and Forge Pond to help assess the *Fish Consumption Use*.

BREAD AND CHEESE BROOK (SEGMENT MA95-58)

Location: Headwaters north of Old Bedford Road, Westport to confluence with the East Branch Westport River, Westport
Segment Length: 4.94 miles
Classification: Class B



The drainage area of this segment is approximately 10.6 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	67%
Residential	20%
Agriculture	5%

MassWildlife has proposed that Bread and Cheese Brook be reclassified in the SWQS as a cold water fishery (MassWildlife 2001).

WMA WATER WITHDRAWAL AND NPDES SURFACE DISCHARGE SUMMARY

There are no regulated water withdrawals or NPDES discharges in this subwatershed. It should be noted, however, that Westport is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Biology

DWM conducted fish population sampling (8 October 1996) on Bread and Cheese Brook approximately 300 meters downstream from Route 177 (station NB04BAC) in Westport as part of the Biocriteria Development Project. Seven American eel *(Anguilla rostrata)*, one swamp darter (*Etheostoma fusiforme*), one creek chubsucker (*Erimyzon oblongus*), two brook trout (*Salvelinus fontinalis*), and one chain pickerel (*Esox niger*) were collected (MA DEP 1996b).

Also as part of the Biocriteria Development Project DWM conducted benthic macroinvertebrate sampling on Bread and Cheese Brook along the same reach as fish population sampling using a modified RBP III approach (MA DEP 1996b and Nuzzo 1999). Metrics calculated for these samples were not consistent with those used for assessment purposes, therefore, details are not provided here. Please refer to *The Massachusetts Pilot Study on Numeric Biocriteria for Streams and Small Rivers 1996 Data on Macroinvertebrates* report prepared by Lotic Inc. (1998) for additional information.

Habitat and Flow

As part of the fish population and benthic macroinvertebrate sampling for the Biocriteria Project, DWM conducted a habitat assessment of Bread and Cheese Brook approximately 300 meters downstream from Route 177 (station NB04BAC). There were no dams or channelization present in this reach. Substrates were comprised of cobble, gravel, and sand. This stream was used as a reference station and received a habitat score of 166 out of 200 due to the lack of epifaunal substrate, moderate sediment deposition, limited riffle areas, and human activities impacting the riparian zone. *Sparganium* sp. (bur-reed) was present over 30% of the reach (MA DEP 1996b).

Chemistry - water

DWM sampled Bread and Cheese Brook approximately 300 meters downstream of Route 177 in Westport (station NB04BAC) as part of the Biocriteria Development Project on 8 October 1996.

Parameter	Result
Measurement Depth (m)	**i
Time	16:12
Temperature (°C)	10.3
pH (SU)	5.4
Conductivity (µS/cm)	166
Total Dissolved Solids (mg/L)	106
Dissolved Oxygen (mg/L)	10.8
Percent Saturation (%)	96
Turbidity (NTU)	6i

** = censored or missing data
i= inaccurate readings from Hydrolab likely

Too little current data are available; therefore, the *Aquatic Life Use* is currently not assessed.

PRIMARY AND SECONDARY CONTACT RECREATION

WRWA collected bacteria samples from Bread and Cheese Brook at Rte 177 between March and October 2001. Fecal coliform bacteria counts ranged from 0 to 1,190 cfu/100mL (n=17). The geometric mean of the samples collected during the primary contact season was 55.9. Two of the 15 samples (13%) collected during the primary contact season had counts greater than 400 cfu/100mL. Both of the elevated counts were representative of wet weather conditions. *Enterococci* counts at Rte 177 ranged from 0 to 4940 cfu/100ml (n=16).

ESS also collected fecal coliform bacteria samples from the three stations along Bread and Cheese Brook as part of a NPS bacteriological assessment project (01-02/MWI); station WR13 was located at Bedford Road, WR12 was located at Route 6 and WR10 was located at Route 177. Samples were also collected from one unnamed tributary at Gifford Road (station WR11) and a storm drain on the downstream side of station WR13. Samples were collected on 7 June, 21 September, 20 November, and 17 December 2001, and 4 and 30 January 2002 during wet and dry weather. Results from the first two sampling rounds were censored due to lab error. None of the fecal coliform counts exceeded 100 cfu/100 mls (ESS 2003).

ESS noted that large impervious areas along Route 6 and Gifford Road convey storm water runoff directly into Bread and Cheese Brook. Livestock pastures were also noted within 200 feet of the brook.

Based on the elevated fecal coliform bacteria counts during wet weather conditions documented by WRWA, the *Primary Contact Recreational use* is assessed as impaired. The *Secondary Contact Recreational Use,* however, is assessed as support.

Bread and Cheese Brook (MA95-58) Use Summary Table

Designated Uses		Status	Causes	Sources	
			Known	Known	Suspected
Aquatic Life		NOT ASSESSED			
Fish Consumption		NOT ASSESSED			
Primary Contact		IMPAIRED	Fecal coliform bacteria	Unknown	Municipal separate storm sewer systems, grazing in riparian zone, highway/road runoff
Secondary Contact		SUPPORT			
Aesthetics		NOT ASSESSED			

RECOMMENDATIONS BREAD AND CHEESE BROOK (MA95-58)

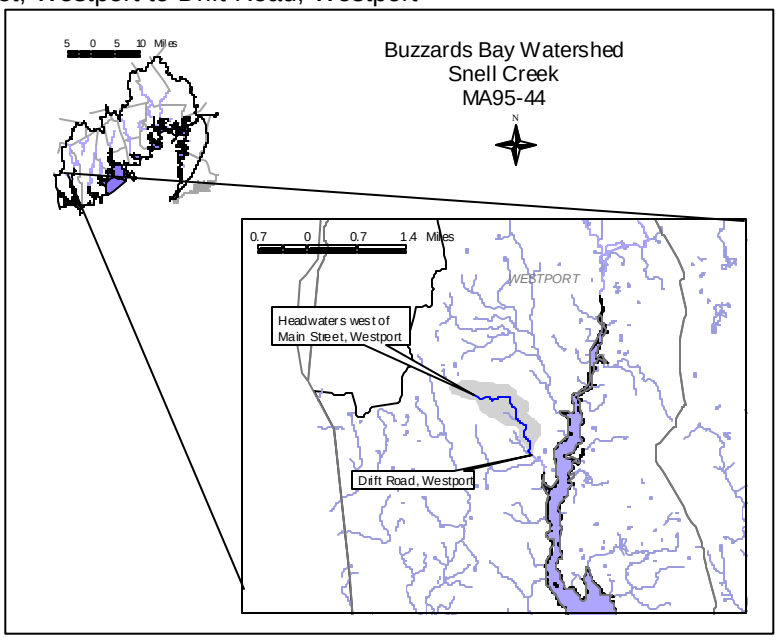
- Continue to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, the Phase II community storm water management programs, and implementation of BMPs to assess the recreational uses.

- Continue to work with the WRWA to promote education and outreach programs to protect surface water resources. Offer technical support and guidance to WRWA to continue/expand their water quality monitoring program. Review final reports to assess the *Aquatic Life Use* and the recreational uses.

- In 1996 DWM identified sediment deposition (most likely from road runoff) in Bread and Cheese Brook downstream of Route 177. As part of a shoreline survey, evaluate the extent of sedimentation problems in this subwatershed. Conduct biomonitoring in this subwatershed bracketing these nonpoint sources to determine if sedimentation and or other nutrient inputs negatively affect the aquatic life. Conduct bacteria monitoring to determine if road runoff is a source of bacteria to this segment and to assess the recreational uses. As a follow up to the survey(s), determine the need to implement erosion control measures and best management practices.

SNELL CREEK (SEGMENT MA95-44)

Location: Headwaters west of Main Street, Westport to Drift Road, Westport
Segment Length: 1.49 miles
Classification: Class B



The drainage area of this segment is approximately 0.5 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	72 %
Agriculture	16 %
Residential	9 %

MassWildlife has proposed that this segment, as well as an unnamed tributary (locally known as Snell Creek) be reclassified in the SWQS as a cold water fishery (MassWildlife 2001).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are no known regulated water withdrawals or surface discharges in this segment.

NPDES SURFACE DISCHARGE SUMMARY

The following general storm water permit was issued by the EPA in October 2001 and will expire in October 2005:

Thad's Auto Salvage MAR05B708

The Town of Westport is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Chemistry-water

WRWA conducted temperature, salinity, pH, and, turbidity monitoring at one station, S-1 Snell Creek at Drift Road, between March and October 2001. Samples were collected during ebb or flood tide between 0600 and 1300 (Carvalho-Souza 2002).

pH

pH in Snell Creek ranged from 6.02 to 7.16 S.U. (n=18).

Temperature

Temperature in Snell Creek ranged from 0 to 21.39 °C with three of the 17 measurements (18%) greater than 20°C.

Turbidity

Turbidity ranged from 0.40 to 4.01 NTU (n=18).

Salinity

Salinity measurements in Snell Creek were all 0.1 ppt (n=18).

Too limited data (lack of biological and DO data) are available; therefore, the *Aquatic Life Use* is currently not assessed.

PRIMARY AND SECONDARY CONTACT RECREATION

WRWA collected fecal coliform and *Enterococci* bacteria samples at Station S-1, Snell Creek at Drift Road between March and October 2001. Samples were collected during both wet and dry weather. The majority of exceedances were recorded during wet weather conditions (Carvalho-Souza 2002).

Station	Fecal Coliform Bacteria Range (cfu/100mL)	Geometric Mean
S-1 (n=20, 17 during primary contact season)	6 – 3,100	92.11 6 samples > 400 (35%) 2 samples > 2,000 (10%)

Enterococci counts ranged from 2 to 37,000 cfu/100mL.

Based on the elevated fecal coliform bacteria counts, the *Primary Contact Recreational Use* is assessed as impaired and the *Secondary Contact Recreational Use* is assessed as support.

Snell Creek (MA95-44) Use Summary Table

Designated Uses		Status	Causes	Sources	
			Known	Known	Suspected
Aquatic Life		NOT ASSESSED			
Fish Consumption		NOT ASSESSED			
Primary Contact		IMPAIRED	Fecal coliform bacteria	Unknown	Municipal separate storm sewer systems, on-site septic systems, highway/road runoff
Secondary Contact		SUPPORT			
Aesthetics		NOT ASSESSED			

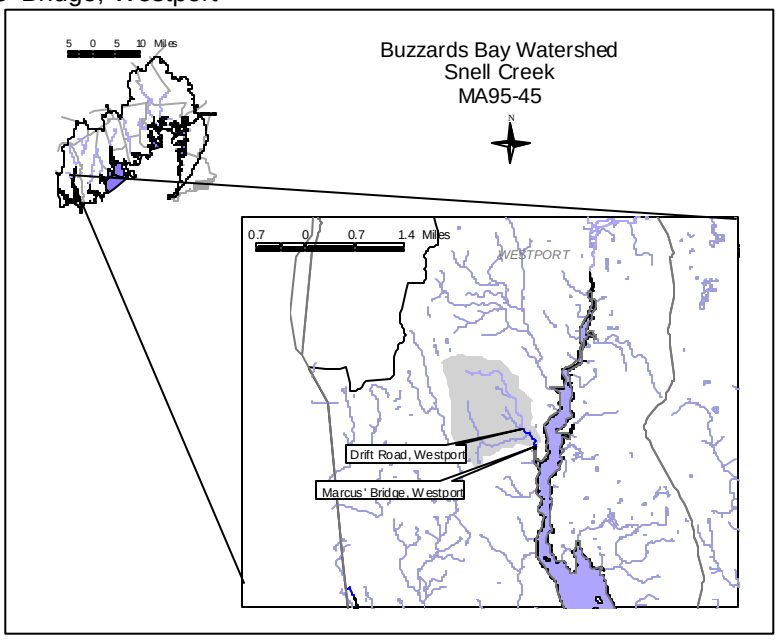
RECOMMENDATIONS SNELL CREEK (MA95-44)

- Continue to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management programs to assess the recreational uses.

- Continue to work with the WRWA to promote education and outreach programs to protect surface water resources. Offer technical support and guidance to WRWA to continue/expand their water quality monitoring program. Review final reports to assess the status of the *Aquatic Life Use* and the recreational uses.

SNELL CREEK (SEGMENT MA95-45)

Location: Drift Road, Westport to Marcus' Bridge, Westport
Segment Length: 0.67 miles
Classification: Class B



The drainage area of this segment is approximately 1.4 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	65 %
Agriculture	16 %
Residential	16 %

This segment is on the 1998 Massachusetts 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).

MassWildlife has proposed that this segment, as well as an unnamed tributary (locally known as Snell Creek), be reclassified in the SWQS as a cold water fishery (MassWildlife 2001).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are no known regulated water withdrawals in this subwatershed.

NPDES SURFACE DISCHARGE SUMMARY

Jose Pimental (MA0040100), EPA Region 1 issued the first *Concentrated Animal Feeding Operations (*CAFO) permit under the NPDES regulations to the 30-acre farm on Drift Road that borders both Snell Creek and the East Branch of the Westport River (segment MA95-40). The CAFO permit requires specific best management practices be used for manure and milk parlor waste to ensure no discharge to the waterbodies. In addition a vegetated buffer of up to 100 feet must be maintained between the pastures and Snell Creek and between the East Branch of the Westport River and the farm.

The Town of Westport a is Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Chemistry-water

WRWA conducted temperature, salinity, pH, and turbidity monitoring at one station S-7 Snell Creek at Marcus' Bridge, between March and October 2001. Samples were collected during ebb or flood tide between 0600 and 1300 (Carvalho-Souza 2002).

pH

pH in Snell Creek ranged from 6.13 to 7.16 S.U. (n=18).

Temperature

Temperature in Snell Creek ranged from 0 to 22.22 °C with three of the 17 measurements (18%) greater than 20°C.

Turbidity

Turbidity ranged from 0.47 to 4.69 NTU (n=18).

Too limited data (lack of biological and DO data) are available; therefore, the *Aquatic Life Use* is currently not assessed.

PRIMARY AND SECONDARY CONTACT RECREATION

WRWA collected fecal coliform and *Enterococci* bacteria samples at Station S-7 Snell Creek at Marcus' Bridge between March and October 2001. Samples were collected during both wet and dry weather. The majority of exceedances were recorded during wet weather conditions (Carvalho-Souza 2002).

Station	Fecal Coliform Bacteria Range (cfu/100mL)	Geometric Mean
S-7* (n=17, 16 during primary contact season)	17 – 6,000	307.16 7 samples > 400 (44%) 4 samples > 2,000 (24%)

*Value reported as zero was not used in the reported range or calculation

Enterococci counts ranged from 12 to 94,000 cfu/100mL.

Based on the high fecal coliform bacteria counts, the *Primary* and *Secondary Contact Recreational uses* are assessed as impaired.

Snell Creek (MA95-45) Use Summary Table

Designated Uses		Status	Causes	Sources	
			Known	Known	Suspected
Aquatic Life		NOT ASSESSED			
Fish Consumption		NOT ASSESSED			
Primary Contact		IMPAIRED	Fecal coliform bacteria	Animal feeding operation, grazing in riparian zone, dairy outside milk parlor area	Municipal separate storm sewer systems, on-site septic systems, highway/road runoff
Secondary Contact		IMPAIRED	Fecal coliform bacteria	Animal feeding operation, grazing in riparian zone, dairy outside milk parlor area	Municipal separate storm sewer systems, on-site septic systems, highway/road runoff
Aesthetics		NOT ASSESSED			

RECOMMENDATIONS SNELL CREEK (MA95-45)

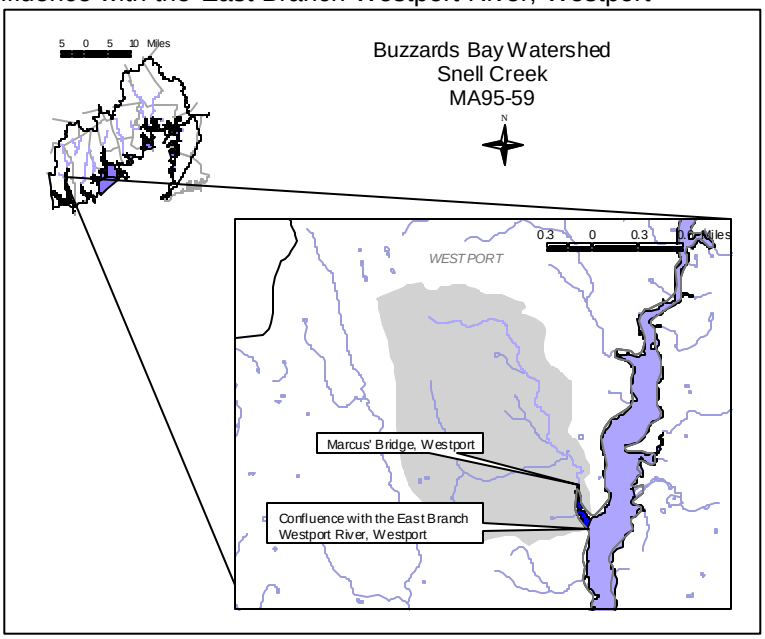
- Continue to monitor farm operation (effectiveness of best management practices) and compliance with CAFO permit requirements that are aimed at reducing bacteria and nutrient inputs to Snell Creek.

- Develop a monitoring program to bracket nonpoint sources of bacteria to Snell Creek and to document the effectiveness of bacteria source reduction activities including treatment of storm water discharges, implementation of best management practices, implementation of vegetated buffer zone between the farm and Snell Creek, and the Phase II community storm water management programs. Data from the program could be used to assess the recreational uses.

- Continue to work with the WRWA to promote education and outreach programs to protect surface water resources. Offer technical support and guidance to WRWA to continue/expand their water quality monitoring program. Review final reports to assess the *Aquatic Life Use* and recreational uses.

SNELL CREEK (SEGMENT MA95-59)

Location: Marcus' Bridge, Westport to confluence with the East Branch Westport River, Westport
Segment Area: 0.01 square miles
Classification: Class SA



The drainage area of this segment is approximately 1.7 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	63 %
Agriculture	18 %
Residential	14 %

WMA WATER WITHDRAWAL AND NPDES SURFACE DISCHARGE SUMMARY

There are no known regulated water withdrawals or NPDES discharges along this segment. It should be noted, however, that Westport is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that growing area BB4.2, which includes this entire segment, is restricted (DFWELE 2000).

Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as impaired.

PRIMARY AND SECONDARY CONTACT RECREATION

As a result of elevated fecal coliform bacteria counts documented by WRWA at Marcus' Bridge and the known problems at the Pimental Farm (see segment MA95-45) both the recreational uses are assessed as impaired.

Snell Creek (MA95-59) Use Summary Table

Designated Uses		Status	Causes	Sources	
			Known	Known	Suspected
Aquatic Life		NOT ASSESSED			
Fish Consumption		NOT ASSESSED			
Shellfish Harvesting		IMPAIRED	Fecal coliform bacteria	Animal feeding operation, grazing in riparian zone, dairy outside milk parlor area	Municipal separate storm sewer systems, on-site septic systems, highway/road runoff
Primary Contact		IMPAIRED	Fecal coliform bacteria	Animal feeding operation, grazing in riparian zone, dairy outside milk parlor area	Municipal separate storm sewer systems, on-site septic systems, highway/road runoff
Secondary Contact		IMPAIRED	Fecal coliform bacteria	Animal feeding operation, grazing in riparian zone, dairy outside milk parlor area	Municipal separate storm sewer systems, on-site septic systems, highway/road runoff
Aesthetics		NOT ASSESSED			

RECOMMENDATIONS SNELL CREEK (MA95-59)

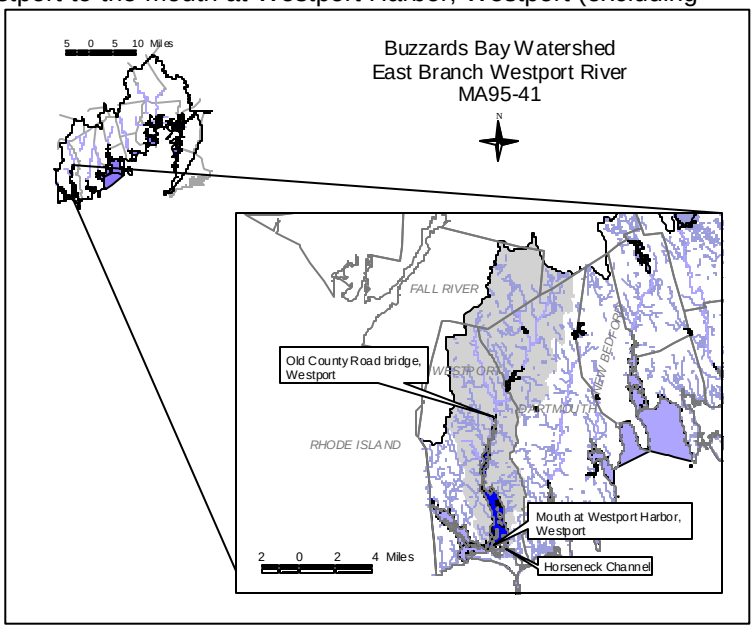
- Develop a monitoring program for bacteria to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, compliance with CAFO permit, and the Phase II community storm water management programs and to continue to assess the recreational uses.

- Review and implement, as appropriate, recommendations from DMF shellfish survey program reports (sanitary surveys and triennial reports) to reduce bacteria and remediate sources causing the closure of the shellfish beds. Continue to review DMF shellfish status report to assess the *Shellfish Harvesting Use*.

- Continue to work with the WRWA to promote education and outreach programs to protect surface water resources. Offer technical support and guidance to WRWA to continue/expand their water quality monitoring program. Review final reports to assess the *Aquatic Life Use* and the recreational uses.

EAST BRANCH WESTPORT RIVER (SEGMENT MA95-41)

Location: Old County Road bridge, Westport to the mouth at Westport Harbor, Westport (excluding Horseneck Channel)
Segment Area: 2.65 square miles
Classification: Class SB, Shellfishing (Restricted)



The drainage area of this segment is approximately 58.4 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	66 %
Residential	14 %
Agriculture	9 %

MassWildlife has proposed that Kirby Brook, a tributary to this segment, be reclassified in the SWQS as a cold water fishery (MassWildlife 2001). There is public access to the Westport River via one asphalt boat launch maintained by the Department of Environmental Management Forest and Parks Division. There are 35 parking spaces at this location (DFWELE 2002). There are two vessel sewage pump-out boats at the Westport Point-Town Dock (BBP undated and DMF 29 January 2003).

The Coalition for Buzzards Bay conducted weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at seven stations on this segment of the East Branch Westport River between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at six stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a.* The Coalition states that the system is currently experiencing "nutrient related habitat decline" as supported by the disappearance of eelgrass beds in the upper estuary and elevated total nitrogen and chlorophyll *a* concentrations, high phytoplankton biomass, low Secchi depths, and frequent oxygen depletion (defined by CBB as <60% saturation). While eelgrass beds are still present in the lower third to half of the region, they have been reduced from historic levels throughout the estuary. This estuary sustains the largest breeding population of osprey and is one of fifteen heron rookeries in Massachusetts. The Coalition divides this segment into three areas, the upper east branch, mid east branch, and outer east branch (Howes *et al* 1999*)*. The 1997-2001 average Health Index Score for the upper east branch was 18.1 (poor), the mid east branch score was 30.6 (poor), and the outer east branch score was 63.4 (fair) (CBB undated b). Sources of nitrogen loading identified by the Coalition include residential and commercial land development, crop and animal agriculture, and onsite septic systems. Dairy cows may contribute to fecal coliform bacteria loading.

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are 169.391 acres of cranberry bog open space in the East Branch Westport River subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 1.51 MGD. This estimate includes the estimates of water use for the upstream segments MA95-40 and MA95-45.

NPDES SURFACE DISCHARGE SUMMARY

The following general storm water permit was issued by the EPA in October 2001 and will expire in October 2005:

F L Tripp & Sons Inc MAR05C082

Jose Pimental (MA0040100). EPA Region 1 issued the first *Confined Animal Feeding Operation (*CAFO) permit under the NPDES regulations to a 30-acre farm on Drift Road that borders both the East Branch of the Westport River and Snell Creek (segmentMA95-45). The CAFO permit requires the size of the dairy herd be permanently reduced and specific best management practices used for manure and milk parlor waste. In addition, a vegetated buffer of up to 100 feet must be maintained between the pastures and Snell Creek and between the East Branch of the Westport River and the farm.

The Town of Westport is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

WRWA conducted temperature, salinity, pH, and turbidity monitoring between March and October 2001 at six stations on this segment and one tributary station. Samples were collected during ebb or flood tide between 0600 and 1300 at the following stations (Carvalho-Souza 2002):

14-River off Cummings Lane
15-River off of Cadaman's Neck
17-River at Doctor's Point
18-River at the Mouth of Snell Creek
19-River off of Farm North Wall
KB-River at the Mouth of Kirby Brook
K4-Kirby Brook at Drift Road

As part of the Coastal 2000 Project, CZM, in partnership with EPA, UMass Boston, and UMass Dartmouth, sampled two stations on the East Branch Westport River-- 39A (near Lower Spectacle Island) and 35B (near Little Ram Island). Sediment toxicity; sediment chemistry; *in situ* DO, temperature, salinity, pH; TSS; chlorophyll *a;* and ammonia samples were collected on 13 September 2000. Sediments were analyzed for 78 analytes and TOC. Benthic community structure and habitat assessments were also conducted, however, final metrics have not yet been calculated. Additional monitoring was conducted in 2001 and results are not yet available (Krahforst 2003).

Habitat and Flow

The Hix Bridge on Bridge Road causes a tidal restriction due to build up of sediments under the bridge (BBP Tidal Atlas Site WP06). Additionally, large granite blocks, which toppled into the river during the Hurricane of 1938, also impede flows. The ACOE conducted a tidal flushing study to determine the benefits of increased tidal flushing (BBP 2002b). The Massachusetts Highway Department reconstruction of the Hix Bridge during the spring of 2003 will improve the storm water drainage facilities on both sides of the river. The drainage from this bridge, at a low point in the road, will now be collected in basins and diverted into a vegetated swale (Janik 2003).

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in the East Branch Westport River from historic 1951 black and white aerial photography. Eelgrass beds in the East Branch Westport River were mapped by MA DEP from field verified 1994 aerial photography (Costello 2003). Decline of eelgrass beds occurred in the areas to the northwest of Upper and Lower Spectacle Island, to the northeast of Big Pine Island, south of Big Pine Island and west of Great Island, east of Great Island and Cunning Island, and east of Wood Point.

Toxicity-sediment

As part of the Coastal 2000 Project (Krahforst 2003) sediment toxicity tests were conducted on sediments from Station 39A and 35B in the East Branch Westport River using the small shrimp-like amphipod *Ampelisca abdita*. (*Ampelisca* construct tubes of fine sand grains and feed on detritus and are especially sensitive to oil pollution). Amphipods were exposed to sediments for 10 days under static conditions following the EPA Environmental Monitoring and Assessment Program (EMAP) procedures (EPA 1995 and ASTM 1991). Twenty juvenile amphipods were added to each test chamber for a ten-

day exposure. The surviving amphipods were counted, and the results reported as the average number of amphipods surviving in the sample tests divided by the number of amphipods surviving in the control sediment, expressed as a percent. Lower values of this result indicate higher toxicity. The result was considered to be statistically significant if sample and control values were distinct with a p-value # 0.05 in a one way analysis of variance (ANOVA) F test. The assay was taken to indicate toxicity if the survival rate was less than 80% of the control and the test was statistically significant. Sediments from Station 39A were not toxic (survival >80%). Sediments at 35B, however, were acutely toxic (74.74% mean survival when compared to control survival).

Chemistry-water

DO

The dissolved oxygen concentration measured by Coastal 2000 on 13 September 2000 at Station 35B was 7.32 mg/L (surface) and 6.06 mg/L (bottom). The DO concentration at Station 39A was 5.52 mg/L (surface) and 5.56 mg/L (bottom).

pH

WRWA reported pH ranging from 6.02 to 8.15 SU. Six of the 103 readings from throughout their sampling area were less than 6.5 SU (6%). pH at the tributary station ranged from 5.68 to 7.09 SU (n=22). pH taken as part of the Coastal 2000 Project was 8.04 SU at station 39A, near Lower Spectacle Island, and 8.11SU at station 35B, near Little Ram Island.

Temperature

WRWA reported temperatures ranging from 8.33 to 28.06°C (n=107). Temperatures in the tributary did not exceed surface water quality standards. The surface water temperature at CZM Station 35B was 21.74°C and the bottom temperature was 21.78°C. At CZM Station 39A, the surface temperature was 22.67°C and in the bottom waters the temperature was 21.85°C.

Turbidity

Turbidity at the WRWA stations ranged from 1.62 to 6.93 NTU (n=104). Turbidity in the tributary ranged from 0.53 to 3.53 NTU (n=22).

Salinity

Salinities at the WRWA stations ranged from 0.1 to 30.2 ppt (n=104). Salinity in the tributary ranged from 0.0 to 0.2 ppt (n=19). Salinity at CZM Station 35B was 31.03 at the surface and 30.96 in the bottom water. At Station 39A, salinity was 28.99 (surface) and 30.75 (bottom).

Total Suspended Solids

TSS measured as part of the Coastal 2000 Project at Station 39A was 3.53 mg/L. At Station 35B TSS in the surface waters was 4.03 mg/L and 3.74 mg/L in the bottom waters.

Ammonia- Nitrogen (as N)

The ammonia concentration at station 39A was 0.032 mg/L and at Station 35B, the ammonia concentration was 0.03 mg/L (n=2). Neither of these values exceeded the criteria continuous concentration (chronic criteria) for ammonia-nitrogen.

Chlorophyll a

The chlorophyll a concentration at Station 39A was 1.41 µg/L and at Station 35B the concentration was 1.75 µg/L.

Because of the loss of eelgrass bed habitat, the *Aquatic Life Use* is assessed as impaired for this segment of the East Branch Westport River. The eelgrass bed loss may be associated with nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources (animal feeding operation and storm drains) or other anthropogenic activities that result in reduced water clarity. Suspected sources of nutrient enrichment include septic systems. Habitat alteration (tidal restriction) in the form of sedimentation at the Hix bridge is also a concern.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing areas BB3.0, BB3.13, BB4.0, BB4.24 are approved; BB4.13 and BB4.20, BB4.7, BB4.8, BB4.9 are conditionally approved; BB4.1, BB4.5, BB4.6, and BB4.11 are prohibited; and BB4.2 is restricted (DFWELE 2000).

Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as support for 2.01 mi^2 and impaired for 0.64mi^2.

PRIMARY AND SECONDARY CONTACT RECREATION

WRWA collected fecal coliform and *Enterococcus* bacteria samples at their water quality stations between March and October 2001(Carvalho-Souza 2002).

Station	Fecal Coliform Bacteria Range (cfu/100mL)	Geometric Mean (cfu/100mL)
14 (n=23; 20 samples collected during primary contact season)	2 - 2,900	30.56 (3 greater than 400-14%) (1 greater than 2,000- 4%)
15 (n=20; 18 samples collected during primary contact season)	1 - 9,200	30.54 (4 greater than 400- 22%) (3 greater than 2,000- 15%)
17 (n=15, 14 samples collected during primary contact season)	6 - 25,000	89.70 (4 greater than 400- 29%) (2 greater than 2,000- 13%)
18 (n=15, 13 samples collected during primary contact season)	6 - 30,600	321.93 (4 greater than 2000- 27%)
19 (n=15, 15 samples collected during primary contact season)	10 - 29,900	291.71 (4 greater than 2,000 – 27%)
KB (n=11, 10 samples collected during primary contact season)	56 - 31,800	422.85 (2 greater than 2,000- 18%)
K4 (n=20, 18 samples collected during primary contact season)	14 - 2,500	87.02 (2 greater than 400 – 11%) (1 greater than 2,000 – 5%)

Enterococci counts ranged from 0 to 49,400 cfu/100mL (n=83). *Enterococci* counts at the tributary station ranged from 3 to 13,500 cfu/100mL (n=17)(Carvalho-Souza 2002).

ESS conducted a bacteriological NPS assessment project (01-02/MWI) of the East Branch Westport River. In-stream sampling occurred in the upstream segment of the river. One wet weather storm drain sample was collected from station WR4 on 17 December 2001; the fecal coliform bacteria count was 60 cfu/100mL. There are three additional storm drains that discharge untreated storm water to the East Branch Westport River downstream of Head Bridge/Old Colony Road (ESS 2003). Fecal coliform bacteria at station WR1 (storm drain along west side of Head Bridge at Old Colony Road) ranged from 1 to 700 (n=3). At station WR2 (storm drain along east side of Head Bridge at Old colony Road) fecal coliform bacteria counts were 610 and 1,600 cfu/100mL (n=2). Sampling from the storm drains indicated that station WR5 at Gifford Road, between Old Colony Road and Rte 177 (upstream of this segment), was a significant source of fecal coliform bacteria during wet weather (counts were 580,000 and 2,100,000 cfu/100mL; n=2). Fecal coliform bacteria at station WR1 ranged from 1 to 700 (n=3) and at station WR2 fecal coliform bacteria counts were 610 and 1,600 cfu/100mL. Station WR5 is immediately downstream from the Ferry Farm. The area has three small detention/infiltration basins, however, it does not appear to be designed properly. ESS recommended that the downgradient side of the system be reconstructed or reinforced with a water impermeable material and that vigorous behavioral BMPs be implemented at the farm.

The Town of Westport was awarded a s. 319 grant for a storm water mitigation project in 2002. The project will install two BMPs; one a pocket wetland at station WR2 and the other at the farm on Gifford Road to treat the first flush using sediment collection and effluent infiltration. Pre- and post water quality monitoring will be conducted to determine the inefficiency. The project is expected to take 2½ years to complete. QAPP development began in January 2003 (Peirce 2003).

Based on the high fecal coliform bacteria counts, the *Primary* and *Secondary Contact Recreational Uses* are assessed as impaired for the upper 2.43 square miles. The lower 0.22 square miles are assessed as support based on the DMF shellfish classification (approved).

East Branch Westport River (MA95-41) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		IMPAIRED	Estuarine bioassessment (decline of eelgrass bed habitat)	Total nitrogen	Animal feeding operation, municipal separate storm sewer systems	On-site septic systems, Changes in tidal circulation/ flushing
Fish Consumption		NOT ASSESSED				
Shellfish Harvesting*		2.01 mi^2 SUPPORT 0.64mi^2 IMPAIRED	Fecal coliform bacteria		Animal feeding operation, dairy outside milk parlor area, grazing in riparian zone, municipal separate storm sewer systems	On-site septic systems, highway/road runoff
Primary Contact		2.43 mi^2 IMPAIRED 0.22 mi^2 SUPPORT	Fecal coliform bacteria		Animal feeding operation, dairy outside milk parlor area, grazing in riparian zone, municipal separate storm sewer systems	On-site septic systems, highway/road runoff
Secondary Contact		2.43 mi^2 IMPAIRED 0.22 mi^2 SUPPORT	Fecal coliform bacteria		Animal feeding operation, dairy outside milk parlor area, grazing in riparian zone, municipal separate storm sewer systems	On-site septic systems, highway/road runoff
Aesthetics		NOT ASSESSED				

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS EAST BRANCH WESTPORT RIVER (MA95-41)

- Review the results of the ACOE flushing study and implement recommendations as appropriate. Data from the report could be used to assess the *Aquatic Life Use*.

- Review the sediment chemistry and biomonitoring results of the CZM Coastal 2000 Project to assess the status of the *Aquatic Life Use* and investigate the potential source of sediment toxicity at Station 35A near Little Ram Island.

- Continue to support the implementation of best management practices (BMPs) at dairy farms within the region to reduce bacteria/nutrient inputs to the subwatershed.

- Review and implement recommendations in the DMF anadromous fish assessment report, when available, to improve water quality and spawning habitat. If applicable, review for data to assess the *Aquatic Life Use*.

- Develop a monitoring program for bacteria to document the effectiveness of bacteria source reduction activities including treatment of storm water discharges, compliance with CAFO permit, and the Phase II community storm water management programs and to continue to assess the recreational uses.

- Review and implement, as appropriate, recommendations from DMF shellfish survey program reports (sanitary surveys and triennial reports) to reduce bacteria and remediate sources causing the closure of the shellfish beds. Continue to review DMF shellfish status report to assess the *Shellfish Harvesting Use*.

- Continue to work with the WRWA to promote education and outreach programs to protect surface water resources. Offer technical support and guidance to WRWA to continue/expand their water quality monitoring program. Review final reports to assess the *Aquatic Life Use* and recreational uses.

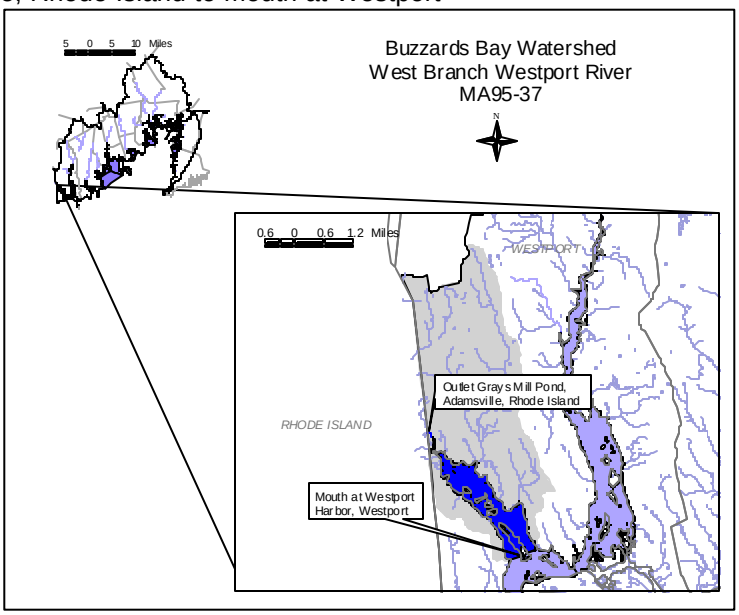
- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports to continue to assess the *Aquatic Life Use*.

- Implement those 11 salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are WP04 through WP14. Site WP06 is at the Hix Bridge where the Massachusetts Highway Department has a reconstruction project scheduled for 2003. Develop a monitoring plan to assess the effectiveness of the projects and to assess the *Aquatic Life Use*.

- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Review data to assess the *Aquatic Life Use*.

WEST BRANCH WESTPORT RIVER (SEGMENT MA95-37)

Location: Outlet Grays Mill Pond, Adamsville, Rhode Island to mouth at Westport Harbor, Westport
Segment Area: 1.28 square miles
Classification: Class SA, Shellfishing (Open)



The Massachusetts portion of the drainage area for this segment is approximately 9.1 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	67 %
Agriculture	19 %
Residential	10 %

This segment is on the Massachusetts 1998 303(d) List of Waters as not meeting water quality standards for pathogens (MA DEP 1999).

MassWildlife has proposed that Dunghams and Angeline brooks, tributaries to this segment be reclassified in the SWQS as a cold water fishery (MassWildlife 2001).

The headwaters of the West Branch Westport River form an impoundment at Adamsville Pond, which is also known as Greys Mill Pond. Since 1675 the pond has been utilized to operate Grey's Grist Mill and has historically been the spawning grounds for river herring, primarily alewives. However, the dam at the outlet precludes herring from reaching the pond. The owners of the mill have been actively involved in maintaining fish passage to the pond. In 1995, the Town of Westport, assisted by DMF, installed a wooden fish ladder along the south side of the dam and brook. On March 31, 2001, seven inches of rain resulted in flooding and destruction of the fish ladder. The Town, in consultation with DMF and the United States Department of Agriculture Natural Resources Conservation Service, replaced the ladder in the winter of 2002. The aluminum steep pass ladder utilizes a complex baffling system that allows the herring to pass into the spawning area quickly and with less effort. During the spring of 2002, volunteer fish counts were conducted to determine the effectiveness of the ladder (BBP 2002a).

The Coalition for Buzzards Bay has conducted weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at three stations on this segment of the West Branch Westport River between May and September from 1992 to the present. Samples were collected between 6 and 9 am. More intensive sampling of nutrients was conducted at two stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. The Coalition states that the system is currently experiencing "nutrient related habitat decline" as supported by the disappearance of eelgrass beds in the upper estuary, elevated total nitrogen and chlorophyll *a* concentrations, low Secchi depths, and periodic oxygen depletions (defined by CBB as <60% saturation). Eelgrass beds are present in the lower third to half of the region. Sources of nitrogen loading identified by the Coalition include crop and animal agriculture and residential and commercial development (Howes *et al.* 1999). The Coalition's 1997-2001 Average Health Index Score for this segment is 56.1 (fair) (CBB undated b).

WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are no regulated water withdrawals from this subwatershed.

NPDES SURFACE DISCHARGE SUMMARY

Westport is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and

enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in the West Branch Westport River from historic 1951 black and white aerial photography. Eelgrass beds in the West Branch Westport River were mapped by MA DEP from field verified 1994 aerial photography (Costello 2003). Loss of eelgrass beds occurred along the western shore between Sanford Flat and Canoe Rock. Decline of the beds along the eastern shore occurred between Judy Island and Sanford Flat.

Chemistry-water

WRWA conducted temperature, salinity, pH, and turbidity monitoring at one station in the river off of 448 River Road (station 6) between March and October 2001. Samples were collected during ebb or flood tide between 0600 and 1300 (Carvalho-Souza 2002 and WRWA 2001).

pH

pH ranged from 7.75 to 8.16 SU (n=18).

Temperature

Temperature ranged from 2.22 to 24.44 °C (n=18).

Turbidity

Turbidity ranged from 0.69 to 3.06 NTU (n=18).

Salinity

Salinity ranged from 19.4 to 32.3 ppt (n=18).

Due to the loss of eelgrass bed habitat the *Aquatic Life Use* is assessed as impaired for the West Branch Westport River. The eelgrass bed loss may be associated with nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources or other anthropogenic activities that result in reduced water clarity. Suspected sources of nutrient enrichment include animal feeding operations, storm drains, and septic systems.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB3.0 is approved, BB3.11 and BB3.12 are conditionally approved, and BB3.3 and BB3.6 are prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status the *Shellfish Harvesting Use* is assessed as support for 0.50 mi^2 and impaired for 0.78 mi^2.

PRIMARY AND SECONDARY CONTACT RECREATION

WRWA collected fecal coliform and *Enterococcus bacteria* samples at one station in the river near 448 River Road (station 6), between March and October 2001(Carvalho-Souza 2002). Fecal coliform bacteria counts from this location ranged from 0 to 2,500 cfu/100mL (n=19). Of the 17 samples collected during the primary contact recreational season the geometric mean was 8.6 (excluding zero values) and only one count (6%) was greater than 400 cfu/100mL. Samples were collected during both wet and dry weather and the two highest counts were recorded during wet weather conditions. *Enterococci* counts ranged from 0 to 3,200 cfu/100mL.

Based on the low fecal coliform bacteria counts in the river near 448 River Road and the stricter shellfish guidelines, the *Primary* and *Secondary Contact Recreational uses* are assessed as support for lower 0.5 mi^2 but are not assessed for the upper 0.78 mi^2.

West Branch Westport River (MA95-37) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		IMPAIRED	Estuarine bioassessment (loss/decline of eelgrass bed habitat)	Total nitrogen		Animal feeding operation, municipal separate storm sewer systems, on-site septic systems
Fish Consumption		NOT ASSESSED				
Shellfish Harvesting*		0.5 mi^2 SUPPORT 0.78 mi^2 IMPAIRED	Fecal coliform bacteria		Unknown	Municipal separate storm sewer systems
Primary Contact		SUPPORT lower 0.5 mi^2 NOT ASSESSED 0.78 mi^2				
Secondary Contact		SUPPORT lower 0.5 mi^2 NOT ASSESSED 0.78 mi^2				
Aesthetics		NOT ASSESSED				

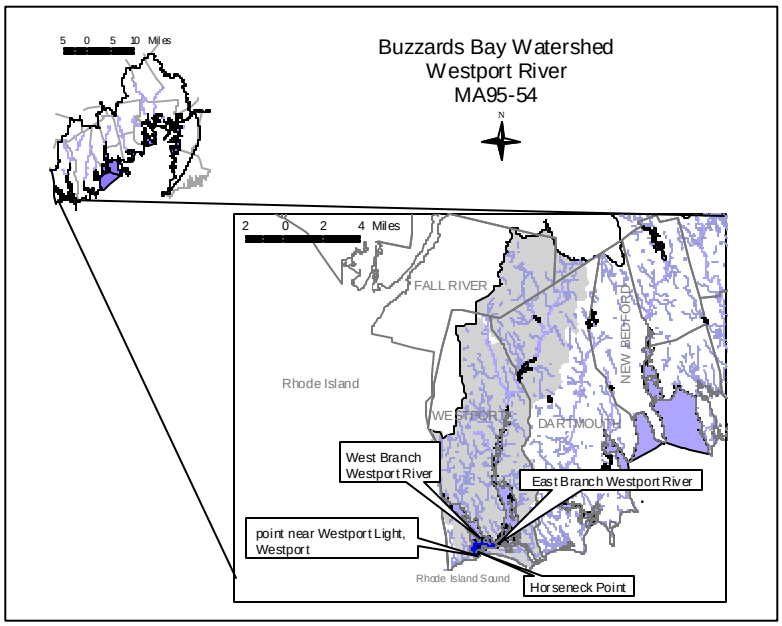
*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS WEST BRANCH WESTPORT RIVER (MA95-37)

- Continue to support the implementation of best management practices (BMPs) at farms within the region to reduce bacteria and nutrient inputs to the West Branch Westport River.
- Review and implement recommendations in the DMF anadromous fish assessment report (when available) to improve water quality and increase habitat. If applicable review data to assess the *Aquatic Life Use*.
- Continue to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, the Phase II community storm water management programs, and on-site septic system improvements and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish survey program reports (sanitary surveys and triennial reports) to reduce bacteria and remediate sources causing the closure of the shellfish beds. Continue to review DMF shellfish status report to assess the *Shellfish Harvesting Use*.
- Work with the Coalition for Buzzards Bay to improve quality assurance procedures, data exchange, and if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports to continue to evaluate the status of the *Aquatic Life Use*.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Review data to assess the *Aquatic Life Use*.
- Continue to work with the WRWA to promote education and outreach programs to protect surface water resources. Offer technical support and guidance to WRWA to continue/expand their water quality monitoring program. Review final reports to assess the *Aquatic Life Use* and the recreational uses.
- Implement the four salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are WP01, WP02, WP 15 and WP16. Develop a monitoring plan to determine the effectiveness of the restorations and to assess their impacts on the *Aquatic Life Use*.

WESTPORT RIVER (SEGMENT MA95-54)

Location: From the confluences of the East and West Branches of the Westport River to Rhode Island Sound at a line drawn from the southwestern point of Horseneck Point to the easternmost point near Westport Light, Westport (consistent with DMF DSGA BB3.0)
Segment Area: 0.74 square miles
Classification: Class SA



The drainage area of this segment is approximately 71.7 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	65%
Residential	14%
Agriculture	10%

ACOE is evaluating a project to dredge the entrance channel to the Westport River from Buzzards Bay at the request of the Town of Westport (ACOE 31 January 2002).

The Coalition for Buzzards Bay has conducted weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in the Westport River between May and September 1992 to the present. Samples were collected between 6 and 9 am. More intensive sampling of nutrients was conducted at three stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. The Coalition states that the system is currently experiencing "nutrient related habitat decline" as supported by the disappearance of eelgrass beds in the upper estuary, elevated total nitrogen and chlorophyll *a* concentrations, low Secchi depths, and periodic oxygen depletions (defined by CBB as <60% saturation). Eelgrass beds are present in the lower third to half of the region. Sources of nitrogen loading identified by the Coalition include crop and animal agriculture and residential and commercial development (Howes *et al* 1999). The Coalition's 1997-2001 Average Health Index Score for the Westport River inlet is 80.4 (good/excellent) (CBB undated b).

WMA WATER WITHDRAWAL AND NPDES SURFACE DISCHARGE SUMMARY

There are no known regulated WMA water withdrawals or NPDES discharges in this segment. It should be noted, however, that Westport is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in the Westport River from historic 1951 black and white aerial photography. Eelgrass beds in the Westport River were mapped by MA DEP from field verified 1994 aerial photography (Costello 2003). Decline of the beds occurred in the vicinity of Whites Flat, the Westport Yacht Club, Hudson Cove, Canoe Rock, and Baileys Flats and Cory's Island.

Chemistry-water

WRWA conducted temperature, salinity, pH, and turbidity monitoring at two stations: off of Westport Point Town Wharf (station 11A) and the Harbor entrance at Charlton Wharf (station 7) between March

and October 2001. Samples were collected during ebb or flood tide between 0600 and 1300 (Carvalho-Souza 2002).

pH
pH ranged from 7.68 to 8.18SU (n=36).

Temperature
Temperature ranged from 2.2 to 23.6°C (n=36).

Turbidity
Turbidity ranged from 0.29 to 1.90 NTU (n=36).

Salinity
Salinity ranged from 22.4 to 32.4 ppt (n=36).

Due to the decline of eelgrass bed habitat the *Aquatic Life Use* is assessed as impaired for this segment of the Westport River. This loss may be attributed to nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources and recreational uses or other anthropogenic activities that result in reduced water clarity Suspected sources of nutrient enrichment include animal feeding operations, storm drains, recreational activities (boating) and septic systems.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB3.0 is approved, BB3.5 is conditionally approved, and BB3.7 is prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as support for 0.7 mi^2 and impaired for 0.04 mi^2.

PRIMARY AND SECONDARY CONTACT RECREATION

WRWA collected fecal coliform and *Enterococcus* bacteria samples at two stations: off of Westport Point Town Wharf (station 11A) and the Harbor entrance at Charlton Wharf (station 7) between March and October 2001(Carvalho-Souza 2002). Their data are summarized below:

Station	Fecal Coliform Bacteria Range (cfu/100mL)	Geometric Mean (cfu/100mL)
11A (n=19, 17 samples collected during the primary contact season)	<1 - 1040	5.02 1 sample > 400 (6%)
7 (n= 9*; all samples collected during primary contact season)	1 -157	5.93

*Note: samples with values reported as zero were not reported here.

Enterococci counts at station 11A ranged from 0 to 410 cfu/100mL (n=17). The counts at station 7 (n=17) ranged from 0 to 240 cfu/100mL (Carvalho-Souza 2002).

Based on the low fecal coliform bacteria counts and the DMF shellfish classification information, the P*rimary* and *Secondary Contact Recreational Uses* are assessed as support.

Westport River (MA95-54) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		IMPAIRED	Estuarine bioassessment (decline of eelgrass bed habitat)	Total nitrogen, other anthropogenic substrate alterations		Animal feeding operation, municipal separate storm sewer systems, on-site septic systems
Fish Consumption		NOT ASSESSED				
Shellfish Harvesting*		0.70 mi^2 SUPPORT 0.04 mi^2 IMPAIRED	Fecal coliform bacteria		Unknown	Municipal separate storm sewer systems
Primary Contact		SUPPORT				
Secondary Contact		SUPPORT				
Aesthetics		NOT ASSESSED				

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS WESTPORT RIVER (MA95-54)

- Review and implement recommendations in the DMF anadromous fish assessment report (when available) to improve water quality and increase habitat. If applicable, review data to assess the *Aquatic Life Use*.

- Continue to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management programs and to assess the recreational uses.

- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce pollutants causing the closure of the shellfish beds. Continue to review the DMF Shellfish Status Reports to assess the *Shellfish Harvesting Use*.

- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality and to assess the *Aquatic Life Use*.

- Continue to work with the WRWA to promote education and outreach programs to protect surface water resources. Offer technical support and guidance to WRWA to continue/expand their water quality monitoring program. Review final reports to assess the *Aquatic Life Use* and the recreational uses.

- Implement the five salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are WP03, WP17 through WP20. Develop a monitoring plan to determine their effectiveness and to assess the improvements to water quality and the aquatic life.

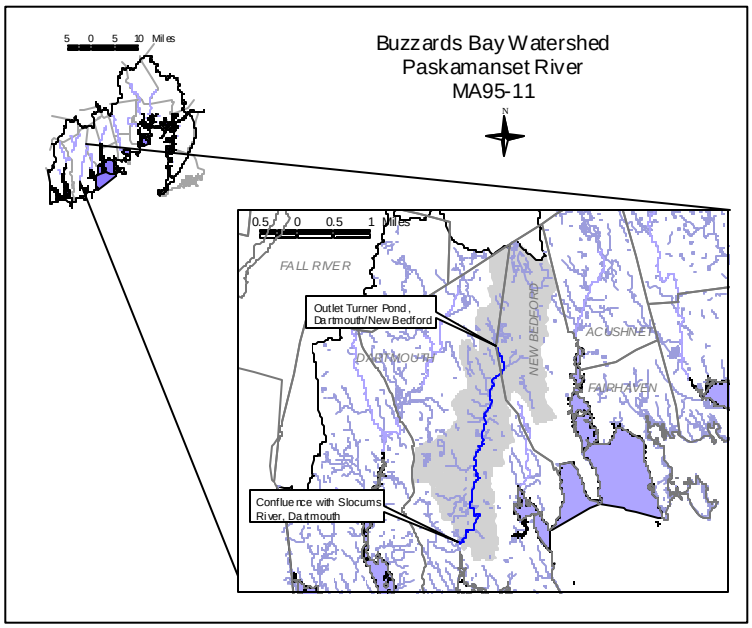
THE SLOCUM/PASKAMANSET RIVER DRAINAGE AREA

The Slocum/Paskamanset River Drainage Area in Dartmouth and New Bedford consists of two segments:

- Paskamanset River (Segment MA95-11)
- Slocums River (Segment MA95-34)

PASKAMANSET RIVER (SEGMENT MA95-11)

Location: Outlet Turner Pond, Dartmouth/New Bedford to confluence with Slocums River, Dartmouth
Segment Length: 10.27 miles
Classification: Class B



The drainage area of this segment is approximately 28.4 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	58%
Residential	15%
Open Land	11%

This segment is on the Massachusetts 1998 303(d) List of Waters, needing confirmation, as not meeting water quality standards for pathogens (MA DEP 1999).

A quarry was operated at the 12-acre Sullivan's Ledge disposal area, located within the Paskamanset River watershed in the northwestern corner of New Bedford, until about 1932. In 1935 the City of New Bedford acquired the site through tax title foreclosure. Between the 1940s and the 1970s local industries used the quarry pits and adjacent areas for disposal of hazardous material and other wastes including electrical capacitors, fuel oil, volatile liquids, tires, scrap rubber, demolition materials, brush and trees. After a fire at the site in the 1970s, the City backfilled the only existing open pit and covered all exposed refuse. In 1982, electrical capacitors were unearthed when the Massachusetts Department of Public Works drilled test borings as part of a plan to build a commuter parking lot. Concentrations of volatile organic compounds (VOCs) in the groundwater on-site and immediately off-site increased with depth. Inorganic compounds and PCBs were also present in the groundwater. The soil was contaminated with PCBs and polycyclic aromatic hydrocarbons (PAHs) with the highest contaminant concentrations found along the eastern and southern boundaries. Soils eroded from the site and were transported by an unnamed stream. Sediments contaminated with PCBs were found in an unnamed stream, Middle Marsh, four golf course water hazards, and a portion of the Apponagansett Swamp. The quarry area was capped to reduce potential exposure and long term groundwater treatment is in place. Likewise, the unnamed stream, Middle Marsh, and water hazards have been cleaned and the resulting materials buried within the on-site cap (EPA 13 December 2002 c).

From 1997-2001, the Buzzards Bay Project conducted a 319 project to demonstrate proactive land conservation as a viable tool for nitrogen management through the use of conservation restrictions, outright land purchase, and agricultural preservation restrictions. The Smith Mills Property is located at the headwaters of the Paskamanset River and lies within an Aquifer Protection District; park benches and a canoe access site were planned for the property (BBP 1997-2001).

In 2000 the Coalition for Buzzards Bay began water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in the Paskamanset River between May and September. Samples have been collected between 6 and 9 am.

Three landfills are located within this subwatershed. The Greater New Bedford Compost Site, a landfill owned by the Greater New Bedford Refuse District, is partially located within this subwatershed on Dartmouth/Freetown town line (MA DEP BWP 2000). The Dartmouth Municipal Landfill is located on Russells Mills Road, Dartmouth, approximately 1000 feet from the Paskamanset River. Between the 1970's and 1994 the landfill received sludge from the Dartmouth WWTP. In 1996 the landfill was capped, and a leachate collection system was installed (Howes *et al* 1999). The third landfill, the New Bedford Municipal Landfill, is located north of Hathaway Road and west of Route 140, approximately one-half mile from the Paskamanset River. It received reject capacitors and other waste products containing PCBs from Aerovox and Cornell Dubilier Electronics, as well as residuals (grit, sludge, ash) from the New Bedford WWTP.

WMA WATER WITHDRAWAL SUMMARY * (APPENDIX F)

Facility	PWS ID	WMA Permit Number	WMA Registration Number	Source (G = ground)	Authorized Withdrawal (MGD)	Average Withdrawal (MGD)		
						1999	2000	2001
Country Club of New Bedford		9P42407202			0.19	0.07	0.01	0.09
Dartmouth Water Department**	4072000	9P242407201	42407202	4072000-01G 4072000-02G 4072000-03G 4072000-05G 4072000-06G 4072000-07G 4072000-08G 4072000-09G 4072000-10G 4072000-11G 4072000-12G	Registered = 1.35 Permitted = 2.11	3.07	2.97	2.83

*Excludes any authorized cranberry growers.

**Dartmouth Water Department has twelve withdrawal points in the Buzzards Bay Basin – eleven in Segment 95-11 and one in Segment 95-40. The Authorized Withdrawal and Average Withdrawal volumes indicated are system wide for all seven sources combined.

Dartmouth is required to monitor streamflows in the Paskamanset River at the USGS gage station near Russells Mills. During the summer low flow period between June 1 and September 14, withdrawals from Dartmouth Wells E-1, E-2, F-1 and F-2 shall cease on any day during which streamflow at the stream gauge at Russells Mills Road falls to 5.0 cubic feet per second (cfs) and shall not resume until the date when streamflow increases to reach or exceed 5.0 cfs. The Town has developed a conservation plan to conserve water that includes metering, leak detection and repair, and education users.

There are 28.612 acres of cranberry bog open space in the Paskamanset River subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 0.26 MGD.

NPDES SURFACE WASTEWATER DISCHARGE SUMMARY

The following general storm water permits were issued by the EPA in October 2001 and will expire in October 2005:

Titleist and Foot Joy Ball Painting MAR05B930
Dartmouth Hub MAR05B896
Ergste Westig Massachusetts LP MAR05B835
Crapo Hill Landfill MAR05B826
Titletist Pilot Production Proc Dev MAR05B933
Polaroid Corporation MAR05B909
AFC Cable Systems MAR05C228
Depuy A Johnson & Johnson CO MAR05B888
Goyette's Inc. MAR05B913

The Town of Dartmouth (MA0033588) is permitted (16 September 1992) to discharge emergency overflow from lagoons at the Chase Road Well D Water Treatment Plant via outfall 001 to this segment.

Dartmouth and New Bedford are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

There is one active USGS stream gage in the Buzzards Bay Watershed located on the Paskamanset River at the bridge near Russells Mills Road, South Dartmouth. The period of record for this gage (0115933) is October 1995-present. The average discharge for the six years is 53.3 cfs. The maximum discharge occurred on 31 March 2001 (772 cfs) and the minimum discharge occurred on 8 August 1999 (0.38 cfs). The 7Q10 for the Paskamansket River at this gage is 0.7 cfs (USGS October 2002). It should be noted that 1999 was a drought year (USGS 5 June 2001). Mean monthly discharges in cubic feet per second for the months of May, June, July, August, and September are provided in the table below (Socolow *et al* 1998, 1999, 2000, and 2001).

Table 3. Mean monthly discharges for the Paskamanset River at USGS Gage 0115933

Year	May	June	July	August	September
2001	44.5	102	20.7	21.2	9.58
2000	58.2	36.4	13.1	22.7	7.92
1999	28.2	5.67	1.72	2.65	9.37
1998	87.9	115	41.8	12.9	8.33
1997	42.3	18.6	4.27	13.2	5.87

A USGS study published in 1995 entitled *The Streamflow, Ground-Water Recharge and Discharge, and Characteristics of Surficial Deposits in Buzzards Bay Basin, Southeastern Massachusetts* indicated that major ground water withdrawals severely impact streamflows in this river and in the Mattapoisett (Bent 1995).

There is a weir pool and denil fishway located northeast of Rock Dundee Road, at the Russells Mill Dam in the Russells Mills Village, Dartmouth, that allows passage of some fish species to the freshwater portion of the Paskamansket River (DFWELE 1997). In 2000, DMF and Dartmouth began repairing this ladder. DMF plans to continue work on the ladder (Brady 2003). It should be noted that there is an eleven-foot cascade at the confluence of Destruction Brook and the Paskamanset River that impedes fish passage. The Dartmouth Natural Resources Trust is conducting an assessment to determine possibilities for improved fish passage to Destruction Brook (DNRT 2003).

"*An Assessment of the Fish Assemblage and Habitat Quality of the Paskamanset River Near the Town of Dartmouth, Massachusetts"* was prepared for Woodard & Curran and the Town of Dartmouth by New England Environmental, Inc. of Amherst, MA and Ichthyological Associates, Inc. of Lansing, NY in January 1995.

Too limited instream physicochemical/biological data are available and, therefore, the *Aquatic Life Use* is currently not assessed for the Paskamanset River. While minimum streamflow thresholds have been developed for WMA permitees in this subwatershed, potential effects of water withdrawals have not recently been evaluated and, therefore, are still of concern. Consequently, the *Aquatic Life Use* is identified with an Alert Status.

FISH CONSUMPTION

It should be noted that fish toxics monitoring was conducted at three stations in the Paskamanset River subwatershed by DWM in 1988; Turner Pond, New Bedford/Dartmouth, unnamed tributary along New Bedford Municipal Airport southwest runway, New Bedford and Smith Mills Pond, Dartmouth. PCB concentrations did not exceed the MDPH action level of 1.0 mg/Kg in any of the samples analyzed

(Maietta 1989b). Mercury concentrations were above the MDPH action level of 0.5 mg/Kg in fish tissue from Turner Pond resulting in MDPH issuing an advisory (see lakes assessment section). In addition, slightly elevated mercury concentrations (2 samples) were found in fish from Smith Mills Pond, however, due to the fact that one sample was an individual fish and the other was incorrectly identified as an individual fish (was actually composite) no advisory was issued. Since no site-specific fish consumption advisory was issued for the river, the *Fish Consumption Use* is not assessed.

Paskamanset River (MA95-11) Use Summary Table

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

* Alert Status issues identified -- see details in the use assessment section

RECOMMENDATIONS PASKAMANSET RIVER (MA95-11)

- Develop a monitoring plan to evaluate the impacts of water withdrawals on streamflow/habitat in this segment/subwatershed to assess the *Aquatic Life Use*.

- Review and implement recommendations in the DMF anadromous fish assessment report, when available, for improving effectiveness of fish ladders in this segment. If applicable, review data to assess the *Aquatic Life Use*.

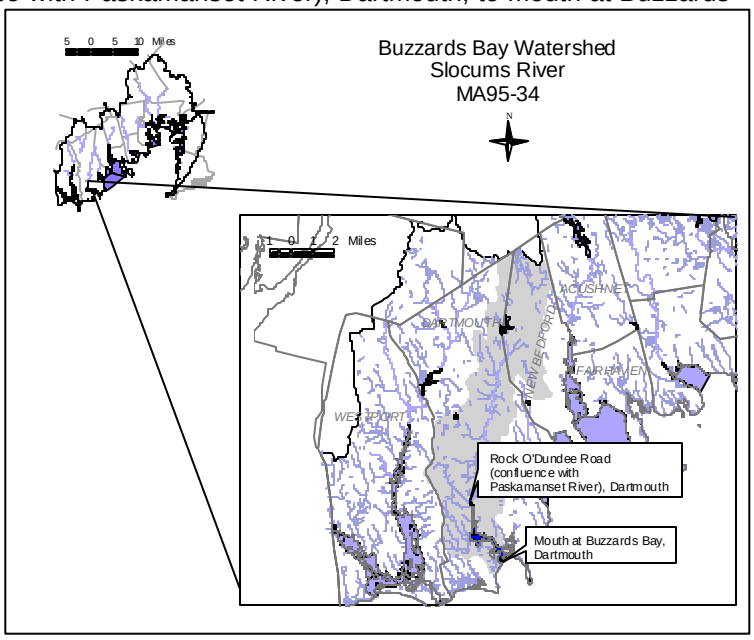
- MPDH is currently reevaluating their Fish Consumption Advisory for Smith Mills Pond and the Paskamanset River between Turners Pond and this location. Additional fish toxics monitoring should be considered for this segment if deemed necessary to refine the extent of the advisory.

- Investigate and abate potential sources of contamination including storm water discharges and landfills that may contribute to degraded water quality in this segment and downstream in the Slocums River.

- The *Turn the Tide* initiative "will create a restoration plan for the Slocums/Little River Estuary and Apponagansett Bay". Partners in the Turn the Tide initiative should consider developing a similar program in the Paskamanset River to identify potential sources of pollution and remediate known sources that may be contributing to degraded water quality in the Slocums River.

SLOCUMS RIVER (SEGMENT MA95-34)

Location: Rock O'Dundee Road (confluence with Paskamanset River), Dartmouth, to mouth at Buzzards Bay, Dartmouth
Segment Area: 0.67 square miles
Classification: Class SA, Shellfishing (Open)



The drainage area of this segment is approximately 37.1square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	60%
Residential	14%
Open Land	9%

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).

From 1997-2001 the Buzzards Bay Project conducted a 319 project to demonstrate proactive land conservation as a viable tool for nitrogen management through the use of conservation restrictions, outright land purchase, and agricultural preservation restrictions. In the Slocums River Subwatershed, the Dartmouth Natural Resources Trust, The Trustees of Reservations, and the Town of Dartmouth purchased the 16-acre Island View Farm, the 614-acre Dartmoor Farm, the 303-acre Destruction Brook Woods, and the 0.72 acre Smith Mills Property. 506 acres of Dartmoor Farm were sold to DFWELE and made into the Dartmoor Wildlife Management Area (BBP 1997-2001).

The *Turn the Tide* initiative "will create a restoration plan for the Slocums/Little River Estuary and Apponagansett Bay. The project will assess non-point source pollution loads in these waterways, educate the community about the dangers of ignoring this water quality issue and ultimately create a restoration strategy to be implemented by citizen action." More details about Turn the Tide can be found on-line at http://www.savebuzzardsbay.org/wwd/advocacy/turn-the-tide.htm

Demarest Lloyd State Park is one of the "best kept secrets in the Massachusetts forest and park system". An 1800-foot saltwater beach is backed by rambling hills of beach grass and shaded, grassy picnic sites. A broad, scenic marsh lines the Slocum River on the park's eastern edge. The Buzzards Bay surf is calm and shallow, giving rise to warm water temperatures through most of the summer. It is also a great spot to see egrets, herons, ospreys, terns and hawks (MA DEM Undated e). Public access to the eastern side of the Slocums' shores is provided at the 55-acre Katharine Nordell Lloyd Center for Environmental Studies, Inc. The Lloyd Center (http://www.thelloydcenter.org) is a not-for-profit education and research organization whose mission is to help create the next generation of environmental stewards - through education and research (Lloyd Center 2001).

Applied Coastal Research and Engineering, Inc. was awarded a Massachusetts Watershe Initiative grant in FY 2002 to conduct flushing studies for the Slocums and Little River in Dartmouth in concert with the Massachusetts Estuaries Project. This involved collecting quality-assured field data (such as tidal cycle, bathymetry and streamflow) and developing hydrodynamic models for each embayment as well as the potential movement of water between the two rivers. Using data collected between April and May 2002, the estimated flushing rate in the Slocums River was 0.55 days. The particle tracking model indicated that nutrients in the water from the upper Slocums River is recycled for a number of tidal cycles and "will likely have a significant impact on the overall estuarine health" (Ruthven *et al.* 2003).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at three stations in the Slocums River between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at three stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. The Slocums River is a "classic drowned estuary, formed by the flooding of an eroded river valley by rising relative sea level" and supports significant saltmarsh habitat. Eelgrass beds are sparse to absent and sediments are soft and organic-rich with a "mayonnaise consistency", which is common in eutrophic coastal waters. Shellfish abundance is sparse, with most found in localized areas near the banks (Howes *et al.* 1999). High nitrogen and chlorophyll *a* concentrations, poor water transparency and frequent oxygen depletion resulted in poor Health Index Scores for the Inner Slocums (the average 1997-2001 score was 29.3). The Outer Slocums River received an average score of 53.6 (fair) (CBB undated b and Howes *et al* 1999).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are 74.617 acres of cranberry bog open space in the Slocums River subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 0.41 MGD. This estimate includes the estimate of water use for the upstream segment MA95-11.

NPDES SURFACE DISCHARGE SUMMARY

There are no regulated wastewater discharges to this subwatershed, however, Dartmouth is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003). It should be noted that upstream of this segment in the Paskamansett River, there are numerous general permittees that ultimately discharge to this subwatershed.

USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in the Slocums River from historic 1951 black and white aerial photography. A field survey performed by MA DEP in 1998 revealed no eelgrass in the entire river (Costello 2003).

Because of the loss of eelgrass bed habitat, the *Aquatic Life Use* is assessed as impaired for this segment. This loss has been attributed to nutrient enrichment (i.e., elevated nitrogen loadings) or other anthropogenic activities that result in reduced water clarity. Potential sources of nutrient enrichment include septic systems, golf courses, landfills, and high density urban development upstream of this segment in the Paskamanset River subwatershed.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB7.0 is approved and BB8.0 is prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status the *Shellfish Harvesting Use* is assessed as support for 0.01 mi^2 and impaired for 0.66 mi^2.

PRIMARY AND SECONDARY CONTACT RECREATION

MA DEM (2002) collected *Enterococci* bacteria samples from their salt water beach in Demarest Lloyd State Park between May and August 2002. The beach was not officially closed or posted according to the MDPH database. This beach is located on Buzzards Bay at the mouth of the Slocums River.

The *Primary* and *Secondary Contact Recreational Uses* are assessed as support for 0.01 mi^2 based on the more stringent guidelines for shellfish harvesting. The remaining 0.66 mi^2 are not assessed.

AESTHETICS

Noxious "soft, goopy, green" algal blooms have been reported in the Slocums River in the vicinity of the Lloyd Center for Environmental Studies (Cohen 2003). Due to the lack of additional information (i.e., duration of bloom {days, months}, species, extent of area affected) the *Aesthetics Use* is currently not assessed for the Slocums River. This use is, however, identified with an Alert Status due to the potential for aesthetic quality degradation.

Slocums River (MA95-34) Use Summary Table

Designated Uses		Status	Causes		Sources
			Known	Suspected	Suspected
Aquatic Life		IMPAIRED	Estuarine bioassessment (loss of eelgrass bed habitat)	Total nitrogen	On-site treatment systems (septic systems), urbanized high density area, municipal separate storm sewer systems, landfills
Fish Consumption		NOT ASSESSED			
Shellfish Harvesting*		0.01 mi^2 SUPPORT 0.66 mi^2 IMPAIRED	Fecal coliform bacteria		On-site treatment systems (septic systems), urbanized high density area, municipal separate storm sewer systems
Primary Contact		0.01 mi^2 SUPPORT 0.66 mi^2 NOT ASSESSED			
Secondary Contact		0.01 mi^2 SUPPORT 0.66 mi^2 NOT ASSESSED			
Aesthetics**		NOT ASSESSED			

* For watershed-wide shellfish growing area data see Appendix E.

** Alert Status Issues identified—see details in use assessment section

RECOMMENDATIONS SLOCUMS RIVER (MA95-34)

- DMF has identified that flow manipulation associated with cranberry bog operations results in the loss of juvenile anadromous fish (Brady 2003). DMF and the Cape Cod Cranberry Growers (CCCG) developed BMPs for the protection of juveniles. DMF and CCCG should continue to work together to educate growers and develop operating practices that maintain baseflows for the protection of the aquatic life.

- Review and implement recommendations in the DMF anadromous fish assessment report, when available, for improving effectiveness of fish ladders, thereby increasing habitat, in this segment. If applicable review data to assess the *Aquatic Life Use*.

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports to continue to assess the *Aquatic Life Use*.

- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports. Identify sources of bacteriological contamination and abate causes of the shellfish bed closures. Continue to review the DMF Shellfish Status Report to assess the *Shellfish Harvesting Use*.

- Design and conduct a bacteria survey to assess the recreational uses for this segment and to document the effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewering/septic system upgrades, and the Phase II community storm water management

programs as much of this subwatershed. Under the Beach Bill, Demarest Lloyd State Park is required to conduct bacteria monitoring at the public beach. Continue to review closure information/ bacteria data to assess the recreational uses. An increasing number of recreational paddlers use the Slocums (there is a paddler access point at Russell's Mills at the upstream end of this segment).

- Design and conduct a survey to identify and determine the extent of noxious algal blooms and macroalgae distribution near the Lloyd Center for Environmental Studies. Additional monitoring could be conducted to determine chlorophyll *a* and nitrogen concentrations in the water column. Data from this survey could be used to assess the *Aquatic Life Use*, the recreational uses, and the *Aesthetics Use*.

- Implement the five salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the town. Sites in this subwatershed are DA13, DA23, DA24, DA25, and DA26. Develop a monitoring plan to determine the effectiveness of the restoration projects and to document improvements to water quality and the aquatic life.

- Work with the partners of *Turn the Tide* to implement the recommendations from the project and restore the Slocums River including:
  - identifying sources of pollution in the Slocums/Little Rivers and Apponagansett Bay,
  - developing an Estuary Restoration Strategy for the Slocums/Little Rivers and Apponagansett Bay,
  - educating citizens about the value of these areas to Dartmouth's quality of life and the role we all must play in maintaining them,
  - remediating known sources of pollution on the Paskamansett River and Buttonwood Brook, and
  - creating a model for public and private, community-based restoration that can be used in other areas along Buzzards Bay and throughout New England.

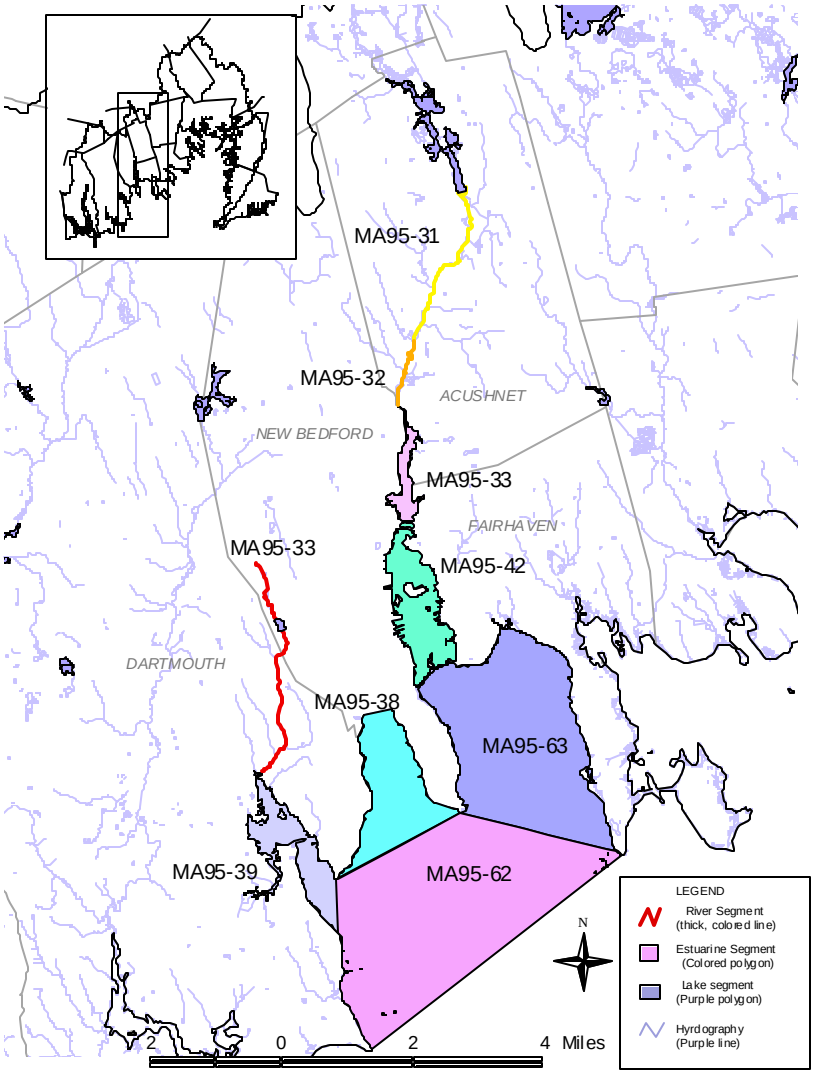
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality and to assess the *Aquatic Life Use*.

THE NEW BEDFORD HARBOR DRAINAGE AREA

The New Bedford Harbor Drainage Area is located in New Bedford, Acushnet, and Dartmouth. In addition to the Harbor the drainage area includes its main tributary (the Acushnet River), two coves (Clark Cove and Apponagansett Bay), and open coastal water outside the three estuaries. The drainage area consists specifically of the following nine segments:

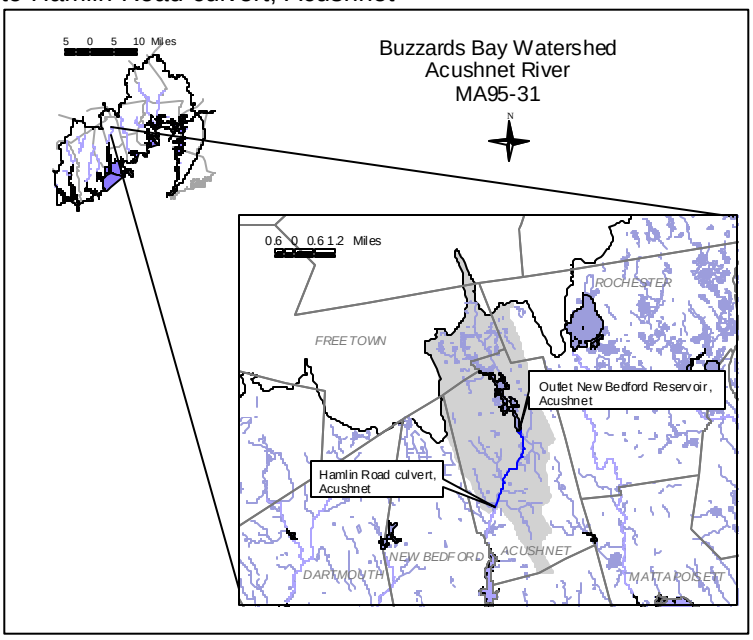
- Acushnet River (Segment MA95-31)
- Acushnet River (Segment MA95-32)
- Acushnet River (Segment MA95-33)
- New Bedford Inner Harbor (Segment MA95-42)
- Outer New Bedford Harbor (Segment MA95-63)
- Clarks Cove (Segment MA95-38)
- Buttonwood Brook (Segment MA95-13)
- Apponagansett Bay (Segment MA95-39)
- Open Water Outside New Bedford Harbor (Segment MA95-62)

Figure 12. New Bedford Harbor Drainage Area



ACUSHNET RIVER (SEGMENT MA95-31)

Location: Outlet New Bedford Reservoir to Hamlin Road culvert, Acushnet
Segment Length: 3.00 miles
Classification: Class B, Warm Water Fishery



The drainage area of this segment is approximately 16.3 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	56%
Residential	18%
Open Land	13%

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens, nutrients, organic enrichment/low DO, and siltation (MA DEP 1999).

In 2001 MassWildlife stocked trout in the Acushnet River for recreational fishing (DFWELE 24 September 2002).

Using funds from the New Bedford Harbor Superfund Site remediation, the Division of Marine Fisheries recently completed renovations to the fishway and dam at the outlet of New Bedford Reservoir totaling $250,000. Two studies are planned to remove the Saw Mill Dam and the dam at Hamlin Street. Environmental Notification Forms were recently completed (Brady 2003).

As part of the Massachusetts Estuaries Project a nutrient and bacteria TMDL will be developed in the next few years for the Acushnet/New Bedford Inner Harbor System, which encompasses this segment.

WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

Facility	PWS ID	WMA Permit Number	WMA Registration Number	Source (G = ground)	Authorized Withdrawal (MGD)	Average Withdrawal (MGD)		
						1999	2000	2001
Acushnet River Golf Course		9P242400301		Irrigation Well	0.1 (permitted)	NA	0.1	0.1

* Excludes any authorized cranberry growers NA= Not Applicable

There are 423.711 acres of cranberry bog open space in the Acushnet River subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 3.78 MGD.

NPDES SURFACE DISCHARGE SUMMARY

The Town of Acushnet is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

Due to the lack of current information, the designated uses for this segment are not assessed.

Acushnet River (MA95-31) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

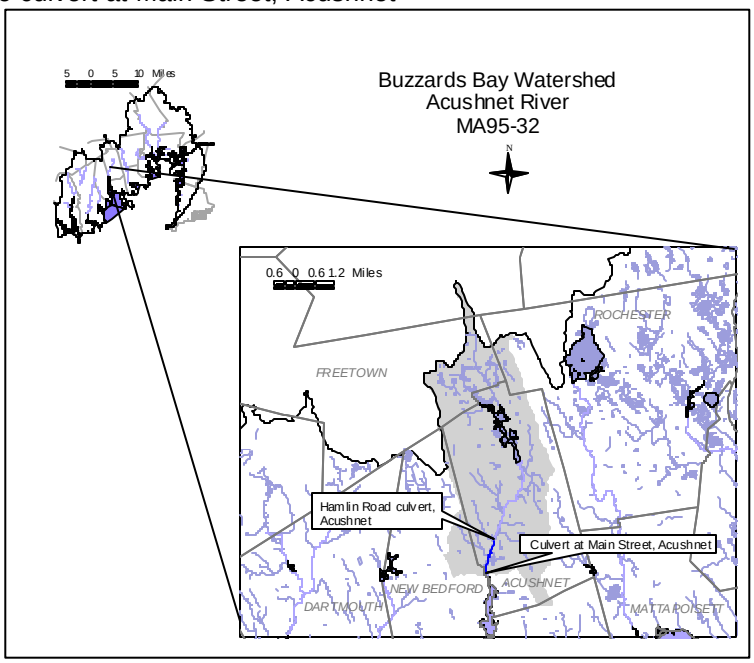
RECOMMENDATIONS ACUSHNET RIVER (MA95-31)

- Develop a bacteria monitoring plan to document the effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management program and to assess the recreational uses.

- Develop a nutrient/bacteria TMDL for the Acushnet River/New Bedford Harbor system in accordance with the Massachusetts Estuaries Project.

ACUSHNET RIVER (SEGMENT MA95-32)

Location: Hamlin Road culvert, Acushnet to culvert at Main Street, Acushnet
Segment Length: 1.10 mile
Classification: Class B, Warm Water Fishery



The drainage area of this segment is approximately 18.7 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	51%
Residential	22%
Open Land	13%

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens, nutrients, and organic enrichment/low DO (MA DEP 1999).

In 2001 MassWildlife stocked trout in the Acushnet River for recreational fishing (DFWELE 24 September 2002).

There is a weir pool that allows fish passage on this section of the Acushnet River (DFWELE 1997). DMF is undertaking a project to remove the two dams on the Acushnet River – the Saw Mill Dam and the dam at Hamlin Street on this segment. Environmental Notification Forms for this $750,000 project have recently been completed. Funding for these projects is provided in part by the New Bedford Harbor Superfund remediation (Brady 2003).

As part of the Massachusetts Estuaries Project a nutrient and bacteria TMDL will be developed by SMAST in the next few years for the Acushnet/New Bedford Inner Harbor System which encompasses this segment.

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in this segment of the Acushnet River between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at one station at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Howes *et al* 1999). The Acushnet River received an average Health Index Score of 22.7 (poor) due to elevated levels of nitrogen, chlorophyll *a*, and routine oxygen depletion (Howes *et al* and CBB Undated b).

WMA WATER WITHDRAWAL SUMMARY

There are 429.602 acres of cranberry bog open space in the Acushnet River subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 3.84 MGD. This estimate includes the estimate of water use for the upstream segment MA95-31.

NPDES SURFACE DISCHARGE SUMMARY

Acushnet Company- Titleist Golf Division (MA0005428) is permitted (20 November 1986) to discharge treated sanitary waste via outfall 008 and treated process waste, NCCW, and boiler blow-down from outfall 010 to the Acushnet River. The permit includes a 92 °F temperature limit for outfall 010 and secondary limits for BOD= 30 mg/L, TSS = 30 mg/L, oil & grease = 10 mg/L, fecal coliform bacteria = 200/100mL.

The Town of Acushnet is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Biology

DFWELE Southeast District conducted fish population sampling at two stations (downstream of Hamblin Street and Below Acushnet Saw Mill Dam) on this segment of the Acushnet River on 21 September 2000 using backpack electroshocking gear. Fifty-six American eel (*Anguilla rostrata)*, 26 alewife (*Alosa psudeoharengus*), six redfin pickerel (*Esox americanus americanus*), five pumpkinseed (*Lepomis gibbosus*), five tesselated darters (*Etheostoma olmstedi)*, two bluegill (*Lepomis macrochirus*), two yellow perch (*Perca flavescens)*, one largemouth bass (*Micropterus salmoides*), and one creek chubsucker (*Erimyzon oblongus*) were collected downstream of Hamblin Street. Below Acushnet Saw Mill Dam 121 mummichogs (*Fundulus heteroclitus*), 56 American eel, 52 alewife, and two fourspined sticklebacks (*Apeltes quadracus*) were collected (Richards 2003).

Due to the limited physico-chemical and biological data for this segment of the Acushnet River, the *Aquatic Life Use* is currently not assessed. However, this use is identified with an Alert Status because of the poor health index rating identified by the Coalition.

Acushnet River (MA95-32) Use Summary Table

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

* Alert Status issues identified-- see details in use assessment section

RECOMMENDATIONS ACUSHNET RIVER (MA95-32)

- Review and implement recommendations in the DMF anadromous fish assessment report, when available, for improving effectiveness of fish ladders in this segment and increasing habitat. If applicable, review data to assess the *Aquatic Life Use*.

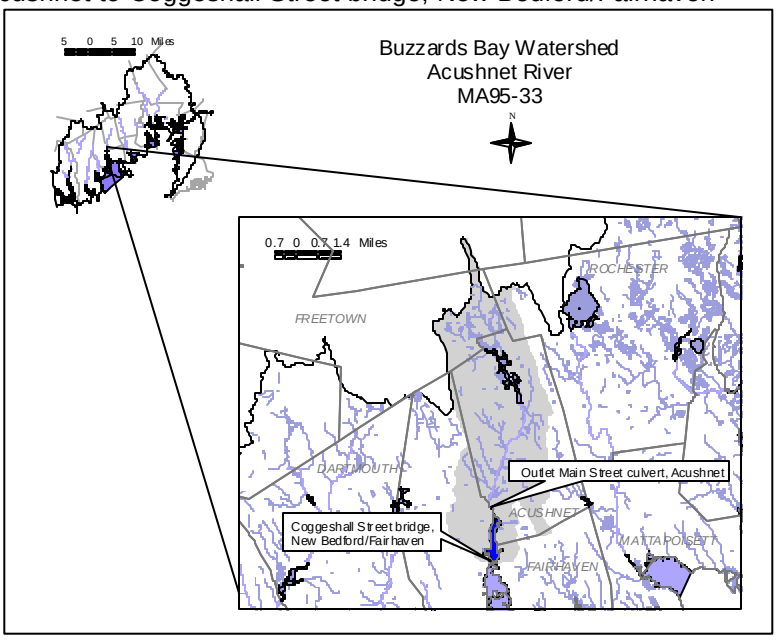
- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports to assess the status of the *Aquatic Life Use*.

- Develop a bacteria monitoring plan to bracket nonpoint source discharges and to document the effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management programs and to assess the recreational uses.

- Develop a nutrient/bacteria TMDL for the Acushnet River/New Bedford Harbor system in accordance with the Massachusetts Estuaries Project.

ACUSHNET RIVER (SEGMENT MA95-33)

Location: Outlet Main Street culvert, Acushnet to Coggeshall Street bridge, New Bedford/Fairhaven
Segment Area: 0.31 square miles
Classification: Class SB, Shellfishing (Restricted), CSO



The drainage area of this segment is approximately 21.7 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	45 %
Residential	25 %
Open Land	13%

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens, nutrients, organic enrichment/low DO, priority organics and metals (MA DEP 1999).

In 2001 MassWildlife stocked trout in the Acushnet River for recreational fishing (DFWELE 24 September 2002). DMF (1999) noted that all of the creeks and streams that flowed into the harbor have been routed through culverts.

The *Acushnet River TMDL Surface Water Flow and Nitrogen Load: Nitrogen Loading to New Bedford Inner Harbor* project commenced during the winter of 2002. The purpose of this study is:

> "to quantify Acushnet River discharge and nitrogen loading from the upper watershed region to New Bedford Inner Harbor and to support the development of water quality models and nitrogen loading thresholds for this system. In addition, analysis will be made to determine the potential for the river to be a source of bacterial (fecal coliform, *E. coli*, *Enterococci*) contamination to the estuary. A stream gauge will be maintained and nitrogen and bacterial samples {will be} collected weekly for 12 months, with additional samples associated with rain events. The goal of the project is to help acquire sufficient data that can later be used by DEP and EPA in the development of appropriate TMDL and management approaches for the restoration of water quality in the Acushnet River Estuary system. Also, the data collected are directly applicable to on-going nitrogen issues relating to management and permitting of NPDES discharges within this system. The project will leverage other proposed and on-going efforts for this system (EMPACT, CZM, EPA) and is an important component for application of the Massachusetts Estuaries Project approach to the Acushnet River Estuary" (Howes and Samimy undated).

The 18,000-acre New Bedford site is an urban tidal estuary with sediments that are highly contaminated with polychlorinated biphenyls (PCBs) and heavy metals. At least two manufacturers in the area used PCBs in the production of electric devices from 1940 to the late 1970s, when the EPA banned the use of PCBs. These facilities discharged industrial wastes containing PCBs directly into the harbor and indirectly via the City's sewerage system. As a result the harbor is contaminated, in varying degrees, for at least six miles from the upper Acushnet River into Buzzards Bay. Two major cleanup projects are underway. The first project is a 4.5-acre sediment dewatering and transfer facility. By May 2003 the $10 million bulkhead for the facility is scheduled to be completed; after which the 50,000 square foot facility can be constructed. Full scale dredging is anticipated to begin in spring 2004. The second project is the cleanup of the Acushnet River area north of Wood Street. Because this area had PCB concentrations up to 46,000 ppm, EPA prioritized this effort. Two temporary dams were built to dewater the sediments. By March 2003 approximately 7 acres of contaminated sediments should be removed. The dams will be removed following sediment remediation and beginning in late spring 2003 an extensive wetland restoration and shoreline planting program is scheduled to begin. Other activities that have been

completed as part of the remediation include the excavation and restoration of the "Early Action" shoreline areas in Acushnet in May 2001. Additionally, to allow for future remedial dredging submerged power cables have been relocated into a utility corridor, 13 abandoned fishing vessels have been removed, and a CSO that discharged to the dewatering area has been relocated (EPA 13 February 2003).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in this segment of the Acushnet River between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at one station at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Howes *et al* 1999). The Acushnet River received an average Health Index Score of 22.7 (poor) due to elevated levels of nitrogen, chlorophyll *a*, and routine oxygen depletions (Howes *et al* and CBB Undated b).

WMA WATER WITHDRAWAL

There are 429.602 acres of cranberry bog open space in the Acushnet River subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 3.84 MGD. This estimate includes the estimate of water use for the upstream segment MA95-32.

NPDES SURFACE DISCHARGE SUMMARY

The City of New Bedford (MA0100781) discharges via ten CSOs to this segment of the Acushnet River. The permit will expire 2 January 2004. Additionally, there are nine storm drain discharges to this segment.

Aerovox Inc. (MA0003379) is permitted (17 December 2000) to discharge storm water via outfall 003 and 005-007 to the Acushnet River/New Bedford Harbor. The permit includes an oil & grease limit = 15 mg/L. Aerovox operated a capacitor manufacturing operation. From the 1940s-1978, the facility released PCB contaminated wastewater onto shoreline mudflats and into New Bedford Harbor. The facility was required to monitor storm water discharges at the site due to residual PCB contamination. See Sources of Information for additional information.

The following general storm water permits were issued by the EPA in October 2001 and will expire in October 2005:

Riverside Auto Service MAR05B748
Titleist and Foot Joy Ball Planting MAR05B931, MAR05B929
Acushnet Rubber Company MAR05C166, MAR05C167

Acushnet, Fairhaven, and New Bedford are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

As part of the New Bedford Harbor Superfund remediation process, a 30-year New Bedford Harbor Long Term Monitoring program (NBH-LTM) was developed to assess the spatial and temporal environmental changes as a result of remediation activities. The program involves collecting data related to the sediments of New Bedford Harbor and includes sediment chemistry analysis, sediment toxicity testing, characterization of the benthic invertebrate community, and bioaccumulation studies. Baseline sampling was conducted in 1993 with full-scale sampling occurring before and after major remedial events or on a 3-5 year time frame (Nelson *et al* 1996).

Applied Science Associates, Inc (ASA) was contracted by New England Interstate Water Pollution Control Commission and EPA to perform a flushing study of the Acushnet River estuary (New Bedford Inner Harbor) for use in developing the nitrogen TMDL. As part of the project a dye study was undertaken in October 2001 to estimate residence time of wastewater discharged from the Fairhaven WWTP. Salinity data were collected from 13 stations during high and low tidal conditions each day from 30 October to 2 November 2001 (ASA 2002b).

AQUATIC LIFE

Biology

As part of the New Bedford Harbor Long Term Monitoring Program (NBH-LTR), EPA conducted an evaluation of the benthic community condition. Species richness, EMAP index of benthic community condition, and community structure were examined using a probalistic sampling design at 27 hexagonal segments with approximately 30 stations per segment throughout the upper, lower, and outer harbor areas. In 1993, the first baseline sampling period, the upper harbor (this segment) exhibited signs of a stressed ecosystem and degraded benthic community based on "opportunistic qualities of the species, low diversity, and low number of dominant species" (Nelson *et al* 1996). Additionally, bioaccumulation studies of PCBs in tissue using the blue mussel, *Mytilus edulis*, and the mummichog, *Fundulus heteroclitus*, have been conducted as part of the NBH-LTR since 1994. Mummichogs were collected from two stations in the upper harbor. Results from 1994 showed a dramatic decreasing gradient with the highest concentrations of PCBs in the upper harbor. Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

Toxicity-Sediment

In 1993, as part of the NBH-LTM program, sediment toxicity tests using the euryhaline benthic amphipod *Ampelisca abdita* were conducted on 27 sediment samples from the upper harbor. Average percent survival from these sites was 55% (Nelson *et al.* 1996).

Chemistry-water

Salinity

Salinity measurements reported by ASA as part of the flushing study for the estuary ranged between 12 and 32 ppt with the lower salinity in the upper estuary. The largest gradient was observed in this segment. Salinity change with depth was very small, but variations existed near the surface (ASA 2002b).

Chemistry-sediment

In 1993, as part of the NBH-LTM Program, numerous sediment samples from the 27 sites were collected by a Young-modified van Veen grab sampler from the top 2 cm of New Bedford upper harbor, composited, and analyzed for 18 PCB congeners, TOC, and acid volatile sulfide, and nine metals (Ni, Pb, Cd, Cu, Zn, Hg, As, Se, Cr). The highest sediment concentrations of PCB were in this segment (high of 431 µg/g). In general, total PCB concentrations decreased along a gradient from the upper to the outer harbor (Nelson *et al*.1996). Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be out for review in 2003 (Nelson 2003).

From Nelson *et al.* 1996. Average metal and total PCB concentrations (in µg/g dry wt) in the upper harbor sediment from 1993. N (the number of stations in the segment) = 27. S-EL (severe effect level) and L-EL (low effect level) from Persuad *et al.* 1993in µg/g dry wt.

Parameter	Average Concentration	S-EL	L-EL
As	5.2	33	6
Cd	67	10	0.6
Cr	310	110	26
Cu	630	110	16
Hg	0.43	2	0.2
Ni	34	75	16
Pb	270	250	31
Se	0.32	NA	NA
Zn	630	820	120
Total PCBs	44	530	0.07

The *Aquatic Life Use* is assessed as impaired because of PCB contamination. It should be noted that remediation activities are underway and are being monitored closely by EPA.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB15.1 is prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status the *Shellfish Harvesting Use* is assessed as impaired for this entire segment.

PRIMARY AND SECONDARY CONTACT RECREATION

Because of the active CSO discharges and the poor aesthetic quality (see below) the *Primary* and *Secondary Contact Recreational Uses* are assessed as impaired. It should be noted that the City of New Bedford has eliminated CSOs on the north side of the Coggeshall Street bridge and at Howard Avenue through the redirection of flows and the installation of new sewers (Furtado 2003).

AESTHETICS

Massachusetts Community Water Watch (MCWW) conducted monthly shoreline surveys at four stations on this segment of the Acushnet River: Hamlin Street, Mill Road, Tarklin Hill Road, and Wood Street between October 1999 and April 2000. The Hamlin Street site was the most rural site with stream banks that were well vegetated. Three culverts under the bridge impeded flows and were blocked by wood planks and tree debris. Downstream from the bridge the banks were channelized by a rock retaining wall. Duckweed was noted along with thick epiphytic algae, small patches of oil, and on one occasion a "brownish-orange gooey substance". Stream bank erosion was noted near Hamlin Street, which runs adjacent to the river. Trash was also noted along the roadside. At Mill Street, the riverbanks are vertical cement and rock walls and vegetation is lacking. A CSO was notd to be discharging milky-grayish water with small patches of scum and had a distinct rotten eggs/sewage odor. Trash noted at the CSO included toilet paper, plastic bags, feminine hygiene wrappers and restaurant trash. At Tarklin Hill Road, ten discharge pipes and one CSO pipe were noted. The CSO discharged murky-gray water and a grayish sludge was noted on rocks and the streambed directly below the outfall. Trash and debris at this site consisted of food and beverage containers, toilet paper, motor oil containers, a shopping cart, and metal poles. At the Wood Street site, the streambed was soft, dark mud, and occasionally had an orange tint. There were three pipes discharging raw sewage at least once during the survey. MCWW noted that the pipe directly south of the bridge on the New Bedford side always had a steady flow of sewage and occasionally had an oily scum over the surface. Upstream from the Wood Street bridge, a CSO discharged to a tributary to the Acushnet River. Trash and debris at the Wood Street site was "unsightly" and included Styrofoam cups, large metal car parts, tires, and shopping carts (MCWW 2000).

Based on the abundance of trash and debris, objectionable odors and color, and the CSO discharges this segment of the Acushnet River is assessed as impaired for the *Aesthetics Use.* It should be noted that the City of New Bedford has eliminated CSOs on the north side of the Coggeshall Street bridge and at Howard Avenue through the redirection of flows and the installation of new sewers (Furtado 2003).

Acushnet River (MA95-33) Use Summary Table

Designated Uses		Status	Causes	Sources
			Known	Known
Aquatic Life		IMPAIRED	PCB	Contaminated sediments, CERCLA NPL (Superfund site)
Fish Consumption		NOT ASSESSED		
Shellfish Harvesting*		IMPAIRED	Fecal coliform bacteria, PCB	CSO, urbanized high density area, Contaminated sediments, CERCLA NPL (Superfund site)
Primary Contact		IMPAIRED	Oil & grease, odor, and color, trash and debris	CSO, urbanized high density area
Secondary Contact		IMPAIRED	Oil & grease, odor, and color, trash and debris	CSO, urbanized high density area
Aesthetics		IMPAIRED	Oil & grease, odor, and color, trash and debris	CSO, urbanized high density area

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS ACUSHNET RIVER (MA95-33)

- Develop a nutrient/bacteria TMDL for the Acushnet River/New Bedford Harbor system in accordance with the Massachusetts Estuaries Project.
- Implement recommendations outlined in the Massachusetts Water Watch Shoreline Survey report to improve the aesthetics of the Acushnet River.
- Review the EPA New Bedford Harbor Long-Term Monitoring 1995 and 1999 sampling results when available to assess the *Aquatic Life Use*.
- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and if deemed necessary, to increase spatial and temporal coverage of *in-situ* monitoring. Review final reports to assess the *Aquatic Life Use*
- Develop a bacteria monitoring plan to document effectiveness of bacteria source reduction activities including CSO abatement actions (e.g., elimination of cross connections and/or CSO outfalls), treatment of storm water discharges, and the Phase II community storm water management programs and to assess the recreational uses.
- The City of New Bedford should continue efforts to complete a reassessment of their CSO abatement program and develop a Long-Term CSO Control Plan that will achieve compliance with the water quality standards.
- The City of New Bedford should operate and maintain their sewer system to minimize the frequency and volume of CSO discharges by implementing the Nine Minimum Controls pursuant to federal and state CSO policies.
- Implement the DMF *Sanitary Survey of New Bedford/Fairhaven Inner Harbor (BB: 15.1)* report recommendations (Whittaker 1999) listed below to improve water quality and abate pollutants causing shellfish bed closures. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
    - The City of New Bedford & Town of Fairhaven should establish a pollution abatement plan concentrating on education and regulation directed toward the fishing and recreational fleets.
    - CSO and storm drains that have been compromised by illegal use or structural malfunctions should be addressed immediately.
    - The practice of fish processing houses discarding fish offal and other materials into the harbor should be stopped immediately.
- Implement the two salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are NB02 and NB03. Develop a monitoring plan to document the effectiveness of the restoration and improvements to water quality and the aquatic life.

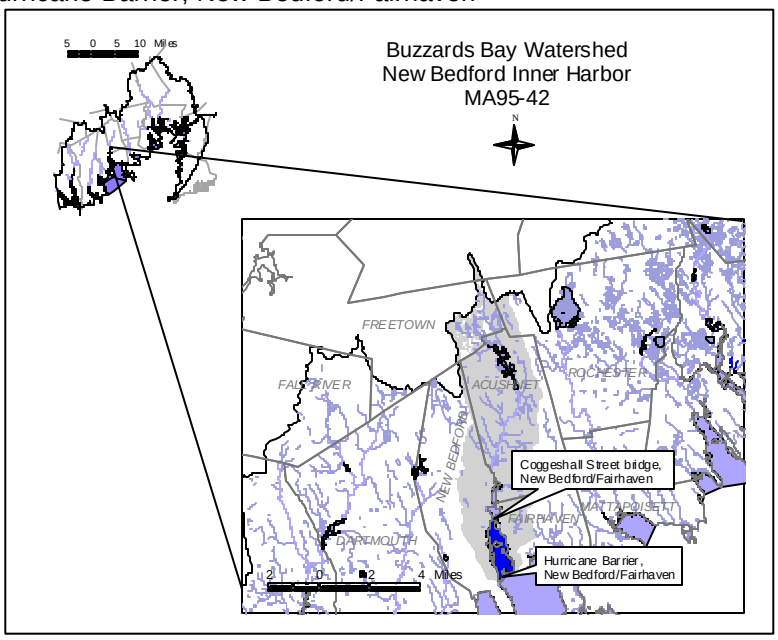
NEW BEDFORD INNER HARBOR (SEGMENT MA95-42)

Location: Coggeshall Street Bridge to Hurricane Barrier, New Bedford/Fairhaven
Segment Area: 1.25 square miles
Classification: Class SB, Shellfishing (Restricted), CSO

The drainage area of this segment is approximately 26.5 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	39%
Residential	28%
Open Land	13%

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for priority organics, metals, nutrients, organic enrichment/low DO and pathogens (MA DEP 1999).



New Bedford Inner Harbor has a history of water quality problems dating back to colonial times when agriculture adversely impacted the watershed by causing soil erosion and silting of the river. Following the agrarian era, whaling dominated the area during the early 1800s and the associated construction of large wharfs, piers and the Fairhaven bridge increased destruction of salt marshes by restricting tidal flows. Textile manufacturing had the most significant influence on the area by introducing pollutants, especially raw sewage, and occupying the remaining tracts of saltmarsh. The electronics and fishing trades culminate the industrial heritage of the region (DMF 1999). Two major electronics companies manufactured capacitors and utilized as much as 2 million pounds of PCBs per year (Nelson 1996). The effects on the fishing industry have yet to be determined.

The 18,000-acre New Bedford Harbor site is an urban tidal estuary with sediments that are highly contaminated with polychlorinated biphenyls (PCBs) and heavy metals. At least two manufacturers in the area used PCBs while producing electric devices from 1940 to the late 1970s, when the EPA banned the use of PCBs. These facilities discharged industrial wastes containing PCBs directly into the harbor and indirectly via the City's sewerage system. As a result, the harbor is contaminated in varying degrees for at least 6 miles, from the upper Acushnet River into Buzzards Bay. Two major cleanup projects are underway. A 4.5-acre sediment dewatering facility and transfer facility are planned. Full scale dredging is anticipated to begin in spring 2004. Additionally to allow for future remedial dredging, a corridor for submerged power cables was completed, 13 abandoned fishing vessels were removed, and a CSO that discharged to the dewatering area was relocated (EPA 13 February 2003).

The New Bedford-Fairhaven-Acushnet Hurricane Protection Project, begun in 1962, was completed in 1966 at a cost $18.6 million. The project is divided into three features: a barrier extending across New Bedford and Fairhaven Harbor with an extension dike on the mainland, Clarks Cove Dike in New Bedford, and Fairhaven Dike. The barrier across the harbor is a 4,500 foot-long earthfill dike with stone slope protection with a maximum elevation of 20 feet (ACOE 1995). Twin sector gates seal the 150 foot-wide navigation channel across New Bedford Harbor in 12 minutes providing tidal flood protection to ~1400 acres and preventing $17.6 million in damages. In 2000 they were operated nine times (ACOE 31 January 2002). The extension dike begins at the western end of the main dike and extends along Rodney French Boulevard for 4,600 feet. It has a maximum elevation of 22 feet with three circular gated conduits and a street gate on Rodney French Boulevard East. Clarks Cove Dike is a 5,800 feet long earthfill dike with stone slope protection. The dike extends around the north and east sides of the cove. The dike has street gates at Rodney French Boulevard West and Cove Road and a pumping station.

Fairhaven Dike is also an earthfill dike with stone slope protection and a four-foot diameter gated conduit. It begins at the foot of Lawton Street and runs east for about 3,100 feet (ACOE 1995).

The *Acushnet River TMDL Surface Water Flow and Nitrogen Load: Nitrogen Loading to New Bedford Inner Harbor* project commenced during the winter of 2002 as a first phase of the Estuary Project. The purpose of this study is:

> "to quantify Acushnet River discharge and nitrogen loading from the upper watershed region to New Bedford Inner Harbor and to support the development of water quality models and nitrogen loading thresholds for this system. In addition, analysis will be made to determine the potential for the river to be a source of bacterial (fecal coliform, *E. coli*, *Enterococci*) contamination to the estuary. A stream gauge will be maintained and nitrogen and bacterial samples {will be} collected weekly for 12 months, with additional samples associated with rain events. The goal of the project is to help acquire sufficient data that can later be used by DEP and EPA in the development of appropriate TMDL and management approaches for the restoration of water quality in the Acushnet River Estuary system. Also, the data collected are directly applicable to on-going nitrogen issues relating to management and permitting of NPDES discharges within this system. The project will leverage other proposed and on-going efforts for this system (EMPACT, CZM, EPA) and is an important component for application of the Massachusetts Estuaries Project approach to the Acushnet River Estuary" (Howes and Samimy undated).

There is public access to the Acushnet River at Pease Park, Fairhaven. The Town of Fairhaven maintains two asphalt boat launches with 30 parking spaces (DFWELE 2002). There is a vessel sewage pump-out facility at Pope's Island Marina, New Bedford. A pump-out boat is docked at the State Pier for large vessels.

ACOE is assisting CZM in the preparation of a Dredged Material Management Plan for maintenance dredging of the navigation channels in New Bedford and Fairhaven Harbor. The Fairhaven side would require dredging of approximately 70,000 cubic yards of shoal material and the main deep-draft channel has an authorized depth of 30 feet and would require removing 1.3 million cubic yards of material to restore the authorized dimensions. However, navigation traffic projections at this time do not demonstrate a need for dredging those areas. CZM is in the process of developing an Environmental Impact Report that would recommend options for the disposal of dredge materials (ACOE 31 January 2002). ASA used hydrodynamic and pollutant models to simulate circulation, fate and transport of heavy metals, PCBs, and total petroleum hydrocarbons during dredging. Results indicated that an instantaneous release of material would have a greater initial impact on water quality, but concentrations would rapidly decrease with time. A continuous release, however, would result in an increase of pollutant concentrations with time, although none of the contaminant levels would exceed chronic water quality criteria with the exception of copper (ASA 2002a).

Dr. Jefferson Turner, students, and research associates at UMass Dartmouth have conducted 141 monthly cruises of Buzzards Bay between October 1987 and October 1998 to establish temporal and spatial trends of hydrography, water quality, and plankton community structure. Station 8, in the main channel of the inner harbor, was sampled for conductivity, temperature, dissolved oxygen, depth, Secchi disk depth, salinity, nutrients, chlorophyll *a* and phytoplankton. Salinity was "almost uniformly 30 ppt throughout the study at virtually all times". Salinities were lower at Station 8 immediately after or during heavy rain. Mean surface temperatures at station 8 were below SWQS. The mean Secchi disk depth at station 8 ranged was 2.9 and ranged from 1 to 5.5 m. DO levels at Station 8 ranged from 2.8 to 14.1 mg/L with a mean of 9.1 mg/L. Chlorophyll *a* concentrations at station 8 ranged between 0.92 µg/L and 64.66 µg/L with a mean of 12.84 µg/L. Ammonium concentrations ranged between 0.00 µM and 19.72µM and averaged 4.09µM. Phosphate ranged between 0.10µM and 8.86µM with a mean concentration of 1.67µM. *Pseudo-nitzschia,* a genus of diatom that has been known to produce toxic algal blooms, was encountered in Buzzards Bay at Station 8. It is not known if the toxic species occurs in Buzzards Bay. Additionally, the dinoflagellate *Alexandrium tamarense*, which can produce paralytic shellfish poisoning toxins, was found frequently at Station 8 in abundances in the "range of thousands" of cells per liter (Turner *et al* 2000). Based on lower salinities, higher chlorophyll *a* concentrations, and anecdotal information of "green blobs of phytoplankton", Turner *et al.* (2000) speculate that water flow/circulation is reduced in the inner harbor due to the Hurricane Barrier.

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at four stations in New Bedford Inner Harbor between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at three stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Howes *et al* 1999). New Bedford Inner Harbor received an average (1997-2001) Health Index Score of 44.4 (fair) (CBB Undated b). Principle sources of nitrogen to this system are the Fairhaven WWTP and the City of New Bedford CSOs. The Hurricane Barrier contributes to degraded water quality by reducing tidal flushing and allowing the build-up of nutrients and coincident phytoplankton blooms. Additionally soft organic rich sediments may also release nutrients to the water column in the summer (Howes *et al.* 1999).

WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

Facility	PWS ID	WMA Permit Number	WMA Registration Number	Source	Authorized Withdrawal (MGD)	Average Withdrawal (MGD)		
						1999	2000	2001
Revere Copper Products, Inc.			42420101	Rodman Pond	0.08	0.08	0.07	0.08

* Excludes any authorized cranberry growers

There are 429.602 acres of cranberry bog open space in the New Bedford Inner Harbor subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 3.84 MGD. This estimate includes the estimate of water use for the upstream segment MA95-33.

NPDES SURFACE DISCHARGE SUMMARY

Revere Copper Products, Inc (MA0004821) is permitted (26 December 2000) to discharge plate mill cooling, hot breakdown mill, hot breakdown furnace, and hot roll mill discharge via internal outfall 004B; treated wastewater from sheet washing, plate washing, boiler condensate and chemical wastewater via internal outfall 002A; and 0.165 MGD of compressor cooling, furnace cooling, boiler condensate blowdown, and storm water via outfall 002 (includes discharges resulting from internal outfalls 002A and 004B) to the Acushnet River. The facility's whole effluent toxicity limit is LC_{50}= 50% effluent (outfall #002) with a temperature limit of 85°F. (Their prior permit also required whole effluent toxicity testing on outfall 004B). The permittee is also authorized to discharge storm water via outfall 004C.

The Town of Fairhaven (MA0100765) is permitted (21 March 2003) to discharge 5 MGD of treated sanitary wastewater via outfall 001 to the Acushnet River (New Bedford Inner Harbor). The facility's whole effluent toxicity limit is LC_{50}= 100% effluent. The Town of Fairhaven analyzed their effluent for Total Residual Chlorine (TRC) on 27 occasions between March 1996 and March 2002. All concentrations were below the MDL of the permit that was in effect (issued in 1989). While the 1989 permit allowed the effluent to be seasonally disinfected, the permittee is now required to install an ultraviolet ray (UV) disinfection system to meet the more stringent TRC limit of 107 µg/L MDL. Also, operational criteria of the existing facility need to be evaluated and implemented to reduce nitrogen levels to the maximum practicable extent.

The City of New Bedford (MA0100781) discharges via 12 CSOs to Buzzards Bay (meaning New Bedford) Inner Harbor. The permit will expire 2 January 2004. Additionally, there are six storm drain outfalls that discharge to this segment.

Glen Petroleum Company (MA0003301) is permitted (25 December 1979) to discharge via outfall 001 to the Acushnet River. The permit includes secondary limits for oil & grease= 15mg/L.

Trio Algarvio Inc., a fish processing and aquaculture facility, (MA0110329) is permitted (20 March 1996) to discharge 0.15 MGD via outfalls 001 and 002 to New Bedford Inner Harbor. The permit includes secondary limits for BOD= 30 mg/L and TSS= 30 mg/L.

The following general storm water permits were issued by the EPA in October 2001 and will expire in October 2005:

DN Kelley & Son Inc. MAR05B654
Global Companies LLC MAR05B694

New Bedford and Fairhaven are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

As part of the New Bedford Harbor Superfund remediation process, a 30-year New Bedford Harbor Long Term Monitoring program (NBH-LTM) was developed to assess the spatial and temporal environmental changes as a result of remediation activities. The program involves collecting data related to the sediments of New Bedford Harbor and includes sediment chemistry analysis, sediment toxicity testing, characterization of the benthic invertebrate community, and bioaccumulation studies. Baseline sampling was conducted in 1993 with full scale sampling occurring before and after major remedial events or on a 3-5 year time frame (Nelson *et al.* 1996).

AQUATIC LIFE

Biology

The predominant shellfish species of New Bedford Inner Harbor is the quahog *Mercenaria mercenaria* with an estimated standing crop in 1998 of 110 million individuals (540,000 bushels). Soft-shelled clams (*Mya arenaria*), oysters (*Crassostrea virginica*) and slipper limpets (*Crepidula spp*) were also present (DMF 1999).

As part of the New Bedford Harbor Long Term Monitoring Program, EPA conducted an evaluation of the benthic community condition. Species richness, EMAP index of benthic community condition, and community structure were examined using a probalistic sampling design at 27 hexagonal segments with approximately 30 stations per segment throughout the upper, lower, and outer harbor areas. In 1993, the first baseline sampling period, the middle harbor (this segment) exhibited signs of a stressed ecosystem and significantly impacted benthic community based on dominant opportunistic species (Nelson *et al* 1996). Bioaccumulation studies of PCBs in tissue using the blue mussel, *Mytilus edulis*, and the mummichog, *Fundulus heteroclitus*, have been conducted as part of the NBH-LTR since 1994. Mussels and mummichogs from the middle harbor showed decreased levels of PCBs when compared to the upper harbor. Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing these data and it is expected to be available for review in 2003 (Nelson 2003).

Habitat and Flow

The Inner Harbor has an average depth of six feet around the periphery and up to 30 feet in the navigation channels. The natural channeling seems to occur north to south with the major flow passing along the New Bedford side. Natural and manmade obstructions (i.e., the Hurricane Barrier) significantly affect the flushing and tidal exchange within the estuary. All of the creeks and streams that flowed into the Harbor have been routed through culverts (DMF 1999).

ASA was contracted by New England Interstate Water Pollution Control Commission and EPA to perform a flushing study of the Acushnet River estuary (New Bedford Inner Harbor). As part of the project, a dye study was undertaken in October 2001 to estimate residence time of wastewater discharged from the Fairhaven WWTP. Water elevations measured at the Coggeshall Street Bridge were dominated by semi-diurnal tides and varied at a fortnight cycle. The residence time of the Fairhaven WWTP effluent in New Bedford Inner Harbor was estimated to be less than 22 hours. Using three methods (freshwater exchange method, modified tidal prism method, and boundary fitted pollutant transport model numerical simulation) flushing time was estimated to be between 11 and 19 days. As freshwater inputs increased, flushing time decreased to between 6 and 18 days (ASA 2002b).

Toxicity-water

Effluent

Between March 1996 and June 2002, the Town of Fairhaven conducted 26 whole effluent toxicity tests using mysid shrimp, *Mysidopsis bahia*, and inland silversides, *Menidia beryllina*. There was no acute toxicity detected in any of the tests (LC_{50}'s ranged from >73 to >100% effluent).

Revere Copper Products Inc. (MA0004821) conducted 12 whole effluent toxicity tests on effluent from outfall 002 using the test organism *M. bahia* between March 1997 and September 2002 and four tests using the test organism *M. berylinna* between March 2001 and September 2002. No acute whole effluent toxicity was detected (LC_{50}'s >100% effluent). Between March 1997 and September 2000, eight whole effluent toxicity tests were also conducted on effluent from outfall 004B. No acute toxicity to mysid shrimp (*M. bahia*) was detected (LC_{50}'s > 100% effluent).

Ambient

Water from New Bedford Inner Harbor was collected near a small sandy beach (off of South Street, Fairhaven) approximately 500 feet from the Fairhaven WWTP outfall location for use as dilution water in their whole effluent toxicity tests. In the 26 tests conducted between March 1996 and June 2002, survival (exposed 48-hours) of *M. bahia* was not less than 95% and survival (exposed 48-hours) of *M. beryllina* was not less than 85%.

Toxicity-Sediment

As part of the NBH-LTM program sediment toxicity tests using the euryhaline benthic amphipod *Ampelisca abdita* were conducted on 27 sediment samples from the lower harbor. Average percent survival of test organisms exposed to sediment from the lower harbor was 66% (Nelson *et al* 1996). Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

Chemistry-water

Water from Inner New Bedford Harbor was collected for use as dilution water in the Town of Fairhaven whole effluent toxicity tests. These data, maintained in the MA DEP TOXTD database, from the 26 sampling events are summarized below.

Salinity

Salinity measurements reported by ASA as part of the flushing study ranged between 12 and 32 ppt with a negative gradient downstream. Salinity change with depth was very small, but variations existed near the surface (ASA 2002b)

pH

pH in New Bedford Inner Harbor ranged from 7.05 to 7.98 SU (TOXTD).

Alkalinity

Alkalinity in New Bedford Inner Harbor ranged from 40 to 107mg/L (TOXTD).

Total Suspended Solids:

Total suspended solids concentrations in New Bedford Inner Harbor ranged from 12 to 256 mg/L (TOXTD).

Ammonia (as N)

Ammonia concentrations ranged from <MDL to 0.980 mg/L (TOXTD). (No comparison to water quality criteria were conducted due to a lack of temperature data.)

Chemistry-sediment

As part of the NBH-LTM Program, numerous sediment samples were collected from the top 2 cm of New Bedford lower harbor at 27 sites using a Young-modified van Veen grab sampler, composited, and analyzed for 18 PCB congeners, TOC, and AVS (acid volatile sulfide), and nine metals (Ni, Pb, Cd, Cu,

Zn, Hg, As, Se, Cr) at a total of 27 stations in this segment. Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

From Nelson *et al* 1996. Average metal and total PCB concentrations (in µg/g dry wt) in the lower harbor sediment from 1993. N (the number of stations in the segment) = 27. S-EL (severe effect level) and L-EL (low effect level) from Persaud *et al* 1993 in µg/g dry wt.

Parameter	Average Concentration	S-EL	L-EL
As	5.3	33	6
Cd	12	10	0.6
Cr	190	110	26
Cu	450	110	16
Hg	0.40	2	0.2
Ni	11	75	16
Pb	130	250	31
Se	0.42	NA	NA
Zn	260	820	120
Total PCBs	8.2	530	0.07

The *Aquatic Life Use* is assessed as impaired because of historic PCB contamination. It should be noted that remediation activities are underway and are being monitored closely by EPA. Additional concerns for New Bedford Inner Harbor include reduced tidal flushing and elevated nutrient levels.

FISH CONSUMPTION

MDPH issued the following fish/seafood consumption advisory for New Bedford Harbor due to PCB contamination:

> Area I (which encompasses this entire segment)—The general public should refrain from consuming all fish and lobster from this area (#191).

Based on the MPDH fish/seafood consumption advisory for New Bedford Inner Harbor, the *Fish Consumption Use* is assessed as impaired.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB15.1 is prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as impaired for this entire segment

PRIMARY AND SECONDARY CONTACT RECREATION

DMF noted that coliform levels are high following significant rain events and that during the winter counts were higher which may be attributed to the Fairhaven WWTP discharge which is not chlorinated in the winter. The Town of Fairhaven has implemented a new wharf and marina management plan to address potential sources of bacteria (DMF 1999).

According to the 1990 Facilities Plan for New Bedford, the Inner Harbor received an average of 50 CSO discharges per year (595 million gallons) and 1,308 MG of separate storm water discharges (CDM 1990). New Bedford has examined every CSO and has repaired and/or attempted to eliminate malfunctions. Additionally, New Bedford has undertaken projects that include upgrading the WWTP, reconstructing two pump stations, and conducting an inflow and infiltration study. It should be noted that the City of New Bedford has eliminated the CSO on the north side of the Coggeshall Street bridge, the CSO at Kenyon Street at North Front Street, which used to discharge to drainage swale, and the CSO at Pearl Street through the redirection of flows and the installation of new sewers. Additionally, the overflow structure at Wamsutta Street at Acushnet Avenue and the interceptor were eliminated. A new force main was constructed and is tied in to a new pump station (Furtado 2003).

DMF noted that two storm drains in the vicinity of the Gifford Street and Coggeshall Street exhibited elevated levels of fecal coliform bacteria. (These were referred to the DPW for further investigation and remediation.)

Major waterfowl populations near Marsh Island, Palmer's Island and the fish processing plants were also noted. (DMF1999).

Because of the active CSO discharges and the poor aesthetic quality, the *Primary* and *Secondary Contact Recreational* uses are assessed as impaired. It should be noted, however, that bacterial source reduction activities are ongoing and should result in improved conditions.

AESTHETICS

Massachusetts Community Water Watch conducted monthly shoreline surveys at the Coggeshall Street bridge between October 1999 and April 2000. MCWW noted five pipes and two natural springs draining to this segment. One pipe north of the causeway had a milky-gray runoff with an oily sheen and was only uncovered during low tide. Trash is very heavy and is a "huge eye-soar". Styrofoam cups, plastic bags, tires, a bicycle, a shopping cart, and metal signposts were noted (MCWW 2000).

The DMF sanitary survey noted abundant debris and runoff, CSOs, waterfowl, flowing storm drains and other discharge pipes, fish offal from fish processing plants, oil sheens/spills, hull paint scrapings. During the DMF sanitary survey there was a 200-gallon oil spill. A number of derelict vessels are "stored" near Herman Melville Boat Yard (DMF 1999). EPA since removed the abandoned vessels as part of the New Bedford Superfund remediation.

Based on the abundance of trash and debris, objectionable odors, oil sheens, and the CSO discharges, this segment of the Acushnet River is assessed as impaired for the *Aesthetics Use.*

New Bedford Inner Harbor (MA95-42) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		IMPAIRED	PCB	Reduced tidal flushing, total nitrogen	Contaminated sediments, CERCLA NPL (Superfund site)	Changes in tidal circulation/flushing, CSO, urbanized high density area, municipal point source discharge
Fish Consumption		IMPAIRED	PCB		Contaminated sediments, CERCLA NPL (Superfund site)	
Shellfish Harvesting*		IMPAIRED	Fecal coliform bacteria, PCB		CSO, urbanized high density area, contaminated sediments, CERCLA NPL (Superfund site)	Waterfowl
Primary Contact		IMPAIRED	Oil & grease, odor, and, trash and debris		CSO, urbanized high density area	Waterfowl
Secondary Contact		IMPAIRED	Oil & grease, odor, and, trash and debris		CSO, urbanized high density area	Waterfowl
Aesthetics		IMPAIRED	Oil & grease, odor, color, trash and debris		CSO, urbanized high density area	Ship building, repairs, drydocking, ballast water releases

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS NEW BEDFORD INNER HARBOR (MA95-42)

- Develop a nutrient/bacteria TMDL for the Acushnet River/New Bedford Harbor system in accordance with the Massachusetts Estuaries Project.

- Implement recommendations outlined in the Massachusetts Water Watch Shoreline Survey report to improve the aesthetics.

- Review the EPA New Bedford Harbor Long-Term Monitoring 1995 and 1999 sampling results when available to assess the *Aquatic Life Use*.

- Review and implement the Town of Fairhaven Wastewater Treatment Plant study to reduce nitrogen levels to the maximum practicable extent as required by the NPDES permit issued March 2003. Continue to monitor toxicity test results and compliance as part of the *Aquatic Life Use* assessment.

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and if deemed necessary, to increase spatial and temporal coverage of *in-situ* monitoring. Review final reports to assess the *Aquatic Life Use*

- Develop a plan to monitor bacteria levels to document effectiveness of bacteria source reduction activities including CSO abatement actions (e.g., elimination of cross connections and/or CSO outfalls), treatment of storm water discharges, and the Phase II community storm water management programs and to assess the recreational uses.

- The City of New Bedford should continue efforts to complete a reassessment of their CSO abatement program and develop a Long-Term CSO Control Plan which will achieve compliance with the water quality standards for the *Aquatic Life Use* and recreational uses.

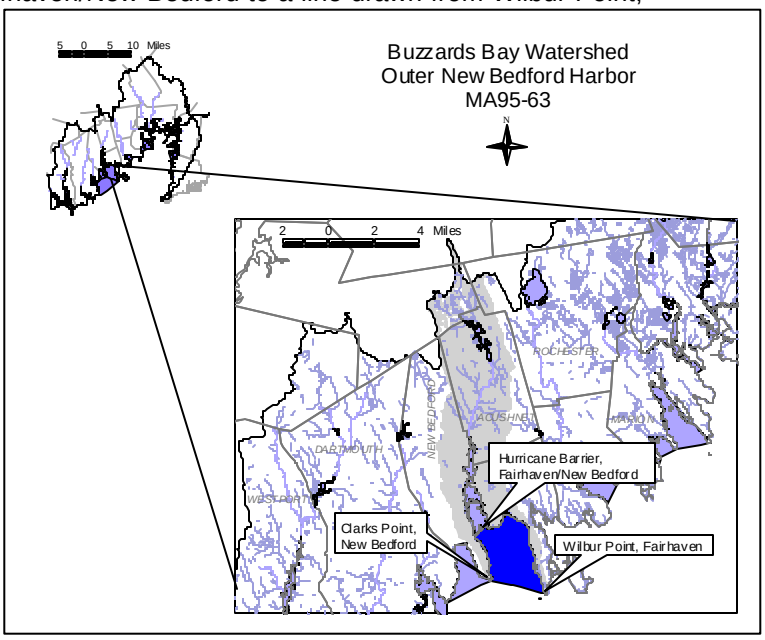
- The City of New Bedford should operate and maintain their sewer system to minimize the frequency and volume of CSO discharges by implementing the Nine Minimum Controls pursuant to federal and state CSO policies.

- Implement the DMF *Sanitary Survey of New Bedford/Fairhaven Inner Harbor (BB: 15.1)* report recommendations listed below to improve the water quality and reopen shellfish beds (Whittaker 1999). Continue to review shellfish status reports to assess the *Shellfish Harvesting Use*.
    - The City of New Bedford & Town of Fairhaven should establish a pollution abatement plan concentrating on education and regulation directed toward the fishing and recreational fleets.
    - CSO and storm drains that have been compromised by illegal use or structural malfunctions should be addressed immediately.
    - The practice of fish processing houses discarding fish offal and other materials into the harbor should be stopped immediately.
    - If construction of additional openings in the hurricane barrier is considered to improve flushing, the action should be preceded by water quality improvements to the Inner Harbor to avoid deleterious impact on the productive shellfish beds of the Outer Harbor.

- Implement the five salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are NB04, NB05, NB06, NB07, and NB08. Develop a plan to monitor the effectiveness of the restoration and improvements in water quality and subsequent affects on the aquatic life.

OUTER NEW BEDFORD HARBOR (SEGMENT MA95-63)

Location: From the Hurricane Barrier, Fairhaven/New Bedford to a line drawn from Wilbur Point, Fairhaven to Clarks Point, New Bedford
Segment Area: 5.82 square miles
Classification: Class SA, Shellfishing (Open)



The drainage area of this segment is approximately 29.4 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Forest	37%
Residential	30%
Open Land	13%

This segment is on the 1998 Massachusetts Section 303(d) List of Waters (as segment MA95-27) as not meeting the water quality standards for priority and nonpriority organics, metals, organic enrichment/low DO and pathogens (MA DEP 1999). As part of the Massachusetts Estuaries Project, a nutrient and bacteria TMDL will be developed by SMAST in the next few years for the Acushnet/New Bedford Harbor System which also encompasses this segment.

There is public access to Outer New Bedford Harbor at two locations along East Rodney French Boulevard. A concrete boat launch with parking for 30 trailers is maintained by the City (DFWELE 2 July 2002). At the mouth of New Bedford Harbor is one of the smaller parks in Massachusetts. Fort Phoenix State Reservation combines historic features, scenic views and a variety of recreational facilities. Minutes from downtown New Bedford, the park contains a half-mile of Buzzards Bay beachfront. Adjacent to the park (and managed by the Town of Fairhaven) is Fort Phoenix, the national landmark Fort from which the park gets its name. From the ramparts remnants one can gaze across the bay to where the first naval battle of the Revolutionary War was fought and to the rolling meadows of the Elizabeth Islands. (MA DEM Undated a)

The 18,000-acre New Bedford site is an urban tidal estuary with sediments that are highly contaminated with polychlorinated biphenyls (PCBs) and heavy metals. At least two manufacturers in the area used PCBs while producing electric devices from 1940 to the late 1970s, when the use of PCBs was banned by the EPA. These facilities discharged industrial wastes containing PCBs directly into the harbor and indirectly via the city's sewerage system. As a result, the harbor is contaminated in varying degrees for at least 6 miles, from the upper Acushnet River into Buzzards Bay (EPA 13 February 2003).

ACOE completed dredging of the hotspot portions of the New Bedford Superfund Site in 1995 and removed 14, 000 cubic yards of sediments. Remediation of the remainder of the harbor involves dredging 500,000 cubic yards of sediments from the estuary and outer harbor. Facilities to treat harbor water pumped during dredging were scheduled to be built in 2002, ComElectric's power cables were relocated in 2003, a CSO was relocated in May 2001, and 16 abandoned and sunken vessels in contaminated soil were removed (ACOE 31 January 2002).

ACOE is assisting CZM in the preparation of a Dredged Material Management Plan for maintenance dredging of the navigation channels in New Bedford and Fairhaven harbors. The Fairhaven side would require dredging of approximately 70,000 cubic yards of shoal material. The main deep-draft channel has an authorized depth of 30 feet and would require removing 1.3 million cubic yards of material to restore the authorized dimensions. However, navigation traffic projections do not at this time demonstrate a need

for dredging those areas. CZM is in the processes of developing an Environmental Impact Report that would recommend options for the disposal of dredge materials (ACOE 31 January 2002).

ASA is conducting a water quality assessment of Outer New Bedford Harbor to evaluate sources and distribution of fecal coliform bacteria. Initial results indicate high concentrations near the Hurricane Barrier and near Boys and Girls Creek. ASA will utilize models to simulate fate and transport of fecal coliform bacteria in the harbor and use DNA (Deoxyribonucleic acid) fingerprinting techniques to determine if the sources are animal or human (ASA 2002a).

ACOE is assisting EPA with a bioavailability study of Boy's Creek tidal marsh involving soil investigations and ecological investigations as part of the Atlas Tack Superfund Site Remediation in Fairhaven. ACOE also will develop a scope of work for excavation and restoration of the upland and marsh soils and sediments.

In 1998 the Buzzards Bay Project and the Town of Fairhaven were awarded a s. 319 grant by the MA DEP Nonpoint Source Program to restore salt marsh habitat to Winsegansett Salt Marsh in the New Bedford Harbor Subwatershed. Winsegansett Salt Marsh is a 30-acre coastal wetland system connected to outer New Bedford Harbor through a series of tidal creeks and is located on the western shore of Sconticut Neck in Fairhaven. Tidal flows in the marsh were restricted by the culverting of the creek under Winegansett Avenue prior to 1956. Reduced tidal flows can alter the water quality within the marsh (e.g., reduced salinity, reduced flushing) thereby reducing diversity and biomass, especially among the plant communities. In Winsegansett Salt Marsh reduced tidal flow led to the proliferation of the non-native nuisance plant *Phragmites australis*, the common reed, which tolerates lower salinity habitats. The project replaced the 18-inch culvert under Winegansett Avenue with two 30-inch concrete arch culverts. Additionally, three culverts under private footpaths were also replaced with two 24-inch ADS plastic culverts. EPA/NOAA Five Star Restoration Challenge Grant funds, FishAmerica Foundation Grant money, and Buzzards Bay Project Municipal Grant Program money were also used to complete this project. The Buzzards Bay Project conducted pre-construction monitoring of salinity, pH, and vegetation distribution/abundance (% cover, stem density, flower density, plant height) on four occasions in 2000 and five occasions in 2001 at seven stations. Post-construction monitoring was conducted in 2002 (BBP 1999-2002).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at two stations in New Bedford Outer Harbor between May and September from 1992 to the present. Samples were collected between 6 and 9 am. More intensive sampling of nutrients was conducted at five stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Howes *et al* 1999). New Bedford Outer Harbor received an average (1997-2001) Health Index Score of 68.8 (good/excellent) (CBB undated b). The Fairhaven WWTP and New Bedford CSOs were listed by CBB as the principle sources of nitrogen to this system. The Hurricane Barrier also contributes to degraded water quality by reducing tidal flow and accumulating organic rich sediments that release nutrients to the water column in the summer (Howes *et al* 1999).

WMA WATER WITHDRAWAL (APPENDIX F)

There are 429.602 acres of cranberry bog open space in the Outer New Bedford Harbor subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 3.84 MGD including the estimated water use for the upstream segments MA95-38 and MA95-42.

NPDES SURFACE DISCHARGE SUMMARY

The City of New Bedford (MA0100781) discharges via seven CSOs to Buzzards Bay Outer Harbor (outfalls 012-018). The permit will expire 2 January 2004.

The City of New Bedford (MA0034428) is permitted (24 June 1992) to discharge storm water via outfalls 042-044 to Clark's Cove and Outer New Bedford Harbor. The permit expired in 1997.

Cornell-Dubilier Electronics Corporation (MA00003930) is permitted (28 February 2001) to discharge storm water via outfall 002 to Fort Phoenix Reach near the Acushnet River Estuary in Lower New Bedford

Harbor. The permit will expire in 2006. Cornell-Dubilier Electronics operated a capacitor manufacturing operation. From the 1940s-1978 the facility released PCB contaminated wastewater onto shoreline mudflats and into New Bedford Harbor. The facility was required to monitor storm water discharges at the site due to residual PCB contamination. (See Sources of Information for additional information.)

The following general storm water permit was issued by the EPA in October 2001 and will expire in October 2005:

Allegheny Rodney MAR05C155

New Bedford and Fairhaven are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

As part of the New Bedford Harbor Superfund remediation process, a 30-year New Bedford Harbor Long Term Monitoring program (NBH-LTM) was developed to assess the spatial and temporal environmental changes as a result of remediation activities. The program involves collecting data related to the sediments of New Bedford Harbor and includes sediment chemistry analysis, sediment toxicity testing, characterization of the benthic invertebrate community, and bioaccumulation studies. Baseline sampling was conducted in 1993 with full scale sampling occurring before and after major remedial events or on a 3-5 year time frame (Nelson *et al* 1996).

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in Outer New Bedford Harbor from historic 1951 black and white aerial photography. Eelgrass beds in Outer New Bedford Harbor were mapped by MA DEP from field verified 1994 aerial photography (Costello 2003). Eelgrass beds have declined along the eastern shore of this segment near Sconticut Neck and have been lost between the Fort Phoenix Beach State Reservation and Harbor View (Farmfield Lane).

Biology

As part of the New Bedford Harbor Long Term Monitoring Program, EPA conducted an evaluation of the benthic community condition. Species richness, EMAP index of benthic community condition, and community structure were examined using a probalistic sampling design at eight hexagonal segments with approximately 30 stations per segment throughout the outer harbor area. In 1993, the first baseline sampling period, the outer harbor (this segment) can "generally be classified as healthy, based on high species richness, positive EMAP benthic index, and even distribution of the dominant species" (Nelson *et al* 1996). Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

Toxicity

Ambient

Between March 2001 and October 2002, water was collected from the Harbor approximately 20 yards north of the concrete pier on the eastern shore of Clarks Point for use as dilution water in the City of New Bedford WWTP's whole effluent toxicity tests. Survival of *M. bahia* (exposed 48-hours) was good (88-100%) and survival of *M. beryllina* (exposed 7-days) was good (85-100%).

Toxicity-Sediment

As part of the NBH-LTM program in 1993, sediment toxicity tests using the euryhaline benthic amphipod *Ampelisca abdita* were conducted on eight sediment samples from the outer harbor. Average percent survival from the outer harbor was 91% with only one sample showing acute toxicity (Nelson *et al* 1996). Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

Chemistry – water

Water was collected from the Harbor approximately 20 yards north of the concrete pier on the eastern shore of Clarks Point for use as dilution water in the City of New Bedford WWTP's whole effluent toxicity tests. These data, maintained in the TOXTD database, are summarized below.

pH

pH ranged from 7.4 to 8.06 SU.

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged from BDL to 8.66 mg/L. (No comparison to water quality criteria was conducted because of the lack of temperature data.)

Total Suspended Solids

TSS ranged from 32 to 62 mg/L.

Chemistry-sediment

In 1993, as part of the NBH-LTM Program, numerous grab samples sediments were collected from the top 2 cm of New Bedford outer harbor at 23 sites using a Young-modified van Veen grab sampler, composited, and analyzed for 18 PCB congeners, TOC, AVS (acid volatile sulfide), and nine metals (Ni, Pb, Cd, Cu, Zn, Hg, As, Se, Cr). Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

From Nelson *et al* 1996. Average metal and total PCB concentrations (in µg/g dry wt) in the outer harbor sediment from 1993. N (the number of stations in the segment) = 23 (includes sediment samples from Clarks Cove and Open Water). S-EL (severe effect level) and L-EL (low effect level) from Persaud *et al* 1993 in µg/g dry wt.

Parameter	Average Concentration	S-EL	L-EL
As	3.1	33	6
Cd	0.28	10	0.6
Cr	19	110	26
Cu	19	110	16
Hg	0.07	2	0.2
Ni	5.3	75	16
Pb	18	250	31
Se	0.23	NA	NA
Zn	42	820	120
Total PCBs	0.83	530	0.07

Because of eelgrass bed habitat loss the *Aquatic Life Use* is assessed as impaired. This loss may be associated with nutrient enrichment from nonpoint sources or other anthropogenic activities that result in reduced water clarity. Suspected sources of nutrient enrichment include the CSO discharges, urbanized high density areas, recreational activities (boating and swimming), and storm water.

FISH CONSUMPTION

MDPH issued the following fish/seafood consumption advisory for New Bedford Harbor due to PCB contamination:

> Area II (which encompasses this segment)—The general public should refrain from consuming lobster from this area (#4949).

Based on the MPDH fish/seafood consumption advisory for New Bedford Outer Harbor, the *Fish Consumption Use* is assessed as impaired.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB15.41, BB15.42, BB15.43, BB15.51 are prohibited and BB15.52, BB15.6, and BB15.7 are restricted (DFWELE 2000).

Shellfish growing areas BB15.4 and BB15.5 were classified as conditionally approved in the July 2000 status report, but have recently been reclassified as restricted (Whittaker 2003).

Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as impaired for this entire segment.

PRIMARY AND SECONDARY CONTACT RECREATION

MA DEM collected weekly *Enterococci* bacteria samples from the beach at Fort Phoenix State Reservation between May and August 2002 (n=16) (MA DEM 2002). The MA DEM Beach at Fort Phoenix was closed to swimming because of elevated *Enterococci* bacteria levels between 8/21-8/23/2001 and again between 7/9-7/10/2002 (MDPH 2002).

Additionally, the following beaches were closed to swimming based on elevated *Entercoccci* levels: public beach at Manhattan Avenue was closed between 8/21-8/24/2001and the semi-public beach was closed between 7/10-7/17/2001; the Reservation Road beach was closed 8/21-8/24/2001; and the Silvershell Beach (Chamber Street) was closed between 8/21-8/24/2001(MDPH 2002b).

New Bedford Outer Harbor received an average of 49 combined sewer overflows per year (595 million gallons) according to the 1990 CDM facilities plan. New Bedford Outer Harbor also received 256 MG of separate storm water discharge (CDM 1990). The City of New Bedford has eliminated CSO discharges at Apponagansett Street, Gifford Street, Butler Street at East Rodney French Boulevard, Cove Street at East Rodney French Boulevard, and Ricketson Street through the redirection of flows and installation of new sewers (Furtado 2003).

While the bathing beaches in this segment have rarely been closed, the presence of CSOs and the number and volumes of past discharges are of concern. Therefore, it is best professional judgment that this segment is currently not assessed. This segment is, however, identified with an Alert Status.

New Bedford Outer Harbor (MA95-63) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life		IMPAIRED	Estuarine bioassessment (decline/loss of eelgrass bed habitat)	Total nitrogen, other anthropogenic substrate alterations		CSO, urbanized high density area, municipal separate storm sewer systems
Fish Consumption		IMPAIRED	PCBs		Contaminated sediments, CERCLA NPL (Superfund site)	
Shellfish Harvesting*		IMPAIRED	Fecal coliform bacteria		Unknown	Municipal separate storm sewer systems
Primary Contact**		NOT ASSESSED				
Secondary Contact**		NOT ASSESSED				
Aesthetics		NOT ASSESSED				

*For watershed-wide shellfish growing area data see Appendix E.

** Alert Status Issues identified—see details in use assessment section.

RECOMMENDATIONS NEW BEDFORD OUTER HARBOR (MA95-63)

- Review the EPA New Bedford Harbor Long-Term Monitoring 1995 and 1999 sampling results when available to assess the *Aquatic Life Use*.

- Develop a nutrient/bacteria TMDL for the Acushnet River/New Bedford Harbor system in accordance with the Massachusetts Estuaries Project.

- Implement the seven salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town of Fairhaven. Sites in this subwatershed are located along the western side of Sconticut Neck and labeled FH08, FH20, FH21, FH21a, FH22, FH23, and FH24. Develop a plan to monitor the effectiveness of the restoration and improvements in water quality as it relates to the *Aquatic Life Use*.

- The City of New Bedford should continue efforts to complete a reassessment of their CSO abatement program, and develop a Long-Term CSO Control Plan which will achieve compliance with the water quality standards.

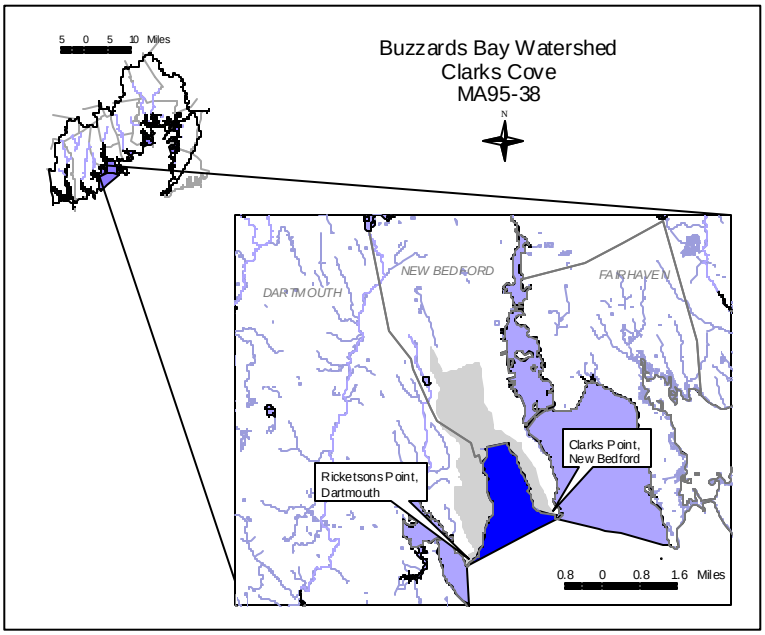
- The City of New Bedford should operate and maintain their sewer system to minimize the frequency and volume of CSO discharges by implementing the Nine Minimum Controls pursuant to federal and state CSO policies.

- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality and to assess the *Aquatic Life Use*.

- Design and conduct a bacteria survey to assess the recreational uses. Consider bracketing point and nonpoint source discharges to determine the effectiveness of the CSO reduction activities and Phase II storm water activities.

CLARKS COVE (SEGMENT MA95-38)

Location: The semi-enclosed waterbody landward of a line drawn between Clarks Point, New Bedford and Ricketsons Point, Dartmouth
Segment Area: 1.90 square miles
Classification: Class SA, Shellfishing (Open), CSO



The drainage area of this segment is approximately 3.3 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Residential	65%
Open Land	17%
Forest	8%

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for priority organics, and pathogens (MA DEP 1999). As part of the Estuaries Project a nutrient and bacteria TMDL will be developed in the next few years for the Acushnet/New Bedford Harbor System that encompasses this segment.

There is public access to Clark Cove via one City-maintained concrete boat launch with parking for 22 trailers (DFWELE 2 July 2002).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at three stations in Clarks Cove between May and September from 1992 to the present. Samples were collected between 6 and 9 am. More intensive sampling of nutrients was conducted at four stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Clarks Cove contains one of the "most significant quahog fisheries in Buzzards Bay". The City of New Bedford has done extensive work on its CSOs in Clarks Cove, although in 1999 seven were still discharging. Eelgrass beds are expanding in this segment (Howes *et al.* 1999). High transparency, low nitrogen levels, sporadic plankton blooms, and rare instances of oxygen depletion are apparent in the average (1997-2001) Health Index scores for Inner Clarks Cove and Outer Clarks Cove, 76.9 and 81.8, respectively (both good/excellent) (CBB undated b).

As part of the New Bedford Harbor Superfund remediation process, a 30-year New Bedford Harbor Long Term Monitoring program (NBH-LTM) was developed to assess the spatial and temporal environmental changes as a result of remediation activities. The program involves collecting data related to the sediments of New Bedford Harbor and includes sediment chemistry analysis, sediment toxicity testing, characterization of the benthic invertebrate community, and bioaccumulation studies. Baseline sampling was conducted in 1993 at two segments in Clarks Cove with full scale sampling occurring before and after major remedial events or on a 3-5 year time frame (Nelson *et al.* 1996). EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

WMA WATER WITHDRAWAL

There are no known regulated water withdrawals from this subwatershed.

NPDES SURFACE DISCHARGE SUMMARY

The City of New Bedford (MA0034428) is permitted (24 June 1992) to discharge site dewatering discharges via outfalls 045, 046, and 047 to Clark's Cove and storm water via outfalls 042-044 to Clark's Cove and Outer New Bedford Harbor. The permit expired in 1997.

The City of New Bedford (MA0100781) discharges via nine CSO locations to Clark's Cove (outfalls 003-011). The permit will expire 2 January 2004.

Dartmouth and New Bedford are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

MA DEP identified the presence of eelgrass in Clarks Cove from historic 1951 black and white aerial photography (Costello 2003). Eelgrass beds in Clarks Cove were mapped by MA DEP from field verified 1994 aerial photography. MA DEP field verified 1994aerial photography determined that the eelgrass bed identified in 1951 along the eastern shore near Clarks Point and along the western shore near Mashers Island and Ricketsons Point appear to be declining slightly. Eelgrass bed mapping was not conducted in Clarks Cove in 2002.

Since recent (2002) eelgrass bed habitat data are not available, the *Aquatic Life Use* is currently not assessed. This use is identified, however, with an Alert Status as the decline of eelgrass bed habitat may be indicative of reduced water clarity or nutrient enrichment from anthropogenic activities. Nitrogen thresholds and habitat quality guidelines are currently being developed by the Massachusetts Estuaries Project to better evaluate the status of the *Aquatic Life Use*.

FISH CONSUMPTION

MDPH issued the following fish/seafood consumption advisory for New Bedford Harbor due to PCB contamination:

> Area II (which encompasses this segment)—The general public should refrain from consuming lobster from this area (#4949).

Based on the MPDH fish/seafood consumption advisory for New Bedford Outer Harbor, the *Fish Consumption Use* is assessed as impaired.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB13.1, BB13.20, BB13.21, and BB13.22 are conditionally approved; BB13.3, BB13.4 and BB13.6 are restricted; and BB13.5 and BB13.7 are prohibited (DFWELE 2000). Shellfish growing areas BB13.3 and 13.4 have been reclassified as prohibited (Whittaker 2003).

Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as impaired for this entire segment.

PRIMARY AND SECONDARY CONTACT RECREATION

Hidden Bay Beach, a semi-public beach in Dartmouth was closed between 6/6-6/14/2001and again between 8/20-8/24/2002 due to elevated *Enterococci* levels (MDPH 2002b).

According to the 1990 CDM Facilities Plan for New Bedford, Clark Cove received an average 496 million gallons of CSO per year and CSOs discharged an average of 45 times per year. Additionally, Clark Cove received 286 MG of separate storm water discharges (CDM 1990). However, the City of New Bedford has since done extensive work on its CSOs in Clarks Cove. As of 1999 seven were still discharging. In the Clarks Cove area, more than 500 homes were dye tested, resulting in the identification of numerous cross connections. The City of New Bedford corrected these cross connections and eliminated the CSO at Seymour Street. Additionally, the City undertook an approximately four million dollar renovation project of its collection system in the Clarks Cove area including the installation of two new pump stations, two new interceptors, and sewer separation work that has greatly reduced CSO activity. The New Bedford Wastewater Treatment Plant was also upgraded, increasing capacity, thereby further reducing CSO activity (Furtado 2003).

Too little data are currently available so the *Contact Recreational Uses* are both not assessed. These uses are identified with an Alert Status, however, because of the presence of the CSO discharges.

Clarks Cove (MA95-38) Use Summary Table

Designated Uses		Status	Causes	Sources
			Known	Known
Aquatic Life		NOT ASSESSED		
Fish Consumption		IMPAIRED	PCBs	Contaminated sediments, CERCLA NPL (Superfund site)
Shellfish Harvesting*		IMPAIRED	Fecal coliform bacteria	CSO, urbanized high density area, municipal separate storm sewer systems
Primary Contact**		NOT ASSESSED		
Secondary Contact**		NOT ASSESSED		
Aesthetics		NOT ASSESSED		

*For watershed-wide shellfish growing area data see Appendix E.

** Alert Status issues identified see details in assessment section.

RECOMMENDATIONS CLARKS COVE (MA95-38)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring so that the status of the *Aquatic Life Use* can be assessed.

- Develop a plan to monitor bacteria levels to document effectiveness of bacteria source reduction activities including CSO remediation/abatement activities, treatment of storm water discharges and the Phase II community storm water management programs and assess the recreational uses.

- Review and implement, as appropriate, recommendations from DMF sanitary survey and triennial reports to improve water quality and possibly reopen shellfish beds. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.

- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality and to assess the *Aquatic Life Use*.

- Review the EPA New Bedford Harbor Long-Term Monitoring 1995 and 1999 sampling results when available to assess the *Aquatic Life Use*.

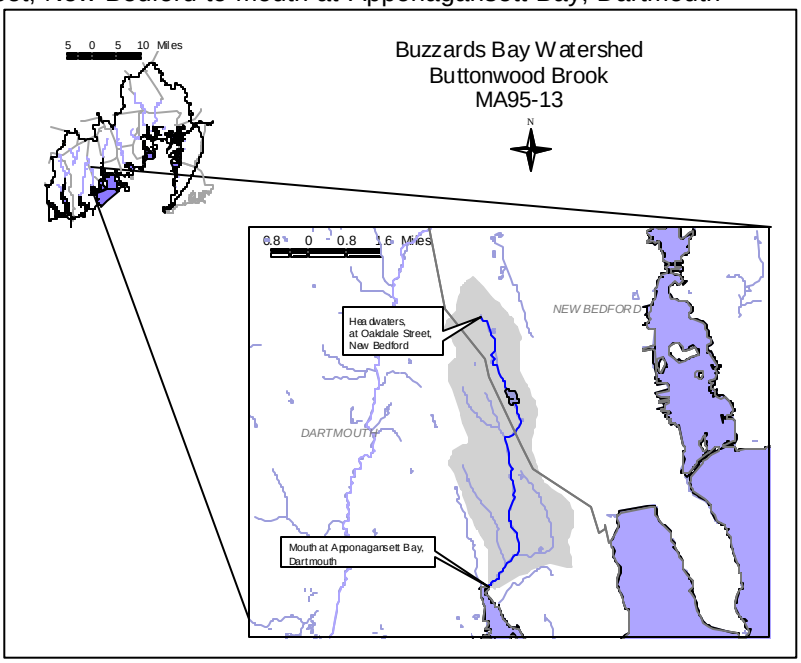
- The City of New Bedford should continue efforts to complete a reassessment of their CSO abatement program, and develop a Long-Term CSO Control Plan which will achieve compliance with the water quality standards.

- The City of New Bedford should operate and maintain their sewer system to minimize the frequency and volume of CSO discharges by implementing the Nine Minimum Controls pursuant to federal and state CSO policies.

- Develop a nutrient/bacteria TMDL for the Acushnet River/New Bedford Harbor system in accordance with the Massachusetts Estuaries Project.

BUTTONWOOD BROOK (SEGMENT MA95-13)

Location: Headwaters, at Oakdale Street, New Bedford to mouth at Apponagansett Bay, Dartmouth
Segment Length: 3.8 miles
Classification: Class B



The drainage area of this segment is approximately 3.065 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Residential	51%
Forest	24%
Open Land	14%

This segment is on the 1998 Massachusetts Section 303(d) List of Waters, needing confirmation, as not meeting the water quality standards for pathogens (MA DEP 1999).

Buttonwood Brook is "a controlled stream which has been engineered to provide needed storm water management" and is cited as the major source of fecal coliform bacteria to Apponagansett Bay (Howes *et al* 1999). Buttonwood Park Zoo, located along the brook, was reopened in August 2000 upon completion of a ten million dollar renovation to the zoo facilities. Renovations included the demolition of a 400 linear foot concrete flume and re-routing this channel into a new watercourse. The new watercourse consists of earthen embankments, bordering wetlands and a vegetated buffer to keep the zoo animals from entering the watercourse (Gould 1998).

In 2000 the Coalition for Buzzards Bay began conducting water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in Buttonwood Brook between May and September. Samples were collected between 6 and 9 am.

WMA WATER WITHDRAWAL AND NPDES SURFACE DISCHARGE SUMMARY

There are no regulated water withdrawals or wastewater discharges in this segment. It should be noted, however, that both Dartmouth and New Bedford are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

Due to the lack of current available data the designated uses for Buttonwood Brook are not assessed.

Buttonwood Brook (MA95-13) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

RECOMMENDATIONS BUTTONWOOD BROOK (MA95-13)

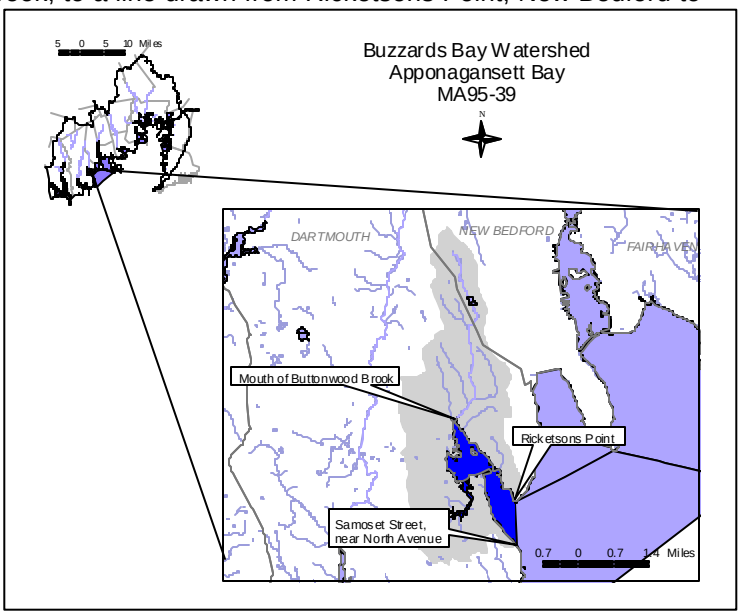
- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring so that the status of the *Aquatic Life Use* can be assessed.

- Develop a plan to monitor bacteria levels to document the effectiveness of bacteria source reduction activities including treatment of storm water discharges, improvements at Buttonwood Park Zoo and the Phase II community storm water management programs and to assess the recreational uses.

- Continue to support nonpoint source assessment activities within this subwatershed to identify the major pollutant inputs to Apponagansett Bay and then remediate those pollution sources. One such project is the City of New Bedford's storm water sampling project, which seeks to identify nutrient and bacteria sources in the upper reaches of Buttonwood Brook under a MA CZM Coastal Pollution Remediation Program grant. When complete, review the final report for information to assess the Primary and Secondary Contact Recreational uses.

APPONAGANSETT BAY (SEGMENT MA95-39)

Location: From the mouth of Buttonwood Brook, to a line drawn from Ricketsons Point, New Bedford to Samoset Street near North Avenue, Dartmouth
Segment Area: 0.95 square miles
Classification: Class SA, Shellfishing (Open)



The drainage area of this segment is approximately 8.2 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Residential	40%
Forest	32%
Open Land	10%

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).

There is public access to Apponagansett Bay via two asphalt boat launches maintained by the Town of Dartmouth. Sixty-six parking spaces are available at this site (DFWELE 2002). There are two vessel sewage pump-out boats (North Side Bridge Town Dock and Davis & Tripp's Marina) operating on Apponagansett Bay (Howes *et al.* 1999, BBP Undated, and DMF 29 January 2003).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at six stations on Apponagansett Bay between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at seven stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Howes *et al* 1999). Nutrient inputs to Apponagansett Bay cited in the Baywatchers report include Buttonwood Brook and Buttonwood Park Zoo. Buttonwood Brook is "a controlled stream which has been engineered to provide needed storm water management" and is cited as the major source of fecal coliform bacteria to Apponagansett Bay. Apponagansett Bay exhibits "areas of anoxic bottom sediments consisting of fine organic-rich particles and periodic blooms of macroalgae (*Ulva lactuca* and *Gracillaria sp.*)". Eelgrass bed loss has been significant throughout the mid-1980s. Light penetration is poor; long-term means of Secchi disk depths are 1.27 m and 1.89 m. Water quality problems in Apponagansett Bay originate from the bay's hydrodynamics and inputs from septic systems, lawns, farmland, and other watershed inputs (Howes *et al.* 1999). Inner Apponagansett Bay received an average (1997-2001) Health Index Score of 26.5 (poor), Middle Apponagansett Bay received an average score of 54.9 (fair), and Outer Apponagansett Bay received an average score of 63.3 (fair) (CBB undated b).

WMA WATER WITHDRAWAL SUMAMRY (APPENDIX F)

There are 4.452 acres of cranberry bog open space in the Apponagansett Bay subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 0.04 MGD.

NPDES WASTEWATER DISCHARGE SUMMARY

Davis and Tripp Inc. (MAR05B657) was issued a general permit by the EPA in October 2001, which will expire in October 2005.

Dartmouth is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

There is a tidal restriction at Bridge Street (the causeway connecting South Dartmouth to Padanaram Village). This restriction (Site DA01) has reduced tidal flow into upper Apponagansett Bay (BBP 2002b).

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in Apponagansett Bay from historic 1951 black and white aerial photography (Costello 2003). Eelgrass beds in Apponagansett Bay were mapped by MA DEP from field verified 1994 aerial photography. MA DEP field verified 1999 aerial photography determined that the eelgrass bed north of Gulf Road had disappeared. However, the beds south of Gulf Road appear to be stable. Poor water clarity and the presence of sea lettuce (a macroalgae capable of creating nuisance conditions) have been documented by the Coalition for Buzzards Bay.

The *Aquatic Life Use* is currently not assessed for Apponagansett Bay. However, due to the decline of eelgrass bed habitat north of Gulf Road and the reduced water clarity and presence of macroalgae, this use is identified with an Alert Status. Decline in eelgrass bed habitat may be associated with nutrient enrichment and reduced water clarity. Suspected sources of nutrient enrichment in this subwatershed include septic systems, lawns, farmland, and other nonpoint source inputs as well as the tidal restriction.

FISH CONSUMPTION

MDPH issued the following fish/seafood consumption advisory for New Bedford Harbor due to PCB contamination:

> Area III (which encompasses this segment)—The general public should refrain from consuming all bottom fish, American eel, flounder, scup, and tatuog from this area (#4948).

Based on the MPDH fish/seafood consumption advisory for New Bedford Outer Harbor, the *Fish Consumption Use* is assessed as impaired.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing areas BB12.5 and BB12.6 are approved; BB12.20, BB12.3, and BB12.7 are conditionally approved; and BB12.4 is prohibited (DFWELE 2000). Shellfish growing areas BB12.1 and BB12.2 have been reclassified from restricted to prohibited (Whittaker 2003).

Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as support for 0.27 mi^2 and as impaired for 0.68 mi^2.

PRIMARY AND SECONDARY CONTACT RECREATION

Bay View Beach in Dartmouth was closed from 6/25-7/1/2002 due to elevated *Enterococci* levels (MDPH 2002b).

Based on the more stringent shellfish harvesting guidelines, the *Primary* and *Secondary Contact Recreational Uses* are assessed as support for 0.27 mi^2. The remaining 0.68 mi^2 are currently not assessed.

Apponagansett Bay (Segment MA95-39) Use Summary Table

Designated Uses		Status	Causes		Sources	
			Known	Suspected	Known	Suspected
Aquatic Life*		NOT ASSESSED				
Fish Consumption		IMPAIRED	PCBs		Contaminated sediments, CERCLA NPL (Superfund site)	
Shellfish Harvesting**		0.27 mi^2 SUPPORT 0.68 mi^2 IMPAIRED	Fecal coliform bacteria		Unknown	On-site treatment systems, urbanized high density area, municipal separate storm sewer systems
Primary Contact		0.27 mi^2 SUPPORT 0.68 mi^2 NOT ASSESSED				
Secondary Contact		0.27 mi^2 SUPPORT 0.68 mi^2 NOT ASSESSED				
Aesthetics		NOT ASSESSED				

* Alert Status issues identified—see details in use assessment section

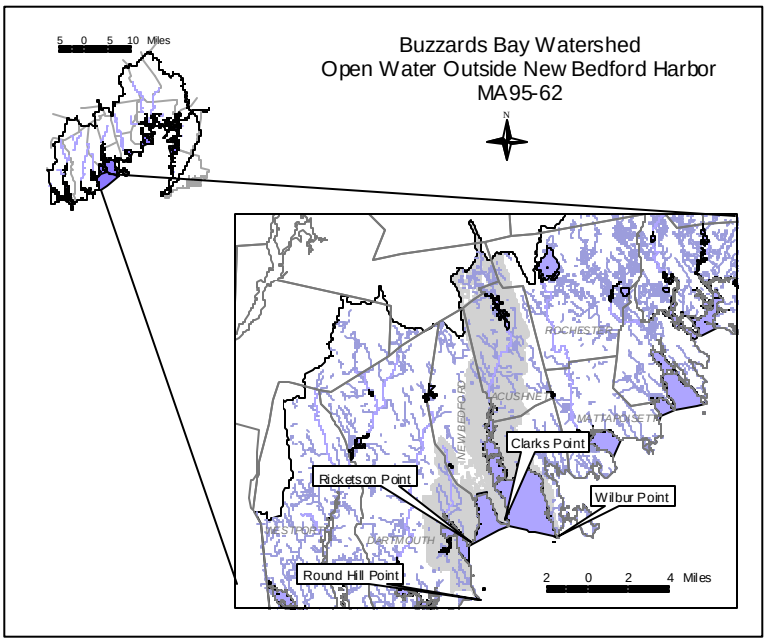
**For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS APPONAGANSETT BAY (MA95-39)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring to continue to evaluate the status of the *Aquatic Life Use*.
- Develop a plan to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewering, and the Phase II community storm water management programs and assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports. Continue to review the shellfish status report to assess the *Shellfish Harvesting Use*.
- Implement the ten salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are DA01, DA02, DA03, DA14, DA15, DA16, DA17, DA18, DA19, and DA20. The tidal restriction on the bridge at Gulf Road (Site DA02) is the seventh highest priority site in Buzzards Bay and the culvert at Old Road (Site DA17) is the ninth highest priority site. Develop a plan to monitor the effectiveness of the restoration and the improvements to water quality and affects on the aquatic life.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality to assess the *Aquatic Life Use*.
- Address NPS pollutant inputs into Apponagansett Bay to reduce shellfish bed closures. Continue to support nonpoint source assessment activities within this subwatershed to identify the major pollutant inputs to Apponagansett Bay and then remediate those pollution sources.

OPEN WATER OUTSIDE NEW BEDFORD HARBOR (SEGMENT MA95-62)

Location: Open water area encompassed within a line drawn from Wilbur Point, Fairhaven to Clarks Point, New Bedford to Ricketson Point, Dartmouth to East/Central Avenues, Dartmouth down to Round Hill Point, Dartmouth and back to Wilbur Point, Fairhaven
Segment Area: 8.02 square miles
Classification: Class SA, Shellfishing (Open)



The drainage area of this segment is approximately 42.4 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

Residential	35%
Forest	34%
Open Land	13%

A portion of this segment (formerly part of MA95-27) is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for priority and nonpriority organics, metals, organic enrichment/low DO and pathogens (MA DEP 1999). The majority of this segment has never been assessed.

The 18,000-acre New Bedford site is an urban tidal estuary with sediments that are highly contaminated with polychlorinated biphenyls (PCBs) and heavy metals. At least two manufacturers in the area used PCBs while producing electric devices from 1940 to the late 1970s, when the EPA banned the use of PCBs. These facilities discharged industrial wastes containing PCBs directly into the harbor and indirectly via the City's sewerage system. As a result the harbor is contaminated in varying degrees for at least 6 miles, from the upper Acushnet River into Buzzards Bay (EPA 12 February 2003).

ACOE is assisting CZM in the preparation of a Dredged Material Management Plan for maintenance dredging of the navigation channels in New Bedford and Fairhaven harbors. The Fairhaven side would require dredging of approximately 70,000 cubic yards of shoal material. The main deep-draft channel has an authorized depth of 30 feet and would require removing 1.3 million cubic yards of material to restore the authorized dimensions. However, navigation traffic projections do not at this time demonstrate a need for dredging those areas. CZM is in the process of developing an Environmental Impact Report that would recommend options for the disposal of dredge materials (ACOE 31 January 2002).

Dr. Jefferson Turner, students, and research associates at UMass Dartmouth have conducted 141 monthly cruises of Buzzards Bay between October 1987 and October 1998 to establish temporal and spatial trends of hydrography, water quality, and plankton community structure. Station 7, was located over the subsurface outfall of the primary treatment sewage plant of New Bedford, and was sampled for conductivity, temperature, dissolved oxygen, depth, Secchi disk depth, salinity, nutrients, chlorophyll *a* and phytoplankton. Salinity was “almost uniformly 30 ppt throughout the study at virtually all times”. Mean surface temperatures at station 7 were below SWQS. The mean Secchi disk depth at station 7 was 2.3 and ranged from 0.8 to 6.0 m. DO levels at Station 7 ranged from 3.0 to 13.8 mg/L with a mean of 9.3 mg/L. Chlorophyll *a* concentrations at station 7 ranged between 0.79 µg/L and 27.65 µg/L with a mean of 6.69 µg/L. Ammonium concentrations ranged between 0.14 µM and 70.53 µM and averaged 6.97 µM. Phosphate ranged between 0.08 µM and 8.02 µM with a mean concentration of 2.58µM. *Pseudo-nitzschia,* a genus of diatom that has been known to produce toxic algal blooms, was encountered in Buzzards Bay at Station 7. It is not known if the toxic species occurs in Buzzards Bay. Additionally, the dinoflagellate *Alexandrium tamarense*, which can produce paralytic shellfish poisoning toxins, was also found at Station 7 in abundances in the range of hundreds of cells per liter. After the New Bedford

WWTP was converted to a secondary treatment facility, water quality at station 7 clearly improved – increased water transparency, decreased ammonium, bacterioplankton and rod-shaped bacteria (Turner et al 2000).

WMA WATER WITHDRAWAL SUMMARY

There are no direct water withdrawals from this segment. (See upstream segments for information on cranberry bog withdrawals.)

NPDES SURFACE DISCHARGE SUMMARY

The City of New Bedford (MA0100781) is permitted (2 January 2001) to discharge 30 MGD of treated effluent via outfalls 001and 002 to Buzzards Bay. The permit expires in 2006. The facility's whole effluent toxicity limit is $LC_{50} \geq 100\%$ effluent and C-NOEC $\geq$ 12.5% effluent. The facility was upgraded from a primary to a secondary treatment plant with a new outfall in August/September 1996.

Dartmouth, New Bedford and Fairhaven are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

As part of the New Bedford Harbor Superfund remediation process, a 30-year New Bedford Harbor Long Term Monitoring program (NBH-LTM) was developed to assess the spatial and temporal environmental changes as a result of remediation activities. The program involves collecting data related to the sediments of New Bedford Harbor and includes sediment chemistry analysis, sediment toxicity testing, characterization of the benthic invertebrate community, and bioaccumulation studies. Baseline sampling was conducted in 1993 with full scale sampling occurring before and after major remedial events or on a 3-5 year time frame (Nelson *et al.* 1996).

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in this segment from historic 1951 black and white aerial photography. Field surveys conducted by MA DEP in 2000 revealed stable eelgrass beds that appear to be expanding near Wilbur Point, Fairhaven and Round Hill Point, Dartmouth (Costello 2003).

Biology

As part of the New Bedford Harbor Long Term Monitoring Program, EPA conducted an evaluation of the benthic community condition. Species richness, EMAP index of benthic community condition, and community structure were examined using a probalistic sampling design at nine hexagonal segments with approximately 30 stations per segment throughout the outer harbor area. In 1993, the first baseline sampling period, the outer harbor (this segment) can "generally be classified as healthy, based on high species richness, positive EMAP benthic index, and even distribution of the dominant species" (Nelson *et al.* 1996). Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

Toxicity

Effluent

The City of New Bedford (MA0100781) conducted 25 whole effluent toxicity tests using the mysid shrimp (*M. bahia*) and the inland silverside (*M. berylinna*). The effluent was acutely toxic to *M. bahia* in six of the 23 valid test events with LC_{50}s ranging between 63.10 and >100% effluent. Acute toxicity was only detected once with *M. berylinna* (July 1997 LC_{50} = 68.7% effluent). C-NOEC's for the silverside tests ranged from 12.5 to 100% effluent (no violations of the C-NOEC permit limit).

Toxicity-Sediment

As part of the NBH-LTM program in 1993, sediment toxicity tests using the euryhaline benthic amphipod *Ampelisca abdita* were conducted on nine sediment samples from the outer harbor. Average percent survival from the outer harbor was 91% with only one sample showing acute toxicity (Nelson *et*

al 1996). Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

Chemistry-sediment

In 1993, as part of the NBH-LTM Program, numerous sediment samples were collected from the top 2 cm of New Bedford outer harbor at 23 sites using a Young-modified van Veen grab sampler, composited, and analyzed for 18 PCB congeners, TOC, and AVS (acid volatile sulfide), and nine metals (Ni, Pb, Cd, Cu, Zn, Hg, As, Se, Cr). Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

From Nelson *et al* 1996. Average metal and total PCB concentrations (in µg/g dry wt) in the outer harbor sediment from 1993. N (the number of stations in the segment) = 23 (includes samples from New Bedford Outer Harbor and Clarks Cove). S-EL (severe effect level) and L-EL (low effect level) from Persaud *et al* 1993 in µg/g dry wt.

Parameter	Average Concentration	S-EL	L-EL
As	3.1	33	6
Cd	0.28	10	0.6
Cr	19	110	26
Cu	19	110	16
Hg	0.07	2	0.2
Ni	5.3	75	16
Pb	18	250	31
Se	0.23	NA	NA
Zn	42	820	120
Total PCBs	0.83	530	0.07

Although eelgrass bed habitat data are available and it appears that the beds are stable and healthy, the habitat accounts for only about three percent of this segment's area. Therefore, given the limited current biological and physico-chemical (e.g., dissolved oxygen, nutrients, suspended solids) data, it is best professional judgment that the *Aquatic Life Use* is currently not assessed. Acute toxicity in the New Bedford WWTP discharge is of concern. However, its effect on water quality is likely very limited.

FISH CONSUMPTION

MDPH issued the following fish/seafood consumption advisory for New Bedford Harbor due to PCB contamination:

> Area III (which encompasses this segment)—The general public should refrain from consuming all bottom fish, American eel, flounder, scup, and tatuog from this area (#4948).

Based on the MPDH fish/seafood consumption advisory for New Bedford Outer Harbor, the *Fish Consumption Use* is assessed as impaired.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB11.0 and BB14.0 are approved, BB11.3 and BB14.3 are conditionally approved, and BB11.2, BB11.30, BB14.2, and BB14.30 are prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as support for 4.82 mi^2 and impaired for 3.2 mi^2.

PRIMARY AND SECONDARY CONTACT RECREATION

In this segment there are three public beaches - Noquitt Beach, Anthony Beach, and Town Beach. According to the Dartmouth Board of Health, there have been no closures (Dartmouth 2003 and MDPH 2002b).

Based on the more stringent shellfish harvesting guidelines, 4.82 mi^2 are assessed as support for the *Primary* and *Secondary Contact Recreational uses*. The remaining 3.2 mi^2 are not assessed.

Open Coastal Water Outside New Bedford Harbor (Segment MA95-62) Use Summary Table

Designated Uses		Status	Causes	Sources	
			Known	Known	Suspected
Aquatic Life		NOT ASSESSED			
Fish Consumption		IMPAIRED	PCBs	Contaminated sediments, CERCLA NPL (Superfund site)	
Shellfish Harvesting*		4.82 mi^2 SUPPORT 3.2 mi^2 IMPAIRED	Fecal coliform bacteria	Unknown	Municipal separate storm sewer systems
Primary Contact		4.82 mi^2 SUPPORT 3.2 mi^2 NOT ASSESSED			
Secondary Contact		4.82 mi^2 SUPPORT 3.2 mi^2 NOT ASSESSED			
Aesthetics		NOT ASSESSED			

*For watershed-wide shellfish growing area data see Appendix E

RECOMMENDATIONS OPEN COASTAL WATER OUTSIDE NEW BEDFORD HARBOR (SEGMENT MA95-62)

- Develop a plan to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management programs and assess the recreational uses.

- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to remediate sources of pollutant causing the shellfish bed closures. Continue to review the shellfish status report to assess the *Shellfish Harvesting Use.*

- Review the EPA New Bedford Harbor Long-Term Monitoring 1995 and 1999 sampling results when available to assess the *Aquatic Life Use*.

- Continue to review New Bedford WWTP whole effluent toxicity test reports as part of the *Aquatic Life Use* assessment. If acute toxicity continues to be problematic, determine the need for a Toxicity Identification Evaluation/Toxicity Reduction Evaluation (TIE/TRE).

- Implement the four salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town of Dartmouth. Sites in this subwatershed are located in Nonquitt and are labeled DA04, DA05, DA21 and DA22. The culvert of Nonquitt Marsh (site DA04) is the second highest priority site in Buzzards Bay. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.